

# AESTHETICS AND PSYCHOBIOLOGY

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New York

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## PREFACE

Aesthetic questions have nothing to do with psychological experiments but are answered in an entirely different way.

L. WITTGENSTEIN

It is improbable that more nonsense has been written about aesthetics than about anything else: the literature of the subject is not large enough for that. It is certain, however, that about no subject with which I am acquainted has so little been said that is at all to the purpose.

C. BELL

George Bernard Shaw once said the more things a man is ashamed of the more respectable he is. Students of aesthetics seem to be ashamed of nothing.

C. C. PRATT

The end of poetry is to produce excitement in co-existence with an overbalance of pleasure.

W. WORDSWORTH

What was remarkable about the Terezin camp was the richness of its cultural life. Creative cultural activity was a reflection of the resistance against the Nazism no less than a testimony to the fact that culture is equally necessary to man as providing food to live on.

Inscription referring to exhibition of paintings and drawings by concentration-camp prisoners in the Museum of the Lesser Fortress, Terezin (Theresienstadt), Czechoslovakia.

Psychological aesthetics can contribute to general psychology as much as it receives.

C. A. MACE

Experimental aesthetics is the second oldest branch of experimental psychology. Fechner, whose book, *Elements of Psychophysics*, launched the first branch in 1860, turned his attention to aesthetic problems within the next few years.

Despite its relative antiquity, experimental aesthetics is far from being among the most advanced areas of psychological research. It has been in its protracted infancy, marked by long periods of suspended animation, for over a century. It was cultivated fairly intensively by the researchers of the early twentieth century. But, although it continued to attract the interest of theorists willing to extrapolate from other areas of psychology, direct experimental attacks on its subject matter remained rare and sporadic, especially in comparison with the feverish investigation that so many other topics of no greater intrinsic importance have received. An Aesthetics Section of the British Psychological Society was founded in 1922 but ceased to exist in 1937.

During the 1960s, however, there have been unmistakable signs of reviving interest in the psychology of art and aesthetics in many parts of the world. The impressions of anybody who surveys the research literature will confirm this, but there are many other tangible signs. The International Association for Empirical Aesthetics was founded in 1965 and began to organize periodic International Colloquia. The International Congresses of Aesthetics have been including papers by experimental psychologists and other behavioral scientists since the fifth Congress, held in Amsterdam in 1964. Division 10 (Psychology and the Arts) of the American Psychological Association is undergoing a clear revitalization. A large symposium on "Problems of Artistic Perception" was held in Moscow in 1968.

There are evidently several reasons for this resurgence. Social and economic forces are bringing us up against problems of leisure and problems relating to the human environment. Disciplines like geography and urbanology are not only paying more attention to aesthetic and related aspects, as well as to hygienic and practical aspects, of the matters that concern them. They are interesting themselves more and more in the light that contemporary psychology can cast on these aspects.

But much of the encouragement for renewed interest in psychological

aesthetics comes from a number of recent developments, which hold out hope of breaking the log jam of decades and moving ahead from now on at a faster pace. A surprising number of lines of research have demonstrated the motivational importance of factors like novelty, complexity, surprise, and ambiguity. The term "collative" variables has been proposed to cover all of these. As will be argued in the book, these seem to be identifiable with the irreducibly essential ingredients of art and of whatever else is aesthetically appealing. The rapid crescendo of experimental work on the various psychological effects of these variables has given rise to what may justifiably be called the "new experimental aesthetics."

Apart from this, information theory has supplied techniques for analyzing and measuring some of the properties of perceived patterns that are of the utmost concern to aesthetics, and great advances are being made towards unraveling the brain processes that underlie pleasure and reward. In fact, most of the current research with the greatest relevance and promise with respect to aesthetics does not go on under the heading of "aesthetics" at all, and the fields in which it is to be found are ones commonly considered remote from the study of art.

The primary aim of this book is to review developments in all these areas of research, to compare them with what aestheticians of both recent times and past centuries have had to say, and to attempt a provisional synthesis that will at least bring key problems to the fore.

Readers are accustomed to finding profound analyses of individual artists or individual works in books on "the psychology of art." What will be found in this book is quite different, which is one reason for the choice of terms in the title. To any one who has read, and felt himself enlightened by, typical examples of the literature on art, our content must seem like scratching the surface. But there is no known way of reaching the depths of anything without going through the surface, and when, as in the present case, we have to make our way through recalcitrant material, a considerable time must unavoidably be spent near the surface in the early stages.

A preliminary statement of some of the points made in this book appeared in Chapter 9 of an earlier book, *Conflict, Arousal and Curiosity* (Berlyne, 1960). They had grown out of an attempt to review research by myself and by many other investigators on exploratory behavior and kindred topics. At least some phases of human aesthetic behavior constitute singularly elaborate forms of exploratory behavior and cannot be altogether unrelated to the simpler forms of exploration that have been studied in human beings and in lower animals.

Some years later, I did my best to review several currents of psychological and physiological research that connect upward or downward

changes in arousal with reward or pleasure. The resulting tentative account of psychophysiological mechanisms underlying hedonic processes was presented at the 1967 *Nebraska Symposium on Motivation* (Berlyne, 1967). As was mentioned at the time, recent findings in this area of inquiry seemed to provide valuable hints to anybody who sought to understand the most puzzling of all forms of pleasure, namely those that depend mainly on the structure of stimulus patterns and the interrelations of stimulus elements—in other words, aesthetic pleasures.

Apart from the much exploited "intelligent general reader," the subject matter of the book could be of interest to two principal audiences, namely specialists in psychology and specialists in art. There are, of course, grave difficulties in designing a book for such different groups of readers, so that some indulgence must be requested from both. Psychologists must excuse me either for laboring what may be obvious and familiar to them or alternatively for making bold statements that they can recognize as oversimplified and controversial (although I have done my best to distinguish what is generally accepted among psychologists from what must be regarded as open to debate). Nonpsychologists will be asked to take on trust statements that cannot be elaborated in the space available or that can only be followed rather vaguely by somebody without previous instruction in psychology. I have tried to bear the non-psychologist in mind and to give at least minimum elucidations of everything for his benefit. But he may from time to time encounter references to "variables," "correlation coefficients," and "factor analysis" without being in a position to appreciate fully the implications of statements using these terms. He may feel induced or compelled to skip some of the more technical-sounding passages here and there. On the other hand, the psychologist might feel inclined to pass over Chapter 1 (which is meant primarily to correct misconceptions of the objectives of contemporary psychology that are common among laymen) or Chapter 4.

Apart from some preliminary research and final polishing, which were carried out at the University of Toronto, the book was written at the Institut d'Esthétique et des Sciences de l'Art of the University of Paris. I spent the academic year 1968-69 at this Institute, while on sabbatical leave from the University of Toronto and holding a Visiting Professorship awarded jointly by the Scientific Affairs Division of NATO and the Minna-James-Heineman Foundation. I must thank the extremely congenial personnel of the Institute for their never failing helpfulness and especially Professor R. Francès, both in the capacity of Director of the Institute and in that of Director of the Laboratory of Experimental Psychology of the University of Paris-Nanterre, where he allowed some experiments to be carried out. The opportunity was also taken during the year to benefit from discussions in several countries, not only with

psychologists interested in aesthetics and motivation, but also with representatives of other pertinent activities, ranging from neurophysiologists to painters.

The preparation of the manuscript and some of my own research reported in it were supported by research grant APB-73 from the National Research Council of Canada. The typing of the manuscript owes a great deal to the skills and resourcefulness of Miss E. Asome, Mrs. J. E. Peters, and the staff of the University of Toronto Stenographers' Pool. Mrs. Peters also gave invaluable and efficient help in the preparation of the bibliography and indexes and in many other ways.

D. E. B.

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## PSYCHOBIOLOGY

Most books on the psychology of aesthetics or of art begin by saying what is meant, or is going to be meant in the book, by "aesthetics" or by "art." But at this time, it seems best to postpone the question of how art and aesthetic phenomena may be defined or characterized and to begin instead with a discussion of what is going to be meant by psychology.

Many different activities are carried on at the present day under the heading of "psychology," and even more have borne this label in the past. These activities vary widely in their goals and in their methods, and it is often hard to tell what they all have in common apart from the fact that they all make statements about human beings and sometimes about animals. In this book, the word "psychology" will refer to the kind of subject matter that is taught in departments or institutes or laboratories of psychology in contemporary universities in virtually all advanced countries. It is in fact coming to flourish in more and more parts of the world. It is very different from what many laymen have been led to picture as psychology. The widespread image is dominated by popular accounts of psychoanalysis and of the use of psychological tests to measure human abilities and personality traits. Consequently, many people, including exponents of other professions and scholarly disciplines, react with astonishment, and not infrequently with incredulity, when told that many present-day psychologists have no professional interest whatever in neurosis and psychosis and that they are in search of principles applying to human beings in general, and perhaps also to many animal species, rather than immersing themselves in the dissimilarities that make every human individual unique.

It is not surprising that many laymen and beginning students of psychology feel confused and aggrieved. They find that what most psychologists have to dispense bears little resemblance to the "psychology" that they have heard so much about, which seems to be a partly philosophical, partly literary, partly medical pursuit. They feel that psychology ought at least to deal with problems of the "psyche," i.e. the mind or soul. Actually, if they really want to take word origin seriously, they should demand that psychologists study the physiology of respiration.

tion, since the word "psyche" is a derivation of the Greek verb "*psykhein*", meaning "to breathe."

It might very well be helpful if the name "psychology" could be abandoned altogether or perhaps be left to those who approximate the widespread image of a psychologist. But as often happens when the disadvantages of a particular nomenclature begin to be recognized, it is no doubt too late. For one thing, modern psychology grew out of earlier activities, from which it is very different, quite gradually, so that there never occurred such a complete break that the adoption of a new name seemed called for. Alternative names have, however, been proposed from time to time, such as "anthropology," "behavioristics," "psychonomics," and "pragmatology." But it seems unlikely that any of these will catch on. "Experimental psychology" is sometimes used to distinguish the kind of psychology with which we are concerned. But this expression has, unfortunately, acquired a variety of meanings, some of them of rigorous research, based on observation, that do not involve experiments in the strict sense of studies in which an experimenter controls or manipulates a situation. So it may very well be that the word "psychobiology" will turn out to be the best and least misleading compromise. There are, in fact, signs that this term is coming to be used more and more.

### Psychobiology as a branch of science

The first observation to make about psychobiology is that it is a scientific discipline. This statement is apt from the outset to provoke unfavorable reactions ranging from derision to revulsion. But these misgivings are based on misunderstandings.

Some will express vigorous incredulity on the grounds that psychology is far from being an "exact science." By this they mean that psychologists, unlike exponents of, say, physics or chemistry, cannot explain the processes they study with precision and confidence and cannot provide fully adequate solutions for practical problems of a psychological nature. In fact, the only honest answer that a psychologist can give to most of the questions that laymen are likely to address to him is "We don't know! More research needs to be done!" Whether a branch of study can be called scientific does not depend on whether it has yet answered its questions. It depends on what kinds of questions it is asking and what methods it adopts in seeking answers to them. In other words, it does not become a branch of science when it has successfully completed its work but, from the outset, when its course has been set.

The aims that distinguish scientific inquiry from other intellectual activities can be summed up quite briefly. First, scientific inquiry con-

fines its attention to observable phenomena. This means that it is concerned with events that can be perceived through the eyes and the ears, so that there can be more measure of agreement about the nature of an event among observers in the same vicinity. Statements will at times be made about entities and occurrences that cannot be directly observed, but these are invoked as aids to making sense of observable data. Then, scientific inquiry claims not only to describe observable events but to note associations and correlations among them—in other words, to indicate which events tend to go together with which—enabling them to be predicted, controlled, and explained.

The ideas of prediction and control, when applied to human beings, may immediately cause alarm in many circles. Some people refuse to believe that what human beings do can be predicted and controlled. Others feel that it would be highly undesirable if it could be done. These terms all too often conjure up images of sinister Svengali-like characters who "bend people to their will" or mysterious "thought-reading machines" by means of which everything that anybody does or thinks can be foretold in advance. But these are misconceptions. Psychology like other branches of science deals with probabilities. To predict in the sense that is relevant here means simply to be able to say what is likely to happen with more success than by guessing at random. Similarly, to control phenomena means simply to be able to make them more likely or less likely to occur than they would be otherwise. The word "influence" might convey this idea more accurately, but the word "control" has already acquired this kind of technical sense. It is easy to see that any kind of interaction among human beings, whether it be the large-scale organized activity of government or industry or simply a social gathering of a few friends, would be impossible if we were entirely unable to foresee what anybody is likely to do. The sole function of many social institutions that are widely accepted as indispensable, e.g., child rearing, education, and law enforcement, is to control and influence human behavior.

The nature of explanation is unfortunately more difficult to specify than that of control and prediction. There is less agreement on what it amounts to, and it could do with much more analysis than it has received. To explain something means to provide statements that could answer a question beginning with "why." Various kinds of statements perform this function in different contexts, but the kind of explanation that scientific inquiry can provide is a "causal" explanation. This is a matter of relating an event to be explained to other events that occur at the same time or have occurred previously. Once again, it can deal only with the probable accompaniments or consequences of the events that are singled out as causes. As a branch of science advances, effects and causes can be specified with greater and greater precision and as-

surance. The natural sciences, physics and chemistry, can now predict, control, and explain much of their subject matter with virtual certainty. The behavioral sciences, like psychology, are still a long way from this, although they are advancing progressively in this direction.

In view of the widespread suspicions and fears of the application of the scientific method of inquiry to human activities, especially to such revered activities as the arts, the circumscribed limits within scientific investigation goes on must be emphasized. A science is one of the many pursuits that use language to formulate statements about natural phenomena and are held to contribute to "knowledge." But it is far from being the only one. Its aims and the statements it provides in fulfilling them are worthwhile and important. It is one of the few that incorporates reasonably clear-cut criteria for determining how successfully their aims have been fulfilled. There are, however, many people who regard themselves as contributing to knowledge but who have set themselves very different aims and have consequently used language in very different ways.

As far as art and aesthetic phenomena are concerned, psychology and other branches of science (including physics, chemistry, and physiology) can try to answer certain questions that might appropriately be asked. But other kinds of questions to which answers might be welcomed must be outside their field of competence. Some of these will fall within the bailiwick of aesthetics, criticism, and art history. Aesthetics, as a branch of philosophy, has in the last few decades received some rather severe blows (see Plebe, 1959). Writers like Ogden and Richards (1923) and the logical positivists have contended that its statements are nothing but expressions of emotion, designed to evoke similar emotional reactions in readers, and cannot thus be classified as true or false. Consequently, the value of non-scientific aesthetics has been called in question. Science, including the psychology of art, must keep aloof from issues of this sort. It has its own tasks to get on with. Tasks that fall outside its domain may be legitimate and worthwhile and, if so, must be left to other disciplines using other methods. Although scientific and non-scientific approaches to the same subject matter can often be fruitfully brought into contact with one another, their methods and their objectives are so different that any attempt to combine the two will, it is safe enough to say, redound to the disadvantage of both.

One of the main obstacles to appreciating the value of scientific inquiry, especially as applied to aesthetic phenomena, is what we may call the fallacy of "nothing-but-ism." This consists of supposing that, when the scientific investigator says that a human being, or art, or anything else, is this, that, or the other, the statement implies that he, she, or it is "nothing but" this, that, or the other. An exponent of a particular branch of science has to confine his attention to those particular char-

teristics that are relevant to his particular goals of the moment. This does not mean that there are no other characteristics that would be worth noting by someone with different objectives.

So, if an engineer is designing a footbridge over which human beings have to be able to walk safely, all that matters to him is that a person has a certain weight and will occupy certain locations on the bridge. From this information, he can calculate stresses and identify a structure that will resist them. The results of his calculations would not have been any different if the human beings he is considering had been replaced by sacks of potatoes of the same weight on wheels. This does not of course imply that human beings are without important attributes other than weight and location, or that there are no differences between human beings and sacks of potatoes that would be of the utmost importance to other branches of science or for various nonscientific pursuits. To represent a man as a gravitational force applied to a certain point is not to say that he is "nothing but" a gravitational force. It is not to deny that he may also be an arrangement of vital organs (for the anatomist or physiologist), a "featherless biped" (for Plato or the modern zoologist), "the beauty of the world! the paragon of animals!" (for the poet), or "the most ravenous of all the beasts of prey" (for the philosopher).

Scientific inquiry cannot advance very far without working out techniques for measuring properties of its subject matter. And since the effectiveness of a work of art invariably hinges quite subtly on how much of a certain quality is present, measurement must play a central role in the psychology of art. This in itself is a common cause of disquiet. It is often found convenient, especially in these days of sophisticated data processing, to represent human beings and some of their attributes by numbers. Many people feel, quite unreasonably, that they are being reduced to "numbers" or treated as though they were "nothing but" a collection of numbers. Strangely enough, these people have names and are usually quite attached to them. They do not mind in the least when they are addressed by their names or see their names in print. They understand quite well that the use of a name to represent a human being can be a useful device in many situations. They do not complain that to have a name means to be treated as "nothing but" a collection of letters of the alphabet.

The objections that we have been considering are apt to come mainly from conservative and traditionalist circles. But somewhat similar misgivings are often expressed nowadays from a Marxist or neo-Marxist point of view. The nonevaluative, empirical study of art may be felt to contribute to the "alienation" of "bourgeois" society, to kill the enjoyment of art and neglect the ways in which art can be a vehicle of social progress. Marcuse (1941), echoing many previous critics of "positivism,"

claims that those who favor "negation of metaphysics" and the "subordination of imagination to observation" must "acquiesce in the given." Some would no doubt feel it to be a betrayal of an ideological commitment if they questioned this assertion. But others will find it unconvincing. There undoubtedly are people who are so preoccupied with examining characteristics of human life as it has so far existed, and the functions that these characteristics can be seen to have performed, that they fail to feel indignant at what they should find intolerable and to work for its removal. However, this is not a necessary consequence of objective research. The unbiased investigation of facts and of the causal laws that govern them is surely a necessary preliminary to deciding which facts ought to be altered and how this can best be done. The approach that we are adopting does not imply so much negation of metaphysics or criticism or evaluation as the separation of these activities from empirical research. The objection that empirical research is bound to be colored by one's value systems and general view of the world will be made, and anybody who fails to see this will be accused of naïveté. But there is nevertheless an important difference between those who try to exclude subjective biases as much as possible and those who deliberately give them free play.

If the processes of ascertaining facts and interpreting them in the light of an ideology are combined, the resulting dangers are obvious. Only facts that fit the ideology are likely to be noticed, and they are apt to be distorted in support of a preordained interpretation. In other words, a critical attitude to the facts is likely to be achieved at the expense of a critical attitude to the ideology.

### Psychobiology as the study of behavior

For a long time, psychologists regarded "mind" as their subject matter. Mind was identified with conscious experience in the early day of experimental psychology, but Freud and other depth psychologists introduce the concept of unconscious mental processes that ought to be added to the psychologist's area of concern. Nowadays, it is widely acknowledged that psychologists must study human and animal behavior. Some psychologists still accept that the mind as well as behavior is their concern. There is, in fact, a lively neo-cognitivist or neo-structuralist current that grew up in the early 1960s and aims to lay bare mental structure, while denying that those who possess these structures are necessarily aware of them. Such a view inevitably affects methods of investigation and the content of theories. But it makes less difference than might be supposed, since what goes on in the mind can be subjected to scientific inquiry only insofar as it is reflected in observable behavior.

By behavior is meant changes in the organism that can be accessible to an observer, as distinct from those that only the subject himself can know about. Bodily movements are included, of course, as well as what the subject says spontaneously or in reply to questions. Behavior can also be taken to include processes going on inside the organism, including those in the brain, that can be detected only with the help of sensitive instruments placed in contact with the surface of the body. The psychologist interested in behavior is willing to talk about processes going on inside the organism that cannot be observed directly but must be inferred from what can be observed. There are arguments about the precise logical status of these "intervening variables." They are however indispensable devices for handling, and making sense of, the extremely complicated interrelations that often connect observed facts. Furthermore, as already mentioned, the student of behavior is interested in the verbal responses of human subjects. The late nineteenth- and early twentieth-century psychologists interested in conscious experience regarded the "introspective report" as their main instrument of inquiry. The present-day psychologist has quite a different attitude to verbal reports. He does not regard them as a peephole through which he can have a grandstand view of what is going on inside the mind. He regards them rather as an incomparably rich, but not necessarily complete, accurate, or precise, source of information about internal processes. He is also likely to prefer verbal responses that conform to restrictions imposed by rigorous methods of questioning. These can yield data amenable to sophisticated mathematical analysis.

What has just been said implies that, as far as aesthetics is concerned, the experimental psychologist or psychobiologist must concentrate on the scientific study of *aesthetic behavior*. This means the behavior of the creative artist when he is producing a work, the behavior of the interpretative artist when he is performing a work, and the behavior of the "appreciator," (to introduce a word that will conveniently stand for the reader, listener, viewer, or audience member) when he is exposed to a work of art, as well as the behavior through which the appreciator seeks exposure to works of art. Once again, visible bodily movements, audible speech, and psychophysiological processes recorded by appropriate equipment will be included.

Much of what is commonly expected from those who concern themselves with the psychology of art and much of what is commonly offered under this heading will be omitted. Many art lovers like to read detailed accounts of the experiences that a creative artist goes through or that a work of art evokes in the appreciator. Psychoanalytic writings have also fostered interest in accounts of unconscious mental processes that are alleged to play a part in the formation and appreciation of art. But all these cannot yet be derived from scientific study in our restricted

sense. They cannot yet satisfy the criteria by which a product of scientific study must be judged. In any case, it is one of the tasks of the poet or novelist, and of those forms of art criticism that approach artistic creation, to depict aesthetic experiences in full richness. This alone makes it inappropriate or presumptuous for the behavioral scientist, with his very different techniques and training, to attempt to do so.

### Psychology and biology

Largely owing to the impact of the theory of evolution, modern psychology has one salient characteristic that marks it off rather sharply from anything that went by the name of psychology more than a century ago. Psychologists have come to recognize that the behavior they study depends on biological processes. For one thing, the form it takes is determined by events in the body—mainly in the brain, of course, but also in other organs. Secondly, every piece of behavior is the product of two mechanisms by which behavior is made adaptive. The first of these is *natural selection*, which has given rise to bodily structures that engender inherited patterns of behavior, some of which appear from birth and some of which appear in later stages of development after a process of maturation. The other is *learning*, a term that psychologists use in a very broad sense to cover acquisition of a habit, a skill, an attitude, a belief, or any form of behavior that results from interaction with the environment.

In carrying out his work, the psychologist must constantly keep in close touch with the findings of other biological sciences, including general biology, evolutionary theory, genetics, embryology, general physiology, and, especially, brain physiology. He must concern himself with animal behavior, as well as with human behavior, and do his best to determine how the two are related (which, needless to say, means noticing differences as well as similarities between them).

So the psychologist cannot feel that he has completed his work and explained a form of behavior until he has placed it in a biological perspective, which means relating it to natural selection and to learning. Every form of behavior must depend on bodily structures, including characteristics of the human nervous system, that have appeared in the course of evolution because they could contribute to the survival of the individual and of the species. This must hold for aesthetic activities as well as for any others, so that the psychological study of art must include a search for the biological origins of art.

Here a word of caution must be offered. We must assume that all existing behavior depends on bodily characteristics that have been inherited and preserved by the species because of some selective advantage

### Psychobiology

or survival value and perhaps also on some learning capacities that have established themselves because of their role in the competitive struggle for existence. This does not necessarily mean that everything that we now do contributes to health and longevity. On the contrary, many of the uses that we make of our biological equipment are indifferent or even harmful to our physical well-being.

An example is thinking. We must assume that our ancestors acquired and retained the capacity to think because this capacity enabled them to compete more effectively for the necessities of life and to protect themselves more effectively than animals that lacked these capacities. Nevertheless, much of the thinking that we do today is not directed at practical problems, let alone at matters of life or death. It is, in fact, by no means impossible that, within the next century, the human race will exterminate itself as a result of its thought processes in a way that would be quite out of the question for species that are unable to think.

So, to revert to art, it is quite possible that aesthetic activities perform valuable or even indispensable biological functions at present and that human beings are healthier and more viable with them than they would be without them. Various suggestions along these lines have been made, and we shall examine some of them in the final chapter. Whether this view has any validity remains to be determined. It does not have to be the case, but the biological roots of art must be sought whether it is the case or not.

Once again, it must be stressed that the analysis of art in biological terms, which is the province of a psychologist and his colleagues in other biological sciences, is only one of many ways of approaching art. Other approaches have their exponents and their audiences, but the value of what they are doing must be judged by other criteria than those adopted by science.

## 2 HISTORICAL OVERVIEW

### The foundation of experimental aesthetics

Like so many other intellectual currents, the discussion of aesthetic problems has gone on continuously in Western society since it was launched by the philosophers of ancient Greece. Important writings on aesthetics have also been produced for many centuries by other major civilizations, notably those of India, China, and Japan. In these literatures, psychological questions have inevitably been considered in conjunction with questions of other kinds. Answers to psychological questions were generally based, until recently, on generalization from an author's own experiences when confronted with works of art and on his day-to-day observation of his fellow men. These are, of course, extremely hazardous bases on which to erect dogmatic theories, and they leave many gaps, which do not always become fully apparent until more rigorous methods of inquiry have come into use.

The beginnings of experimental psychology are commonly traced back to the publication in 1860 of the book *Elemente der Psychophysik* (Elements of Psychophysics) by the German physicist and philosopher, as well as psychologist, G. T. Fechner. Earlier pioneers, such as E. H. Weber and Sir Francis Galton, had, however, sought answers to psychological questions with the help of systematic empirical methods about the middle of the nineteenth century.

Aesthetic phenomena are among the most complex phenomena within the domain of psychology, and this is often used as an excuse by psychologists for being able to say so little about them. Nevertheless, they were actually among the first to be taken up by experimental psychology. Fechner was, among other things, the founder of "experimental aesthetics," and the first studies to which this label can be attached were carried out by him over 100 years ago.

An experiment on preferences among rectangles was carried out in 1865 (see Ch. 14). But what was apparently the first empirical investigation on reactions to works of art took place in 1871, when two versions of Holbein's *Madonna with Burgomaster Meyer* were displayed side by side in a Dresden museum. There had been controversies on the authenticity of these two versions, and Fechner took part in them. Experimental

### Historical Overview

or other empirical methods could hardly answer this question, but Fechner realized that another question, namely which picture was more highly valued, could be investigated by asking visitors to the exhibition to write down their judgments. The experiment did not fulfill its primary aim. Only a small portion of the visitors responded to the invitation to participate, and, of these, a large number failed to carry out the instructions properly so that their judgments could not be used. Nevertheless, Fechner's innovation was of the highest importance methodologically, since it introduced the practice of answering psychological questions pertaining to art by obtaining and recording the reactions of a sample of subjects representing a particular population. In 1876 Fechner published a book called *Vorschule der Ästhetik* (Elementary Aesthetics). The contents of this book were mainly theoretical, but it included reports of a few experiments that were carried out in more rigorous conditions than the Dresden experiment. Fechner characterized the new experimental aesthetics that he was advocating as an aesthetics "from below," meaning by that one that began with particular facts and worked its way up to generalizations, thus contrasting with the aesthetics "from above" that went from "the most general ideas and concepts" to the particular and was exemplified by the traditional aesthetics of the philosophers.

Fechner also pointed out three methods to be used for experiments in aesthetics, all of which have been in use from that time on. First, there was the *method of choice*, in which several subjects are presented with a number of objects and asked to compare them with respect to their "pleasingness" (*Wohlgefalligkeit*). Variants of this method have dominated the experimental psychology of aesthetics ever since. Secondly, there is the *method of production*, in which subjects are required to produce an object (by drawing or by manipulating some apparatus) that conforms as far as possible to their tastes. Finally, there is the *method of use*, in which works of art or other objects are examined, on the assumption that the characteristics that are most commonly found in them will be those that win the most widespread approval in the society that has originated them.

Since the publication of Fechner's book, there have been many experiments in which judgments indicative of preferences have been elicited from samples of subjects. Sometimes these experiments have been conducted under the heading of "experimental aesthetics." At other times, they have been classed with some other area of psychology, such as personality study or motivation theory, although their findings are of undoubtedly relevance to aesthetics.

Sometimes, genuine artistic material, such as reproductions of paintings, pictures of vases, and musical excerpts, has been used. At other times, the material has been much simpler, consisting of patches of

color, visual shapes, or isolated sounds. In the former case, there is the advantage of studying reactions to real art and the disadvantage that any two works of art differ from each other in several different respects, so that the actual factor responsible for any differences in reactions to them is difficult to pin down. The use of artificially simple material overcomes this drawback but may be open to the criticism that it is a long way from anything that could be regarded as art and may thus prevent us from identifying essential components of real-life aesthetic behavior.

The procedures for obtaining and recording judgments have become more and more varied as the scaling techniques used by psychologists have become more and more sophisticated. Subjects might, for example, be asked to rank-order a collection of objects from the most to the least preferred. One common method is the method of paired comparison, in which objects are presented for judgment two at a time, so that the preferred member of each pair can be indicated. This amounts, of course, to rank-ordering two objects at once. The method of triads, in which objects are presented three at a time and the most and the least preferred member is to be indicated on every trial, amounts similarly to rank-ordering by threes.

Subjects may, on the other hand, be required to select a number representing degree of preference or liking for each object in the collection in turn. As a variant of this rating method, subjects may be asked simply to pick out objects that they like, which is equivalent to rating every object of the collection on a 2-point scale, assigning either the number 1 or the number 0.

The aim of such experiments has sometimes been, as it was for Fechner and his immediate successors, to relate preferences to properties of the works of art or other objects that are presented. In recent decades, many of them have been designed to ascertain relations between differences in taste and differences in personality.

We have available today a whole armory of refined mathematical techniques for analyzing the data that come out of experiments in which verbal judgments are obtained. These techniques permit us to work out systems of dimensions, along each of which a score can be allotted to a particular object. Different objects can then be compared quantitatively with one another, and each object can, in fact, be assigned a location in a multidimensional space. Moreover (Coombs, 1964), every judge (subject) can be assigned a point in the same space, representing the "ideal object" that would come nearest to satisfying him completely. Geometrical principles can be used to calculate the distance between the subject's ideal point and any object that may be submitted for his judgment, so that the smaller the distance the more the subject will like the object. Similarly, the closer together the points correspond-

ing to two objects, the more the objects will resemble each other in the properties on which preferences depend. Sometimes, there will not be much similarity between the spaces derived from the judgments of two subjects, so that a separate system must be worked out for each and will tell something about the way his tastes are organized. At other times, there will be a high degree of consistency among subjects, so that their ideal points can be located in the same space and distances between them will indicate how far the tastes of individuals resemble one another.

### Psychoanalysis and Gestalt psychology

Although in his *Vorschule der Ästhetik* Fechner laid down some sixteen principles of aesthetics, they were derived from informal everyday observation and not from the empirical studies that he initiated and advocated. The numerous preference-scaling experiments that have succeeded his work have yielded a large number of worthwhile findings. But, at least until relatively recently, little in the way of theory, and especially little in the way of theory linking aesthetic with other psychological phenomena, has arisen from them.

In the early part of the twentieth century, however, the influence of two very different psychological movements began to be felt, namely psychoanalysis and Gestalt psychology. Both of them developed comprehensive psychological theories with important things to say about art as about other matters. They both based their theories on empirical observations, although only the Gestalt school can be said to have conducted experiments in the true sense. Neither of them carried out substantial empirical research on aesthetic phenomena directly. They both formed the conclusions that they drew about aesthetics by generalization from their research on other phenomena.

The contributions of the psychoanalysts consist mostly of analyses of individual artists or individual works. Famous early examples are Freud's papers on Leonardo da Vinci and Michaelangelo's *Moses* and Ernest Jones's study of *Hamlet*. But apart from these, statements about art in general can be found scattered through the writings of Freud and his followers. Some of the overall conclusions have been summed up by Prescott (1912), by Sterba (1940), and by Waelder (1965).

Freud's explanation of the creation and appreciation of art had much in common with his explanation of other imaginative products, including dreams, slips of the tongue, jokes, fairy tales, neurotic symptoms, and psychotic fantasies. Like these other phenomena, art is interpreted as a vehicle of disguised expression for unfulfilled wishes, which are to a large extent unconscious. It effects compromises between the

fundamental biological desires that belong to the "id" and the demands of the "ego" and "superego," which are the parts of the personality that handle adaptation, respectively, to external reality and to the demands of society. The ego and superego are usually responsible for frustrating direct gratification of the desires that must seek symbolic fulfillment as a substitute. They also impose the distortion or disguise that prevents the "latent" content from becoming manifest and thus arousing anxiety.

Some dreams and fantasies, however, depict painful and frightening, rather than desired, experiences. This certainly applies to a great deal of art also. In later psychoanalytic writing (e.g., Freud, 1920), "mastery" of anxiety by "working through" disturbing material was recognized as another function of imaginative activity. The relevance of this process to art has been emphasized by Kris (1944).

There are, however, some important differences between art and other outgrowths of fantasy. The unconscious content of a work of art has some degree of universality, so that it can perform a substitute-wish-fulfilling function for many people and not just for the artist himself. Like all fantasy, it represents a turning away from reality, but the artist "finds a way back to reality," because he molds his fantasies into "truths of new kind, which are valued by men as precious reflections of reality" (Freud, 1911, p. 224). Finally, "by obeying the laws of beauty" in constructing his works, the artist "softens what is offensive in them, conceals their personal origin and . . . bribes other people with a bonus of pleasure" (Freud, 1913, p. 187).

The evidence adduced in favor of psychoanalytic theories comes partly from an examination of human imaginative products such as those already mentioned but mainly from the material produced by free association. Some of this free association was Freud's own and occurred during his attempts to analyze his own dreams, lapses of memory, and other psychological processes. Most of it, however, was that of patients undergoing psychoanalytic therapy for neurotic ailments.

Psychoanalytic theory has been the target of a wide miscellany of criticisms. It is often not easy to see precisely what observable facts are implied by its theoretical statements. There are even times, critics claim, when its statements can be contorted to make them compatible with any imaginable observation, so that they are immune to empirical refutation, which makes them scientifically worthless. Objections have also been levelled at psychoanalysis as a source of data. First, most of Freud's pioneering work was done with patients living in Vienna in the late nineteenth or early twentieth century and belonging to the social classes that could afford the not inconsiderable cost of his treatment. The generalizability of the conclusions to human beings of other social classes,

nationalities, and periods has often been questioned, especially by those having access to the data of comparative anthropology. Freud claimed that his theoretical statements were based on what patients spontaneously said of themselves after acquiring "insight" through intensive therapy. But recent experiments on verbal processes have shown how even slight changes in the behavior of a listener, e.g., facial expressions or mutterings indicative of approval, can direct conversation toward a particular subject matter and increase the likelihood that a particular belief will be expressed. This can apparently happen even when neither the listener nor the speaker is aware that it is happening (Verplanck, 1955). The validity of psychoanalytic assertions about effects of childhood experiences on personality and about the effectiveness of psychoanalysis as a therapeutic technique have been found to be without adequate support in reviews of available findings by Orlansky (1949) and by Eysenck (1953). Some of the psychoanalyst's contentions have, however, been corroborated to some degree by experimental and statistical investigations (Sears, 1943; Blum, 1949), and others have, after some reformulation, been judged compatible with psychological and physiological knowledge from other sources.

The difficulties of determining whether psychoanalytic interpretations are valid and whether more promising alternative interpretations may have been overlooked are of course compounded when analyses of works of art, whose authors are not available for therapy and may not even be living, are offered. Furthermore, while psychoanalytic aesthetics has a great deal, whether it be right or wrong, to tell us about content, it has little to say about the formal or structural aspects of art. In general, Freudian theory encourages us to identify form with the processes, dependent on the ego and superego, that restrict the gratification of instinctive desires, and, in particular, sees a close relation between the constraints of artistic form and the liking for tidiness or orderliness that Freud associated with the "anal-retentive impulses" resulting from bowel training. But this, apart from other doubts that might be expressed about it, hardly deals adequately with many problems pertaining to formal aspects of art. For example, it does not offer any help in determining why certain structures are found much more conducive to aesthetic appreciation than others, especially since slight quantitative differences are so critical. All these strictures are, if anything, even more applicable to the voluminous writings on aesthetics of other depth psychologists, notably Jung and his school.

The views of the Gestalt psychologists on aesthetics are to be found mainly in a paper by Koffka (1940), although the work of Arnheim (1954), one of the most important and prolific contemporary writers on the psychology of art, is rooted in Gestalt theory.

The Gestalt school brought to aesthetics two original and extremely

fruitful ideas. The first of these is "physiognomics," the idea that certain human postures and behavior and certain nonhuman objects are inherently expressive of certain emotional states, because they possess the same structure as these emotional states. For example, a weeping willow looks sad because "willow branches convey the expression of passive hanging" (Arnheim, 1954, p. 434).

A rather similar notion is central to Langer's (1948) aesthetic theory. She holds, for example, that music can symbolize emotional experiences because the music and the experience possess similar temporal patterns: both can have phases of "motion and rest, attention and release, of agreement and disagreement, preparation, fulfillment, excitation, sudden change . . ." (p. 185).

The hypothesis of physiognomic expression is certainly suggestive. But by itself it does not help us to understand why human beings should take pains to expose themselves to expressive patterns. Nor does it indicate which emotional experiences and which forms of expressions will satisfy creative artists and appreciators more than others.

The second and, as we shall see, ultimately more significant contribution of the Gestalt school was the concept of "goodness of configuration." According to Gestalt psychologists, we do not see and hear isolated visual elements or sounds but "configurations" or "patterns" (*Gestalten*), which depend on processes of perceptual organization occurring in the nervous system. Some forms of organization are "better" than others, and the brain tends to gravitate from "worse" to "better" configurations in accordance with the "law of Prägnanz." This law often has adaptive consequences. For example, the search for something that will round off a pattern and leave it with a "good" structure can steer us toward appropriate actions or toward solutions of problems that we are thinking about. On the other hand, the law of Prägnanz is responsible for many of the distortions to which perception, memory, and thought are subject.

Unfortunately, the Gestalt account of the distinguishing characteristics of "good" configurations is, to say the least, rather rudimentary. In discussing the laws of Prägnanz, Koffka (1935, p. 110) states that "the term 'good' is undefined. It enhances such properties as regularity, symmetry, simplicity, and others . . ." These indications are sometimes enough for us to pick out the "better" of two patterns. They hardly permit us to determine, in all cases, which is the "better" of any two patterns that may be presented to us. Furthermore, although "goodness" obviously exists in varying degrees, we are offered no guidance towards devising ways of measuring this property. Regularity, symmetry, and simplicity are readily recognizable as factors that play a large part in determining how satisfying a work of art will be. Here especially, we badly need ways of differentiating the degrees to which these properties exist, or, in other words, of measuring them, since, as we continually have occasion to

note, the success of a work of art requires them to be present to just the right extent. A shade too much or a shade too little can often spoil things.

The Gestalt school was partial to terms borrowed from civil engineering such as "stresses," "strains," "forces," "equilibrium," and "stability." For them, these were more than just metaphors. They maintained that the work of the brain depends on three-dimensional patterns of forces that are set up within it and resolve themselves into "good" configurations, just as, in many physical situations involving networks of interacting forces, changes take place and cease only when a particular kind of structure, affording equilibrium, has been reached. But reliance on concepts that are so firmly tied to a particular theory of brain functioning can be hazardous when our knowledge of brain physiology is still so inadequate. Definitions that are neutral with respect to alternative neurophysiological theories are desirable. During the past 20 years or so, knowledge of how the brain works has made enormous strides. Although a few findings have had some degree of compatibility with Gestalt ideas (e.g., findings indicating the importance of relatively long-lasting potential differences between points in the brain), the emerging picture of the brain's operations is, on the whole, far from consonant with the Gestalt school's speculations.

The Gestalt position has a further serious limitation as far as aesthetics is concerned. Koffka (1940, p. 261), noting that "perception tends toward balance and symmetry," says that "perception is . . . artistic." This suggests that the more balance and symmetry something has, the more artistic it is. It is true that Arnheim, who attaches great importance to balance in his aesthetic discussions, warns against the one-sided and static view of human motivation that overemphasis on balance can engender. Balance may always be the final goal, but the turmoil and striving that precede the attainment of balance are essential also. Nevertheless, the Gestalt school and its law of Prägnanz must unavoidably encourage the view that aesthetic satisfaction goes together with maximum regularity and simplicity, which, as we shall see, is far from being generally tenable.

## Later developments

While all the currents so far reviewed continue to inspire theoretical and experimental work on the psychology of aesthetics, progress in theory has been fitful and desultory. Nevertheless, there are now clear signs of a revival of interest in aesthetics among psychologists, and this is due in no small measure to a number of developments that hold out promise of advances in new directions.

The chief of these are (I) the experimental study of exploratory

behavior in human beings and animals, together with the impact of this work on motivation theory and, in particular, recognition of the motivational importance of factors like novelty, complexity, and uncertainty; (2) the advent of information theory; and (3) neurophysiological and psychological findings centering on the concept of "arousal."

The bearing of these developments on the psychology of aesthetic behavior will be explored in later chapters.

## 3

## IMPEDIMENTS TO PROGRESS

Although men have thought and written about art for thousands of years and the experimental psychology of aesthetics has gone on for a century, nobody can feel content with, let alone proud of, what this work has so far accomplished. A book or article on aesthetics is as likely as not to attempt a completely fresh start, as if nothing had been established that the author is bound to take into account and as if everything that had been said about the arts before now could safely be ignored. And anybody who attends a meeting of aestheticians is apt to hear the same questions raised as were raised thousands of years ago and essentially the same answers proposed.

Why has the outcome of so much effort, stretching over such a long time, been so disappointing? It is not hard to recognize some of the factors that have made progress difficult.

## Art as a supernatural phenomenon

It is well known that the origins of art are bound up with magic and religion. There has been a great deal of speculation about the functions of the earliest known art objects, namely, the paintings and reliefs found in caves that were occupied by human beings in the Old Stone Age. Since they are often found in dark and inaccessible places, and since paintings are sometimes superimposed on one another, it is believed that they did not serve primarily as decoration but that they must have been used in ceremonies designed to favor success at hunting or avoidance of natural calamities. Drama has grown out of religious ritual at several different times and places, (e.g., among the ancient Greeks, in medieval Europe, among the Hindus, in Japan). Poetry, music, pictures, and sculptures are, and always have been, essential accessories to religious practice all over the world, even when, like the sculptures on the portals of Gothic cathedrals or the statues that often stand outside Hindu or Buddhist temples, they play no part in ritual. They serve to acquaint believers with the details of iconography or imbue them with emotions conducive to approved behavior.

In philosophical circles, art has often been connected with the world

of "Ideas" or abstract essences, which is supposed to show dimly through the perceptible objects that surround us. The original and most powerful spokesman of this view, Plato, expressed a contempt for artists, on the ground that they produce imperfect imitations of visible objects that are themselves imitations of Ideas. But later Greek philosophers, like Aristotle and Plotinus, were able to respect artists for their capacity to conceive Ideas or abstract forms and to materialize them in their works, making them accessible to the contemplation of others. The belief that art pictures a superior reality has persisted ever since, whether or not superior reality is identified with something like Plato's world of Ideas.

These lofty views of the functions of art have naturally encouraged lofty views of the character and role of the creative artist. In many societies, such as those of ancient Greece during much of its history, Europe in the Middle Ages, and many contemporary nonliterate societies (see Smith, 1961; Laude, 1966), practitioners of the visual arts have often been regarded simply as craftsmen, who might very well achieve respect and wealth if they do their work competently but are hardly counted among the higher orders of humanity. Poets and musicians have commonly enjoyed higher esteem, perhaps as Hauser (1951) suggests, because visual artists work with their hands and are apt to get them dirty. Nevertheless, there are periods when individual artists come to the fore, their names become known and are proudly attached to their works, and they come to be idolized. This happened, for example, in the later phases of the ancient Greek period, during the Renaissance, and especially during the Romantic period. So the belief that minute analysis of the biographies and personalities of creative artists is worthwhile and even indispensable for the full appreciation of their works has been implanted in Western society for some time, although it would no doubt seem strange in many parts of the world.

In conformity with this glorification of artistic activity, philosophers and critics have commonly spoken of the vocation and character of the artist in the most adulatory terms. And artists themselves have not always been prevented by modesty from concurring.

The way in which the artist conceives of worlds of his own making and gives them lasting reality has been compared with the work of divine creation. We are told by Leonardo da Vinci that painting is "a divinity, because it transforms the painter's mind into something similar to mind of God." In the early nineteenth century, the French critic Lamennais declared that "to know, to understand the work of God is science; to reproduce it in material and tangible conditions is art." Homer pictures the poet as inspired by the Muse. Shamans, who are found in most hunting societies and are the forerunners of our creative artists according to Lommel (1968), serve as mouthpieces for supernatural beings. For Plato, the belief that poets write under divine influence was a further reason

for looking down on them and denying them any credit for what value their works might possess. But many later thinkers, as well as Plato's predecessor Democritus, revered the artist for enjoying special communion with the divine mind, for an ability to see the realities underlying the world. As Plotinus (in the *Enneads*) puts it, ". . . the material thing becomes beautiful by communicating the thought that flows from the Divine."

In humbler and more naturalistic moments, artists have contented themselves with claims to exceptional wisdom and access to mysterious sources of knowledge that are beyond the reach of the average man. "Poetry is the breath and finer spirit of all knowledge" (Wordsworth). "Music is a higher revelation than any philosophy" (Beethoven). "Poets are the unacknowledged legislators of the world" (Shelley). "Greatness in art . . . is the expression of a mind of a God-made great man" (Ruskin). "The artistic life [means] to live as a bourgeois and to think as a demigod" (Flaubert).

It is not for the psychologist either to attack or to defend these attitudes. He can only note them and trace them back to their sources. They and their evaluation belong to nonscientific discussion of artists and the arts. But the fact that works of art and their creators have been held in such awe has certainly made it difficult to adopt the sober, dispassionate stance that scientific examination of aesthetic phenomena must require. It has also inspired a great deal of hostility towards anybody trying to view art coolly and objectively, since any tendency to place art on the same footing as other activities is apt to appear sacrilegious.

### Failure to separate normative and factual questions

Writings of specialists in aesthetics, like conversations about art among ordinary people, have always been devoted in large measure to normative or evaluative questions. There is felt to be a need for criteria by which great art can be distinguished from inferior art; for advice on how to derive as much benefit as possible from looking at pictures, reading literature or listening to music; for guidance on how the creative artist and the performing artist can best carry out their tasks.

These are different from the questions that must be answered by scientific inquiry both in the manner in which answers are sought and in the standards by which answers, when offered, are judged. A branch of science like psychology must confine itself to investigation of facts and of associations among facts. Normative and factual inquiry must be sharply differentiated from each other and carried on separately. Unfortunately, this has not always been done. The habit of thinking about

art in terms of evaluations is so firmly ingrained that it is difficult to adopt the neutral and uncritical point of view that is needed when facts are the target. For one thing, psychologists and others writing on art like to show that they are persons of culture, who can tell the difference between good and bad art and would not be caught dead talking about both in the same breath.

Although the two kinds of inquiry must follow separate courses, their results, once obtained, can often be collated with advantage. The aesthetician interested in normative problems might well find it helpful to take into account what psychologists (as well as anthropologists and sociologists) have discovered about aesthetic behavior. For example, the psychologist has to face the problem of why art exists at all, and, as we have seen, he has to seek biological solutions to this problem. This means, insofar as he relates aesthetic behavior to heredity, asking how it may be an outcome of bodily characteristics that favor survival and, insofar as he relates it to learning, considering what functions it performs for contemporary human beings, so that it reappears and is maintained in every generation. The first of these aspects can have an indirect bearing on problems of evaluation, since it directs attention to the needs of our ancestors, who lived in very different conditions from ourselves. Although we must suppose that the ability to think appeared because it enabled our ancestors to outwit their predators, their prey, and their competitors for limited supplies of food and mates, we do not feel obliged to value most highly the thought processes of those who corner the food market at times of scarcity. On the other hand, if we can show that the arts confer benefits on those who cultivate them at the present time and that this has a great deal to do with the acquisition of aesthetic behavior, somebody seeking criteria for evaluation might very well decide to judge works of art according to how effectively they confer these benefits. But he does not have to adopt this touchstone. For example, if pleasure and preference are indices of these benefits, he may, as many aestheticians and art critics have done in the past, refuse to assign the highest value to those works that are liked by the most people.

In recent Anglo-American philosophy, the possibility of differentiating evaluative from factual statements has been called in question. There has been some lively discussion on this issue since it was stirred up by Austin (1962). It can, it is true, be claimed that any statement meant to be factual must inevitably have some evaluative content, if only by implying that the stated fact is worthy of attention. Similarly, it is difficult to make value judgments that are entirely cut off from description or statement of fact. Comparable points have been made repeatedly by philosophers belonging to the continental European Hegelian and phenomenologist-existentialist traditions. Be that as it may, there is still a difference between striving to keep normative matters out of one's

inquiry as much as possible and giving them a central position from the outset.

### Art as a unitary phenomenon

As we noted at the beginning of the first chapter, writers on aesthetics usually feel bound to present fairly early some statement of what art is. This means providing some brief definition or characterization of art pointing to a small number of closely interconnected functions or attributes that all works of art have in common. A widespread underlying assumption is that art has one unitary "essence," which must be identified and taken as a starting point for further discussion. Even though objects that do not fit the definition or categorization may be called "art" by some people, it is implied that they are wrong to do so. The author's own view of art and the principles that grow out of it are then supported by detailed analysis of selected examples that appear to be confirmatory. There is no mention of other artistic material that may be difficult to square with the author's assertions.

This is, of course, an example of the case-history method on which so much has been built in other areas that are of interest to the psychologist, notably psychopathology. The illustrative material that is presented makes a theoretical treatise more interesting and understandable. The theory is admirably designed to throw light on each illustrative case. But apart from the difficulty of deciding whether some other interpretation might account for the facts just as well, it is usually impossible to know whether the illustrations are representative or whether at least as many could be found that would refute the theory.

It has been so thoroughly accepted as the duty of an aesthetician to depict art as something with a single, unitary essence, which has finally been tracked down by himself, that anybody who fails to do so is liable to be condemned as an "eclectic." Nevertheless, some recent aestheticians have protested against this "essentialistic" thinking (e.g., Heyl, 1913; Gallie, 1948; Duvignaud, 1967), and anyone embarking on a scientific study of art must certainly approach with scepticism the idea that there is one purpose for which all art is designed.

When we speak of "functions" of something like art, we are looking for useful or beneficial effects of art, but there is more to it than that. We are looking for effects without which art would not have come into existence and would not continue to exist. It is on the face of it rather implausible that we can find one explanation for something as extraordinarily complex and heterogeneous as art. After all, even confining ourselves to Western civilization, we are dealing with something that ranges from the *Hermes* by Praxiteles to a kinetic construction by

Tinguely, from a Raphael Madonna to a Pollock action painting, from a Puccini opera to electronic music, from the *Iliad* to twentieth-century concrete poetry. Psychologists as far apart as Freud (1900) and Skinner (1957) have shown how even a single thought or word can be selected for several reasons simultaneously and depends on what they call, respectively, "overdetermination" and "multiple causation."

Nature frequently uses one device as a means to several ends and several devices as means to the same end. The blood, for example, serves to transport nutritive substances, waste products, oxygen, carbon dioxide, and the hormones that constitute a chemical communication system. It also helps to regulate body temperature by distributing heat evenly and contains the leucocytes that destroy harmful microorganisms. Some of these multiple functions of the blood are at the same time supplemented by the work of other organs. For example, regulation of body temperature is also facilitated by changes in the basic metabolic rate, by fluctuations of muscular activity, and by perspiration. Communication between one organ and another is carried out by the nervous system as well as by the endocrine system.

As Sparshott (1963) points out, even an object like a car, which was certainly invented with one specific function in view, can be useful in many different ways. Some of them, like providing taxes for the government and employment for garage mechanics, can hardly be regarded as "functions" in our sense; they exist because cars exist rather than vice versa. But as well as providing transportation, cars may be bought because of their value as status symbols or perhaps because of the outlet they provide for aggressive and competitive impulses. Similarly, among other reasons, an artist may create a work for the sake of the wealth and the fame that it may bring him, and several music lovers may attend a concert because patronage of the arts enhances one's position in society or because of the opportunity for gregarious satisfaction that it offers. Many would hasten to protest that these byproducts are not forms of aesthetic enjoyment and are thus only incidental to the functions of art. A scientific investigator must recognize the roles that they may play and carefully examine the grounds for distinguishing them from functions that are acknowledged to be aesthetic.

Art has at one time or another been called on to supply a wide variety of benefits. These include the presentation of pleasing or interesting forms (Herbart, Zimmerman and the German "pure visibility" school of the nineteenth century, Clive Bell in twentieth-century England, twentieth-century Neo-Classical composers and Concrete painters); the provision of intense sensations (Oscar Wilde); the promotion of morality (Plato, Tolstoi); the promotion of religious piety (medieval art in Europe, Hindu and Buddhist art in India, China, and Japan), and knowledge either of the observable world (the nineteenth-century Realists and

Naturalists) or of the world of abstract Ideas (Plotinus, Hegel, and many others); the arousal of emotions resembling those experienced by the creative artist (Du Bos in early eighteenth-century France, the late eighteenth-century and the Romantic period in most Western countries, Tolstoi, Ogden and Richards); the encouragement of loyalty to the regime in power (absolute monarchies of previous centuries, totalitarian regimes in the twentieth century); the encouragement of progress towards more satisfactory forms of social organization (the eighteenth century in Europe, the nineteenth-century positivists, the twentieth-century socialist realists).

This list could easily be extended. Every one of the functions just enumerated has also been held by somebody somewhere to be unnecessary or even improper. The psychologist or other scientific investigator of art must guard against excluding any of them as illegitimate from the outset and, at the same time, against treating any of them as indispensable, until the evidence can be examined.

We must be prepared to find that if two instances of art, A and B, resemble each other in some way, A and a third instance, C, may have something quite different in common, and B and C something else again. The position is in fact the same as faces us with regard to other departments of human activity. A good example is play (see Berlyne, 1969). Essentially the same point has received a great deal of notice from philosophers, since Wittgenstein (1953) introduced his concept of "family resemblance." When we look at the various pastimes to which the word "game" is applied, "we see," he says, "a complicated network of similarities overlapping and criss-crossing: sometimes overall similarities, sometimes similarities of detail." Actually, the point had been made by Stewart (1810) with specific reference to beauty.

The conclusion to which we may ultimately be forced is that art is a useful sociological category but not sufficiently homogeneous to form a useful psychological category. As far as administrative problems and social attitudes are concerned, it may be practical to group together a highly variegated collection of activities and artifacts as "art," "music," or "literature." The activities of the museum director, gallery owner, concert impresario, or librarian, not to mention the violin teacher or paint manufacturer, can appropriately and conveniently be applied to all of them in very similar ways. But they may nevertheless be serving different psychological requirements at different times. In much the same fashion, evening courses on a vast multitude of topics may attract students for widely dissimilar reasons. One lady might study shorthand and typing as a prerequisite for a secretarial career, while another may learn dress-making as a means of saving money by making her own clothes. Another student may take a course in a foreign language with a view to its usefulness during a holiday abroad, and yet another may seek stimulating

intellectual experience by hearing lectures on philosophy. But despite the diversity of benefits provided, the problems of organizing evening courses are much the same whatever the subject matter. So they might as well be administered by the same personnel presented in the same building, and covered by some common label such as "adult education" or "continuing education."

### Art viewed in isolation

As a consequence of the reverence and mystery with which art has so long been surrounded, both philosophical and psychological aestheticians have all too often focused their attention exclusively on art and aesthetic phenomena. There are certainly many respects in which artistic activity is strikingly unique among the occupations with which living creatures busy themselves. Nevertheless, the habit of treating art as a thing apart infringes at least two sound guiding principles for scientific research and therefore stands in the way of progress.

First, one of the prime functions of science, as of philosophy and other intellectual pursuits, has been to find as many connecting links among as many dissimilar phenomena as possible. Scientific knowledge has always provided its fullest satisfactions and triumphs when it has pointed to characteristics, structures, and laws that are common to what seem at first sight to be heterogeneous and unrelated kinds of phenomena. Any two objects in the universe must be alike in some ways and unlike in others, and it is the scientist's business to point out similarities as well as contrasts. A contrast can, in fact, frequently be explained by the operation of an identical principle in different conditions.

This is misunderstood surprisingly often. The writer knows of an institute devoted to research into psychological abnormality whose original plans provided for hospital wards in which patients would be housed but not for the accessibility of normal control subjects. It was apparently thought that to understand psychological ailments means to examine those who are suffering from them, whereas the truth is that an understanding of ill health can be acquired only by examining both the unhealthy and the healthy and comparing the two. In the same way, there can be no understanding of art without bringing art into relation with nonartistic forms of behavior. The psychoanalysts and the Gestalt psychologists were exceptional in realizing this, and, whatever the criticisms to which their theories of art might be open, they had at least the merit of trying to explain art by asking what art has in common with other psychological phenomena.

Secondly, scientific research has to start with the simplest phenomena within a particular area of inquiry and only gradually works its way up

to the most complex. Mechanics had to begin by studying the motion of bodies subjected to a small number of unvarying forces. Chemistry had to begin by studying the simplest inorganic compounds. It is no accident that, nowadays, when specialists in the biochemical basis of heredity are making spectacular advances, attention is focused on the simplest of all organisms, viruses and bacteria.

Aesthetic phenomena are certainly among the most complex of all those with which the behavioral sciences have to deal. In the course of the centuries, art has regularly often been compared with, and related to, activities like philosophy and science, which are no less complex. One noteworthy tradition, associated with such names as Schiller, Groos, Spencer, and Lange, has made much of the affinities between art and play. This tradition has connected art with the forms of behavior that constitute its simpler and less highly organized relatives. But play itself is a highly heterogenous category and can present enough intricacies of its own to confound the investigator (see Berlyne, 1969). We badly need studies linking art with primitive and elementary forms of behavior that no aesthete would dream of mentioning in the same breath, or contemplating in the same glance, as a specimen of artistic creation.

Some kind of aesthetic activity is apparently a feature of all the 3,000 or so distinguishable cultures that are to be found on the earth's surface. This suggests strongly that art grows out of some fundamental characteristics of the human nervous system. If so, since we use the same nervous system for all our behavior, we can expect the same characteristics to play their part in other forms of activity also. These characteristics and the psychological laws that result from them can surely be brought to light only by considering and piecing together the information furnished by a wide range of lines of research relating art to a wide range of behavior.

In view of the multitude of subtly interacting factors that govern reactions to art, many of the keys to an eventual understanding of art can only be revealed, in the first instance, through investigation of much simpler psychological processes. Some of the factors, especially the motivational factors, underlying aesthetic activity will, we can hardly doubt, play an important part in different kinds of behavior. Virtually everything we do can be done in a more or less aesthetic or artistic way. But in art, these factors must be present in a purer form, making them more accessible for study.

Although we noted, a little earlier, how indispensable it is to examine simple cases in the initial stages of scientific research, some qualifications must be recognized. There is a stage in which it may be fruitful to consider the peculiarities of the most complex instances as an aid to understanding the simplest ones, so that inquiries starting out from the simplest and the most complex poles will eventually converge on a satis-

factory picture. For example, the experimental and theoretical work that produced our present knowledge of atomic structure concentrated at first on the atoms of the lightest and simplest elements. Nevertheless, a great deal of early impetus and enlightenment came from the work of Becquerel and the Curies on the radioactivity of uranium and radium, which drew attention to some puzzling peculiarities of the heaviest and most complex atoms.

And to make a further point that some art lovers might take amiss, psychological aesthetics must not confine its attention to human aesthetic behavior. The characteristics of the human nervous system from which art stems can hardly have appeared full-blown all of a sudden. Lower animals are incapable of anything we would dignify with the name of "art" or "appreciation of art" (even though some recent paintings by apes, which will be discussed later, have led to some wavering on this question). Nevertheless, we must surely find, and be illuminated by, phenomena in the behavior of lower animals that can be regarded as rudiments of aesthetic activity, affording glimpses of some intermediate stages in the line of development that culminated in human art. We must of course guard against the frequent error of treating the lower animals that exist at the present day as if they represented early points in our own evolutionary history. Existing species are not in our direct line of descent. They all represent offshoots, and in many cases earlier offshoots, of the evolutionary process and are thus collateral relatives of ours. Nevertheless, they can be assumed to be closer than we are to some of the forms through which our ancestry passed. And, provided that we make due allowance for the probability that their behavior shows characteristics peculiar to their divergent specializations, we can expect some help in tracing the origins of something that reaches fruition only in human societies.

Finally, we must mention in the present connection something that the early experimental aestheticians recognized but that has provoked a great deal of misunderstanding and even derision from time to time. Some experimental work on aesthetics has confronted human subjects with genuine works of art or extracts of works of art. But much pioneering research was rightly done—and much remains to be done—with artificially simple material such as patches of color, shapes, and isolated sounds (which nobody would confuse with "art").

One outstanding figure in the early history of experimental psychology who had some interest in aesthetics, Wundt, complained that there had not been enough of this practice. "It has therefore come about," he wrote, "that the simplest cases of the pleasing and displeasing have been almost entirely lost sight of, although they constitute a necessary basis for psychological theory including the explanation of the most complicated aesthetic effects" (1874, p. 222). Reactions to artificially simple sights and sounds are admittedly a long way from appreciation of

art. On the other hand, any two paintings or musical excerpts must differ in many ways, so that, as we noted in Ch. 2, if one is preferred to the other, we have no way of knowing which particular factor or combination of factors may be responsible. In other words, experiments using simple material and experiments using more complex material both have their advantages and limitations, and both are necessary. But in the early stages of research, experiments with simple material will have a role of special importance. The price of their unique and indispensable contribution will be the familiar taunts that the psychologist is insensitive to the difference between the stuffy artificialities of the laboratory and the luxuriance of real life.

### Preoccupation with uniqueness

Popular wisdom reminds us that "tastes differ," that "there is no accounting for tastes," and so on. And the truth of such maxims is nowhere more obtrusive than in the field of art. The works that are considered artistically acceptable by different individuals and in different parts of the world and at different periods of history contrast with one another so conspicuously that it is often deemed hopeless to look for principles applying to them all. This is undoubtedly why so many art specialists content themselves with the study of particular works, particular artists, or, at best, particular styles. That, they believe, is all that can be done fruitfully. Statements about art in general are, it often seems, fated to be nebulous, platitudinous, or wrong.

It is partly a matter of perspective. Anybody who studies personality theory, anthropology, or history is inevitably impressed with the dissimilarities between human beings and human societies that are revealed to him. He might understandably greet any attempt to generalize about human nature with scepticism. But as soon as any two human beings are compared with, say, a tree, their similarities will appear immense and their differences minor.

Tastes can be diverse and yet depend on common factors and principles. For example, different people's evaluations may be governed by the same variables, but the values of these variables that are optimal for some individuals will not be optimal for others. The curves that can be drawn to represent how evaluations vary with a particular variable may well be distinct but have the same general shape. After all, aesthetic tastes are no more heterogeneous than the material substances that are found in the universe. These substances are, however, all subject to many universally valid scientific laws, e.g., those of quantum mechanics and of the theory of chemical bonds. And their dissimilarities can, in fact, be deducted and explained with the help of these common laws.

## Concentration on verbal judgments

In the vast majority of investigations in experimental aesthetics, subjects have been presented with a number of patterns and required to indicate how much they like them, prefer them, find them pleasing, and so on. They are sometimes required to express these judgments in speech or in writing. At other times, they have to gather together, or point to, objects that they like or check off items on a printed list. Whichever it may be, the data that are recorded and form the basis for the experimenter's conclusions are judgments expressed in a verbal form or in some equivalent of a verbal form.

Now, verbal judgments are of undeniable interest in themselves, and they have produced a large mass of valuable findings. Talking and writing about art certainly make up a considerable part of the behavior that results from exposure to artistic products, and what people say about aesthetic matters is of great interest to artists and art lovers.

Verbal responses are not just empty noises issuing from the mouth. They must reflect important processes going on inside the nervous system that can have a great influence on visible nonverbal behavior. So when a person says that he likes this more than that, it must tell us something about his nonverbal reactions to the same objects in other circumstances. Unfortunately, although we know that verbal expressions of preference must reveal a great deal about nonverbal forms of behavior, we rarely know exactly what. And before we can know, much more research will have to be devoted to the specific question of how verbal and nonverbal responses to art are related.

We already have reason to doubt some of the assumptions that might be made, such as that people will spend more time looking at art objects that they say they value more highly. Available evidence on such questions will be reviewed later. The relative lack of experiments using nonverbal measures of aesthetic behavior is a deficiency of experimental aesthetics, but the much longer established nonscientific approaches to aesthetics have also suffered from excessive preoccupation with what human beings say about art.

Quite apart from our need to know more than we do about the correlations between verbal and nonverbal responses, Freud and many other writers before and since have drawn our attention to the fact that a subject's verbal reports cannot reflect all of the internal processes that govern his behavior because he is not "conscious" or "aware" of many of them. And even when he is aware of processes going on inside him, we cannot generally expect him to be capable of describing them fully and accurately.

## 4

# LEARNING, STIMULI, AND RESPONSES

We must once again postpone attempts to characterize aesthetic phenomena. Before we can fruitfully do so, we must review some basic notions coming from psychology and neighboring disciplines that will help us in our subsequent discussion. We must, above all, consider some of the psychological processes that are commonly believed to play important roles in the appreciation of art and see what contemporary psychology has to say about them.

## Learning

The first notion we must take up is that of *learning*. For the psychologist, this term has a rather wider usage than it has in everyday language. There is no universally accepted and satisfactory definition of learning, and there are still controversies, which future research will have to resolve, over ways in which learning works and how forms of learning should be classified. Nevertheless, it can be said in a general way that learning covers all changes in behavior that are (1) relatively permanent (which can be taken to mean that they last for at least a day) and (2) dependent on interactions with the environment. Psychologists have long given up trying to distinguish behavior due to heredity from behavior due to environmental differences, since all behavior is clearly affected by both. But a distinction between "unlearned" and "learned" behavior is still recognized as useful. The former consists of behavior patterns that occur in all normal members of a species regardless of the environmental condition to which they have been exposed, barring a few exceptional ones (such as injury or deprivation of stimulation) that prevent them from occurring. Unlearned responses may appear from birth in the form of innate reflexes. Alternatively, they may take some months or years to appear, having to wait for processes of growth and maturation in the nervous system or other bodily systems to reach the appropriate stage.

On the other hand, learned forms of behavior will not appear at all

unless certain kinds of environmental conditions have been perceived through the sense organs. Often, performance and practice of particular bodily movements is essential. At other times (as in what is called "latent learning" or "observational learning"), it is enough for the organism to perceive environmental events in certain combinations or sequences. The behavior of invertebrate and lower vertebrate animals depends largely on inherited and unlearned factors. But most of the behavior of higher mammals, including human beings, clearly results from learning, so that an understanding of how learning works can hold the key to much of human psychology.

Whether all learning depends on one kind of process in the nervous system, obeying one set of laws, or whether there are two or more quite distinct learning mechanisms obeying different laws is still an unresolved issue. Consequently, any division of learning into categories must be provisional and presented with caution. Nevertheless, the following principal kinds of learning are worth listing:

*Classical (Pavlovian) conditioning.* This is exemplified by the famous experiments of Pavlov in which some perceptible event (the sound of a metronome ticking, the sight of a light flashing, pressure applied to the skin, and so on) was presented shortly before delivery of food to a hungry dog. As a result of repeated pairings of the prior signal (the conditioned stimulus) and ingestion of the food (the unconditioned stimulus), the conditioned stimulus came to evoke secretion of saliva.

In this kind of learning, we have an unconditioned stimulus that already evokes a distinct reaction, either unlearned or the result of previous learning (salivation in Pavlov's experiments). If a conditioned stimulus occurs repeatedly just before, or about the same time as, this unconditioned stimulus, it also acquires the power to evoke the response when acting by itself. Classical conditioning appears to be the main process through which emotional reactions or automatic protective reactions (such as blinking or involuntarily withdrawing the hand) and various changes in internal organs (which are major constituents of emotional reactions) are transferred to new situations.

*Instrumental (operant) conditioning.* This is the kind of learning undergone by the animal that finds its way to the food placed in the goal box of a maze or switches off shock by depressing a lever. In instrumental conditioning, the performance of a particular action is followed by a "rewarding" event (which may be external or internal), in consequence of which the future performance of similar actions in similar situations becomes more likely and more vigorous. It is the main kind of learning through which adaptive bodily movements are mastered, as well as social, linguistic, and intellectual skills.

*Remembering.* Although the term "remembering" is sometimes

used broadly to cover all forms of learning, it is usually reserved for learning that enables a human subject to represent a previously experienced object or event symbolically (i.e., in words or in images). The precision with which something can be remembered can vary all the way from the exact reproduction of rote memory to the meaningful remembering through which somebody can sum up in his own words the content of a passage that he has previously read or the recognition of somebody who can pick out objects that he has seen before.

*Reasoning.* Reasoning, which can occur in rudimentary forms in animals, consists in the acquisition of a new course of action or a new combination of words or thoughts through piecing together of elements accruing from two or more previous experiences. It may seem strange and at odds with everyday practice to speak of reasoning as a form of learning. But there are several respects in which reasoning is inseparable from learning (see Berlyne, 1965). First, the fruits of previous learning form the building blocks of any solution of a problem that we can reason out. Secondly, the skills and techniques of thinking are continually being modified and refined by learning. Lastly, once reasoning has provided us with the solution of a problem, the solution is generally remembered from then on, so that the reasoning process does not need to be repeated when a comparable problem is met in the future.

Coming back to aesthetic behavior, we can see how all these kinds of learning have their contributions to make. Classical conditioning must account for much of what we call "meaning" in the arts, including the emotional repercussions of visual and auditory patterns and their power to evoke associated thought and imagery. Emotional and other reactions will be transferred from visual representations of depicted objects (through "primary stimulus generalization") and from literary passages to described objects and events (through "semantic generalization"). One device that can be used to scale affective reactions is Osgood's semantic differential (Osgood, Suci, & Tannenbaum, 1957). Drake (1970) and Miss S. Nainudel in our own laboratory (see Berlyne, 1971) have used it to measure effects of poetry. Their results confirm that exposure to poetic excerpts concerned with specific objects (e.g., "The Hawk," "Autumn," "Brook," "Snake") modifies affective reactions to their subject matter. Further research must show whether such changes are lasting, in which case one could legitimately speak of emotional learning due to contact with art.

The steps that the appreciator takes to gain access to artistic products depend on instrumental conditioning. So do the skills through which a work of art is created or interpreted by a performing artist. No one could overlook the differences between artistic creation and the kinds of simple trial-and-error learning that have been investigated for so many years in

the psychological laboratory. But there are also unmistakable similarities. For example, the French poet Valéry (1919, pp. 70-71) writes of the necessary role of chance in supplying the elements out of which the artist's work is constructed. Then comes the essential phase during which the artist selects from among these elements, of which most are insignificant but the odd one is valuable. There is an obvious analogy here with the phases of random behavior and response selection that characterize the animal in the maze or Skinner box. It is true that the artist's initial gropings are not completely haphazard. But neither is the trial-and-error behavior of the animal. In all these cases, there are mechanisms bringing to the fore elements that have a greater-than-average chance of being successful (see Berlyne, 1965). If the animal's selection of a response to be retained and learned depends on external rewarding consequences (e.g., access to food, termination of pain), the artist's selection depends on internal consequences, notably his own aesthetic satisfaction and his anticipation that his audience will derive aesthetic satisfaction from what he has produced.

Rote memory is obviously utilized by the concert pianist or the actor, but recognition and meaningful remembering have a basic role in temporal art forms like literature and music. The appreciation of a novel is impossible unless earlier incidents and descriptions are remembered when later parts are read. In poetry and music, the use of repetition, variation, or contrast requires the appreciator to remember what he read or heard a few minutes ago. Traditional musical forms in all major cultures have depended heavily on the listener's ability to discern the return of an earlier theme or a modified and abbreviated reference to it. Many contemporary avant-garde composers are experimenting with forms that do not depend on memory in this way and call for each phase of a work to be appreciated for itself rather than primarily for its relations with what went before or what may come after. For example, works by Stockhausen and others consist of sections that can be played in any of several orders.

The work of the creative artist, as he sets himself "problems" and finds ways of overcoming them, obviously makes considerable use of reasoning among other psychological processes and, as has often been pointed out, has much in common with the reasoning of the scientist or mathematician. Works of art are supposed, among other things, to make appreciators "think." The word "think" covers many processes in which successions of thoughts (including words and images) succeed one another, from "free association" or unconstrained flitting from one thought to another to genuine reasoning. The aim of inciting appreciators to strenuous efforts of reasoning has been particularly associated with certain styles, whether it be a matter of puzzling out the meaning of a deliberately

obscure analogy (e.g., in the Metaphysical poetry of the seventeenth century) or of evaluating alternative solutions to modern social problems (e.g., in the nineteenth-century problem drama or in Brecht's epic drama).

Finally, it is often said that exposure to a work of art should have a permanent impact on the appreciator, that he should never be the same again after experiencing it, that it should leave its mark on him for the rest of his life, affecting ever afterwards the way in which he perceives, feels, and thinks about the world and particular objects in it. All this implies that contact with art constitutes a learning experience and that much of its value derives from this fact.

### Stimuli, responses, and stimulus-response associations

"Stimulus" and "response" are two terms that the psychobiologist can hardly do without unless he finds himself close equivalents of them. Many contemporary psychologists feel uneasy about these words, partly because exponents of particular theoretical approaches have been especially partial to them and partly because of the difficulties that beset attempts to specify or define stimuli and responses precisely. Nevertheless, these words are widely used by psychologists of various interests and theoretical orientations, and there do not seem to be other words that are likely to replace them quickly.

A *stimulus* has traditionally meant some condition causing a sense organ to be excited. However, there have been serious disputes over classification of stimuli and especially over what events can appropriately be regarded as instances of one stimulus. At first sight, it might be thought that stimuli should be classified according to which receptor cells are stimulated; but this will not do. As far as the simplest innate reflexes are concerned, behavior seems to depend primarily on where the excitation impinges on the body, but more complex forms of learned behavior do not work in this way. They usually depend on patterns formed by combinations of stimulating events rather than on which receptors are stimulated and in what manner. For example, we can easily be made to do something whenever we see a letter A, regardless of the region of the retina on which the image is projected. The clearest example is perhaps the ease with which a musical interval can be recognized, as contrasted with the difficulty of identifying the absolute pitch of a note.

In view of all these difficulties, the best procedure seems to be to take the *stimulus situation* as the basic concept. A stimulus situation is the sum-total of events stimulating sense organs at a particular moment. We can then identify *stimuli* or *stimulus conditions* as classes of stimulus situations with something psychologically important in common. This

leaves us free to categorize stimulus situations in any way that psychological research should show to be fruitful. The stimulus situations regarded as instances of one particular stimulus may be distinguished by the presence of a particular kind of object or event or by the presence of a particular kind of relation or network of relations among objects or events (Berlyne, 1965).

Many stimuli belong to the external world. These are obviously the ones that are most accessible for study, and they exert predominant influences on the simplest forms of behavior such as are found in lower animals. But there are also internal stimuli or stimulus conditions, which are generally at least as important as external stimuli in determining human behavior. They include events that stimulate the receptor cells that are distributed through various internal organs. Physiologists have recognized the importance of the "internal environment" since the work of Claude Bernard in the middle of the nineteenth century. It is often also convenient to regard events in the brain as stimuli, since they can cause events to take place elsewhere in the brain or give rise to bodily movements, just as external stimuli do so more indirectly through the mediation of sense organs and sensory nerves. Virtually everything that an organism does generates internal stimuli, which can exert an influence over what will be done next.

Activities of muscles and glands are *responses*. They produce visible bodily movements, or changes in internal organs (including those that are associated with emotional states), or secretion of substances into the external environment or into the bloodstream. Some responses are not directly observable because they take place inside the body or because they involve contraction of muscles that are too weak to move bones but strong enough to produce proprioceptive stimuli. We can also extend the usage to include processes occurring within the brain (e.g., thoughts) as responses, since they can be evoked by stimuli or by other events in the brain.

Behavior consists of *associations* between stimuli and responses. Some psychologists bridle at this expression, because, in the past, the word "association" has been connected with certain kinds of psychological and neurophysiological theory that no longer win wide support, such as the associationism of the nineteenth century and the reflexology of the early twentieth century. But the term "stimulus-response association" can be used in a neutral way to mean simply a tendency for the response in question to be more likely to occur when the stimulus in question is present than when it is not. This is in accord with the sense that statisticians give to the word "association." It leaves us quite uncommitted with respect to questions of theoretical interpretation. Learning consists of a strengthening and weakening of stimulus-response associations as a

result of exposure to particular environmental conditions. Sometimes, a response that was formerly not associated at all with a stimulus becomes associated with it through learning. At other times, a stimulus and a response are already associated, but the association becomes stronger—the response becomes even more likely and more vigorous in the presence of the stimulus—than it was before the learning took place.

## 5 INFORMATION, UNCERTAINTY, REDUNDANCY

What is now known as "information theory" grew out of the work of Wiener (1948) on "cybernetics" (defined as the "science of control and communication in animals and machines") and of Shannon (Shannon & Weaver, 1949) on the "mathematical theory of communication." Later on, we shall argue for a narrower usage of the word "communication" than these writers adopted. They were concerned in the first place with the analysis of communication (in the ordinary sense of the word) or interaction between one human being and another (e.g., over a telephone line), between human beings and machines (e.g., in industrial situations), between machines or parts of machines (e.g., in automatic self-regulating systems).

The concepts and measuring techniques that they introduced were found, in due course, to be particularly useful for analyzing interactions between parts of the same animal or human organism and between the organism and its external environment. Consequently, they have had a great influence on recent biology, physiology, and psychology.

The language of information theory was seen to offer hope of fulfilling a need that has long been felt, namely some way of treating quantitatively, and eventually of measuring, what the Gestalt school called "goodness" of configuration. Suggestions along these lines were made by Hochberg and McAlister (1953) and by Attneave (1954) and were later extended into a systematic theory of visual and auditory structure by Garner (1962). All these writers were interested, in the first place, in the psychology of perception. But since terms like "goodness" and "structure" refer to characteristics on which aesthetic reactions to patterns depend, their work is of the utmost importance for aesthetics also.

The growing use of computers to analyze the statistical properties of artistic material and to produce simulacra of poetry, graphic art, and music (cf. Pinkerton, 1956; Attneave, 1959) encouraged an interest in the mathematical, including information-theoretic, properties of aesthetic patterns. Some English-speaking writers sought help from information theory toward understanding motivational aspects of aesthetics (e.g.,

Meyer, 1957; Kraehenbuehl & Coons, 1959; Berlyne, 1960). The most thoroughgoing attempts to establish a new foundation for aesthetics in information theory have been those of the Franco-German school of "informational aestheticians" that was founded by Moles (1958) and Bense (1965) and includes Frank (1959), Günzenhäuser (1962), Alslaben (1962), and Kiemle (1967) among its members.

We must, therefore, look at some of the concepts of information theory that will be of use to us in later chapters.

### Uncertainty

Like the other information-theoretic measures, uncertainty depends solely on probabilities or relative frequencies of events and has no necessary connection with how uncertain anybody feels. It is true that a feeling of uncertainty (subjective uncertainty) is likely to increase with uncertainty in this statistical sense. But uncertainty is best regarded, in accordance with Ashby's (1956) suggestion, as a measure of amount of "variety."

A measure of uncertainty can be worked out whenever we have a sample space. This is a situation in which some event is to be selected from a set of alternative classes of events (signals). We do not know which event will occur, but we can enumerate the alternative classes and assign a probability to each of them. The value of uncertainty, in *bits*, is provided by Shannon's famous formula,  $-\sum_{i=1}^n p_i \log_2 p_i$ , in which  $p_i$  is the probability that the event will belong to class  $i$ . Defined in this way, uncertainty has two important properties: it increases with the number of alternative classes of events, and, if the number of alternative classes is held constant, it reaches a maximum when the classes are equally probable.

It will be evident that every element in a work of art is chosen from a set of alternatives that can be regarded as signals. For any particular art form and style, the set or vocabulary from which each element is chosen is limited. The alternatives that can occur in a particular location constitute a sample space. Their relative frequencies can be calculated and a probability associated with each of them. Consequently, every location in a work of art, whether spatial or temporal, can be allotted an uncertainty value. In a painting, for example, a spot will have a certain hue, saturation, and "value" (to use the term that painters use for what psychologists call "intensity" or "brightness"), each chosen from a set of alternatives. In music, every note possesses one of a number of alternative pitches, timbres, durations, and intensities. In a literary work, every word

must be chosen from a vocabulary provided by a natural language or from a subcategory to which the choice is restricted.

It is also evident that uncertainty will be greater in certain portions of a work than in others. For example, there is relatively little uncertainty at the beginning and at the end of a piece of traditional Western music, since it will probably begin with the tonic note and end with a perfect cadence. Similarly, at the end of an even-numbered line of traditional verse written in couplets, the sample space will be smaller than that available for the rest of the line, since the final word must rhyme with the final word of the preceding line.

Uncertainty will generally be greater in some styles than in others. This may occur because of differences in the size of the available vocabulary. For example, more variety is possible in modern ballet than in classical ballet, where movements consist of recognized figures beginning and ending with the five accepted positions of arms and legs. A poet of the seventeenth or eighteenth century had to confine himself to "poetic diction," compatible with contemporary notions of *style noble*, and had to replace perfectly respectable but mundane words by elegant circumlocutions. In much contemporary poetry, on the other hand, vocabulary is extended virtually beyond limit to include not only colloquialisms but obscenities and neologisms. Uncertainty will also vary as the relative frequencies of acceptable elements approach, and depart from, equality. There is, for example, more uncertainty in atonal music, in which any one of the twelve notes of the chromatic scale may occur with equal likelihood at any time, than in tonal music, where the seven notes belonging to the key in which a passage is written are much more likely than chromatic notes that do not and, among the seven notes, the tonic and the dominant appear more often than others.

### Amount of information

Once the awaited signal has appeared and we know which alternative has been chosen, we can assign an *amount of information*. This (also measured in *bits*) will be greater, the lower the probability of the class to which the signal belongs, the appropriate formula being  $-\log_2 p_i$ . In accordance with this formula, the amount of information varies between zero and infinity as the choice of the event in question varies between certainty and impossibility.

Uncertainty can be identified with the average or expected amount of information, which can be calculated before the choice is revealed, whereas the actual amount of information cannot be specified until it is clear which choice was made.

### Transmitted information

If we are considering two sample spaces, X and Y, we can use a measure of *transmitted information*, which will represent the degree of interdependence between what happens in the one sample space and what happens in the other. It is therefore a measure of a degree of correlation or association between the selection of signals in two situations or systems.

If transmitted information exceeds zero, a knowledge of which signal has been selected in X will help one to guess what will be selected in Y. This does not mean that one will be able to predict with complete confidence exactly what will happen in Y. It means that the chances of guessing successfully will be better than they would have been without a knowledge of what is happening in X. In other words, measures of transmitted information are measures of the degree to which uncertainty regarding one situation is reduced when one knows which alternative has been realized in another situation.

The most commonly used measure of transmitted information is *average rate of information transmission* (per signal or per unit time). For some psychological purposes, however, and particularly with regard to motivational problems (see Berlyne, 1960), *actual amount of transmitted information*, i.e., the amount by which uncertainty about X is reduced on receipt of a *particular signal* belonging to Y, may be more important.

When the average is used, two implications of the definition of this measure must be noted. First, information transmission is bidirectional and symmetrical. When we are examining interrelations among events into our systems, X and Y, it is convenient to designate one of the systems or situations the "input" and the other the "output." But if knowledge of what happens in the input reduces uncertainty about the output, the opposite must also be the case. For example, in the case of a telephone line, the microphone is usually considered the input end and the receiver the output end. But if hearing what comes out of the receiver reduces one's uncertainty about what was said into the microphone, hearing what is said into the microphone likewise reduces one's uncertainty about what will be heard by somebody listening into the receiver. And the average amount of uncertainty reduction in the two cases must necessarily be equal.

Second, for information to be transmitted from one sample space to another, there need be no direct causal connection between the two. If the information transmission between X and Y is greater than zero, there must be a causal relation somewhere to account for this. But the

explanation may be that X and Y are both subject to causal influence from a third system of factors, Z, so that information can be said to pass from X to Y and vice versa *through* Z.

Even though there might be no physical link between X and Y, it is useful to speak of an "information channel" linking X and Y. Such a channel will have a limited maximum capacity, such that, if more information is introduced into the channel than it can transmit, some of this information will be lost at the output end. Sometimes, there will be two or more outputs, in which case events in the output system are determined jointly by what happens in the several inputs. If the total information from all the inputs does not overstep the channel capacity, it may be preserved in its entirety at the output end. Otherwise, some of the input information will be lost, which means either that the output events will reflect what is happening in some of the inputs but not the others or that they will reflect with some error (residual uncertainty) what is happening to all of them.

As far as psychology is concerned, there are two important sample spaces that are linked by information transmission, namely the set of possible stimulus situations and the set of possible bodily acts (i.e., motor responses, including verbal responses). It is clear that a knowledge of the stimulus situation to which an organism is exposed will reduce uncertainty about what the organism will do, just as a knowledge of what the organism is doing will reduce uncertainty about the kind of stimulus situation that it is confronting.

There are, however, processes going on inside the organism that are affected by the external environment and, in their turn, help to determine its responses. They can, therefore, be regarded as intermediary events through which information is transmitted from environment to behavior. They include the events in the nervous system that neurophysiological techniques reveal and also the "intervening variables" that figure in psychological theories.

Biological adaptation requires a maximum degree of correspondence or resemblance (i.e., maximum information transmission) between the actual response that the organism is performing at any moment and the optimal responses that would have the most beneficial consequences. The external environment of the moment normally contains a great deal of information about (i.e., transmitted from) the optimal response space, which is why it can steer behavior in adaptive directions. But it does not contain all the information about the optimal responses that is necessary. So it is desirable for as much as possible of the missing information about the optimal response to reach behavior from other sources. This is usually achieved through internal processes, inherited or learned, which represent (are correlated with, correspond to, transmit

information from) past, future, or present events that are out of range of the sense organs.

### Information transmission in art

When a human being is exposed to a work of art, information is transmitted, as in all perceptual processes. But there are two important peculiarities. First, since a work of art is produced by another human being and reflects processes going on within him, there is information transmitted from person to person through the work of art. Secondly, whereas many stimulus situations influence an organism's internal conditions, which in their turn influence outwardly visible behavior, aesthetic stimulus patterns commonly modify internal processes (thoughts, images, emotions) without giving rise to any corresponding action. In other words, the information from a work of art is transmitted as far as the appreciator's internal state but no farther. According to Moles (1958), this is the distinguishing characteristic of "aesthetic information."

If we trace the information back through the work of art to processes going on within the creative artist, we find that these in their turn are influenced by (and therefore convey information from) events in the external environment by which he has been affected. Art commonly depicts, or informs us about, external objects or characteristics of the world in general. It may also express, or transmit information about, social conditions, including the values prevalent in a particular culture or subculture to which the artist may or may not belong. Information transmitted from external conditions is *semantic information* (of which *social information* is a subcategory). Information about processes within the creative artist that are peculiar to him constitutes *expressive information*.

### Syntactic information and redundancy

Any work of art can be regarded as an ordered collection of locations. These will be spatial locations in the visual arts and temporal locations in literature and music. In the case of drama, ballet, and the cinema, not to speak of recent experiments with kinetic sculpture and spatial music, each location will have to be identified by both spatial and temporal coordinates. Each location is occupied by an element selected from a sample space corresponding to the location.

There is obviously interdependence between selection of elements at different locations. In other words, once an element has been found to occupy a particular location, certain elements are more likely than

others to be found at certain other locations. In pre-Impressionist Western painting and in Oriental painting, if there is a brush stroke of a particular color in one spot, adjacent spots will be more likely than not to have the same color, though perhaps in a different shade. In pre-Wagnerian Western music, whenever a dominant-seventh chord occurs, it is highly likely that a tonic chord will follow. In the facade of a Classical, Gothic, Indian, or Chinese building, whatever is found at one place in the left-hand half will probably resemble what will be found in the corresponding place in the right-hand half. It follows that information is transmitted between elements of the same work or between elements of a pattern comprising a portion of a work. Information transmitted in this way may be called *syntactic information*. It is the same as Meyer (1956), with special reference to music, calls "embodied meaning" and Garner (1962) calls "internal constraint." It is closely related to the information-theoretic concept of *redundancy*.

Suppose that we have an input situation with  $n$  bits of uncertainty, and suppose that there is an output capable of providing us with enough information to eliminate completely our uncertainty about the input. It is clear that this output must itself have at least  $n$  bits of uncertainty, since it must be capable of delivering at least as many messages as there are alternative possibilities in the input. This condition can be fulfilled if the repertoire of the output contains as many different signals as there are possible input situations. Then, one output signal will suffice to identify completely the situation that obtains at the input at any moment. But the repertoire of signals will often be insufficient for this. For example, the number of possible messages that the sender of a telegram might wish to convey is far larger than the number of letters in the alphabet (although, if he confines himself to standardized greetings for festive occasions, there may be fewer than 26 of them, so that a message of this kind could be represented by a single letter). Consequently, several output signals will be needed for each message. They may form a succession, such as the letters sent over a telegraph line or the words sent over a telephone wire. They may form a spatial array, as in the case of the dots of varying lightness and darkness that make up a printed black and white photograph, or they may form a spatio-temporal array, as in a film or a television program.

If each output signal is selected from a sample space of  $n$  possibilities and there are  $H$  bits of uncertainty to be transmitted, then the minimum number of output signals that will suffice is equal to  $H/\log_2 n$ . This minimum will be reached only if all possible combinations of output signals are used equally often. It is realized in some military codes, where every sequence of three letters of the alphabet might be used to communicate a different message, and in our familiar system of numerals, in which every combination of digits represents a different number.

Information channels of this type achieve maximum economy with respect to the number of signals but are vulnerable if anything goes wrong. If a single signal is lost or transmitted incorrectly, the input situation cannot be identified at all.

If the condition for maximum economy is not fulfilled, then we have some degree of *redundancy*. An output situation may consist of  $m$  signals, each selected from a sample space of  $n$  alternatives. The actual output uncertainty ( $H^y$ ) will be less than the maximum uncertainty ( $H^{\max} = m \log_2 n$ ) obtainable with such resources. It may be that some of the alternative *signals* occur more often than others, producing what Garner (1962) has called *distributional redundancy*. Alternatively, some *combination of signals* may be more frequent than others, producing Garner's *correlational redundancy*\*.

Correlational redundancy is identifiable with syntactic information transmission. If certain combinations of signals occur more often than others, it follows that, if a particular signal occupies a particular location, certain signals will be more likely than others to occupy other locations. Consequently, once the nature of the element in a particular location is known, uncertainty about what will be found in other locations will be reduced. Correlational redundancy entails transmission of information between elements of the same pattern. If an output with some redundancy transmits information about an input situation, there will be some degree of duplication or overlap between the information contents of different output elements, which is uneconomical but provides at least a partial safeguard against loss of distortion.

The importance of redundancy, especially correlational redundancy, for aesthetics is shown by the attempts that have been made (e.g., Garner, 1962; Gunzenhäuser, 1962) to identify "structure" and "order" with redundancy, which not only lend precision to the meaning of these terms but offer prospects of eventually being able to measure these factors. In the case of structure, this suggestion applies only to its quantitative aspect—i.e., to "structure" as something that different patterns have in differing *degrees*, or, in other words, to amount of "structuredness." It cannot help us in the qualitative analysis of "structure" as something of which different patterns have different *kinds*. This will be discussed later. The identification of "order" with redundancy also requires some circumspection, as our later discussion of "grouping" and "supersigns" will show.

The concept of redundancy is the basis of the quantitative information-theoretic analyses of "goodness of configuration" that have been proposed. Attneave (1954) describes a possible procedure for measuring

\* Distributional and correlational redundancy seem to correspond, respectively, to the "discrimination redundancy" and "schematic redundancy" distinguished by Evans (1967).

"goodness." It requires an experimenter to uncover portions of a pattern successively, inviting subjects to guess what each new portion will be like just before it is disclosed. When patterns are regular and symmetrical (e.g., geometrical figures), subjects will have a high proportion of successes, and there will be relatively little uncertainty most of the time about the guesses to be voiced at a particular stage. If, on the other hand, irregular, disorganized patterns are used, to see one part of a pattern will afford no help at all in predicting what the remaining elements will be like. The analysis by Hochberg and McAlister (1953) is in different terms but the same in essence. "Good" configurations are, they maintain, selected from smaller populations than other patterns. For example, the number of possible squares (given a certain maximum length and a certain error of measurement) will be smaller than the number of possible rectangles. The number of rectangles will similarly be smaller than the number of irregular quadrilaterals. Similarities and equalities among different components of a pattern must inevitably diminish the number of possibilities and thus the actual uncertainty. And since some possibilities are excluded (e.g., possibilities involving sides of different lengths in the case of squares), the uncertainty will be less than the maximum uncertainty associated with the range of possible elements, which means that there will be redundancy. Handel and Garner (1960) have actually asked subjects to rate patterns of dots for "goodness" and found that high ratings were given to those patterns that could be regarded as belonging to smaller sample spaces or to sample spaces with greater correlational redundancy.

Of course, motivational, including aesthetic, phenomena must depend directly, not on the usual objective information-theoretic measures, but rather on their subjective equivalents (Berlyne, 1960; Driscoll & Lanzetta, 1965; Green & Courtis, 1966). Objective uncertainty, amount of information, and so on, are determined by the objective sample space (i.e., the alternative events that could actually occur) and by objective probabilities (the relative frequency with which events belonging to the sample actually occur). But preferences and emotional reactions will surely be governed by the membership of a subjective sample space (i.e., the events that the subject represents to himself as possible alternatives) and by subjective probabilities (i.e., how likely the subject considers each of the alternative possibilities to be).

### Informational correspondence, isomorphism, iconicity

An input often contains a number of distinct elements, which may occupy different locations in space or time or both and may even originate in different sources that direct information into one channel. Similar-

ly, the output may be divisible into a number of elements. There will be complete information transmission between the input and output as long as a particular combination of input elements always gives rise to the same output combination and a particular output combination always arises from the same input combination. But even with perfect information, there can be some important differences in another quantity, *positive interaction uncertainty* (McGill, 1954; Garner, 1962). There is positive interaction uncertainty whenever a combination of elements transmits information that is not to be found in any of its components acting alone.

If positive interaction uncertainty is equal to zero, than we have what may be called informational correspondence (Berlyne, 1965, p. 126ff). This means that each output element enables us to identify a corresponding input element, so that the information obtained from the whole output is equal to the sum-total of the information contents of the separate output elements. But at the other extreme where positive interaction uncertainty is at a maximum and there is no informational correspondence, one has to have the whole output combination to be able to identify any input element at all.

Some familiar illustrations may make these notions clearer. Let us take, for example, a line drawing of a monkey. Some of the lines inform us about the appearance of the monkey's head, others about the appearance of his legs, yet others about the appearance of his tail, and so on. If the portion of the drawing corresponding to the monkey's rear end were lost or obliterated, we should still know what the head looked like. In contrast, the use of a word to designate an object usually means high positive interaction uncertainty and no informational correspondence. If somebody tells us that a certain animal is a MONKEY, we know immediately what the head, legs, body, and tail look like, but the letters MO do not tell us about one part of the animal and the letters NKEY about the remaining part. On the contrary, if we knew only the first two letters, we should have no way of knowing whether the animal in question is a monkey, a mouse, or a moose, and we should not know what any of its major parts looked like.

However, we must beware of thinking that pictures and words are always identifiable, respectively, with high and low informational correspondence. If I read off a list of members of a society, each name enables us to identify a particular member, so that informational correspondence is high. When, on the other hand, pictures of animals are used to represent political parties on ballot papers in countries with a high illiteracy rate, the whole picture identifies a whole party with all its attributes. Each part of the picture does not specify a particular characteristic of the party or a particular section of its membership.

The notion of positive interaction uncertainty is closely bound up

with the notion of "style" in art. It is sometimes a matter of personal style. We say that a painter or writer depicts something in his characteristic manner, "as he sees it," or that he shows us "how he feels" about it. At other times, an artist's way of depicting something is characteristic of his social group, with its peculiar ideology, values, and artistic conventions. A whole work then tells us something both about the object represented and about the artist and his social background. But we cannot separate the parts of the work that carry information about the artist and the parts that carry information about the object. All parts convey information about both. Similarly, we cannot predict what any of the work will be like if we do not know both about the object and about the artist.

The proportions of output information contributed by these various sources will vary widely from style to style. In ancient Egypt or in Chinese painting during much of its history, the input information is to be found predominantly in the artistic conventions and, through them, the values of a society. At other times, as in Romantic or Expressionist art, a major part comes from the artist's individual reactions. In Realist and Naturalist art, much of the information comes from objective characteristics of the objects or events represented, and expressive information will be minimal, although it will not be completely absent. There may even be a triple interaction of information coming from an object, from a style characterizing a group, and from an artist's idiosyncrasy, as in Cubist painting.

A special case of informational correspondence is *isomorphism*. This brings us back to the qualitative aspect of "structure." The quantitative aspect, amount of structure or of structuredness, can, as we have seen, be equated with redundancy. But we still need ways of analyzing different kinds of structure. One way to handle this problem is to say that two systems have the same structure if they are isomorphic with each other. This term implies a correspondence of elements in the two sets and a correspondence of relations between elements in the two sets. A good example is the isomorphism between a map and a geographical region. A spot on the map corresponds to a place in the region and vice versa. And there is also a correspondence between spatial relations. If one spot on the map is two inches above another spot, the place corresponding to the first mark may be two miles north of the place corresponding to the second mark, and so on. As we have seen, the Gestalt psychologists and Langer (1948) have attached great importance to isomorphism, or similarity of structure, between works of art and emotional states.

Finally there is a special case of isomorphism that may be called *iconicity*, following a usage that can be traced back to Peirce (1906). Iconicity implies a similarity in other respects besides structure. It implies,

for example, similarity in color and shape when signals are visible, and similarity in pitch and timbre when signals are auditory. A telephone line or a television frequency can, therefore, be recognized as an iconic channel. Isomorphism can be preserved without iconicity, e.g., when a visual diagram is used to represent and clarify the structure of musical work or when a musical work represents a succession of emotional states. Presence or absence of iconicity is what distinguishes "representational" or "figurative" painting. In literature, it is largely confined to onomatopoeic words and imitative rhythms, apart from attempts by contemporary Concrete poets and their precursors to produce resemblances between the printed forms of their poems and material objects. Iconicity likewise characterizes some forms of "program music" (e.g., the storm in Beethoven's *Pastoral Symphony*, the braying of the ass in Strauss's *Don Quixote*).

## Abstraction and distortion

Information means selection from among alternatives, and complete transmission of information means specification of a particular object or event or succession of events. This can be achieved by a single output signal if the output repertoire is large enough to permit the assignment of a different signal to every input contingency. Otherwise, several output signals must be used. Since every input element must have a unique combination of properties, a convenient procedure is to represent each input property by a different output signal until specification is complete. This involves, of course, informational correspondence.

An output may, however, specify certain properties of the input but not others. When this is the case, information transmission is, of course, incomplete. Selection among alternative possibilities is partial. Inputs that do not possess the specified properties are excluded. But several inputs that possess these particular properties but still differ from one another in other respects are still in the running. For example, if a monkey has consistently followed food under plaques with triangles, he will learn to approach triangles regardless of their color or size. This means that information about shape only is reaching his motor system. Triangles that are quite distinguishable by color or by size are being treated alike and the differences among them ignored. Information about these properties reaches the monkey's eyes but is discarded before reaching the muscles. Similarly, a name may suffice to single out one human being among all the objects in the universe. So may a complete description of physical characteristics. If, however, I say that I saw a redhaired man, this will convey a great deal of information by

excluding all inanimate objects, plants, subhuman animals, women, children, and men with hair of other colors. Yet it will still leave thousands of possibilities open, with corresponding residual uncertainty. If I say I saw a man with red hair and glasses, this will transmit more information and leave less residual uncertainty, because the selection is narrowed down still further, even though it is not yet complete.

The partial transmission of information from a particular source is what we call *abstraction*. This is close to the everyday meaning of the word. It is also close to the meaning it has in discussions about art, although what is generally called Abstract art represents an extreme degree of abstraction. This term denotes certain kinds of nonrepresentational and nonfigurative painting, and it is sometimes, though improperly, applied to all nonrepresentational or nonfigurative art. But abstraction can also be found to different degrees in representational art.

Abstraction means incomplete specification. The object described or depicted is narrowed down to a particular class of objects, but the information provided does not enable us to single out a particular member of this class. The fine differences that distinguish one individual object from another are obscured. In art, this is achieved in either of two ways. One way is simply to omit some properties or details. Much Chinese and Japanese painting is in monochrome, so that information about color is withheld, and contains only outstanding features of the scene portrayed, so that major portions of the composition may be left blank. Persian and Indian miniatures, like the paintings of the Fauves, present areas of uniform color, ignoring differences in texture and the gradations and shading of color (what painters call "modeling") that are normally found on a surface. Kandinsky covered his canvases with patches of colors that evoke corresponding emotions when encountered in the natural world, but he made little attempt to reproduce the shapes of the objects possessing these colors.

If the first form of abstraction amounts to ignoring certain dimensions along which objects differ, the second consists in reducing the number of positions that can be occupied along a particular dimension or set of dimensions. It consists, in other words, of what is called "idealization" or (if it is dictated by a convention common to a social group) "stylization": the artist recognizes a limited number of ideal forms and represents each object by the ideal form to which it most clearly approximates (or else by some compromise between its actual form and its nearest ideal form). In ancient Greek sculpture of the classical period, as in the academic, Neo-Classical painting of the seventeenth and eighteenth centuries, human beings were portrayed in conformity with accepted canons of beauty, so that the individuality of particular models, in whom reality presumably fell short of the ideal, was wholly or partly lost. Cézanne's famous proposal to "treat nature through the cylinder, the

sphere, the cone . . ." profoundly influenced the Cubists and encouraged the use of regular, geometrical shapes to mask the heterogeneity and irregularity of real objects. In Mondrian's Neo-Plasticist paintings, all the lines of the universe are represented by verticals and horizontals and all the colors by black, white, and highly saturated red, yellow, and blue.

Although the distinction is difficult to make absolute, the Abstract art of painters like Kandinsky and Mondrian and the somewhat less extreme abstraction found in the Abstract Impressionism of Monet's latest period and of his successors, Bazaine and Manessier, must be distinguished from styles like Suprematism, Concrete art, Constructivism, Op art, and Minimal art, at least if we are to believe painters' pronouncements on the aims of their own works. The works of these latter currents, like so much "abstract music," especially of the twentieth-century Neo-Classical school, are meant to be interesting or worthy of attention in themselves without representing anything outside themselves. In other words, semantic information is absent or at a minimum, and syntactic information is predominant. Other nonrepresentational styles, like Abstract Expressionism, Action painting, and Tachisme are, we must suppose, different again. They give primacy to expressive information, since their information content comes mainly from the artist's emotional experiences and impulses to bodily movement.

Abstraction must not be confused with *distortion* or, to follow one of many uses of the term in aesthetic circles, "symbolism." Distortion occurs when there are discrepancies between the representation of an object and the properties that the object actually possesses. This means that expressive information from the artist's internal processes has at least partly replaced semantic information from the object itself. However, a distorted representation can have full individuality and specificity, so that it need not entail any abstraction at all.

During the Romantic period, artists were particularly interested in human idiosyncrasy, especially if it was unusual, and in "local color," i.e., in sights and sounds peculiar to particular times and places. So, in their works, there was generally as little abstraction as in those of the Realist and Naturalist schools. But, in contrast with the aspirations of these schools, there was considerable distortion or departure from what existed in the real world (historical inaccuracy, overdramatization, portrayal of characters "larger than life"). Surrealism, like those phases of the Romantic school that favored fantasy and the supernatural, carries distortion of semantic information to its limits, by presenting objects and events, or combinations of objects and events, that do not and could not exist in reality. But it usually presents them in full and vivid detail.

Abstraction in art, like so many other phenomena to which information theory has drawn attention, stems from the limitations of channel capacity. First, since the nervous system of the appreciator can only

handle a small proportion of the information that flows in through sense organs, there are always some features of external reality that are not registered. The artist can, by simply omitting other information, maximize the likelihood that the information he deems important will be received and processed. Apart from that, there are limits to the capacity of the channel that links the artist with the appreciator's sense organs through the work of art. This channel can convey both semantic and expressive information, as well as syntactic information. If information from two or more sources is pouring into a channel and overstepping its capacity, then, as we saw earlier, several alternative outcomes are possible. Information from one source or the other may preponderate to the exclusion of all or part of the information from competing sources, or there may be partial transmission of information (leaving residual uncertainty) from every input source. Thus, an artist may concentrate on semantic information, depicting objects realistically and stamping his work with little if anything of an individual imprint. On the other hand, semantic information may be wholly or largely sacrificed to expressive or syntactic information, embodied in fantasy or in nonrepresentational art. An intermediate position is the compromise of moderate abstraction (e.g., Post-Impressionist painting, Fauvism, Expressionism, Cubism, literature of the German Impressionist school), where the artist concentrates selectively on aspects of the external world that are in keeping with his "internal vision."

## 6

## SIGNS AND SYMBOLS

There has been a great deal of talk about the use of "symbols" in art, but the term has referred to very different things at different times. The use of concrete objects to represent abstract concepts or emotional states (as in Symbolist poetry) is perhaps what is most often meant. Depth psychologists like Freud, Jung, and their followers have also introduced a wide public to the view that the constituent elements of a work of art are symbols of unconscious wishes and thoughts, so that the artist himself is not aware of their significance.

The concepts of "sign" and "symbol" have, however, been given a much broader scope by the "semiotic" movement. This movement was launched by the philosophers Peirce (1906), Ogden and Richards (1923), and Morris (1939, 1946). It also received substantial contributions from psychologists like Hull (1930) and Osgood (1952) and has, in its turn, had a profound impact on the psychology of intellectual processes.

For these writers, a "sign" is anything that "stands for" something else, and it is this relation of "standing for" that calls for examination. It is clear that at least four entities are involved in the relation. There is (1) the *sign*, which is an object or event from which stimuli originate; (2) the human or animal organism (called the *interpreter* by Peirce and by Morris) whose sense organs are stimulated by the sign; (3) the *interpretant* (to use, once again, a term adopted by Peirce and Morris), which is some effect that the sign has on the interpreter; and (4) the *significate* (Peirce's *object*, Ogden and Richard's *referent*, Morris's *significatum*), which is the object or event for which the sign stands. The interpretant is evidently what connects the sign with the significate and is thus the crux of the sign process.

The interpretant was at first conceived as a conscious experience that the sign induces in the interpreter's mind. Peirce spoke of it as a "mental effect" and as something going on in a "quasi-mind." Ogden and Richards used the words "meaning" and "thought" interchangeably, but their usage of the word "thought" was evidently capacious enough to encompass a wide range of mental events, as they spent a great deal of time pointing out that signs are often used "emotively," i.e., to evoke emotional attitudes and little else.

It has commonly been believed that the principal function of a

work of art is to give the appreciator experiences, and especially emotional experiences, resembling those the creative artist had while composing the work. Tolstoi (1897-98), for example, vigorously championed this view, and it has become rather commonplace in critical writing and in courses on the appreciation of visual art, music, and poetry. It is not infrequently lamented that the appreciator cannot hope to gain from a work of art more than a dim and reverential glimpse of the experiences of the artist, whose thoughts and feelings are much deeper and more intense than any of which an ordinary human being might be capable.

The behaviorist or neo-behaviorist psychologist could hardly content himself with theories that identify meaning with conscious experience. He must concern himself with the effects of signs on observable behavior. Sometimes, a sign clearly evokes behavior resembling what the significate would have evoked if it had been present. This is a large part of what we mean when we say that a sign is a "substitute for" a significate. A skillful description of a tragic event may make a listener shed tears just as he would have done if he had witnessed it. The sight of nimbus clouds, recognized as a sign of impending rain, makes people rush indoors, which is exactly what they do when they feel raindrops. So Watson and others influenced by behaviorism were led to identify meaning (the interpretant) with responses that were originally evoked by the significate but later transferred to the sign as a conditioned stimulus through classical conditioning. As for Pavlov's dogs, which came to salivate when hearing the beats of a metronome as well as on receiving food, the sound was a sign of an impending opportunity to eat. However, this analysis ignores certain salient facts about the sign process that led Morris and Osgood to propose more involved accounts:

1. Behavior evoked by a sign is not in general identical with the behavior that would have been evoked by its significate, and it is sometimes very different indeed. Piaget (1945) and Werner and Kaplan (1963) have contended, in fact, that the ability to differentiate between the sign and the significate is an indispensable feature of the sign-significate relation.<sup>1</sup> There must be, in other words, some circumstances and some respects in which the sign and the significate evoke quite different responses. The internal signs of imagination are sometimes confused with external reality, and words are confused with the objects or events that they denote, by psychotics and occasionally by normal human beings in their less rational moments. But when this happens, we would say that the relation between the sign and what it stands for has been misunderstood. As Langer (1942, p. 48-9) puts it "If I say 'Napoleon,' you do not bow to the conqueror of Europe as though I had introduced him, but merely think of him. If I mention a Mr. Smith of our common acquaintance, you may be led to tell me something about him behind his back, which is just what you would *not* do in his presence." In this vein, she

maintains that the so-called emotional effects of music and other arts must be unlike the genuine emotions induced by real-life events. She mentions, for example, that both musicians and listeners can adjust rapidly to the change from one movement of a work to another movement of a quite different tempo and representing a quite different mood. This, she suggests, would hardly be possible if deep and genuine emotions were aroused.

2. When a sign is perceived, there may very well be no immediate effect on overt behavior. There may be solely internal effects, whose presence and nature are undetectable except by sensitive psychophysiological equipment or by questioning. This is, of course, particularly true when a person is exposed to art. It is in keeping with Moles's (1958) definition of "aesthetic information" as information that proceeds only as far as the appreciator's internal condition and does not reach his motor organs.

3. The principal effect of a sign on the interpreter often takes the form of generating a "disposition." This means a state in which a certain kind of overt behavior is likely to occur if particular external situations are encountered some time later. Contact with art is often supposed to change people permanently, to turn them into "different persons" from what they were. This presumably implies that their future reactions to a wide variety of events will differ from what they would have been if this contact had not occurred.

These three characteristics of the sign process can be illustrated with a modification of an example given by Morris. Suppose that a motorist driving along a highway is stopped by a policeman and informed that the road is blocked five miles ahead. Immediately after receiving this warning, the motorist may very well act no differently than if the incident had not occurred, apart perhaps from thanking the policeman. We may have no way of knowing whether he understood or believed the warning until several minutes later, when he sees a sign indicating an exit. He then leaves the highway, which he would not have done if he had not had the exchange with the policeman. In other words the warning gave him a disposition to respond in a particular way, namely by turning to the right, if and when a particular stimulus, namely an exit, were perceived. It is also noteworthy that driving as far as the exit and then leaving the highway is not what the motorist would have done if he had seen a blockage in front of him. Then, he would have turned around and driven in the opposite direction. It may, on the other hand, be maintained that he would have done what he did if he had been able to see the blockage five miles ahead with some kind of telescopic vision.

Attempts to take account of these characteristics culminated in Osgood's analysis of the sign process (1952), according to which the sign comes to evoke, through classical conditioning, some, but not all, components of the behavior associated with the significate. These components

(known as the "mediator") will generally consist of internal responses. When the sign is later encountered without the significate, the mediator will be evoked, and the internal stimuli produced by the mediator will combine with the external stimuli of the moment in determining the overt behavior that the subject will perform. Generally, it will be at least partially distinct from the overt behavior that would have occurred if the significate had been present instead of the sign.

### Symbols and communication

Some signs, such as nimbus clouds, are produced by inanimate nature. Other signs, such as the footprints that enable an animal or a fleeing criminal to be tracked down, are produced inadvertently by living organisms. Footprints may very well not be noticed by the organism producing them or, if they are noticed, they may not be recognized as aids to pursuers. The signs are then signs for the pursuers only and not for the organisms producing them. On the other hand, a human fugitive might very well realize how his footprints might betray him and consequently take steps to obliterate them or use them to lead his pursuers astray. In this case, they are signs for him as well as for the pursuers, and they may be said to have the same meaning or interpretant for him and for the pursuers, even though they evoke different overt behavior from him and from them.

A stimulus that is a sign for the organism producing it can be classified as a *symbol*. This is a slight modification of Morris's (1946) usage, since he introduces the additional condition that the symbol must be synonymous with some other sign.

A symbol may be an action (e.g., talking aloud or silently) which produces sign stimuli while it is going on, or an object, which continues to exist and generate stimuli after its originator has ceased to act on it. A symbol may affect only the originator's own behavior. Such symbols form the basis of thinking and other devices for self-regulation of behavior (Berlyne, 1965). On the other hand, unless symbolic responses are solely internal and thus productive of sign stimuli that are accessible only to the originator, the resulting sign stimuli may act as signs for other organisms also. If the symbol has at least to some extent the same meaning for both the originator and a recipient, we may speak of *communication*. The word "communication" has sometimes been used as a synonym for "information transmission," but this narrower usage seems inadvisable. It is in accord with Mead's (1934) concept of a "significant symbol," which is said to exist when "the individual responds to his own stimulus in the same way as other people respond."

### Symbols and information transmission

It will be recognized that response to signs is a special case of information transmission. This is the best seen if we think of the sign as selected from a repertoire or sample space of signs and the significate as selected from a sample space of significates or, in other words, as a variable that can take on different values (properties of a particular object or event, presence or absence of a particular object or event). The interpreter's internal and external responses (the interpretant) vary concomitantly with the sign, and the sign varies concomitantly with the significate. There is thus transmission of information from the significate to the interpretant through the sign. If the sign is a symbol, and the originator is not the same organism as the interpreter, there is a further link in the information channel. Information is transmitted from the significate through the internal and external behavior of the originator and then through the sign to the behavior of the interpreter.

However, not all information transmission along such channels qualifies as a sign process. Two additional conditions must be met:

1. The sign must be an indispensable link in the channel through which information from the significate reaches the interpreter. In other words, his behavior would not vary concomitantly with properties of the significate--would not take account of the significate--if it were not for the sign.

2. The interpreter must react to the sign as he does because of the information that it transmits from the significate. In other words, it evokes the behavior (overt or internal) that it does because the interpreter has learned to recognize it as a representation of the significate.

### Symbols and art

Morris analyzed aesthetic processes in terms of signs and symbols in an article (1939) on "Aesthetics and the theory of signs" and in sections on "poetic discourse" in his book *Signs, Language and Behavior* (1946). He has later agreed (1964) that what he said about poetic discourse is applicable to aesthetics generally. The fruitfulness of Morris's approach has, however, been severely questioned by Rudner (1951) and by Stevenson (1965) but defended by Ballard (1963). Langer's (1942) aesthetic theory has much in common with Morris's, although she concentrates on the symbolization of emotion through structure.

Morris's article (1939) introduced the challenging idea that one portion of a work of art can have other portions of the same work as

significates. One part of the sign complex can indicate properties of other parts. This is compatible with the definition of a sign process as a "mediated taking account of something" that Morris offered at that time. In accordance with that definition, something can be said to act as a sign of something else that is present simultaneously with it if the interpreter's behavior would not otherwise have taken account of the second object or if his response to the second object would otherwise have been different. According to Morris's later conception (1946), "if something, A, controls behavior toward the goal in a way similar to (but not necessarily identical with) the way something else, B, would control behavior with respect to that goal in a situation in which it were observed, that A is a sign." This definition seems to imply that B, the significate, must be absent. An element of a work of art could not, therefore, signify another element of the same work if that element were present and perceived at the same time. But it might do so when, say, portions of a painting are scanned in succession or elements are present successively as in music or literature.

We already know that there can be transmission of information—syntactic information—from one portion of a pattern to another, and that syntactic information, dependent on redundancy, is of great importance in art. This can be regarded as symbolization only if the two conditions laid down above are fulfilled. Does an appreciator react to a particular portion of a work only because it tells him what another portion will probably be like? Would he not respond to the signified portion at all if the signifying portion had not been present? It seems unlikely that these questions can generally be answered in the affirmative. There may be times, however, when an appreciator is made to notice, or respond appropriately to, one element only through the influence of a prior element that prepares him for it. Normally, however, an appreciator responds to the relation between two of the elements, which is not at all the same as the state of affairs that would be implied by these two conditions.

In both his article and his book, Morris saw the representation of "values" or "value properties" as the distinguishing mark of the aesthetic use of symbols. "A value," he says, "is a property of an object relevant to an interest—namely, the property of satisfying or consummating an act which requires objects with such a property for its completion." In his book (1946), he characterizes "poetic discourse" as the "valuative" use of "appraisors." An "appraiser" is a "sign that signifies something as having a preferential status for behavior," and a sign is used "valuatively" when it causes "preferential behavior" toward something.

This view is certainly untenable if Morris's definition of value is taken seriously. It would surely imply that a neon sign saying "Restaurant" must be an aesthetic pattern, since it certainly signifies the presence

within the building to which it is attached of objects with a "preferential status" for somebody who is hungry. Clearly, not everything that signifies opportunities for gratification is art.

On the other hand, art is commonly used to induce the appreciator to share the artist's attitudes to philosophical, religious, political, social, and moral questions. By no means all works of art serve this purpose, however. On the other hand, all works of art, it would seem, transmit information about objects or events, or characteristics of objects or events, that the artist considers worth attending to, looking at, feeling strongly about, and thinking about. If the work is effective, the appreciator will be induced to consider them so also. Although all sorts of other extrinsic values may or may not be signified and propagated by a work of art, all art signifies at least *intrinsic values*. The notion of intrinsic value will be elaborated on in a later chapter. For the moment, it will be enough to say that something is intrinsically valuable or pleasant or rewarding if it is, as we say in everyday language, valuable or pleasant or rewarding "in itself" or "for its own sake" rather than because it leads to something else. So we may conclude that one indispensable function of art is to tell the appreciator which stimulus patterns seem to the artist to be worth looking at or hearing or contemplating. The patterns in question may be ones found in a particular external object or event, in thoughts, feelings, or other internal processes, or in the work of art itself.

## Art as communication

If a work of art can be regarded as a system of symbols, we can go farther and conclude that art fulfills the additional criteria for being classed as communication in the sense discussed earlier. The creative artist (and, if there is one, the performing artist also) is supposed to react to the work in a similar way to the appreciator. The work is supposed to have similar "meaning" for both (or all). Following what was said about communication of intrinsic values, the artist must himself value what his work is designed to make the appreciator value.

If an artist fails to evoke in the appreciator a reaction resembling his own or, in other words, to make the appreciator value a form and subject matter that he values, we say that he has failed to communicate and that the work is consequently not a success. On the other hand, an artist may intend to generate in others reactions that he does not share. The meanings or interpretants for the artist and for the appreciator may have little in common. The work may induce the appreciator to pay attention to something that the artist himself does not regard as worthy of attention. In such cases, we say that the artist is "insincere" or lacking in "integrity" (cf. Tolstoi, 1897-98).

This simplifies the task of the psychological aesthetician considerably. He has to consider the aesthetic behavior of the appreciator as well as that of the creative artist and perhaps also that of a performing artist. And the overt responses through which they gain contact with aesthetic patterns are certainly different. Nevertheless, as long as we can assume that their internal reactions on exposure to a work are largely similar, we can apply some principles, particularly motivational principles, to them all. There will, of course, be limitations to this. For example, the creative artist may well make use of some procedures in the composition of his work (e.g., the mathematical procedures used by architects or by the serial and stochastic composers of the twentieth century) that the appreciator may have no way of recognizing. The knowledge that the work has been derived from these procedures may be an important source of satisfaction for the creative artist that the appreciator lacks.

Moreover, even a sincere artist can hardly be unaffected by the material and other satisfactions that come with favorable notice from critics and the public. A complicated system of pressures and counterpressures (feedback loops) ensures some convergence between the tastes of the artist and those of his audience, particularly of influential elites among his audience (see Moles, 1967; Martindale, 1969). The rewards and punishments that govern the artist's behavior must depend partly on the social factors that determine which works will be exhibited, performed or read, published or sold, and praised. And, of course, the artist's products in their turn modify the preferences of his potential patrons.

## 7

## EMOTION AND AROUSAL

Art is commonly (but not invariably) expected to evoke "emotions" or "feelings." The word "feeling" has been used in a number of distinct senses, both by psychologists and by laymen, and since, in one of its senses, it is more or less synonymous with "emotion," we may as well confine ourselves to the latter term.

In the eighteenth century, Du Bos (1719) stated that "the first aim at painting is to move us. A work which moves us greatly must be excellent on the whole." About a century later, Wordsworth (1800) offered his famous characterization of poetry as "the spontaneous overflow of powerful feelings."

Actually, the belief that art should, as one of its prime functions, express and induce emotion, which is now so widely taken for granted, is a relatively recent one. It has been firmly implanted only since the Romantic period of the early nineteenth century, although it had some advocates (such as Du Bos and Herder) during the eighteenth century and drew a great deal of encouragement from Aristotle's famous statement that tragedy serves to purge the passions through pity and terror, as well as from Plato's contention that art should be used to promote courage and other praiseworthy emotions. Over the last century, influential voices have been raised from time to time against the widespread view that music, in particular, works by stirring up emotions (e.g., Hanslick, 1854; Stravinsky, 1935; Langer, 1942).

Sometimes, restrictions have been placed on the kinds of emotion that art should express or evoke. Tolstoi (1897-98) saw art as an activity "having for its purpose the transmission to others of the highest and best feelings." Many, from Plato to twentieth-century dictators, have feared that art might stir up undesirable and discreditable emotions and have held that it should be suppressed when it does so. Others, such as Bell (1949), have recognized something called "aesthetic emotion" as the proper intermediary through which art does its work. Langer (1942) differentiates between the evocation of emotion and the symbolization of emotion for contemplation, regarding the latter only as the business of art. We shall discuss possible interpretations of views like these which contrast the emotional effects of artistic and non-artistic stimulus patterns. But it is worth noting that virtually every kind of emotion, repu-

table or disreputable, has at one time or another received some form of aesthetic embodiment.

The word "emotion" is actually not used very much by contemporary psychologists. Until 20 or 30 years ago, the word was quite often used in the titles of monographs, chapters of elementary textbooks, and courses, but as with many other terms taken over from ordinary language, the boundary lines of what it denotes are not distinct enough or properly located for the purposes of science. Its connotations overlap with those of motivational terms that are now widely used in psychological circles, notably "drive" and "arousal." It has been suggested, notably by Mowrer (1946), that emotions can be identified with "secondary drives" (sometimes known as "acquired drives"), which are motivational conditions produced by external stimuli as a result of learning. This suggestion fits certain cases quite well. When we have learned to be frightened or angry on witnessing a certain event, we should certainly be prepared to call the resulting state an emotional state in accord with Mowrer's suggestion. But we also call fear and anger emotions when certain stimuli induce them innately. On the other hand, we are often made to feel hungry or thirsty by perception of some external event that owes its motivational significance to previous learning (e.g., the sight of a succulent dish or of a clock indicating that it is lunch time), but the word "emotion" is not generally used in such contexts. Love is commonly acknowledged to be an emotion, but lust seems to be a questionable case. So the dividing lines between "emotional" and other motivational conditions are far from clear.

However, despite the changes in terminology that have established themselves, we must clearly examine, at least cursorily, the present situation with regard to the phenomena that everyday parlance regards as "emotional." As already indicated, this will necessitate paying special attention to their physiological aspects, since these have been the focus of most of the recent advances that are relevant.

### Intensive and directive aspects

Present-day views tend on the whole to be in keeping with some suggestions that were made by Duffy as long ago as 1934 and turned out to be remarkably prescient in the light of later discoveries. Duffy considered the question of how so-called emotional states differ from non-emotional states and came to the conclusion that they differ in two main respects. First, when emotions are said to be aroused, there is a higher than usual level of activation. In other words, behavior is on the whole more vigorous, and more energy is being expended. All emotional states, regardless of their origin or coloring, are alike in as far as this *intensive* aspect is concerned. But emotional states also have their *directive* as-

pects, which distinguish one kind of emotion from another. They impel the organism toward particular kinds of energetic action, which are not likely to occur at all, or at least not likely to be elicited so strongly, when an organism is not emotionally aroused. For example, anger brings to the fore aggressive behavior—fighting, threatening, destructiveness—while fear brings out flight, learned avoidance responses (actions that have been acquired through learning because of their ability to avert threat), or sometimes immobility (Pavlov's "passive defensive reflex"). The work of Duffy and later writers drew attention to the likelihood that these intensive and directive manifestations depended on distinct external conditions, so that it seems prudent to separate them conceptually and study them as distinct phenomena.

Let us first consider the directive aspect of emotional or, to use what is now a more usual term, motivational processes. These are certainly not without significance for aesthetic phenomena, but the intensive or activating aspect will have to figure more prominently in our later discussion. Areas that have been located in the lower, and phylo-

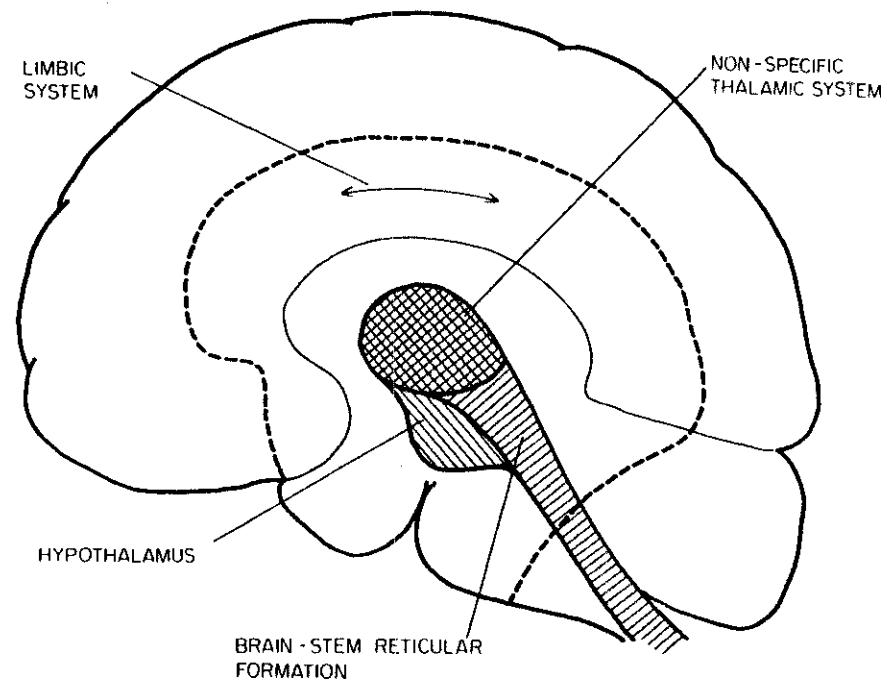


Figure 7-1 Schematic section of the human brain, showing structures controlling emotional processes and fluctuations in arousal.

genetically older, parts of the brain apparently control the major kinds of activity that are obviously biologically indispensable. These include feeding, drinking, reproductive activity, flight, attack, and sleep. They are distributed within the hypothalamus and the limbic system at the base of the cerebrum (see Fig. 7-1). When the areas in question are surgically removed or damaged, the corresponding kinds of behavior become weaker or disappear altogether. When they are electrically stimulated, an animal acts as if put into the corresponding motivational (or emotional) condition, but generally only if there is some appropriate object in the environment. Furthermore, learned as well as unlearned activities associated with the corresponding motivational condition make their appearance. For example, when the center for hunger in the hypothalamus is stimulated, a rat will eat food if it is present, even when it would not normally be hungry, and it will also press a bar if it has learned to do so as a means of obtaining food when hungry. Occasionally, these brain centers are stimulated when human beings have to undergo surgical procedures. The patients often report conscious experiences that resemble the equivalent motivational conditions.

## AROUSAL

Epoch-making though these discoveries have been, motivation theory has been even more profoundly touched by work on the activating or energizing aspects of motivation (or "emotion"). This work has given rise to the psychophysiological concept of "arousal," which, among the many other areas of research that it has affected, seems to have great potentiality for throwing light on aesthetic phenomena.

A human being or higher animal can be regarded as possessing, at a particular moment, a particular "level of arousal" or "activation." His position along this dimension can be regarded roughly as a measure of how wide awake, alert, or excited he is. As long as he is enjoying normal health, his lowest levels of arousal will be reached while he is asleep, and, during his waking hours, arousal will undergo fluctuations within the middle range. It will be fairly low while he is relaxed and resting, but it will rise when he is alerted, or in an emotional state, or under the influence of some drive like hunger. His arousal will approach the upper extreme only in extraordinary circumstances, such as those of violent frenzy, passion, or fury.

A rise in arousal entails a number of psychophysiological changes, falling into four main groups. Some of them will be readily visible to an observer, especially when arousal jumps sharply. Others can be detected only with special recording equipment.

*Central effects.* There are various changes in the electrical activity

of the brain. The best known and most extensively studied of these are changes in the electroencephalographic (EEG) waves that can be picked up from electrodes placed in contact with the scalp and connected with powerful amplifying equipment. Generally speaking, an increase in arousal means that these waves become higher in frequency and lower in amplitude. Maximum regularity, associated with "alpha waves" in the 8 to 13 cycles-per-second wave band, tends to appear around the middle of the arousal dimension in a condition of relaxed wakefulness. Other techniques that have come into use more recently have enabled other electrical effects to be detected. For example, conditions productive of a rise in arousal commonly give rise to "DC shifts" (sometimes known as "contingent negative variation" or CNV), which consist of swings of potential difference in a negative direction, lasting several seconds, between a point on the scalp (or, when animals are used, in the brain) and a neutral reference point, e.g., on the ear lobe. Then, physiologists have recently been studying the "evoked potential," a brief pattern of oscillation that appears in the EEG tracing when an external stimulus is presented and generally becomes visible only when many successive tracings are averaged by a computer. An increase in arousal means a change in the form of the evoked potential pattern and a change in the amplitude of its main component, either upward or downward. Finally, microelectrodes, which are small enough to tap the activity of single nerve cells, show a marked change in the level of activity when arousal is raised, some cells discharging more frequently and others evidently undergoing inhibition, since they go over to a slower rate of firing or cease firing altogether.

*Motor effects* There is often a noticeable increase in overall restlessness and bodily movement, although some exceptionally intense levels of arousal, such as may be found in states of panic, may cause immobility amounting to paralysis. Many unlearned reflex movements become more vigorous when elicited and take less stimulation than usual to set them off, although a few reflexes appear to be weakened or inhibited. Learned movements seem likewise to become more energetic. There is also an overall increase in muscular tension or tone.

*Sensory effects* Changes take place in the sense organs and in the structures along the sensory pathways through which excitation is conveyed from sense organs to the central nervous system. The changes in question tend on the whole to increase sensitivity, lowering the threshold (the minimum intensity of stimulation that will be perceived) and increasing ability to detect detail. On the other hand, there are indications that sensory channels may be blocked or relatively desensitized at times of unusually high arousal, suggesting that the aroused organism becomes more selective than usual, concentrating on stimuli that are of prime importance while diminishing the distracting effects of others. These

sensory changes, whichever the direction in which they work, evidently depend on the centrifugal fibers that are now known to convey excitation from the brain to sense organs and sensory relay stations, i.e., in the opposite direction to the excitations (impulses) that convey information along sensory nerves from the sense organs to the central nervous system (spinal cord and brain).

*Autonomic effects.* There is a great multiplicity of changes in the internal organs and in the skin, all of them recognizable as effects produced by mobilization of the sympathetic division of the autonomic nervous system. There are short-lasting and longer-lasting decreases in the electrical resistance of the skin (apparently due to activation of sweat glands), increases in blood pressure and heart rate (although the situation is a little complicated, since some conditions inducing a rise in arousal may cause the heart to beat more slowly), and changes in the rate and pattern of breathing (which, once again, are a little complicated, since both speeding up and slowing down or even momentary stoppages have been reported). Of late, there has been a great deal of interest in another phenomenon controlled by the sympathetic nervous system that holds out great promise as an index of increased arousal. This is an expansion of the pupil of the eye, in the absence of the conditions that have long been recognized as conducive to pupillary dilation, namely an increase in illumination and a change in focus of the eye from distant to nearby objects.

All these changes betoken an increased capacity of the organism to deal with some condition that calls for prompt action. Increased readiness for muscular activity is obviously to the point, although there may be times when the organism's best recourse is to lie low and remain inconspicuous. At the same time, the sense organs and the structures through which they convey information to the brain are given a heightened sensitivity, enabling them to take in more of the information from the external environment that is needed to guide action. There are plenty of indications that electrical changes in the brain go together with intensification of the activities through which incoming information is analyzed, so that appropriate responses can be selected. All the recognized indices of increased arousal occur when a human being endeavors to solve a problem through thinking. And, during increased arousal, there seems to be better discrimination of detail in perceived stimulus patterns and an improved ability to organize speedy and effective action.

Bodily changes indicative of heightened arousal have been found to depend on a group of interacting structures in the brain that are collectively known as the "arousal system" or "ergotropic system." The most prominent and important structure in this group is the brain-stem reticular formation, but centers in the hypothalamus, thalamus, and cerebral cortex have their parts to play (see Fig. 7-1). The reticular forma-

tion is known to control the electrical phenomena that characterize an alerted cerebral cortex. There is also evidence linking it with changes in sensitivity to external stimuli and with facilitation of muscular activity. On the other hand, the hypothalamus apparently controls the processes in the skin and the internal organs that depend on the sympathetic nervous system.

There is a tendency for the various indices of increased arousal to appear together. As one might expect, the correlations are far from perfect in a mobile, intact human being, in whom a particular index may be subject to all kinds of influences tending to raise or depress it. On the other hand, when animals are prepared for neurophysiological experimentation, which means that they are immobilized and cut off from extraneous influences, a tendency for the various manifestations of arousal to coincide, both spontaneously and in response to stimulation, is more clear cut (Bloch, 1965; Bonvallet, 1966).

Nevertheless, the electrocortical signs of high arousal can be made to occur without the "behavioral" signs, and vice versa. This can be done by extirpation of parts of an animal's brain or by administration of drugs. It seems that the two aspects of arousal can also appear separately in certain naturally occurring conditions to which human beings are subject. For example, during "sensory deprivation" (extreme lack of stimulation or extreme monotony) slow waves, indicative of low arousal, are recorded from the brain, whereas muscular tension, heart rate, and skin conductance go up (Schultz, 1965). Similarly, in states of daze or ecstasy brought on by an overabundance of intense and varied stimulation, the body may show extreme excitement and a great deal of motor activity, while blunting of consciousness and suppression of intellectual activity suggest a relatively inactive cortex.

Acting against the arousal system is a group of brain structures sometimes known as the "trophotropic" or "de-arousal" system. These, when activated, produce signs of lowered arousal, including changes in the internal organs produced by the parasympathetic division of the autonomic nervous system. The organism's capacity for emergency action is decreased, and functions like rest and digestion of food, which require relative relaxation and ensure the maintenance and preservation of the bodily tissues, are promoted. Trophotropic structures include centers in the cerebral cortex, thalamus, and hypothalamus, as well as an inhibitory region at the base of the reticular formation. It is noteworthy that some parts of the brain, e.g., the nonspecific nuclei in the thalamus and the caudate nucleus, seem to have both arousing and re-arousing roles. Their stimulation can produce evidence of raised or lowered arousal, depending on the frequency and intensity with which electrical pulses are applied to them.

## Determinants of arousal

The structures belonging to the arousal and de-arousal systems can be activated in three different ways. First, they are responsive to substances circulating in the blood. These include hormones secreted by endocrine glands; the reticular formation can be mobilized by injections of adrenaline, which adrenal glands pour into the blood stream in high quantities at times of fear and other kinds of emotional excitement. Second, the structures in question react to excitation that is making its way from sense organs, along sensory nerves, to the brain. The sensory pathways of the nervous system send collateral fibers to the reticular formation, which is incapable of more than crude differentiation among sensory qualities but takes account of the overall volume, intensity, and duration of stimulation and of the degree to which what is now coming in now differs from what has been received over the last few minutes. Last, there are fibers that convey excitation to centers in the brain-stem from the cerebral cortex. Influences transmitted along these fibers must be decisive when arousal or de-arousal depends on learning, on stimuli that require elaborate perceptual and intellectual analysis to reveal their significance, and on thought processes (including mental images and silent speech).

We must next ask what kinds of factors can raise arousal through these three mechanisms. There are, first, cyclical variations due to periodic changes in the nervous system and in the rest of the body. The clearest example is the diurnal alternation between sleep and waking. There are also seasonal variations, which are, of course, most conspicuous in species that hibernate.

Then, arousal is raised during states of high "drive" or "emotion" such as hunger, thirst, pain, sexual excitement, fear, or anger. These are conditions of "tension" or disquiet, impelling the organism to take action that will alleviate them. They can originate in deficits of vital substances or disturbances within the body, or they can be stirred up by external stimuli that are inherently irritating and injurious or owe their disturbing effects to previous learning.

Signs of heightened arousal have also been shown repeatedly to accompany intellectual effort or muscular activity.

But, of all the factors determining the level of arousal, the most studied, the most accessible for study, and the ones with the clearest relevance to art, are properties of external stimulus patterns. Upward fluctuations in arousal can be produced by stimulus properties of the three major classes that have been of interest to psychologists (Berlyne, 1967).

First, there are what we may call *psychophysical* properties, since

they are the traditional concern of the area of experimental psychology known as psychophysics, which measures ability to discriminate between stimuli. These properties depend on spatial and temporal distributions of energy. Brighter lights, louder sounds, and, generally, more intense stimuli are more arousing, as are those with a more abrupt onset and those that are undergoing the most rapid change.

There is some evidence that hues towards the red, or long wave, end of the visible spectrum are more arousing than the "cooler" hues at the other end. Sounds of high and low pitch appear to raise arousal more effectively than intermediate sounds in the 500 to 800 cps region.

Secondly, there are *ecological* stimulus properties, which involve association with biologically noxious or beneficial conditions. Some kinds of stimulation, which represent threats to health and survival, are innately arousing. They include physical pain and, in lower animals, sights and sounds characteristic of predators. Other stimuli, such as gentle rhythmic stroking of the skin or the degree of warmth and pressure that come from contact with another body (the "contact comfort" that Harlow, [1958] has identified as the original source of the bond between mother and child) are, it seems, innately de-arousing. More numerous and important, at least in human life, are those stimuli whose direct physiological effects are neither favorable nor unfavorable but arouse because of the significance that learning has given them. They resemble stimuli that have in the past regularly heralded or accompanied biologically important occurrences, such as the appearance of food or the onset of pain.

Lastly, and most significant of all for aesthetics, arousal can be raised by such properties of stimulus patterns as novelty, surprisingness, complexity, ambiguity, and puzzlingness. The term *collative* has been proposed to refer to them collectively (Berlyne, 1960). They seem to have many effects in common, and other terms that have been applied to them are unsatisfactory either because they cover some properties in this group but not others or because they commit us prematurely to particular interpretations of how they work. The word "collative," derived from the English verb "collate" or the Latin past participle "*collatum*," advertises to the fact that, in order to decide how novel, surprising, complex, and so on, a pattern is, one must compare or collate information from two or more sources. Sometimes, as with novelty or surprisingness, it is a matter of noting relations of similarity or dissimilarity between something that is present now and something that has been encountered in the past. At other times, as with complexity or incongruity, it is a matter of noting, putting together, and summing up characteristics of several elements that are present simultaneously. Perhaps the term "structural property" would not be too misleading as an alternative. The collative stimulus properties can be usefully discussed in the language of

information theory, although it seems doubtful at the present time that the concepts introduced by information theory are sufficient to cover all noteworthy aspects of them.

We shall be obliged to spend a great deal of time in later chapters on the collative stimulus properties and their motivational effects, since they can be identified with the factors that constitute "form," "structure," or "composition" in the arts.

## Arousal potential

In what follows, it will be convenient to refer to all the properties of stimulus patterns that tend, on the whole, to raise arousal as *arousal-potential*. This term will denote something like the "psychological strength" of a stimulus pattern, the degree to which it can disturb and alert the organism, the ease with which it can take over control of behavior and overcome the claims of competing stimuli. It seems likely that it will also represent the ease with which a stimulus can become associated with a response through learning and the likelihood that information about it will be retained in memory, i.e., the likelihood with which it can on some future occasion be recognized or represented verbally. "Arousal potential" includes psychophysiological properties such as intensity; ecological properties such as association with biological gratifications or discomforts; and collative properties such as novelty, surprisingness, and complexity.

It is important to note that the term refers to properties of stimuli and not to their effects on the arousal system. As mentioned, the greater the arousal potential in a stimulus situation the more aroused an organism is likely to be, all other things being equal. But we must beware of equating a particular quantity of arousal potential with a particular level of arousal or a particular extent of arousal increase. For one thing, the arousal-raising potentialities of a particular quantity of arousal potential will differ from situation to situation and from individual to individual, as we shall see. Furthermore, there are likely to be complications when extremes are reached to upset the simple direct relation between arousal potential and arousal increase. Arousal potential is inordinately low at times of sensory deprivation or boredom, but, as already mentioned, boredom seems to produce at least some manifestations of heightened arousal, apparently due to release of lower brain centers from inhibition by a cortex that is less effective than it usually is during waking hours. Next, experimental subjects are particularly prone to heightened arousal when presented with extremely faint stimuli, so that they have difficulty in determining whether a stimulus is present or not. And, to turn to the opposite pole, we have evidence that extremely

high arousal can lead to a rather abrupt drop in arousal. This can occur, for example, when animals are subjected to intense stimuli for long periods or to long conflict, as Pavlov noticed. He called this phenomenon "supramaximal inhibition" and assumed that it was a protective mechanism which intervenes to safeguard the nervous system against overstrain. Something of the sort seems often to occur when human beings are "bewildered" or "stunned" by a plethora of vivid, novel, varied, or distressing stimuli.

## CLASSIFICATION OF EMOTIONAL STATES

It seems, then, that an emotional state or, more generally, a motivational state has a certain intensity (arousal or activation level) and a certain direction or coloring, which implies a tendency to engage in a particular broad class of behavior. The situation is thus somewhat similar to what we find when we approach color vision. A visual sensation is characterized by a particular brightness (also known as "lightness" or "value"), depending on the amplitude of the light waves or the intake of luminous energy per unit area, and a particular hue, depending on which wave lengths of light predominate and to what extent.

There are, however, visible surfaces that do not have a definite hue. In the light that they give off, none of the visible wave lengths preponderates over the others. These surfaces have the so-called nonchromatic colors—black, white, and the various shades of grey.

Do the nonchromatic colors have equivalents among emotional states? Is there such a thing as a rise in arousal without a specific quality or direction? At least two writers have maintained that there are and that rises and falls in the intensity of nonspecific emotion are important in art. In his book on music (1956), Meyer states that "our own introspective evidence and the reports of experiences of others testify to the existence of undifferentiated emotions." He quotes, with apparent approval, a concurrent statement by Cassirer (1953): "What we feel in art is not a simple or single emotional quality. It is the dynamic process of life itself."

Ordinary language contains hundreds of words that can be called upon to differentiate subtle variants of emotional states. It would seem that poets and novelists, with their original combinations of epithets and metaphors, can extend the fineness of discrimination indefinitely. Some commentators have felt that every work of art presents its unique emotional flavors.

Yet, if we are to further scientific inquiry, we need some classificatory scheme that will relate specific varieties of emotion to one another while taking account of their vast multiplicity. The principal attempts to

satisfy this need fall into two classes. First, there have been lists of basic emotions, often with a recognition that blends of more than one can occur. Early attempts of this sort include McDougall's (1908) seven primary emotions (anger, disgust, elation, fear, subjection, tender emotion, and wonder), corresponding to primary "instincts" or "propensities," and Watson's (1921) three innate emotional patterns (fear, rage, and love). More recently, Plutchik (1962) has offered a system of eight "primary emotional dimensions," corresponding to "prototypic patterns of behavior involved in biological adaptation at all evolutionary levels." Although called "dimensions," they are treated rather as basic categories or constituents of emotional states, since various mixtures of them are discussed and named. The eight are labelled destruction, reproduction, incorporation, orientation, protection, deprivation, rejection, and exploration. Words noting different degrees of intensity of each are distinguished. For example "surprise," "amazement," and "astonishment" represent increasing degrees of intensity along the orientation dimension. Finally, several psychologists have contrived devices for measuring variations in mood or momentary emotional state. They have adopted various dimensional schemes, some of them derived from factor analysis and some from theoretical presuppositions (for reviews, see Davitz, 1969; Spielberger, Lushen, & McAdoo, 1971).

Other classificatory systems make it possible to specify an emotional state by locating it along each of three independent dimensions. As long ago as 1896, Wundt declared that "feelings" vary in degree of *pleasant-unpleasantness*, *excitement-calm*, and *tension-relaxation*. Schlosberg (1954), having studied ability to identify emotions corresponding to photographed facial expressions, adopted *pleasantness-unpleasantness*, *level-of-activation*, and *attention-rejection* dimensions. Osgood, Suci, and Tannenbaum (1957) measured "connotative" (i.e., affective or emotional) meanings of words with the help of their semantic-differential scales and, after applying factor analysis to the data, identified an *evaluative*, an *activity*, and a *potency* dimension.

All these systems, though derived from very different kinds of research, have clearly more in common than the fact that they all content themselves with three dimensions. They all recognize a *pleasantness-unpleasantness* or *evaluative* dimension, as well as an intensity or level-of-arousal dimension (Wundt's *excitement-calm*, Schlosberg's *level-of-activation*, and Osgood's *activity* factor). The third dimensions that they introduce are, however, difficult to interpret and to relate to one another. Since all these authors were looking for independent dimensions to which the axes of a Cartesian space could correspond, their systems recognize pleasantness-unpleasantness and intensity of arousal only to the extent that they are independent of each other. However, as we shall see in the next chapter, there are grounds for believing that arousal and pleasantness

are related, although the relations are rather complicated and degree of upward or downward change in arousal seems likely to be more pertinent than arousal level as such.

Once again, analogies between all these approaches to the classification of emotional states and those used to classify colors obtrude themselves. Attempts to list basic emotions are like attempts to divide the visible spectrum up into regions of similar color, with the possibility of adding to the number of hues by color mixture. The principal difficulty, with color as with emotion, is a lack of objective criteria, and thus of agreement, on where the boundary lines should be drawn. It has, for

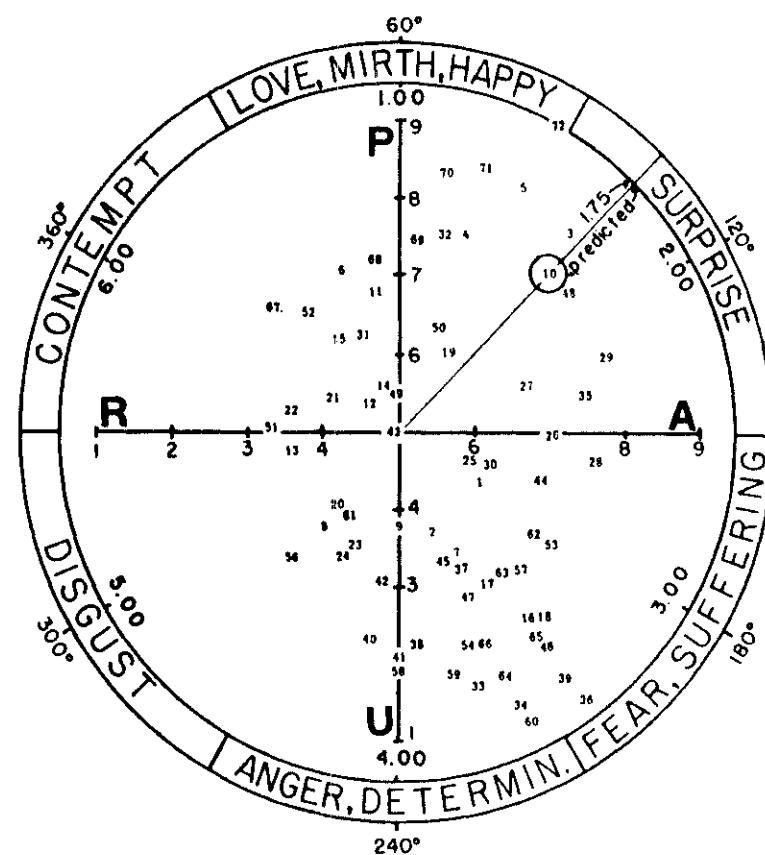


Figure 7-2. Schlosberg's classification of emotional states with reference to the Attention-Rejection (R-A) and Pleasantness-Unpleasantness (P-U) dimensions. (From Schlosberg, 1952.)

example, been established by the experiments of psycholinguists that the familiar seven "colors of the rainbow" are peculiar to own culture; members of other cultures divide up the spectrum quite differently. The three-dimensional classifications of emotional states are reminiscent of the fact that any distinguishable shade of color is equivalent to a combination of three primary colors with a particular luminance attached to each. It might seem hard to believe that three dimensions suffice for the specification of all possible colors; the Maerz and Paul Color Dictionary contains samples of 7,000 distinguishable colors and 4,000 color names. Yet three dimensions are enough. Likewise, there might well be resistance to the suggestion that three dimensions can encompass all the diversity of human emotions. But Figure 7-2, from Schlosberg (1952), shows what a varied range of emotions can be differentiated with the help of only two dimensions.

Certainly, existing classificatory schemes can only be regarded as comparatively fumbling first efforts. Much more progress will hardly be possible until research, including neurophysiological and psychophysiological research, has advanced much farther. And in view of the unclear relations and boundaries between emotional states and drive states, a satisfactory taxonomic system will have to encompass motivational conditions in general.

## 8

## PLEASURE, REWARD, HEDONIC VALUE

Aestheticians have always been loath to identify artistic value with the greatest pleasure of the greatest number, since, if they did so, they would have to rate the latest popular song or grade-B film higher than the acknowledged masterpieces of artistic creation. Nevertheless, the provision of pleasure or enjoyment has long been recognized as a prime function of art by aestheticians from Plato, who asked "would it be possible to define beauty as that which makes us feel joy through hearing and sight?" through St. Thomas Aquinas, who defined as beautiful "those things that, having been seen, please (*quod visum placet*)"; and Hume, who stated that "pleasure and pain . . . are not only necessary attendants of beauty and deformity, but constitute their very essence"; to a recent psychological writer, Metzger (1965), who says, "I begin with a simple, one might almost say, banal thesis: *all art should give pleasure*."

Not that all aestheticians have placed their main emphasis on pleasure. Some schools have considered art to be primarily a source of knowledge or understanding or moral improvement. And it has often been felt that these benefits, like so many other things that are considered good for us, must be wrested from art at the cost of intellectual hard labor.

The early nineteenth-century experimental psychologists, with their partiality for introspective studies, devoted much attention to "pleasantness" and "unpleasantness" as attributes of conscious experiences, particularly of those that they classed as "feelings." They carried out experiments in which the subject was presented with various stimuli and required to report on the "hedonic tone" of each.

The contemporary psychologist is forced by his approach to concentrate on outward correlates of pleasure. The most convenient and most frequently used way to obtain data from which conclusions can be drawn about pleasantness and unpleasantness is that old standby of experimental aesthetics, the verbal expression of preference. Large quantities of information can be obtained by this method with relatively little effort and expenditure on apparatus. The resulting data often lend themselves to sophisticated mathematical treatment. Consequently, verbal methods will

certainly continue to form an essential part of the psychological aesthete's armory for a long time to come. But we have also had occasion to note their limitations and particularly how the theoretical models to which judgments of pleasantness, preference, and the like are fitted must form closed, self-contained worlds until more research has been done to connect them with other forms of behavior.

There are, of course, other nonverbal expressions of pleasure and displeasure—postures, facial expressions, vocalizations. These have been used in research on determinants of pleasure in human infants and occasionally in lower animals. Most human adults have been trained to keep them under restraint and let them out only when socially called for. So they are of limited use for research with such subjects, although volume of laughter and of applause have occasionally been used as measures of pleasurable reaction in audiences.

For the present-day psychologist, measures of pleasure and displeasure must be of interest chiefly (but not exclusively) as aids in the prediction, control, and explanation of nonverbal behavior. And the same must surely apply to the artist. He may derive a certain amount of independent satisfaction from hearing people say that they like his work. But his eagerness to hear such statements must come principally from their value as pointers to what people will do and say in other contexts. If their verbal evaluation of his work is favorable, he believes that they will be more likely to read it, to buy it, to come to see it or listen to it, and to persuade their acquaintances to do likewise. They will be more likely to act in such a way that his status in the world of art, or in society as a whole, or in the eyes of posterity, will be enhanced.

For the psychologist as well as for the artist, verbal and nonverbal expressions of pleasure in the presence of particular objects or events must be of some interest in themselves. They form a prominent part of human behavior. But as already pointed out, they must be of greater interest as clues to how the objects or events in question will affect behavior in other contexts. And there are a number of behavioral phenomena—ways in which stimuli can affect behavior—that occupy crucial positions in psychological theory and seem closely related to pleasure. We must therefore consider them briefly in turn.

**Reward** When a stimulus and a response occur together or in close succession, learning may take place. An association between the stimulus and the response may become established or, if it already existed, it may become stronger. Sometimes, one pairing is enough, but several repetitions are usually necessary to induce a detectable degree of learning. Sometimes, two or more stimuli are experienced together or in close succession, and the organism is not seen to perform any overt response to them. Yet, later behavior shows that something was learned. It so, "latent" or "observational" learning is said to have taken place.

We then infer that an internal response representing the second stimulus became associated with the first stimulus.

Whether learning will occur at all and, if so, how effectively depends partly on how frequently and how closely the stimulus and the response have been paired. But, in some circumstances, they can be contiguous with each other many times, and yet no learning will occur or a stimulus-response association may even be weakened. Additional conditions besides stimulus-response contiguity are necessary for learning and play a part in determining how effective the learning will be. These are known as conditions of "reinforcement." Reinforcing conditions may be properties of the stimuli or responses that participate in the association that is to be strengthened. Usually, however, they will consist of other events that occur at about the same time.

Exactly what serves as a reinforcing event will vary with the kind of learning situation. In classical or Pavlovian conditioning, reinforcement comes from the unconditioned stimulus, the stimulus that originally evoked the response that is to become attached to the conditioned stimulus. In instrumental or operant conditioning, the reinforcement comes from some event that follows completion of the response that is to be learned. Such an event, often called a "reinforcer" by specialists in instrumental conditioning, is best called a *reward*, since this sense is reasonably near to the everyday usage of the word and we need a term that will distinguish this kind of reinforcement from other kinds that concern other forms of learning.

Many responses, and quite possibly all responses, can become more strongly associated with the kind of stimulus situation in which they occur if they are followed by rewarding events. Most experiments on instrumental conditioning study bodily movements dependent on the skeletal musculature. There is, however, evidence that verbal utterances, thoughts, and even visceral responses, such as changes in heart rate and stomach contractions, are also subject to this kind of learning.

Rewarding events often work by removing or attenuating some source of discomfort. Any condition whose elimination or attenuation is rewarding is known technically as an *aversive* condition. Then, certain events weaken, rather than strengthen, the response that they follow. These events are said, both in everyday language and in technical language, to be *punishing*. Many stimuli that human beings say they dislike or find unpleasant are both aversive and punishing in these specialized senses. But the two concepts are logically quite distinct. There may be conditions that are aversive with being punishing or vice versa, and, as we shall see later, there are grounds for suspecting that such conditions are particularly important for aesthetics.

**Feedback** Behavior is guided towards adaptive channels, and kept within these channels once they have been reached, by processes

of negative and positive feedback. If certain events occur while a particular kind of action is in progress, the organism is induced to abandon what it is doing and replace it with something else. This state of affairs is what is known as negative feedback. What results is sometimes more or less random search or "hunting"—a rapid succession of responses sampling the organism's behavior repertoire until negative feedback ceases. At other times, behavior takes a course diametrically opposite to the one that was being taken. Other accompaniments of a course of action may induce the organism to persist in, or intensify, what it is doing. Then, we speak of positive feedback. Behavior pursues the same course until, through some alternation of external circumstances or some accidental deviation, positive feedback is once again replaced by negative feedback.

Positive feedback sounds very much like reward, and the two concepts have more than once been confused with each other. The hunting that is set in motion by negative feedback and continues until positive feedback is restored seems to resemble the trial-and-error behavior of simple instrumental-conditioning situations. There is, however, an important difference in that positive and negative feedback determine simply the behavior of the moment whereas reward and punishment produce learning. In other words, whether an event is rewarding, and how effectively, can be determined only by seeing what happens when the organism is put back into the situation after a delay of hours or days, when the event is no longer present. Learning means a lasting change in behavior, the acquisition or strengthening of a stimulus-response association that will affect future behavior.

*Approach, withdrawal, and avoidance* Instrumental conditioning will ensure that animals and human beings learn to approach sources of rewarding stimulation and to withdraw from objects if contact with them has had punishing consequences. Furthermore, warning signals, i.e., stimuli that regularly precede punishing events, will generally come to evoke learned avoidance responses, i.e., the organism will take steps to forestall the impact of the punishing event altogether. However, there appear to be stimuli that, in at least some animal species, innately and directly impel locomotion towards or away from them. It is not entirely impossible that something of the sort occurs, perhaps in a vestigial form, in human beings.

*Incentive value* Much of our behavior, and of the behavior of infrahuman animals, is governed by expectations. We are likely to embark on actions that we expect to have certain consequences, and, if so, the consequences are said to have positive incentive value. Similarly, we tend to desist from actions with other anticipated consequences, said to have negative incentive value. When faced with a choice among several mutually exclusive acts, each of which may very well have several consequences, the one with the greatest net positive incentive value or smallest

net negative incentive value is likely to prevail. Other terms, such as "utility" and "disutility" or "gain" and "cost," are also current.

Some contemporary theorists attempt to explain all behavior, including the simplest learned behavior of animals, in terms of expectation and incentive value. For example, it is often suggested that reward can be equated with positive incentive value. But this step may be a little hazardous pending further research. We are entitled to speak of expectations when we have means of detecting them. We can certainly discover and measure the expectation of a human being in a particular situation by simply asking him which events he thinks might happen and how likely he judges each of them to be. We can sometimes tell that an animal like the rat is expecting a certain event before it occurs, by observing a preparatory action or an avoidance response before the event is due or by observing reactions indicative of disappointment when an expected event is replaced by something different. But we do not yet have adequate evidence that every rewarding event is preceded by some internal process that represents it.

A further and perhaps more cogent reason for not confusing incentive value with reward value is the fact that anticipation of appealing consequences often brings to the fore behavior that has never been followed by these consequences in the past and has perhaps never been performed before at all. Human beings frequently derive their expectations not far from their own past experience of performing relevant actions in the relevant contexts but from reasoning processes or from the verbal utterances of other human beings. We cannot then speak of instrumental conditioning but of inference (Berlyne, 1965).

## HEDONIC VALUE

Some events, such as an opportunity to eat when hungry or the termination of pain, are associated with reward value, positive feedback, approach, and positive incentive value. They will be verbally reported as pleasant, and they will elicit postural and facial expressions of pleasure. Other events, such as the onset of pain or fear, are punishing and aversive. They generate negative feedback, occasion withdrawal and avoidance, and have negative incentive value. Verbal and nonverbal expressive reactions will indicate that they are unpleasant. A stimulus could conceivably have one of these properties without having the others. And it is by no means established that the four groups of behavioral phenomena invariably go together with verbal expressions of pleasure or its opposite.

A few experimental findings have been claimed as evidence that stimuli receiving higher verbal evaluations have higher reward value in instrumental conditioning situations. The techniques in question are,

however, suggestive rather than conclusive on this point. Apart from other limitations, they do not include a delayed test to make sure that the observed response strengthening was durable. Munsinger (1964) used an apparatus causing a stimulus to be exposed briefly whenever a key was pressed. After a certain, unpredictable number of responses (following what is called a variable-ratio schedule), the stimulus intermittently exposed was replaced by another. In one experiment, the stimuli consist of syllables that other subjects had rated on five of Osgood's semantic-differential scales reflecting the evaluative factor. When negatively valued syllables ceased to appear after responses and syllables with high positive evaluations took their place, there was a significant increase in the rate of pressing the key. In another experiment, for which the same technique (Munsinger & Kessen, 1964) was used but randomly constructed polygons were the reinforcing stimuli, the highest rates of responding were produced by the shapes that were best liked according to a verbal-scaling experiment. Finley and Staats (1967) devised a situation in which sixth-grade children had to press either of two keys to turn out a light whenever it appeared. Whenever one of the two keys was pressed, the experimenter uttered words that had been previously judged on an "unpleasant-pleasant" scale. When the words had been judged pleasant, there was a steady increase in the probability of choosing the response that caused them to be heard, whereas words receiving unfavorable ratings produced a decreasing preference for the response that preceded them.

On the other hand, work carried out in the author's laboratory (Berlyne & Crozier, 1971) makes the relations between reward value and judged pleasingness appear more complicated. On each of 50 successive trials, the subject had to press one of two keys as soon as a buzzer sounded. One of these responses caused a more complex visual pattern to be projected on screen, whereas the other response exposed a less complex pattern. The response bringing on this more complex pattern was the one that gradually became more frequent from trial to trial.

A later experiment (unpublished) showed that the more complex item (the one to which subjects exposed themselves more often) was always rated more "interesting" than the item with which it was paired. But it was not always rated more "pleasing" and, in some pairs, it was rated significantly less "pleasing."

So, much more research will be needed to clear up the relations among verbal evaluations, reward value, and the other phenomena we have been discussing. We shall, however, adopt the working assumption that pleasure, reward value, positive feedback, attractiveness (i.e., capacity to elicit approach), and positive incentive value tend to go together. And we shall use the term *positive hedonic value* to denote them all jointly. Similarly, *negative hedonic value* will denote unpleasantness,

aversiveness, punishment value, negative feedback, repulsiveness, and negative incentive value.

### Hedonic value and arousal

There are at least three reasons for believing that the hedonic value of a stimulus depends on how arousing or de-arousing it is.

First, pleasant or rewarding events seem virtually always to produce observable changes in arousal level or "drive level" (to use an older term that, at least in some of its aspects, means much the same as arousal level). An organism often seems very active and disturbed before it receives a reward, especially when it has been subject to an aversive condition like hunger or fear. The advent of the reward (eating, a safety signal) then produces an abrupt change to quiescence and tranquillity. At other times, a rewarding event, instead of reducing arousal, makes the organism more excited, at least for a while.

Second, as we shall see, the parts of the brain that control fluctuations of arousal and the parts of the brain on which reward and punishment depend overlap to a large extent, and, insofar as they are distinct, they are located close to one another with plentiful connections joining them.

Third, the characteristics on which the pleasantness or unpleasantness of a stimulus hinges are precisely the ones that determine by how much arousal is raised or lowered and thus make up what we have called "arousal potential." They include psychophysiological properties, like intensity, color, and pitch. They include ecological properties involving association, whether inherent or learned, with conditions conducive or threatening to survival and well-being. Most significant of all for aesthetics, they include the collative or structural properties, such as novelty-familiarity, simplicity-complexity, clarity-obscurity, and expect-edness-surprisingness.

There have been vigorous disputes between psychologists who believe that reward can be equated with a decrease in arousal (drive reduction) and those who think rather that arousal-raising (drive-inducing) events are rewarding. It might be thought strange that two such diametrically opposite views could survive and find adherents for so long. Both sides could cite observations that favored their contentions. Rewarding events are not infrequently accompanied by a rise in arousal followed by a fall, so that it is difficult to tell which of these two phases is the crucial one.

*Two mechanisms of positive hedonic value* The points at issue are still far from resolved, but a review of such evidence as we have (Berlyne, 1967), coming from several very different lines of research, sug-

gests that reward or pleasure can occur in either of two ways. First, extremely high arousal seems to be unpleasant, punishing, aversive, and generally disturbing, so that, when arousal approaches the upper extreme, a decrease to a lower arousal level is pleasurable and rewarding. Second, a limited rise in arousal, which is not enough to drive arousal up into the unpleasant range, can apparently be pleasurable. More often than not, such a moderate arousal increment is followed within a few seconds by a drop towards the initial level of arousal, but the rise is what produces the hedonic effect. These two hypothesized mechanisms of hedonic value may be understood a little better after we have linked them with some recent neurophysiological findings.

### Hedonic centers in the brain

In 1954, two complementary discoveries made a great stir and were confirmed by hundreds of later experiments. The experiments in question had apparently located brain centers for reward and for punishment, respectively.

Olds and Milner (1954) placed rats in a rectangular box containing a wide pedal. The pedal was actually a switch connected with a cable that could apply electrical stimulation to a point in the brain through an implanted electrode. The rat delivered stimulation to its own brain whenever it stepped on the pedal. Which point was actually stimulated varied from one rat to another, and it was found with many rats, but by no means all, that brain stimulation produced in this way was highly rewarding. The rats in question would press the pedal repeatedly at a high rate, often for hours on end. Points whose excitation could reinforce instrumental responses were to be found, it seemed, throughout a large part of the brain stem. These points presumably belong to structures that come into play when natural rewards are received and play an essential part in the reinforcement of instrumental responses. Human beings who have had to undergo brain surgery have sometimes had electrodes inserted in the corresponding areas of the brain, and they have generally reported that the delivery of electric pulses to these electrodes produces pleasant sensations.

A little earlier, Delgado, Roberts, and Miller (1954) had located areas in the brain stem where stimulation had opposite effects. Cats would learn rapidly to operate a switch that turned off stimulation of points in these areas or to respond to a buzzer sound that heralded it with a response that averted the stimulation.

*The three hedonic systems* As points in the brain producing these rewarding and punishing effects have been mapped, and particularly as the interconnections between them have been investigated, it has

become apparent that hedonic effects of stimuli depend on the activities and interactions of three systems in the brain. They may be called the *primary reward system*, the *aversion system*, and *secondary reward system*.\*

Figure 8-1 indicates the relative locations of the three systems according to the work of Olds (Olds & Olds, 1965), but it must be emphasized that the anatomical identifications are provisional and open to debate.

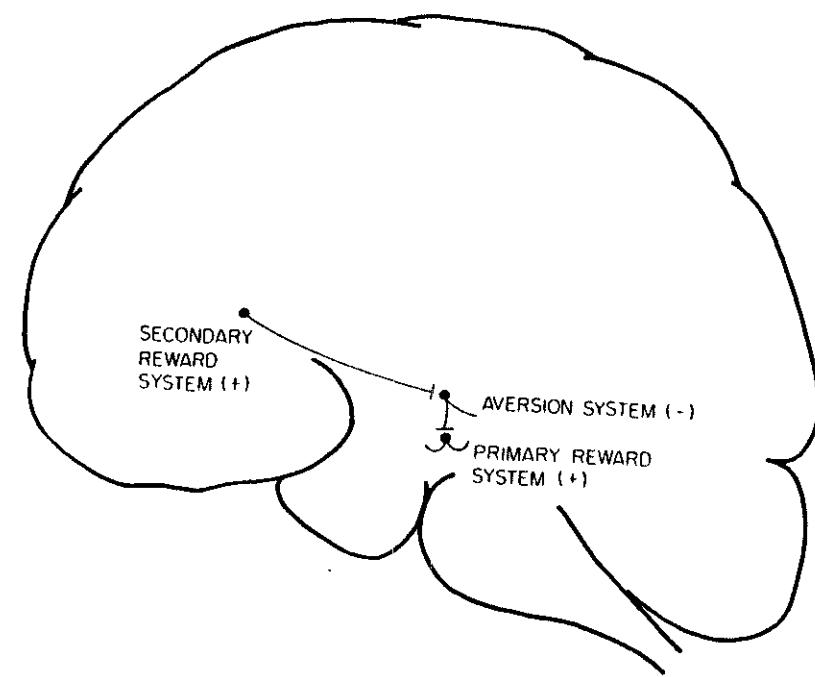


Figure 8-1 Schematic section of the human brain, showing approximate locations of the three systems controlling hedonic processes according to Olds & Olds (1965). The secondary reward system exerts an inhibitory influence on the aversion system, as does the aversion system on the primary reward system.

To discuss the primary reward and aversion systems first, a surprising number of physiologists and psychologists have felt compelled to recognize the existence of two antagonistic networks of cells in the brain, which exert, respectively, facilitatory and inhibitory influence on behavior and

\* It should be made clear that the "secondary reward system" has no special connection with "secondary rewards" (also known as "conditioned reinforcers," "token rewards," and stimuli with "acquired reward value"). Here, it is the system that is secondary and not the reward.

on learning. They have given the two systems a bewildering variety of names: the "start" and "stop" areas (Lilly, 1958); the "positive reinforcement" and "negative reinforcement" areas (Olds, 1962); the "A (approach)" and "W (withdrawal)" systems (Schueirla, 1959); the "go" and "stop" systems (Stein, 1962); the "pull" and "push" systems (Grastyán et al., 1966); the "reward" and "aversion" systems (Berlyne, 1967); the "arousal II" and "arousal I" systems (Routtenberg, 1968); the A system, associated with "expression of discomfort, aversion (*Abwendung*) and self protection," and the Z system associated with "proclivity (*Zuwendung*) and smiling" (Lang, 1967); and the "accessive" and "defensive" systems (Schönpflug, in press).

The two systems are assumed by all these authors to counteract each other. A fair amount of evidence from experiments using removal of brain tissue or else simultaneous stimulation of areas belonging to both systems indicates that the aversion system, when active, inhibits the primary reward system and diminishes the effects on behavior that are attributed to that system (Olds & Olds, 1965). But there is no evidence that activity in the primary reward system inhibits the aversion system. Simultaneous stimulation of the primary system will not reduce the punishing or aversive effects of simultaneous stimulation of the aversion system or of external stimuli that have been paired with electric shock (Brady & Conrad, 1960; Olds & Olds, 1965).

The primary reward and aversion systems are, it is clear, closely connected, and at least partially identifiable, with the brain structures controlling the manifestations of heightened arousal. Powerful and virtually insatiable rewarding effects can be obtained by stimulating the lateral hypothalamus and the medial forebrain bundle, an important tract of nerve fibers that passes along the sides of the hypothalamus. This is what Olds calls the "positive reinforcement focus." However, Valentine and Campbell (1966), having shown that primary rewarding effects can be obtained when large amounts of tissue are cut out of this area, suggest that the essential focus of the system is actually in the reticular formation. This, it will be recalled from Chapter 7, is the principal brain structure governing fluctuations in arousal. Certainly, some of the sites producing marked rewarding effects of brain stimulation lie within the reticular formation. The aversion system (Olds's "periventricular system") consists of fibers passing through the medial hypothalamus into the midbrain tegmentum, which is largely occupied by parts of the reticular formation. A substantial body of experiments shows that stimulation within either the primary reward system or the aversion system produces familiar signs of increased arousal, including changes in heart rate, high-frequency EEG waves, and increased bodily movement.

The secondary reward system, on the other hand, seems to be more

or less identical with the trophotropic or de-arousal system. Olds's experiments point to the existence of what he calls a "positive-reinforcement field," which has a much larger extent than the positive enforcement "focus" or primary reward system and is generally to be found rather higher up, toward the top of the brain-stem and in the limbic system, which occupies the lowest and most primitive parts of the cerebrum. If electrical stimulation of this region results from an instrumental response like bar pressing, the response is repeatedly performed. There are two important contrasts with what happens when the primary reward system is stimulated: the response rate is not so high, and, after responding for a while, the animal will slow down until it eventually becomes inactive. Whereas, as we have noted, activation of the primary reward area is accompanied by signs of raised arousal, activation of the secondary reward system coincides with de-arousal. Its stimulation leads to slow heart beats, the appearance of low-frequency EEG waves, and reduced motor activity.

These observations, together with Olds's experiments on how the three hedonic systems interact with one another, suggest that the secondary reward system produces rewarding effects indirectly. The secondary rewarding system inhibits the aversion system, which in its turn inhibits the primary rewarding system. Activation of the secondary rewarding system thus produces reward by releasing the primary rewarding system from inhibition.

*The three systems and the two mechanisms* We can therefore begin to understand how the two distinct mechanisms of reward, to which the available evidence seems to point, might work. It will be recalled that one of these mechanisms produces reward when arousal is lowered after rising to an uncomfortably high level. The other works through arousal increase rather than arousal reduction and comes into play when arousal is raised to a moderate extent.

The first mechanism, we may plausibly suppose, depends on the secondary reward system. When food is presented to a hungry animal or when fear is alleviated through the appearance of a reassuring stimulus, the secondary reward system becomes active. This, we have seen, reduces the activity of the aversion system, which means a lowering of arousal and an alleviation of unpleasantness. Reports of human beings who have undergone brain surgery confirm that electrical stimulation of some limbic regions makes formerly intractable pain more tolerable and temporarily abolishes severe depression (Heath, 1964). In animals such stimulation eliminates, or at least diminishes, effects of conditioned fear on behavior and mitigates the normal tendency to press a bar switching off stimulation of the tegmental aversion system. Once the aversion system is inhibited, the primary reward system will be disinherited, which

will mean reinforcement of any instrumental responses that are being performed at the time, as well as positive feedback, approach, and other correlates of pleasure.

When, on the other hand, reward comes from moderate arousal increase and has nothing to do with arousal reduction, we can presume that this roundabout way of activating the primary reward system is bypassed. The primary reward system will then be excited directly, and the other two systems will not have necessary roles to play. There is no reason why this could not happen. The reticular formation and the hypothalamus, which are in the locality where centers belonging to the primary reward system are to be found, are abundantly supplied with offshoots of the sensory pathways leading from sense organs to the brain, as well as with fibers transmitting excitation from the cerebral cortex.

### THE WUNDT CURVE

Let us now consider more closely those cases where positive hedonic value comes from a moderate rise in arousal. The mechanism responsible for pleasure and reward value must then depend on interaction between the primary reward system and the aversion system. We have already noted that the aversion system, when activated, inhibits the primary reward system, but that the opposite is apparently not true. Let us further recall that the properties determining how pleasant or unpleasant a stimulus will be, and thus how intensely it will activate either the primary reward system or the aversion system, seem to be the same as those that determine how arousing it will be, i.e., the properties that constitute what we have called "arousal potential."

Let us make two plausible assumptions (see Berlyne, 1967) about thresholds, the threshold being the minimum intensity of stimulation that is needed to produce a particular effect. First, both the primary reward system and the aversion system consist of a large number of neurons or nerve cells. Each neuron will have its individual threshold, and the thresholds must differ somewhat from neuron to neuron. This being so, we can safely suppose that the thresholds will be distributed according to what is called a "normal" or "Gaussian" distribution represented by the curve in Figure 8-2a. The horizontal axis represents possible threshold levels of excitation, and the curve shows the number of neurons possessing each value as a threshold. It may be seen that most neurons will have thresholds around the middle of the range, but a few will need much less or much more excitation to activate them. Figure 8-2b shows the corresponding cumulative distribution function. It represents the number of neurons with thresholds *below* each point on the horizontal axis. In other words, the curve shows how many neurons will

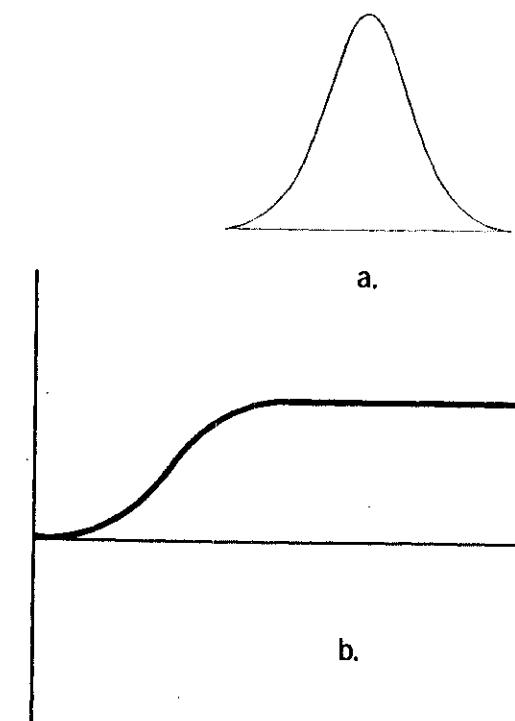


Figure 8-2 (a) The bell-shaped curve representing the normal (Gaussian) probability distribution. (b) The ogival curve representing the normal (Gaussian) cumulative distribution function.

be active—will have crossed their thresholds—at each level of excitation.

Secondly, it seems that the average threshold for neurons in the aversion system is higher than the average threshold for neurons in the primary reward system. On the whole, it will take more excitation, which means more arousal potential, to bring the aversion system into action than to bring the primary reward into action.

Armed with these assumptions, we can now make a little progress towards drawing quantitative conclusions about relations between hedonic value and arousal potential.

We can tentatively assume that the situation is as depicted in Figure 8-3. Here the horizontal axis represents arousal potential. The vertical axis represents degree of activity (which may for practical purposes be identified with the number of neurons excited) in the primary reward and aversion systems. The solid curve represents the way in which activation of the primary reward system varies with arousal potential. The broken

curve does the same for the aversion system. The latter curve is drawn upside down with respect to the former, because the two systems work in opposite directions. The aversion-system curve is also displaced to the right to take account of the assumption that it takes more arousal potential to activate it. There are various pieces of evidence for this (Berlyne, 1967). Schneirla (1959) has reviewed a vast body of observations of many species of animals, indicating that animals tend to approach and prolong moderately arousing stimulation and to flee from, or avoid, severely arousing stimulation. Perhaps the most interesting evidence comes from some experiments performed by the Hungarian neurophysiologist, Grassyán, and his colleagues (1966). They found stimulation of the cat's hypothalamus at moderate intensities to be rewarding. A cat would eagerly run to, and operate, a lever that switched on such stimulation and keep away from a lever that switched it off. When, however, more intense stimulation was delivered through the electrodes, diametrically opposite phenomena appeared. The cat would then operate, and cling to, a lever that switched off the stimulation and give a wide berth to a lever that switched it on.

It seems quite likely that, in most of the natural environments where

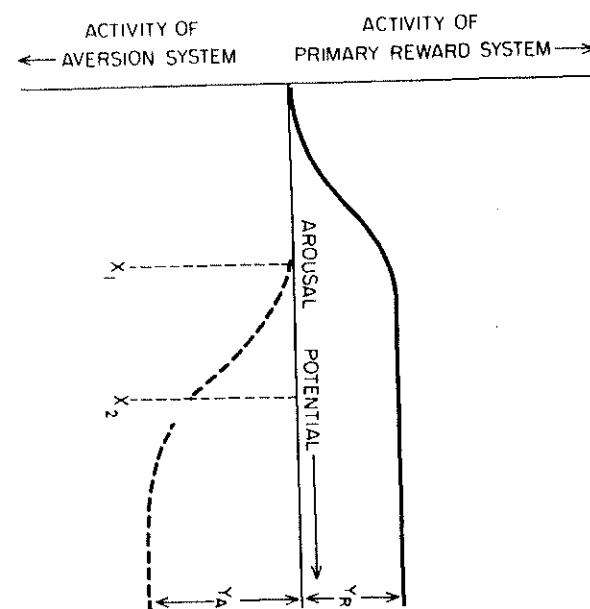


Figure 8-3 Hypothetical curves representing degree of activity of the primary reward system and of the aversion system as a function of arousal potential. (Adapted from Berlyne, 1967).

animals find themselves, relatively moderate stimulation is more likely to mean the presence of food, mates, and other beneficial objects or events, whereas stronger and more novel stimulation is apt to bode danger. This could be the evolutionary origin of a tendency for the primary reward system to be brought into play by stimulation that is not arousing enough to activate the aversion system.

Finally, Figure 8-3 embodies one assumption for which there is no direct evidence but which seems plausible in view of implications to which we shall come in due course. This is the assumption that the distance between the base line and the asymptote (the value to which the curve tends to flatten out) is greater in the aversion curve ( $Y_A$ ) than in the primary reward curve ( $Y_R$ ).

To see what the net result of a particular amount of arousal potential will be, we have merely to take the algebraic sum of the two curves in Figure 8-3. This means subtracting the ordinates of the aversion-system curve from the corresponding ordinates of the reward-system curve. The resultant curve will then have the shape displayed in Figure 8-4.

This is a curve with a long and distinguishing history in psychology. It was first presented in 1874 by the pioneering experimental psychologist,

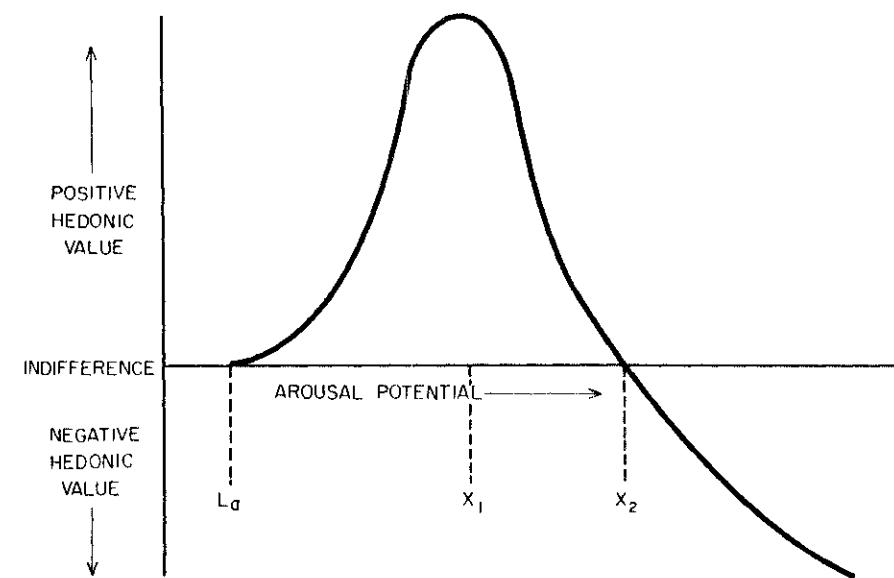


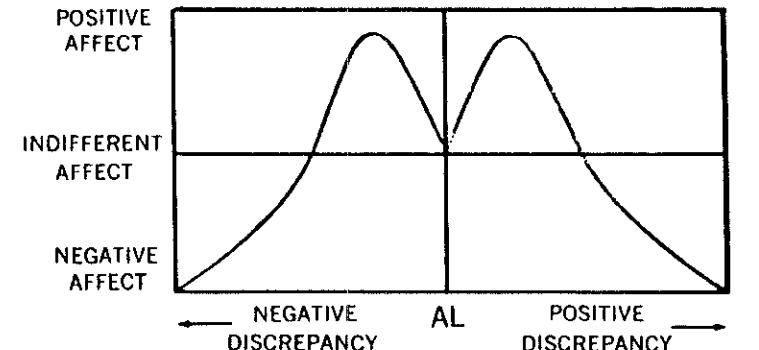
Figure 8-4 The Wundt curve, resulting from the algebraic summation of the two curves in Fig. 8-3. (Adapted from Wundt, 1874; and Berlyne, 1960, 1967).

Wundt.\* He used it to present his views on the relations between pleasantness or unpleasantness, conceived as attributes of the conscious experiences evoked by stimuli and stimulus intensity. We must, however, broaden his interpretation. For us, the horizontal axis represents not merely stimulus intensity but arousal potential, which includes intensity but also other stimulus properties that tend to raise arousal, including biological significance and the collative properties like novelty and complexity. The vertical axis will represent hedonic value, which we must judge from effects on behavior, including reward value and punishment value, as well as from verbal reports.

The curve shows what can be expected to happen as arousal potential is increased from zero. First, there will be no reaction at all for a while; as long as stimulation falls below a certain level, the "absolute threshold" ( $L_a$  in Figure 8-4), the subject will not notice it, and it will have no effect on behavior. As arousal potential rises above the absolute threshold, the stimulus becomes more and more pleasant and rewarding, with positive hedonic value reaching a peak when arousal potential is at a moderately high point. Further increase causes a decline in positive hedonic value towards indifference (represented by the base line), and then the stimulus becomes increasingly unpleasant and punishing with a gradual levelling off.

Another curve that has figured in recent discussions of motivational questions with a bearing on aesthetics is the so-called "butterfly curve" (Fig. 8-5). This curve, introduced by McClelland and others (1953), illustrates their theory of "affect," according to which any stimulus is compared with the subject's momentary "adaptation level." The adaptation level is some kind of stimulation that the organism has been receiving in the recent past or is for some other reason expecting. When a stimulus with a little more or a little less of a particular quality than the adaptation level is received, "positive affect" is held to result, whereas "negative affect" occurs when discrepancies in either direction from the adaptation level become larger. Although the notion of "adaptation level" is not defined as precisely as one might wish, degree of discrepancy from it evidently means novelty or surprisingness, which are important constituents of arousal potential. Since, as the symmetry of the butterfly curve indicates, discrepancies in an increasing or decreasing direction are supposed to have similar motivational effects, the right-hand half of the curve should suffice if we let the horizontal axis represent degree of discrepancy, regardless of direction. And it is noteworthy that the right-hand half has the same shape as the Wundt curve.

\* The underlying hypothesis can actually be traced much further back to Aristippus, the Cyrenaic philosopher of the fourth century B.C., who identified pleasure with "gentle motions" set up within the perceiving subject and pain with "violent motions."



DISCREPANCY FROM ADAPTATION LEVEL

Figure 8-5 The butterfly curve figuring in the theory of McClelland et al. (1953). (From Haber, 1958).

When Wundt first presented this curve, it was not derived from any experimental data, even of the introspective kind to which Wundt and his contemporaries were partial. It seems to have been based simply on his view of everyday experience. Nevertheless, experimental support was not long in coming. For example, curves of this general shape were obtained when human subjects were asked to dip their fingers in water at different temperatures and make judgments of pleasantness or unpleasantness (Lehmann, 1892). Such curves also described the data of experiments in which human beings tasted water containing different concentrations of salty, bitter, and sour substances (Engel, 1928) and were asked to judge each, as well as experiments in which rats were confronted with a range of similar liquids and the amount they drank of each was recorded (Pfaffman, 1960).

The recent period has seen a spate of research on relations between hedonic value and collative stimulus properties, which, we must continually observe, are fundamental to formal aspects of art. Here again, as Chapter 13 will show, the overall picture is in keeping with Wundt's curve, although there are some complications.

## Two implications

This provisional account of relations between hedonic value and arousal potential or, if one prefers, the psychological strength or "impact" (Fiske & Maddi, 1961) of stimulation will guide our subsequent discussion. But before leaving it, two implications of this rudimentary theoretical

model are worth pointing out, since they may have considerable importance for aesthetics.

*The region of overlap* First, there are, as we have seen, grounds for supposing that reward and pleasure can come from either an arousal-increase mechanism or an arousal-decrease mechanism, with the former coming into play when stimuli raise arousal moderately and the latter when stimuli raise arousal markedly. However, the transition between the degrees of arousal increment corresponding to the two mechanisms need not be abrupt. There could be an intermediate region where both mechanisms may be active and need not exclude one another. The state of affairs represented by the curves in Figures 8-3 and 8-4 implies, in fact, that this will be the case. Between the points marked  $X_1$  and  $X_2$  on the Wundt curve (Figs. 8-3, 8-4), arousal potential will be mild enough to fall within the pleasant range but nevertheless high enough to activate the aversion system partially. Consequently, anything that then reduces arousal, and thus inhibits the aversion system, should add to the pleasure that is already present, by disinhibiting the primary reward system further. Everyday life knows many situations in which a phase of propitious anticipation with mounting appetite and tension is followed by a phase of assuagement and relief, and in which both phases are pleasurable. There are plenty of examples connected with mild hunger and subsequent eating, sexual activity, or simply the anticipation and consummation of unwrapping a birthday present. Aesthetic patterns may likewise give pleasure through both arousal increase and closely following arousal reduction.

With reference to sexual activity, Freud (1905b, pp. 606-7 in the translation), distinguished between "fore-pleasure," which is produced by "suitable excitation of an erogenous zone," and "end-pleasure," which is "entirely produced through the discharge." Fore-pleasure, "increases the tension, and in turn serves to produce the necessary motor energy for the completion of sexual act," but "the tension of the libido temporarily subsides with" the end-pleasure, which is "highest in intensity." He later extended the distinction between fore-pleasure and end-pleasure to other psychological phenomena, e.g., humor (Freud, 1905a). Waelder (1965), summing up Freud's view as it applies to motivation in general, writes that "pleasure is felt not only in the final satisfaction which reduces the tensions to zero but also, to a degree, in the state of tension and in the mounting of tension."

It may also be worth recalling in this connection a phenomenon that has for some time been puzzling students of rewarding brain stimulation. In some circumstances, an animal will do something (e.g., pressing a lever) to switch on electrical pulses delivered to its own brain and then, a few seconds later, do something else to switch it off (Bower & Miller,

1958; Roberts, 1958). Stimulation of a particular brain structure at a particular intensity can evidently be both rewarding and aversive.

*Inhibition of aversion system* Second, as arousal potential increases beyond point  $X_2$  on the Wundt curve (Fig. 8-4), hedonic value becomes progressively less positive, and eventually increasingly negative, because of the progressively intensified intervention of the aversion system. If the aversion system were not there at all, we could expect that reward value and pleasantness would continue to go up with increased arousal potential in accordance with the solid curve in Figure 8-3. There may well be times when something like this actually happens. Factors (presumably distinct from the arousal-reducing factors that act on the secondary reward system) may be present to inhibit the aversion system. If this happens, situations that are highly arousing and would, in other circumstances, be intensely disturbing, will become predominantly pleasurable. This is, of course, precisely what occurs in many playful and aesthetic contexts, e.g., when a person is subjected to pejorative remarks that are clearly "meant as a joke" or when he witnesses distressing events as part of a tragic drama.

In the words of the nineteenth-century German psychologist, Döring (1890), "any feeling, whether of pleasure or pain and however evoked, is, as a mental function, pleasurable." When the feeling is unpleasant, there is, he maintains, always a secondary element of "functional pleasure." The bitter-sweet nature of pain and sadness has often been pointed out, and something of the sort may be inferred from the hypothesized interaction of the curves in Figure 8-3.

*The sublime* If, in stimulus situations classifiable as art, there are cues that inhibit the aversion system at least partially and if, as a result, the unpleasant effects of high arousal are mitigated so that pleasant effects can predominate, this may shed light on one recurrent theme in the history of aesthetics. Over the centuries, there has been intermittent discussion of the "sublime," regarded as an ingredient of aesthetic appeal that is distinct from, but second only in importance to, the "beautiful." This discussion can be traced back to the treatise *On the Sublime*, which has sometimes been dubiously attributed to the third-century Greek writer Longinus, its author refers to an earlier essay on the same topic, now no longer extant, by Caecilius of Calacte, who flourished in the first century. "Pseudo-Longinus" (as he is often called) mentions "grandeur of thought" and "vigorous and spirited treatment of the passions" as sources of the sublime. Burke (1757) applies the word "sublime" to the delight that is experienced "when we have an idea of pain and danger, without being actually in such circumstances." He contrasts this with the delight that results from the "removal or diminution of pain," which we can readily connect with our arousal-reduction mechanism of hedonic value.

The most famous treatment of the matter, that of Kant (1790), states: "We call that sublime which is absolutely great." That which is great in magnitude is described as "mathematically sublime." It includes any phenomenon of nature "whose intuition brings with it the idea of its infinity." A distinction is drawn between this and the "dynamically sublime," which "must be represented as exciting fear." It is identified with "might that has no dominion over us." Kant explains further that "there accompanies the reception of an object as sublime a pleasure, which is only possible through the medium of a pain."

It seems clear enough that the stimulus patterns that these writers would characterize as sublime all embody a large measure of arousal potential, such as would in all likelihood be disturbing, or even terrifying, in nonaesthetic contexts.

### Sadness and depression

As already mentioned, there is reason to believe that states of high arousal are generally aversive, punishing, and unpleasant, and psychologists interested in motivation have paid a great deal of attention to conditions of "high drive" or "tension," in which negative hedonic value coincides with a high level of activity and agitation. States of "anxiety," "distress," or "disturbance" are cases in point, as are hunger and other forms of privation.

Yet, there are also states that are markedly unpleasant but bear all the signs of exceptionally low arousal. These bear such labels as "sadness," "dejection," and "grief." The most extreme examples are found in psychotic depression. In such states, an individual is relatively, or sometimes even absolutely, motionless. He is relatively or absolutely unresponsive to external stimuli. When he reacts at all, he does so slowly, after a considerable delay, and lethargically. Motivational states of this sort are commonly expressed and induced by art with characteristics that one would expect to be de-arousing. Paintings with a melancholy content are somber in coloring. Sad music, such as a funeral march, is typically slow-moving, relatively monotonous, preponderantly low in pitch, and soft. Drums are muffled, and melodies move within a narrow range of pitches.

The psychophysiological and medical literatures report indications that both normal sadness and clinical depressive states combine signs of heightened and lowered arousal and, in particular, of processes dependent on the usually antagonistic sympathetic and parasympathetic nervous systems (Davies, 1964; Averill, 1969a, 1969b). Sadness and clinical depression mean an increase in blood pressure. Depressed patients show heart palpitations, sleeplessness, increased muscle tension, increased secretion of adrenaline and noradrenaline, and EEG desynchronization, as

well as decreased gastrointestinal activity, salivation, and colonic functioning. These changes are all suggestive of raised arousal and activation of the sympathetic nervous system. On the other hand, there is lowered motility (indicative of low arousal) and shedding of tears (a parasympathetic phenomenon). During scenes of a cartoon film that are rated sad, children show a shift towards less sympathetic and more parasympathetic activity (Sternbach, 1962).

On the whole, however, the motivational conditions that we are discussing have received lamentably little study, particularly in normal human beings. We can only speculate that they may have something to do with a number of phenomena noted by psychologists and neurophysiologists. Maier (1949) mentions "resignation" or "apathy" as one of several possible reactions to extreme frustration: an animal or human being may simply sit still and give up attempting to cope with environmental threats or stresses. Pavlov spoke of "supra-maximal inhibition," a protective device that supervenes when an animal is subjected to excessive intensity of stimulation or conflict (what Pavlov called "collision" between excitatory and inhibition processes); conditioned reflexes weaken, and there may be generalized somnolence and immobility. This seems related to the "passive defensive reflex," or response to danger and stress by suspension of motor activity, that Pavlov and his followers have studied in lower animals, and perhaps also with Sokolov's (1958) "defensive reflex," a complex of psychophysiological changes that are elicited by extremely intense, novel, or painful stimuli and are accompanied by a blunting of sensory receptivity. There are evidently neural negative-feedback mechanisms, depending on influences from the cerebral cortex and from the inhibitory area at the lower or bulbar end of the reticular formation, that exercise a dampening influence in the reticular arousal system whenever arousal undergoes an abrupt and pronounced rise (Dell, 1963; Bloch, 1965). Gellhorn (1967) reviews evidence that, when stress, which normally activates the sympathetic nervous system, becomes intense, the parasympathetic nervous system may be brought into play, producing a strange mixture of sympathetic processes, indicative of high arousal, and parasympathetic processes, indicative of relaxation. According to Selye's (1956) conception of the "general adaptation syndrome," stress that is intense and prolonged enough leads eventually to the "stage of exhaustion," when "resistance drops below normal."

## 9 PERCEPTION

Aesthetic behavior includes many energetic and readily visible actions through which the artist or the appreciator contrives to have a finished work (or some naturally occurring aesthetic pattern) in front of him. Once his eyes or ears are exposed to aesthetic stimulation, bodily activity is dramatically reduced to, at most, eye movements, rhythmic movements of the head and limbs, and possibly a little fidgeting. At the same time, a great deal of outwardly invisible activity is going on inside the spectator or listener, as subsequent questioning or recording of psychophysiological processes would confirm. The more immobile the subject, the more rapt his posture, the richer and more vigorous his internal activity is assumed to be.

The internal activity includes processes that we have been considering under the headings of "emotion" and "pleasure." But most of what an appreciator is doing inwardly would be described as "perceiving" the aesthetic pattern, and any emotion or pleasure that occurs would be held to result from "perception."

Like so many other psychological phenomena, perception has long been identified with conscious experiences resulting from excitation of sense organs. But the behavioral scientist must look on perceptual processes by which information originating in external events (or, insofar as interoception or proprioception is involved, inside the body) is analyzed and synthesized within the nervous system before gaining control over motor responses.

Nowadays, when terms derived from communication and computer technology are so popular, it is common to speak of ways in which information entering through sensory inputs is "coded." The word "coding" can be misleading. It directs attention to the form taken by the signals in which the information is embodied or to ways in which the information may be translated from one system of signals to another. But there is much more to perception than that. In particular, there is selective rejection of information, and information from sources within the subject is added to, and merged with, the information that comes in from outside.

The experimental psychology of perception, which is eagerly studied by aestheticians and artists and is of undoubted relevance to art, points out equivalences among stimulus patterns. It informs us that certain

### Perception

patterns differing in their physical or chemical properties are nevertheless perceived alike and are thus likely to affect behavior in the same way. For example, Renaissance painters, partly rediscovering some facts known to their Greek and Roman predecessors, recognized that certain two-dimensional arrangements of line and color would produce perceptions resembling those of three-dimensional scenes, notably when they incorporated converging lines (linear perspective), distortions of shape (foreshortening), similar shapes of different size, differences in color and clarity (aerial perspective), and gradual changes in hue and saturation (modeling). The facts of color mixture and color contrast were exploited by the Impressionist painters of the nineteenth century, and several devices by which static patterns are made to look alike moving or changing ones are used in contemporary Op art. Similarly, musicians have made use of equivalences among auditory patterns, particularly of the way in which melodies or sequences of chords sound alike (and may well not be distinguishable at all if sufficient time separates them) when one represents a transposition of the other by a fixed interval.

As we turn to motivational aspects of art and to the fundamental question of why opportunities to perceive aesthetic patterns are sought at all, we must take up rather different questions, bearing on ways in which sensory information is handled before influencing other behavior. Once again, we must try to maintain a biological perspective.

At any moment, a higher organism is capable of performing any of a large variety of responses, but one of these responses, or a few of them, will be optimal; its (or their) consequences would be more favorable than those of other responses. Biological adaptation, and ultimately survival, depends on achieving as close an approximation as possible between the organism's actual response at any moment (what it would be advisable for it to do). In the language of information theory, there must be some information transmission between the sample space of optimal responses and the sample space of actual responses. However, the consequences of performing a particular response depend both on the motivational condition of the organism and on the external stimulus situation of the moment. Put differently, information from the optimal response space is conveyed through events inside the organism and events in the organism's immediate vicinity. Sense organs, which pick up information from these internal and external events and transmit this information to the brain, which, in its turn, transmits it to the muscles and glands, are thus essential to adaptation.

There are, however, two problems that beset all animal organisms. One is that the information in the present stimulus situation is unlikely to be sufficient. The consequences of the actions that could be performed may very well depend on distant events, or even on past or future events, that are not reflected in the stimuli to which the sense organs have

access at the moment. This difficulty may be overcome by moving to another environment where some of the missing information is available. It is however, always necessary, whether this is done or not, to combine the information received from the stimulus situation through the sense organs with information that is stored inside the organism and traceable either to heredity, and thus to the experiences of the organism's ancestors, or to previous learning.

Second, much of the information coming in from the environment (external and internal) must be discarded. This is partly because most of the information coming through sensory channels is irrelevant and offers no help in selecting the most adaptive behavior; it cannot be regarded as information originating in the optimal response space. But it is also because of the limited channel capacity of the human nervous system. The possible stimulus situations to which an organism may be exposed are much more numerous than the number of possible behavior patterns that can occur at a particular moment. Consequently, only a minute proportion—certainly less than 1 percent—of the information coming in from the environment can be reflected in action. What are called perceptual processes thus serve in large measure to reject information. Adaptation depends on rejection of information that is useless for the guidance of behavior and might even deflect behavior away from the optimal response and on recognizing and retaining the relatively rare nuggets of information that can lead behavior in adaptive directions.

Let us now review some of the principal processes, other than simple registration of stimulation by sense organs and conduction of excitation to the brain, that comprise perception.

## Exploration

In the past, many psychologists have been led astray, or at least trapped into a limited and distorted view of perception, by the fact that, in most experiments on perception, an experimenter selects the stimulus patterns to which a subject will be exposed and tells him to look at, or listen to, them.

However, as Dewey (1896) and many more recent writers have reminded us, the stimulus situations that confront an organism in everyday life depend on what it has just been doing. Furthermore, animals, and especially higher mammals, spend much of their time performing actions that have no function other than bringing the sense organs into contact with stimuli of particular kinds, so that they can be said to be selecting or creating their own environments to a large extent.

Practically everything that an animal does changes its external and internal stimulus situation. For example, feeding introduces tastes, smells,

and tactal stimuli that were not there before and reduces internal stimulation associated with hunger. But some forms of behavior expose the organism to stimuli that have, as far as we can see, no biologically important effects on tissues of the body other than the sense organs and nervous system. These forms of behavior make up what is called *exploratory behavior* (Berlyne, 1960, 1963b, 1966b).

Some of it is *extrinsic exploratory behavior*. It seeks out stimuli whose information content is needed to guide subsequent acts with biologically valuable consequences of their own. The behavior of an animal looking for food or for a mate or of a dentist examining somebody's teeth would be examples. In other cases, exploratory responses secure access to stimuli that do not influence what the organism does next. They introduce stimuli that are, as we say, sought "for their own sake." They constitute *intrinsic exploratory behavior*. Much of what we are calling aesthetic behavior consists of intrinsic exploratory responses, and we shall work our way gradually towards the question of why stimuli that are apparently neutral from a biological point of view, i.e., neither beneficial nor noxious in themselves and not associated with beneficial or noxious events, are so energetically sought after and welcomed.

Exploratory responses, whether extrinsic or intrinsic, can take on many forms. Three types can conveniently be distinguished:

1. *Receptor-adjusting responses* These are the most frequent and may or may not be preceded by other kinds of exploratory responses. They consist of changes in posture that direct sense organs toward sources of stimulation (e.g., movements of the eyes, movements of the head, movements of the arms and hands) and physicochemical processes in the sense organs themselves, or in organs attached to them, that alter their sensitivity (e.g., the photochemical changes in the retina that underlie dark adaptation, the changes in the tension of muscle spindles that alter the intensity of proprioceptive stimulation consequent on bodily movements).

2. *Locomotor exploration* This consists of movements towards sources of stimulation or towards vantage points from which they can be inspected more effectively.

3. *Investigatory responses* This is a residual term denoting all other forms of exploration. They are mainly manual. They include handling and moving an object around with the aim of bringing new aspects of it into view or of subjecting it to changes that give rise to additional stimulation. In human beings, the diversity is much greater than in other species, including the focusing of binoculars, switching on and tuning of a television set, or the purchase of a theatre ticket.

One further distinction, which will be taken up again in Chapters 13 and 16, may be the most important of all (Berlyne, 1960). This is a distinction according to function. Some exploratory behavior occurs

when somebody is left in a state of uncertainty and conflict, because he has insufficient information about a particular object or event. This may be because it is novel and he has not yet had time to take cognizance of its properties. Alternatively, it might be because he is perceiving it under unfavorable conditions, e.g., too briefly, too far away, in adequate illumination, or blurred. At a higher, intellectual level, it might be because he has received confusing information about it in a symbolic form, i.e., through spoken or written communication or from his own thought processes. Uncertainty can generate the kind of motivational condition that we call "curiosity." It may be termed "perceptual curiosity" if uncertainty stems from nonsymbolic stimulation and "epistemic curiosity" if it is produced by symbolic structures. It will impel action to obtain further stimulation from, or relating to, the object of the curiosity so that information capable of relieving the uncertainty can be absorbed. We then speak of *specific exploration*. On the other hand, one may seek out stimulation, regardless of content or source, that has appealing collective properties. This has nothing to do with curiosity, but it may be actuated by boredom. Then, we have *diversive exploration*.

It seems likely that specific exploration is connected with reward through arousal reduction, since it relieves an aversive condition of curiosity and conditions productive of conflict and uncertainty appear to intensify arousal (Berlyne, 1961; Berlyne & Borsa, 1968). Diversive exploration will presumably have more to do with reward through moderate arousal increment. Both kinds of exploration must be prominent constituents of aesthetic behavior. Although they differ in psychobiological function, they are both influenced strongly by collective stimulus properties, and much everyday exploratory activity probably partakes of both.

### Attention and abstraction

Exploratory responses determine what kinds of stimuli will reach the sense organs and thus exercise selection before the sense organs are stimulated. But once the stimulation of sense organs has taken place, further selective processes come into play. They are needed because, at any one time, thousands of stimuli are bombarding sense organs and they are each associated with some response or other. For example, in any normal environment we can see and hear a vast number of things, all of which we could at least name, or describe, or approach, or handle. But we are not capable of doing all these things to all the stimuli at once. We can at any one time respond to only a small number of them. Stimuli will thus be competing for control over our behavior, and there must be ways of determining which stimuli will win the contest.

The processes carrying out this selection or filtering fall into two classes, which, at the present stage of research, it is as well to distinguish (Berlyne 1970a, 1970b). First, there is *selective attention*; this term is best reserved for processes that place behavior under the control of particular receptor cells. This means that they let through information from one sensory modality while blocking information coming from others (e.g., causing an organism to react to what it sees and to ignore what it hears), or they let through information that comes from particular locations while blocking information from other locations (as when behavior is determined by what is visible in a particular portion of the visual field or when one responds to what one person is saying while ignoring other sounds that may be audible simultaneously).

Neurophysiologists have amassed evidence that certain nerve fibers convey excitation from higher levels of the brain to various points along the sensory pathways and can inhibit or block messages that would otherwise pass along those pathways. In this way, selective attention to stimuli belonging to a particular modality at the expense of stimuli of other modalities is possible. Selection among stimuli belonging to the same modality must on the other hand depend on processes in the cerebral cortex. There is plenty of evidence that the development of a process in one cortical area is commonly accompanied by inhibition of potentially interfering activities in neighboring areas.

*Abstraction*, on the other hand, is selection according to property rather than according to location. Response to a particular property can be innate. For example, a male European robin in the mating season responds with aggressiveness to the red color of another male's breast. Experiments show that the color is what makes him fight and that the other properties play no part in eliciting this behavior. On the other hand, countless experiments on discrimination learning in rats, monkeys, and children show how they can learn to approach a stimulus pattern characterized by a particular color, shape, or location, and to ignore other properties that do not regularly indicate the presence of a reward.

### Detection of physicochemical properties

Sense organs are extraordinarily efficient at detecting properties like intensity, color, brightness, and movement in the case of sights, or intensity and pitch in the case of sounds. Much of the physiology of sensory processes and of the area of psychological research known as "psychophysics" has examined sensitivity to these properties. They are evidently capable of transmitting a great deal of information concerning the nature of the optimal response and have a great say in the selection of behavior. There are, however, complications with regard to their role. First

of all, these properties interact with one another. For example, perceived color depends mainly on wave length of light but also on factors like size and intensity of a visible object. Secondly, there is interaction between the perceived properties of one object and the properties of adjacent objects. Phenomena like simultaneous contrast and various visual illusions show how the apparent brightness, color, or size of a visual element can be influenced by those of neighboring elements.

## Grouping

The importance of grouping becomes clearer as soon as we face the question of what is meant by "*a stimulus*" to which an organism reacts. It is clear that responses are not in general determined by the stimulation of a single receptor cell. The Gestalt psychologists have been the most vehement spokesmen of the view, supported by a multitude of observations of both human beings and animals, that behavior depends on patterns or configurations of stimuli, each consisting of a collection of elements in a particular arrangement. The nature of the response is determined by the elements jointly and especially by their relations to one another. Furthermore, the way a single element is perceived, i.e., how it influences behavior and how it is described in verbal reports, will frequently vary according to what other elements accompany it and how it is related to them.

The determination of behavior by a combination of stimulus elements, so that a particular response occurs when all elements of a combination are present but not when any element has changed or is absent, has been demonstrated more than once in conditioning laboratories. If performance of a particular act in the presence of, say, a light and a bell is reinforced but reinforcement is withheld when either component occurs alone, an animal will learn to carry out the act only when the combination is presented in its entirety. This is what Razran (1959) has called "configural conditioning" and Hull (1943), "positive patterning." "Negative patterning" can also be obtained, such that a response is evoked by *A* alone or by *B* alone but not by the simultaneous occurrence of *A* and *B*. Razran (1965) has reviewed a large body of Russian experimental evidence indicating that, after repeated presentation, together with reinforcement, of a combination of stimulus elements, an animal comes to treat the combination as a unit even without special training and does not transfer responses associated with the combination to the single components. Furthermore, conditioning experiments have shown that a conditioned response can become associated with a relation as such. This means that, if an animal has learnt to perform a particular

response through a combination of stimuli between which a particular relation obtains, the response will generalize to other combinations exemplifying the same relation. For example, Uznadze (1927) trained a dog to flex a paw on hearing a louder tone followed by a faint tone of equal pitch. The unconditioned stimulus was an electric shock applied to the paw, and this was withheld on presentation of two tones of equal intensity or of pairs of tones whose second member was louder than the first member. It was then found that the dog would perform the movement whenever he heard a louder tone followed by a fainter tone, whatever the actual intensities or the pitch, but not otherwise.

So one important part of perceptual activity consists of determining which stimulus elements to group together to perform a unit whose members will collectively evoke a response. Grouping comprises part of what the German information-theoretic aestheticians call the "formation of super-signs" and view as an essential component of aesthetic appreciation. In many cases, no redundancy, and thus no structure, can be discerned as long as a fine-grain analysis is used and a pattern is broken down into small-scale units. As soon as small-scale units are amalgamated into larger-scale units, and these are treated as signals, considerable redundancy may emerge. To take a rather simple example, if we take a sequence like 00110011... and regard the 0s and 1s as signals, the process may be judged completely random. A 0 is just as likely to be followed by a 0 as by a 1, and so is a 1. Consequently, a signal does not reduce uncertainty about what will come next, and there is no syntactic information. But if we regard "00" as one signal and "11" as another, we see immediately that these two signals occur in strict alternation, so that the occurrence of one leaves no uncertainty at all about what will come next and the sequence is completely constrained.

There are three essential lessons to be learned from the research of the Gestalt school of perception:

1. The tendency to group perceptual elements is universal and irresistible. This can easily be appreciated by looking at the pattern like that in Figure 9-1 or listening to a monotonous sequence of identical sounds like the ticking of a clock.

2. There are invariably several different ways in which elements can be grouped. For example, the circles in Figure 9-1 can be made to form four rows, four columns, a smaller square within a larger square, and yet other arrangements. The ticking of a clock can be heard as a sequence of twos or threes, and pairs can begin with either odd-numbered or even-numbered ticks.

3. Patterns like those just mentioned, in which several alternative groupings are more or less equally likely, are exceptional. Certain

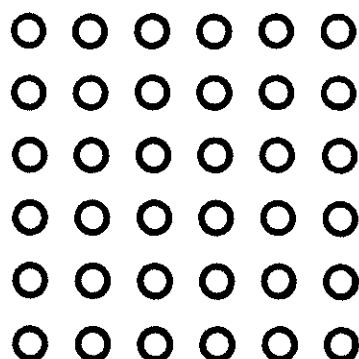


Figure 9-1 Pattern illustrating alternative forms of perceptual organization for one pattern. (From Young, 1936).

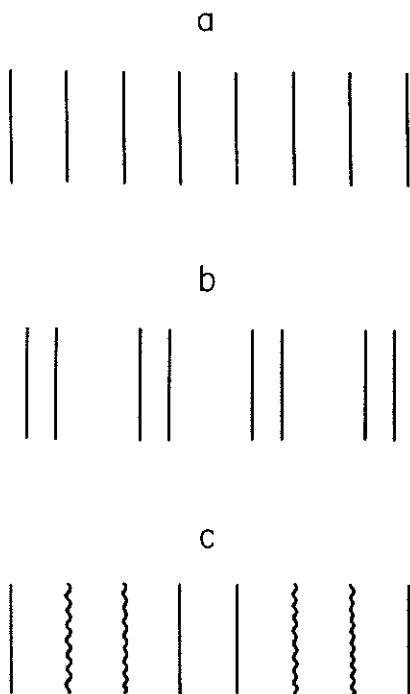


Figure 9-2 Effects of proximity and similarity on perceptual grouping.

groupings are usually much more likely than others. The factors determining which will predominate include similarity and spatial or temporal proximity (compare Figures 9-2b and 9-2c with 9-2a). The Gestalt school believed that the influence of these factors depends on innate properties of the nervous system, but there are grounds for believing that learning may play some part. In other cases, learning is clearly responsible for the prevalence of a particular grouping, e.g., nobody who was unfamiliar with the Latin alphabet would group the white space enclosed in the dotted line together with the thick, black strokes in Figure 9-3 if the dotted lines were missing.

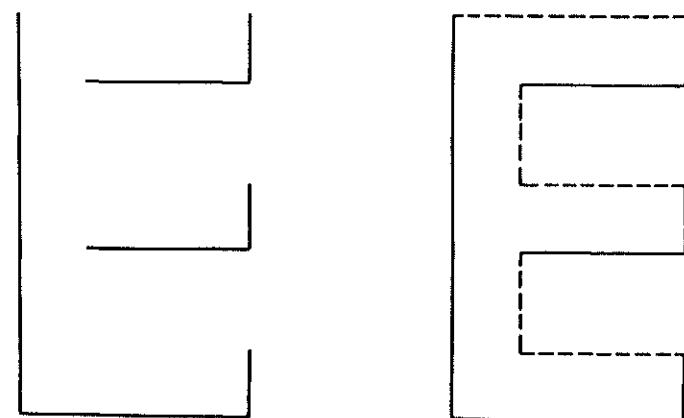


Figure 9-3 Effects of learning on perceptual grouping.

### Comparison and collation

As the Gestalt school, like many writers before and since, have emphasized, behavior can be controlled by relations among stimuli. Consequently, comparison of stimulus elements with one another must be recognized as a further perceptual activity.

Comparison sometimes occurs among elements that are simultane-

ously present. At other times, stimuli that are present at the moment are compared with stimuli that have been present in the past, which means with some kind of trace left by these stimuli in the nervous system. Some of the main aspects of perceptual comparison are as follows.

*Existence and extent of difference (Novelty/familiarity and surprisingness/expectedness)* Some responses, notably exploratory responses and emotional responses (increases and decreases in arousal), depend on whether or not a stimulus element differs from stimuli that had been experienced either in the recent or in the distant past, or, in other words, on how novel or familiar the stimulus is. They are also affected by degree of deviation from what the subject was expecting, which may or may not be the same as what he has just been experiencing. In other words, the location of the stimulus along a surprising-expected dimension generally matters. The intensity of the response usually varies with the degree of discrepancy between the stimulus that is received and the previously experienced or expected stimuli with which it is compared, but the actual direction of the discrepancy is often of little or no importance.

*Direction of difference (response to ordering relations)* At other times, the direction in which a particular stimulus differs from another, i.e., whether it has more or less of a particular property, has a profound effect on how the organism will act. We have just seen an example in the experiment by Uznadze mentioned above, in which whether the dog flexed its paw or not depended on whether or not a tone was fainter than a tone that had just preceded it. Similarly, in innumerable experiments on discriminative instrumental learning, an animal learns to move towards a stimulus that is larger, brighter, or located to the right of, a stimulus that accompanies it or precedes it. There have also been many experiments in which human subjects are required to pick out the "larger," "brighter," or "heavier" of two objects and show themselves able to do so.

*Direction and extent of difference (adaptation level, complexity)* In many instances the response to a stimulus depends on both the extent and the direction of these differences from previously experienced stimuli. This is shown by the experiments of Helson (1964) and others on "adaptation level." A subject is said to possess at any moment an adaptation level with respect to a particular stimulus property. The location of the adaptation level depends on the kinds of stimuli that he has experienced in the past, but especially in the recent past. For example, a particular object may be judged, and otherwise treated as, "light" by somebody who has just been handling heavier objects or by a stevedore who carries large packages around for a living, but it might be "heavy" for somebody who has just been handling light objects or who has a sedentary occupation. How complex a pattern is judged

to be depends on the existence, extent, and direction of differences among its simultaneously presented elements, and as we shall see, many forms of behavior including exploratory and emotional responses hinge on complexity.

*Decentering* A final point of considerable significance has been developed especially by Piaget (1961). Since perception, particularly visual perception, is invariably subject to illusion and since, in particular, the part of a visual field on which attention is focused tends to look larger, clearer, and brighter than the rest, the information gathered in a single glance can be highly unreliable and hazardous as a basis for action. The distortions can be mitigated by combining the information provided by a number of different and successive glances at the same object from different points of view and with different points of fixation. Each glance will introduce distortions of its own, but the distortions will tend to cancel out, so that something approaching a reliable objective view of the object will emerge. For example, when buying a piece of furniture, we all realize that a single, hurried inspection from one angle may not give an accurate idea of how well the item will fulfill the purposes we have in mind for it. There is no way of being absolutely sure that we shall not be disappointed after buying it. But we know that it will be safer to spend some time looking at the furniture from different sides, with eyes focused on different portions, and perhaps under different lighting. After we have examined the appearances that the object successively presents and have compared these appearances with one another, we shall be in the best position to decide whether or not to buy.

### Mediating responses

Stimuli often, if not always, evoke two or more responses in turn. The initial response, like all responses, produces feedback or response-produced stimulation, which joins with the stimulation coming directly from the perceived object in determining what the organism will do next (see Fig. 9-4). The second response is commonly the important

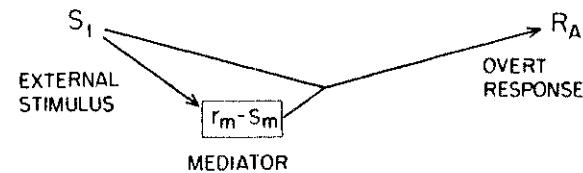


Figure 9-4 Joint determination of an overt response by an external stimulus and a mediator.

one, the one that contributes to adaptation and leads to some external reward. The initial response, which is generally called a "mediating response," may occur solely because of the supplementary guidance that it gives to this later response. When this is the case, the mediating response may, following a usage proposed by Hull (1931), be called a "pure stimulus act." A good example is counting. This consists of focusing attention on each of a set of objects in turn and pronouncing a number on encountering each one. The goal is to identify the number that will be pronounced when the last object is attended to. But in order to arrive at this number, we must go through all the previous numbers. So the number uttered at any moment depends jointly on the sight of an object not yet counted and the stimulation received from the last number uttered.

Mediating responses can usually perform their functions just as well, if not better, if they occur in an implicit or internal form. They cannot then be observed from outside. Nor can they act on the external world. But they can still produce the mediating stimulation through which they contribute to adaptation. In other words, the organism's overt behavior depends on both the stimulation coming from the perceived object and the stimulation coming from its own initial reactions to the object. Mediating responses often, but not always, qualify as symbolic responses: they often correspond to some inaccessible object or event of which the organism would do well to take account in selecting its behavior.

Some mediating responses are unlearned. Most are learned. Many experiments are concerned with the ways in which mediating responses can add distinctive stimulation to the external stimulus situation and thus facilitate discrimination learning. In human life, the mediator that supplies vital information is often reached as the final link in a chain of symbolic responses, so that we may describe it as a product of *thinking*. Sometimes, it can be traced back to two or more distinct learning experiences, so that it is a product of *reasoning*. If as is usually the case it fulfills both of these conditions, it is a product of *direct thinking* (Berlyne, 1965).

Mediating responses take many forms:

*Emotional responses* Some stimuli are innately frightening or painful, or on the other hand, soothing. They evoke emotional responses (including visceral and cortical components) that bias subsequent behavior. At other times, and no doubt more often stimuli evoke conditioned emotional responses because they have in the past accompanied stimuli with emotional effects. Emotional responses are often produced by resemblances, perhaps in physicochemical properties but more likely in structure, between newly encountered stimulus situations and others that have in the past had an emotional impact. This is generally the case

when aesthetic elements are said to "symbolize emotions," to "express emotions physiognomically," or to owe emotional effects to "metaphorical" significance. The generalization may well occur between stimulus patterns of different modalities, in which case emotion can be attributed to "synesthesia."

*Motor responses* The proprioceptive stimulation resulting from bodily movements is a rich source of mediators, and motor responses that serve as pure stimulus acts can do so quite effectively in an implicit or internalized form. This means that slight contractions and electrical changes (action currents) are occurring in the muscles at an intensity that is insufficient for a visible bodily movement but sufficient for proprioceptive feedback. Alternatively, the processes in the brain that would otherwise lead to bodily movements may be subject to inhibitory influences that block the corresponding motor acts but still allow excitation to be transmitted to other parts of the brain.

How much help discrimination learning can obtain from mediating motor responses (overt or internalized) is shown by numerous experiments with animal and human subjects. The ability of motor responses to symbolize absent objects or to facilitate apprehension of objects that are present has been discussed by students of human development like Piaget (1949), Vygotski (1956), and Bruner (1964). But it has also not gone unnoticed by aestheticians. As Berenson (1948) wrote, "the painter's first business . . . is to arouse the tactile sense, for I must have the illusion of being able to touch the figure, I must have the illusion of varying muscular sensations inside my palm and fingers corresponding to the various projections of this figure, for I shall take it for granted as real, and let it affect me lastingly." A psychological aesthetician, Langfeld (1920, p. 109), stated that "all of our perceptions are dependent upon motor attitudes that are assumed towards the object. The eye measures the extent of a line by moving over it, or there is an incipient revival within us of muscular sensations of some other part of the body . . . when we notice the smooth curves of a marble torso, we can probably, if we observe carefully, get a fleeting image of our hands moving in imagination around the figure."

These writers attach importance to manual receptor-adjusting responses, to the movements of the hands and fingers that enable the surface of an object to be explored tactually and give a sense of its form and of the spatial arrangement of its parts, by following its outlines and thus taking on a similar form. As other authors (e.g., Sechenov, 1878; Zaporozhets, 1960) have pointed out, eye movements must likewise reconstruct the shape of an object that is visually examined. They also can thus represent its shape when the object is no longer in sight.

*Imitative responses and empathy* Particular importance, especially with regard to aesthetics, must be attached to imitative movements

and their internal equivalents. Several writers (e.g., Freud, 1905a) have maintained that not only moving human beings and animals or even moving inanimate objects but even stationary objects can elicit imitation, especially in an implicit form.

One prominent current in the aesthetics of the late nineteenth and early twentieth centuries, especially in Germany, held the essence of aesthetic appreciation to be *Einfühlung*. This word, which literally means "feeling into" but is generally translated as "empathy," was first introduced by Robert Vischer (1873).

The notion of empathy is evidently extremely difficult to define with any precision and consistency. Empathy is usually characterized as a process of projecting emotional and other reactions on to an external object, such as a work of art, so that the object seems to embody or express human feelings. But, as a review by Hunstdahl (1967) shows, the term was used by different writers, and even by the most celebrated empathy theorist, Lipps (1903-06), to denote several distinguishable but vaguely described phenomena. Lipps (1903, p. 120) said that empathy is "nothing but the inner side of imitation," especially involuntary imitation (p. 120). However, a few pages further on (pp. 126-7), he retracted somewhat, saying that empathy was not "imitation" in a strict sense. Imitation implies a distinction between the imitating person and an object consciously adopted as a model, whereas empathy implies an "inner doing" that partly dissolves the boundary between the subject and the object.

Empathetic responses were apparently conceived by Lipps as tendencies to movement suggested by perceptible properties, especially spatial properties, of objects, e.g., by ways in which they deviate from normal or neutral forms. For example, a shape with a wide base could suggest a sagging movement, one with a lateral protuberance could suggest spreading out, or a slender shape, especially one broadening out towards the top, could suggest soaring or upward stretching. Lipps insisted that empathy was not "imagined movement" or "sensation of movement." He described it as "the feeling of willing, of inner effort or exertion, of attainment, in short of inner doing." Empathy, especially aesthetic empathy, was, moreover, "the force that is applied to such doing, the freedom of the whole doing, the assurance and ease, the pride, the confidence, the capability."

Criticisms of the notion of empathy have been as fervent as its many expositions and defences. But without entering into the subtleties of this controversy, we can accept the likelihood that certain spatial patterns will, through learning and generalization, elicit internal responses, usually not leading to actual bodily movement but corresponding to changes in posture in the direction of the pattern's salient characteristics.

*Verbal and imaginal responses* The mediating possibilities of verbal labels and comments and images hardly need elaboration. Words and images, like motor acts (including imitative responses), can contribute to abstraction by acting as labels that can classify external stimuli. They can cause physically similar objects to be treated differently and physically different objects to be treated alike, giving rise to what is called "secondary or mediated discrimination" and "secondary or mediated generalization," respectively. These mediators can also determine which response will be made to an external object, by representing other entities that are not perceptible at the time but need to be taken into account. They can represent the frequent accompaniments of the perceived object in the past; they can represent its usual antecedents (including causes of the object's present state) or its normal sequelae (including its effects on other objects). They can represent other members of classes or systems to which the object belongs, so that the response to it can take account of its role within them and its relations with their other elements. Plenty of experiments on discrimination learning, reaction time, and so on, show how the response to a particular stimulus depends on the nature of the set of alternatives from which it has been selected and on what other stimuli might have occurred instead (Broadbent, 1958).

### Motivational aspects of perception

These, then, are all processes that take place when an object or event is perceived. They comprise much of what we call "making sense of" an object or event, "assimilating" it, "organizing" it, "analyzing" it, "structuring" it, and "understanding" it. The results of all these processes provide information that is needed for the selection of a course of action, since the information embodied in the physicochemical properties of the stimulus, registered by the sense organs, is usually not enough. But stimulus patterns are often examined, as in aesthetic appreciation, without leading to any overt, practical action. Nevertheless, all these perceptual processes are so indissolubly part and parcel of the immediate response to a stimulus pattern that they still occur, even though the guidance that they can provide for motor acts—their original biological role—may not be utilized.

With this in mind, we must note a few points with reference to the motivational aspects of perception, which are of necessity bound up with the motivational aspects of aesthetic behavior.

1. *Perception is gradual and takes time.* Early experimenters (Dickinson, 1926; Gemelli, 1928; Freeman, 1929) used tachistoscopes to present brief, fraction-of-a-second glimpses of visual patterns and asked

their subjects to describe what they saw after exposures of varying durations. In this way, it was possible to ascertain how long perception takes to reach various stages. The reports of these experimenters show remarkable agreement in pointing to three principal phases. First, there is a phase in which the subject simply sees that something is there, without knowing what, and perhaps that it occupies a particular extent. Then, there is the phase of the "generic object" or of "generic particularity," in which the subject recognizes a particular class of object without being able to identify all its details and peculiarities. Finally, there is the phase in which perception is complete and the object and its attributes are clearly apprehended.

These experiments all antedated information theory. More recent research with readily quantifiable stimulus material tallies with their findings. For example, when cards bearing letters of the alphabet are displayed tachistoscopically, the number of letters correctly detected increases with duration of exposure and, at each duration, varies inversely with the information content per letter (Miller, Bruner & Postman, 1954).

The upshot of the evidence is, therefore, that the information extracted from a perceived pattern becomes available step by step. The initial uncertainty with respect to the attributes, classification, accompaniments, and significance of a stimulus pattern is eliminated only gradually. Perception goes through intermediate stages, when perceived objects are assigned to broad classes with particulars remaining in doubt. They are not fully identified until a progressive narrowing down has had time to complete itself.

*2. Perception involves difficulty and effort.* We may safely assume that the degree of difficulty and effort is greater in the earlier stages of perception, soon after the initial encounter with a stimulus pattern, than when perceptual activities are nearing completion. It will also be greater with certain patterns than with others. Difficulty and effort will increase with initial uncertainty about the characteristics of a pattern, with the amount of information that has to be absorbed before the pattern has been thoroughly identified and analyzed. This means that they will be greater when patterns are more novel, more surprising, more complex, more ambiguous, more puzzling.

When we say that a psychological process is difficult, we mean that its execution requires some time and that there is considerable danger of carrying it out erroneously or of not completing it at all. We mean that it is fraught with conflict, that the subject will be pulled in different directions by competing response tendencies, and that mutually interfering processes corresponding to all of them will occur simultaneously in the brain, so that many of them will be initiated without being able to reach fruition.

But we also imply certain motivational and emotional effects, associated with words like "effort" or "exertion." We imply a high overall level of activity, overt and internal, a high level of energy mobilization and, in general, all the manifestations of high arousal. We mean that, over and above this general intensification of behavior, activities that are likely to remove the difficulty will be vigorously undertaken until resolution has been achieved. And we mean that there will be an uncomfortable, aversive condition whose removal through the overcoming of the difficulty will be pleasurable and rewarding. This brings us to the next point.

*3. Perception has emotional accompaniments.* According to Collingwood (1938), "it is possibly true to say that every sensum has its own emotional charge" (p. 162). Titchener (1909, Part I, p. 248), one of the founders of experimental psychology, wrote that "you cannot show the observer a wallpaper pattern without by the very fact disturbing his respiration and circulation." Such assertions receive substantial report from experimental evidence.

With a few exceptions, all stimuli that are registered by the nervous system have motivational effects, including the physiological indices of emotional impact. The exceptions are stimuli evoking primitive, unlearned, reflex reactions and those evoking responses that have been practiced often enough to become automatic, so that the subject is not aware of either the stimulus or the response. They also include stimuli that have been repeated several times in a short interval without biologically important accompaniments and stimuli from which attention is deflected. In these cases also, the subject's actions and subsequent reports indicate that he was not aware of the stimulus, but it must evidently be reaching at least some lower levels of the brain, since it will be noticed if it undergoes some change that restores it to the focus of attention. With these exceptions, stimuli evoke the so-called "orientation reaction" or, if they are extremely intense, painful or novel, the "defensive reaction."

The orientation reaction (Sokolov, 1958; Berlyne, 1960) is a name given to a complex of psychological and physiological processes, usually lasting a few seconds after the stimulus has begun to excite sense organs. They include receptor-adjusting and perhaps other exploratory responses; physical and chemical changes within sense organs that increase sensitivity; and various physiological changes indicative of increased arousal, including replacement of slow EEG waves with fast waves, a jump in the electrical conductance of the skin of the palms and soles, increased volume of the extremities due to dilation of blood vessels, expansion of the pupil of the eye, and increased muscular tension. There will also be changes in heart rate and respiration rate, but these seem to vary

in form and direction. All of these changes improve the organism's capacity to take in information from the environment and prepare for the possibility that prompt and vigorous action will be needed.

The defensive reaction has many components in common with the orientation reaction, but there are some differences. For example, the arteries in the forehead undergo dilatation when the orientation reaction is evoked but contraction as part of the defensive reaction. In general, the defensive reaction seems conductive, as might be expected, to reduced sensibility or to protection against a stressful stimulus.

The stimulus properties that determine how intensive the orientation reaction will be or whether it will be replaced by the defensive reaction are precisely those comprising that we have called "arousal potential." Both the orientation reaction and the defensive reaction evidently include a short-lasting rise in arousal (presumably more marked in the rise of the defensive reaction) which might be supplemented by a gradual upward drift in arousal level if repeatedly elicited. There will be times, particularly when the defensive reaction occurs but perhaps also during particularly strong orientation reactions, when increments in arousal are sufficient to produce an aversive condition. This will be likely to happen, for example, when the difficulties of perceptual processing are severe.

When a stimulus pattern is arousing enough to be disturbing, we can expect anything that reduces arousal to be rewarding. This may include removal of the stimulus in question. But it will also include conditions in which the stimulus continues to act but the difficulties of perceptual processing have been eliminated e.g., by successful completion.

*4. Perception can be rewarding and pleasurable.* From all this, we are led to expect that processes constituting perception can have positive hedonic value, quite apart from any help they supply in the selection of actions with extraneous rewarding effects on the environment. As we have just seen, the difficulties of perception may drive arousal up to an aversive level, introducing the possibility of reward and pleasure through subsequent relief, dependent on the secondary reward system. But at other times, perception may entail a moderate arousal increment that gives rise to reward and pleasure through the other mechanism, the arousal-increase mechanism that we have presumed to depend on the primary reward system. Finally, as noted in the last chapter, the continued perception of a stimulus pattern may activate the arousal-increase and arousal-reduction mechanisms of hedonic value in turn.

## 10

## CHARACTERIZATIONS OF ART AND OF BEAUTY

Having now completed the groundwork, we can turn our attention to problems of aesthetics and of art. In default of a solid, comprehensive framework of scientific knowledge, we must derive what guidance we can from the voluminous speculative writings on aesthetics that the centuries have accumulated and from the relatively meager proceeds of the first century of experimental aesthetics.\*

On some points, the aestheticians of the past have made things more difficult rather than easier for us. Their writings form a babel of mutually contradictory pronouncements, all put forward in equally self-assured tones and all backed up with examples. The statements made by one writer are more than likely to be flatly contradicted, with equal assurance, by somebody else.

Nevertheless, we find certain themes coming back again and again with impressive regularity and certain kinds of conclusions to which anybody who attacks the problems seems bound to come sooner or later. The fact that certain views have been voiced continually for a long time does not, of course, imply that they are valid. The history of science contains many examples of beliefs that persisted for hundreds of years but were finally discredited. Nevertheless, there must be some reason for the prolonged recurrence of certain statements, and one possible reason is that they contain an element of truth. So it is worth our while—in fact, we have at present no alternative—to start with what the aestheticians of the past have to tell us and to see how far it can be reconciled with the present state of knowledge in psychology and in neighboring fields of study such as neurophysiology.

### Beauty

It has often been taken for granted that the aim of the artist is to

\* Historical reviews of what philosophers and critics have had to say about aesthetics are to be found in Gilbert and Kuhn (1954), Morpurgo-Tagliabue (1960), Bayer (1961), Venturi (1964), Beardsley (1966), and Osborne (1968).

produce something "beautiful," so that many writers have felt that the problems of art will be disposed of when the concept of beauty has been satisfactorily analyzed. But this position has not gone uncontested. Scenes that would normally be considered the opposite of beautiful, like the raw meat painted by Rembrandt or the episodes of human degradation that occur so frequently in Zola's novels, have found honored places in art. Collingwood (1964) asserted that beauty is always mixed with ugliness and vice versa. Rosenkranz (1855) wrote an *Aesthetic of the Ugly*, and the Futurist poet Marinetti went so far as to say that "the beautiful has nothing to do with art." According to some theories, art can provide satisfaction through properties quite distinct from the "beautiful" such as the "sublime" (see Ch. 8) and the "interesting" (Chernyshevski, 1855).

### The aesthetic and the artistic

Whether or not one holds beauty to be the sole source of aesthetic pleasure, one must recognize that this quality is by no means confined to works of art. Contemplation of natural phenomena can provide pleasures that are closely akin to those derived from art. But there are differences between the artistic and the aesthetically pleasing in nature. Works of art are produced by human artists with a view to both their own satisfaction and the satisfaction of other human beings, and the knowledge that this is the case undoubtedly affects the reactions that works of art evoke. There have, in recent years, been exhibitions of *tableaux-pièges* or other objects not designed as art, and concerts of randomly juxtaposed sounds have been organized as jokes or as experiments. The viewers or listeners generally feel cheated when they find out that these works were not deliberately constructed, or even selected, by human artists for their aesthetic value. It is clear that they would have reacted to them differently if they had known this from the beginning.

Consequently, the artistic has usually been regarded as a special case, but of course a singularly important one, of the aesthetic. The prevailing view has been clearly put by Volkelt (1914):

A garden that is arranged so as to provide a graceful picture belongs to the artistic-aesthetic. On the other hand, a garden which lies there in neglect and charms precisely because of the wild tangle of grass, flowers and bushes is natural-aesthetic. A girl who dresses and adorns herself with the intention of enhancing the impression of her beauty is in this respect acting as an artist. But anybody who dresses in a pleasing way without in the least selecting his clothing with a view to its aesthetic effect is a case of the natural-aesthetic.

Reasonable as this view may seem, one of the most influential German aestheticians of the nineteenth century dissented from it. Fiedler (1914) tended to identify the aesthetic with beauty but maintained that, as far as art is concerned, "The representation of beauty is not its main task or its only task." He regarded beauty, in fact, as rather subsidiary to art and insisted on a sharp differentiation between "aesthetic judgment" and "artistic judgment."

We must recognize the important additional complications that arise from the element of interpersonal exchange, the communication that was discussed in Chapters 5 and 6. But some characteristics and principles seem to be valid alike for a person looking at an attractive landscape and one (who may be the artist himself) inspecting the products of an artist. These are presumably the ones that call for study in the first instance.

### The aesthetic as an end in itself

Many attempts to define art through the aesthetic have started out with the observation that art (or the aesthetically pleasing) is not useful, that it has no purpose outside itself, that it is pursued for its own sake. We are told that "a thing that becomes useful ceases to be beautiful" (Gautier, 1832); that appreciation of art requires "psychical distance," which means "putting [the object] out of gear with practical needs and ends" (Bullough, 1912); and that the "central characteristic of beauty is that it is always an end in itself and never a means to an end" (Newton, 1950).

The same point has been made in the vocabularies of twentieth-century psychological theory. Koffka (1940) stresses the "purity" of art: "demands on the Ego must not issue from sources that are extraneous to the art object." D. Morris (1962) classifies picture-making as an example of the "self-rewarding activities," which are highly developed in primates. "These are actions which, unlike most patterns of animal behavior, are performed for their own sake rather than to attain a basic biological goal."

However, like most of the statements of aestheticians that have been confidently based on speculation or on concentration on particular instances, this view has not gone unchallenged. It was perhaps expressed with most fervor by the advocates of "art for art's sake" in the late nineteenth century, but there have been many societies and periods where the arts have been expected to contribute significantly to vital social purposes. The ancient Greeks, including (according to Xenophon) Socrates, favored the idea of the *kalokagathia* or "beautiful-good." Fechner (1876, p. 203) contended that beauty can exist in an object with a

practical purpose if the purpose is actively facilitated and expressed, and this has, of course, become an accepted maxim for modern industrial design and functional architecture. Art that does not have a lasting effect on the appreciator and modify the way he feels and behaves after leaving it was dismissed by Collingwood (1938) as "play art." It qualifies as art but of an inferior kind.

The reasons for contrasting aesthetic activities with the occupations of "real life," on which grave practical concerns hinge, are easy to see. Art belongs to a world of its own, which is to a large extent cut off from the world in which we carry out our daily work. A work of art is self-contained and isolated from its context. The impact of a painting has little to do with the wall on which it is hung, unless the wall has some characteristic that detracts from its appreciation. Art can be enjoyed when it is useless, and a well-designed implement can be a source of pleasure even when it is not being used.

The situation is a little complicated. Art, as we have recognized, can serve a variety of purposes. Its contribution to these purposes can enhance the satisfaction that it yields, especially if there is a close relation between them and the structure of the work.

Nevertheless, it is certainly possible to enjoy perceiving patterns that do not exist for any reason other than to be looked at or listened to, that nothing else can be done with, and that do not give rise to any specific behavior other than perception. The sources of pleasure that are at work when this happens seem clearly enough to be at work also when a specimen of applied art or a work that provides guidance and motivation for later practical action is contemplated. But here, pleasure is drawn from other sources in addition.

The position seems to be essentially the same as with other kinds of behavior that are said to be pleasurable "in themselves," such as play and intrinsic exploratory behavior. Money and glory may be gained by playing a game well, and exploratory responses can provide cues that enable all kinds of extraneous goals to be reached. Even when play or exploration is extrinsically motivated and rewarded, it can afford access to interesting or pleasing stimulus patterns, stir up and allay curiosity, and the like. In other words, the factors that motivate intrinsic counterparts of these behaviors are likely to be at work together with extrinsic sources of motivation and reinforcement.

When aesthetic activity or any other activity is said to be "self-rewarding," this can hardly be literally true. As far as we can see, reward does not come from performance of particular actions directly but from the internal consequences of these actions, from processes in the brain resulting from the external and proprioceptive stimulation to which they give rise. When D. Morris (1962, p. 144) speaks of actions that "are

performed for their own sake rather than to attain some basic biological goal," it is not clear that the goal is in any sense "less biological" than those of eating, mating, or escape from pain. They are less "basic," if at all, only to the extent that they may be less indispensable. The point surely is that the rewards that act on other kinds of behavior are associated with biologically important effects that are not confined to the sense organs and the nervous system, whereas, as far as so-called "self-rewarding activities" are concerned, reward value depends solely on the kinds of stimulation that reach the sense organs and on the relations between the processes that they bring about in the brain. These consequences will depend mainly on form, structure, or relations among elements, or, in other words, on the collative stimulus properties. So, "intrinsically rewarding" is a better term than "self-rewarding."

This is where the "intrinsic values" come in that were discussed in Chapter 6. Then, modifying C. Morris's view, we concluded that art, whether or not it serves to communicate anything else, communicates intrinsic values. The artist finds, in his work or in the external objects and events to which his work refers, stimulus patterns that have pleasurable direct effects on his nervous system, whether or not they lead indirectly to other satisfactions. In other words, he regards them as worthy of attention in themselves, whether or not they give rise to overt action, and his work causes members of his audience likewise to attend to them and derive intrinsic pleasure for them.

### Inhibition of overt action

Another recurrent observation, not unrelated to the one we have just been discussing, is that a work of art does not evoke motor responses that other patterns with its characteristics would occasion. There have been many anecdotes to illustrate this point, from the story of the birds that came to peck at the grapes painted by the ancient Greek painter Zeuxis to the story, presumably fictitious, of the spectator who stood up in the middle of melodrama, performed in the American West, and shot the villain. These are examples of failure to adopt the "aesthetic attitude," of inappropriate reaction to art, of failure of a stimulus pattern to function as art.

It is significant that exposure to art usually produces much less bodily activity than human beings usually show, which is remarkable since works of art commonly deal with matters of moment, to which strong habits and attitudes are attached, and art is supposed to stir up strong emotions, which usually impel energetic action.

There are evidently sharp differences between the emotions that

participate in aesthetic behavior and emotions that occur otherwise. As Dewey (1934) puts it, "there is an element of passion in all aesthetic perception. Yet when we are overwhelmed by passion, as in extreme rage, fear, jealousy, the experience is definitely nonaesthetic." Langer (1942) feels bound to deny that the function of music (and she later made the same point with regard to other arts) is to arouse emotions. She admits that music can produce physiological effects that are characteristic of emotional states, and she could hardly dispute that people often declare themselves to have been deeply moved by a musical work. But (as mentioned in Ch. 6) she points out several respects in which what the listener goes through is unlike what we normally call an emotional state. For example, the so-called emotional effects do not outlast the stimulus, as seen from the ease at which musicians and listeners can pass from one movement to another associated with a quite different mood. Hindemith (1952) has made much the same point. Langer holds therefore that music can be said only to "represent" or "symbolize" emotions for contemplation. In the words of Pratt (1931), who had taken up a very similar position a little earlier, the structural characteristics of music "*sound the way moods feel.*"

It seems clear enough that art puts people into states resembling in some ways what we recognize as emotions in nonaesthetic contexts but contrasting with them in other ways, notably in the lack of discharge through purposeful motor activity. Whether or not the difference is sufficient to debar us from saying that genuine emotions are aroused is essentially a matter of definition, and the psychology of emotional states has not yet advanced far enough for us to place a boundary line with any confidence or dogmatism.

But we must face the fact that, during exposure to art, many of the responses that comparable stimuli would be expected to evoke in other circumstances, and especially motor responses characteristic of emotional states, are inhibited. In the words of Bullough (1921), aesthetic adaptation means

the attending to the various aspects presented by the object . . . and the opening of all the channels of reminiscence, associations, historical and technical knowledge, influences, emotional resonances, organic sensations, etc., in so far as they may serve to impart an adequate meaning to the object and to lead to an adequate interpretation of it on the lines predetermined by the artist. Negatively, it involves the cutting out of all irrelevant trends of thought, extra-aesthetic points of view, the selection of valuable associations and the suppression of useless or distracting dispositions, especially of such as by their intensity or nature would lead to deviating associations, purely personal interests or reminiscences, splitting the interest in the object or destroying the unity of attention and appreciation.

This followed from his notion, already mentioned, of "psychical distance" between "our own self and its affection" (1912). Moles's (1958) conception of "aesthetic information" has much in common with this view. He regards "works of art as a system of organized perceptions, that do not condition any objective reaction" (1968, p. 15). "Aesthetic information" he says, "does not have the goal of preparing decisions" (1958, p. 135).

We must, therefore, consider why stimuli belonging to a work of art fail to evoke some of the responses, and especially motor responses, that are normally associated with them.

The most influential Russian psychologist of the twentieth century, Vygotski, had some interesting ideas to offer on this question in his posthumous book on aesthetics (1965). He held that "neural energy" could be discharged either centrally or peripherally and, the greater the concentration on one pole, the less the concentration on the other. Aesthetic patterns induce intense fantasy and contemplation, which means intense expression of the central or cortical component of emotion, resulting in a weakening of peripheral expression. This view is rather reminiscent of other "hydraulic" theories, such as those of Freud or the early ethological writers (e.g., Tinbergen, 1951), in which nervous "energy" was likewise conceived as something like a fluid or electric current with several outlets, so that the more there is passing through one outlet, the less there will be left to pass through another. But this kind of theory receives little support from present-day neurophysiological knowledge. On the other hand, Vygotski's hypothesis is also reminiscent of Pavlov's notion of "negative induction," the inhibition of processes occurring in other parts of the brain when particularly strong excitation occurs at one location. This is more in keeping with what is now known about the nervous system and must have some degree of validity with respect to aesthetic behavior. It seems true enough that, the more effectively a work of art incites inner activity, the greater the immobility of the appreciator. But this inhibition is applied mainly to responses like fidgeting or talking to one's neighbor, rather than to the actions that would take place if an emotion were given full rein. Vygotski's hypothesis would seem to imply that anybody underendowed with imaginative powers or anybody whose thought processes were, for some other reason, not fully engaged by a work would be inclined to react to the elements of a work of art as he would if they were encountered in "real life." This is surely not the case.

Vygotski offers a second explanation for the absence of outward expression of emotion, attributing it to the presence of conflicting, and therefore mutually counteracting, factors, which are invariably set in motion by art. For example, differing, and to some extent incompatible, emotions result from characteristics of form and content. Tragedy generates a combination of pleasant and unpleasant feelings. In a similar vein, Puffer (cited by Ogden, Richards, & Wood, 1925), states that art

induces mutually opposed processes that balance one another and "in equilibrium there is no tendency to action." Motor activity can be blocked by the mutual interference of conflicting neural processes, each of which would eventuate in action if it were present alone. But there are plenty of indications that conflict, being a biologically threatening state of affairs, does not generally lead to quiescent paralysis but rather to an aversive state of agitation in which a way out of the impasse is sought. And, as studies of exploratory behavior and thinking seem to show (Berlyne, 1960, 1965), ideational processes, including thought and fantasy, commonly serve as means of resolving conflict.

The characteristics of aesthetic behavior that have just been under discussion become intelligible as soon as we recall the possibility of analyzing works of art as systems of symbols. As pointed out in Chapter 5, a symbol evokes some, but not all, components of the behavior pattern associated with the significate. Furthermore, many symbols do not give rise immediately to motor action but rather to central processes, including some that can be classified as dispositions, i.e., as processes that make the interpreter likely to act in particular ways on future occasions if particular kinds of stimulus situations are encountered. These differences between behavior in the presence of a symbol and behavior in the presence of its significate are due partly to generalization decrement, the well-established fact that stimuli partly resembling a conditioned stimulus evoke the conditioned response in a weakened form. Symbols are distinguishable from their significates, and this holds even for iconic symbols which form such a large part of art. Selective inhibition of particular responses must also result from discrimination learning. Some components of the response pattern evoked by the significate are inhibited in the presence of the sign without its significate because they do not then conduce to reward and may even lessen the prospects of attaining it.

So, while we are engaged in contemplation of an aesthetic object, previous learning causes inhibition of motor responses that would be performed if the object were treated as "real" or nonaesthetic, because these responses would not help but hinder the achievement of the satisfactions that are sought through aesthetic behavior. This inhibition must depend on cues indicating that a particular object is to be taken as a work of art or at least as an occasion for aesthetic appreciation, cues that remind us that we are now in the theater, in an art museum, or reading a book about events that never actually happened to people who ever lived. These must be comparable to the cues that differentiate the playful fighting of animals from real combat (Bateson, 1955) or indicate that a disparaging remark is meant as a joke. They obviate the violent retaliation that could otherwise be expected.

The importance of these cues and of the discrimination learning that makes use of them can be seen when either of them is lacking.

Dramatists have occasionally incorporated episodes into their plays that take place not on the stage but in the body of the theater (Shaw's *Fanny's First Play*) or at the entrance of the theater (Pirandello's *Ciascuno a Suo Modo*). They are consequently not immediately recognized by the audience for what they are. Waxwork figures and *trompe-l'oeil* paintings have sometimes been used effectively to deceive museum visitors, but their role is generally classed as a nonaesthetic one. When taken to the theater, children, who have not yet had time to complete the appropriate discrimination learning, frequently act as if they were witnessing real events happening to real people, as their facial expressions and comments show. The trigger-happy, and presumably inexperienced, Western theater-goer in the story mentioned above must have suffered from a similar disability.

## CHARACTERIZATIONS OF BEAUTY

### Avoidance of extremes

Plato (in the *Statesman*) wrote that all arts are "on the watch against excess and deficit . . . the excellence and beauty of every work of art is due to this observance and measure." He made it clear that by "measure" he meant approximation to the "mean and the fit and the opportune and the due and with all those words in short which denote a standard removed from the extremes." A little later, Aristotle (in the *Nicomachean Ethics*) made the same point with exemplary conciseness: "A master of any art avoids excess and defect but seeks the intermediate and chooses this."

During the centuries that have since elapsed, writer after writer has set about the task of characterizing the beautiful or the aesthetically satisfying in a similar way. But various terms have been used to characterize the dimension along which an intermediate, optimal position is to be sought and the extremes that are to be shunned.

St. Augustine maintained that sights will be pleasant if they are not too obscure or too brilliant and that sounds will be pleasant if they are neither too strong nor too weak. Home (1765) wrote that pleasure comes from something that is neither too rapid nor too slow, neither too varied nor too simple.

Grant Allen, a disciple of Spencer's with a special interest in aesthetics, related the matter to biological adaptation. He asserted (1877, p. 21) that "pleasure is a concomitant of the healthy action of any or all of the organs or members supplied with afferent cerebro-spinal nerves to an extent not exceeding the ordinary powers of recuperation possessed by the system."

Fechner (1876, II, p. 260) put forward the "Principle of the Aesthetic

Mean": "When an object of our contemplation undergoes random variations in size or shape, then, all other things equal, the mean value seems to be preferred from the aesthetic point of view or appears with the character of predominant pleasingness as the normal value in comparison with the others, which, according to their degree of deviation from the mean, can appear less pleasing or, if certain limits are exceeded, even displeasing." The resemblance between this statement and the implications of Wundt's curve or the butterfly curve are noteworthy.

Explicit reference was made to Wundt's curve by his former student, Külpe (1893), for whom "elementary aesthetic feelings" depended on the relations between the sensation and the "reproduction" due to a stimulus object. By "reproduction," he apparently meant memory images of similar objects or images of other objects occurring through association. If there is too little "effectiveness" and "facility of reproduction," there will be indifference, he wrote. If there is more, there will be pleasure, and if there is too much, there will be unpleasantness.

In Dewey's (1934, pp. 40-41) words:

the non-aesthetic lies within two limits. At one pole is the loose succession that does not begin at any particular place and that ends—in the sense of ceasing—at no particular place. The other pole is arrest, constriction, proceeding from parts having only mechanical connections with one another, . . . rigid abstinence, coerced submission, tightness on one side and dissipation, incoherence and aimless indulgence on the other, and deviations in opposite directions from the unity of an experience.

Kris and Kaplan (1948) speak of the opposite dangers of the "unintelligible" and the "uninspired." The value of an aesthetic message for the receiver depends, according to Moles (1968), on avoidance of "perfect originality," which is reached with a completely unpredictable and completely incomprehensible series of signs, and "perfect banality," or perfectly comprehensible, total redundancy, which brings nothing new to the recipient but is very easy to understand, e.g., endless repetition of the same sign.

### Interaction of two factors

If, as one proceeds along a certain dimension, beauty or pleasure or aesthetic value rises for a while, reaches a maximum in some intermediate sector, and then falls as the opposite extreme from the starting point is approached, we have an example of the inverted U-shaped curves that are quite often encountered in psychology, especially in the study of motivation. Such a curve could come about through the interaction of two factors, one coming into play in the lower reaches of the dimension

and tending to increase pleasure, while the other begins to predominate when the upper reaches are entered and militates against pleasure. This is precisely the state of affairs represented by our Figure 8-3 in Chapter 8. It will be remembered that the two curves representing the presumed action of the primary reward and aversion systems combine to produce the Wundt curve, which rises to a peak and then falls. It resembles an inverted, though somewhat lopsided, U in shape.

Since the Renaissance, most attempts to specify the conditions making for beauty or aesthetic pleasure have focused on the necessity of equilibrium between two mutually counterbalancing factors. The first to do this clearly was perhaps Descartes (1650), who wrote that

among the objects of every sense, the one that is most agreeable to the soul [âme] is not the one that is perceived by it either very easily or with great difficulty but the one that is not so easy to become acquainted with that it leaves something to be desired in the passion with which the senses are accustomed to approach their objects or so difficult that it makes the senses suffer in striving to become acquainted with it.

Baumgarten (1750), often regarded as the father of aesthetics since he was the first to use the term in its present-day sense, held that "the richer and greater a thought is, the more correct, more vivid, more certain and more lively it is, the more beautiful it is." But richness or multiplicity has to be combined with clarity. Novelty, originality, and variety are needed to make things lively and to prevent undue dryness and sobriety. There must be coherence and economy, however, to preclude fatigue.

Many later definitions of beauty are traceable to Leibnitz's (1714) definition of "perfection": "to obtain as much variety as possible but with the greatest order that one can." Hutcheson (1725) applied the notion to aesthetics: "the Figures which excite in us the Ideas of Beauty seem to be those in which there is Uniformity amidst Variety." What is important is, expressed "in the Mathematical Style," the "compound ratio" between these two factors: "... where the Uniformity of Bodys is equal, the Beauty is as the Variety; and where the Variety is equal, the Beauty is as the Uniformity." Moses Mendelssohn (1757) proclaimed likewise that "uniformity in multiplicity (*das Einerlei im Mannigfaltigen*) is a quality of beautiful objects." In the next century, Hegel (1835) equated beauty with the imposition of unity on the variety of external phenomena through regularity, symmetry, subordination to laws, and harmony. When Fechner came to write his book on aesthetics (1876), he laid down the "Principle of the Unitary Connection of the Manifold."

Hegel belonged to a long philosophical tradition that viewed art as a means of glimpsing the stable world of Ideas behind the shifting heterogeneity of the perceptible world. So, for writers like him, the principle of unity in variety had a metaphysical significance. Others,

beginning with Descartes, derived it from psychological considerations. Variety was what could stir up emotion and offer a challenge to our perceptual and intellectual capacities. Unity enabled us to meet the challenge. It guarded against the dangers of bewilderment and fatigue.

This kind of interpretation became particularly common in the nineteenth century, as the relevance of biological adaptation received more and more notice. Spencer (1870) wrote that "the primitive source of aesthetic pleasure is that character in the combination which makes it such as to exercise the faculties affected in the most complete ways with the fewest drawbacks from excess of exercise" (p. 704). The same point had been made, perhaps rather more clearly, by Gerard (1764) a century before: "... moderate difficulty, such as exercises the mind without fatiguing it, is pleasant and renders the object by which it is produced agreeable." Dewey (1934, p. 49) saw that there is "an element of passion in all aesthetic perception. Yet when we are overwhelmed by passion . . . the experience is definitely nonaesthetic. There is no relationship left to the qualities of the activity that had generated the passion." Consequently, "elements of balance and proportion" are necessary as well. For Lipps (1903), "pleasure arises to the extent that a mental process produces favorable conditions for its apperception." Apperception means "grasping, apprehending, taking account of a sensation, perception, imagination, and noticing it or its object, directing attention towards it." But intensity of pleasure depends also on the amount of opportunity for apperception, on the degree of claim on apperception. Kris and Kaplan (1948) see art as a form of problem solving. The constituents of the problems are "aesthetic ambiguity" (by which they actually mean multiplicity of meaning) and "stringencies" or conditions within which the problem is to be solved. Ambiguity is identified with inspiration. It stimulates the "primary process," the "functional regression" that governs dream fantasy, whereas satisfaction of stringencies "provides . . . for the element of skill"; and "art . . . is a product of inspiration as well as skill."

These authors' conception of stringency exemplifies a growing tendency to interpret the factor needed to counterbalance "variety" or "multiplicity" more broadly than as "unity" or "uniformity." It has for example, been equated with "order" or "lawfulness." "The first quality that we demand in our sensations," writes Fry (1920), "is order, without which our sensations will be troubled and perplexed, and the other quality will be variety, without which they will not be fully stimulated. Order implies unity." Newton (1950) defines "beauty" as "law-abiding behavior," but he points out that "a certain percentage of apparent disobedience must take place among the prevailing obedience. . . . The intuition must occasionally be baffled, or it will become bored and lose its sensitivity."

Inevitably, some writers have posited complementary human motives

or needs to which the two complementary factors appeal. According to Schiller (1801), there is a "sensuous urge" (*Stofftrieb*) which derives from the "physical nature and existence of man or his sensuous nature" and demands "that there be change, that time have a content." There is also an "urge for form" (*Formtrieb*) which derives from the "absolute existence of man or his rational nature" and "strives for unity and permanence." The object of the sensuous urge is called "life" and the object or the form urge is called "pattern" (*Gestalt*). The two urges converge in a third urge, the *play urge*, which aims at "living pattern," with which Schiller identified beauty. Schleiermacher (1842) recognized a need for enthusiasm and a need for inspiration (*Besinnlichkeit*), and Zeising (1855), a craving for variety and a craving for order. Implicit in the views of Spencer and others are a tendency to seek maximum stimulation and a tendency to seek minimum effort.

Fechner (1876, I, p. 53ff), in discussing his "Principle of Unitary Connection of the Manifold," asserts that, if a human being is to feel at ease during contact with an object, his innate constitution requires "a certain variability in forms of activity or impressions, which means that the object must offer a multiplicity of points of attack." Otherwise there will be "a displeasing impression of monotony, uniformity, boredom, emptiness, baldness, poverty." But human nature also requires the successive forms of interaction with an object to have something in common so that they will hang together. Without this "unitary connection" there will be a "displeasing feeling of distraction, fragmentation, disconnectedness, or even contradiction." Worringer (1908) writes of an urge for empathy, which implies "self-affirmation, affirmation of the general will to activity that is in us" and an urge to abstraction, which is an urge "to alienate oneself from individual feeling . . . to seek deliverance from the fortuitousness of humanity as a whole, from the seeming arbitrariness of organic existence in general, in the contemplation of something necessary and irrefragable."

Spearman (1931) went back to Aristotle's statement (in the *Nicomachean Ethics*, X, iv) that ". . . the most perfect act is that whose energy is well-disposed. . . ." Like many of his contemporaries, Spearman invoked a vaguely conceived "mental energy," but, if he had been writing a few decades later, he would no doubt have realized that distribution of transmitted information is likely to be more to the point. Be that as it may, he formulated a "law of retentivity," according to which "the occurrence of any mental event inclines it to occur subsequently." This was coupled with a "law of fatigue": "the occurrence of any mental event produces an influence opposed to its occurrence afterwards." Referring to art, he deduced that, if "well disposed" or "perfect energising" is to be ensured, "the principle of retentivity which demands repetition must be supplemented by the principle of fatigue which demands variety" (p. 48). To

be aesthetically pleasing, repetition "needs to be intermixed with changes which refresh again."

Most familiar of all is the Freudian view that artistic activity, like so many other psychological phenomena, provides satisfaction, generally partial and disguised, both for the sexual and aggressive desires located in the "id," and for the restrictive and repressive demands of the "ego" and the "superego."

### Birkhoff's theory

All the two-factor theories reviewed so far were derived from speculation, sometimes closer to metaphysics and sometimes closer to biological thinking with a scientific orientation. Birkhoff's (1933) theory has much in common with them and is equally speculative. But it represents a break with the past in introducing measurement of the two interacting factors and thus holding out hopes of predicting aesthetic value by calculation.

Birkhoff's two factors are C (complexity) and O (order). C represents the extent to which an object calls forth an "effort of attention" and a "feeling of a tension" due to receptor-adjusting responses of the eyes, the throat muscles, and so on. Order is related to the associations, mainly unverbalized, that are evoked by properties like symmetry, repetition, and sequence. He supplies formulas enabling values of C and O to be computed for polygons, vase outlines, melodies, and lines of poetry. Unfortunately, the governing principles depend on the peculiarities of these classes of material and provide little, if any, guidance for working out analogous measures applicable to a broader range of objects. In polygons, C is the number of indefinitely extended straight lines that contain all the sides, and O increases with such properties as symmetry and horizontal-vertical orientation. In vases, C is identified with a number of "characteristic points" on which the eyes can rest. In music, C is a number of notes in a melody, and O depends on melodic or harmonic sequences. In poetry, C is the number of elementary sounds plus the number of word junctures that "do not admit of liaison," and O is derived from the presence of rhyme, alliteration, and assonance.

Having introduced these measures of O and C, Birkhoff introduces a variable M, representing aesthetic value, and puts it equal to O/C. Since M varies directly with O and inversely with C, the equation implies that the simplest and most regular patterns will be highest in aesthetic value. This is not borne out by everyday experience or by experiments in which subjects have been required to judge polygons selected from those illustrated in Birkhoff's book (Davis, 1936; Eysenck, 1941a). The evidence indicates rather that aesthetic value is curvilinearly related to

Birkhoff's M, reaching a maximum when M is neither too high nor too low.

Rashevsky (1938) proposed an alternative mathematical model based on avowedly speculative neurophysiological postulates. Each of the major components of a visual pattern generates excitation in a corresponding group of neurons, which is also subject to inhibition from other groups that are simultaneously excited. Aesthetic value depends on the "total net excitation" that is transmitted to a "pleasure center." Symmetry reduces "effective complexity" and thus excitation "by subtraction rather than division," i.e., by adding inhibition. The aesthetic values deduced for polygons from this model showed fairly good agreement with the rankings obtained in Davis's experiment. Eysenck (1942) has suggested that the equation  $M = O \times C$  would be most in keeping with available data. According to this equation, aesthetic value can be increased by increases in either complexity or order, but where the maximum lies will depend on the precise scales used.

The information-theoretic aestheticians accept Birkhoff's account of how O and C combine to determine aesthetic value, but they translate his variables into information-theoretic equivalents (Gunsenhäuser, 1962, 1968; Bense, 1965). C is identified with uncertainty ( $H$ ) and O with redundancy ( $R = (H_{max} - H)/H_{max}$ ). By substituting these values in the formula  $M = O/C$ , it is inferred that  $M = \frac{1}{H} - \frac{1}{H_{max}}$ .

### Arousing and arousal-moderating factors

Despite the very different terms in which the two components of beauty or prerequisites of aesthetic pleasure have been specified through the centuries, it is not hard to discern common ground. There is always one factor, whether it be called "multiplicity," "variety," or "complexity," that can be expected to raise arousal. Several writers have, in fact, explicitly characterized it as a source of "emotion." Then, there is the other factor, "unity," "order," or "lawfulness," that can be expected to lower arousal or at least to keep any arousal increment within bounds.

As discussed by many theorists, the first factor provides grist for processes of perceptual and intellectual analysis, gives them something to work on, challenges them. The other factor gives them some prospect of success; it provides a basis for efforts at organization and interrelation. In other words, the first factor tends to make perception difficult, with all the implications of difficulty touched on in the last chapter. We may call it the factor of "disorientation" and the other the factor of "orientation." This follows Peckham's (1965) usage, but it also provides a connection with the "orientation reaction." The orientation reaction, it will

be remembered, is a system of psychophysiological changes that come into play when there is disorientation. It is so called because its function is to reorient the organism to its environment.

In Chapter 8, we discussed the two mechanisms on which pleasure and reward apparently depend. One operates when there is an increment in arousal that is moderate in extent. The other operates when arousal is driven up to a rather high level and then brought down again. Whether pleasure is generated by either of these mechanisms or whether it is replaced by indifference or unpleasantness is a delicate quantitative matter. It turns on the degree to which arousal is raised or lowered and on the interplay of factors that can drive arousal upwards and factors that can keep arousal down or lower it. As far as the first or arousal-increase mechanism is concerned, these counterbalancing factors must act simultaneously to keep the extent of the arousal increment within the rewarding range. In the case of the second or arousal-reduction mechanism, the arousing and arousal-moderating factors must operate in turn. It was also pointed out in Chapter 8 that these two mechanisms are not mutually exclusive. There may well be first an arousal increment that is small enough to be rewarding, followed by additional reward from arousal decrease. It was also suggested that this state of affairs may occur quite often in art.

So, it is far from surprising that so many writers should have sensed that beauty or pleasure from perception depends on the simultaneous operation of two opposing factors or groups of factors and that each must be present to an extent that is not excessive.

It is clear we shall need precise techniques of measurement before we can make precise predictions about aesthetics reactions and thus feel that we really understand how aesthetic processes work. Work like that of Birkhoff or of the information-theoretic aestheticians constitute faltering first steps in this direction, but their applicability is limited to particular kinds of material and circumstances and they are as yet without firm empirical validation. These limitations will no doubt be removed as research proceeds. The arousing and arousal-moderating factors, the constituents of disorientation and orientation, will have to be specified with more precision, and more experiments will be needed to reveal the general forms of the relevant mathematical functions.

### One-sided views

Contrasting with the two-factor theories or definitions that are being reviewed, there are writers who have laid stress on single determinants belonging to either the arousing or arousal-moderating group.

As examples of the former category, we have Du Bos's belief that the

arts serve to remove boredom by stirring up feelings: "the art of poetry and the art of painting are never more applauded than when they have succeeded in affecting us, because in affecting us they stir us" (1719). Hemsterhuis (1769) defined beauty as "that element in an object to which affords the largest number of ideas in the shortest time." Among recent writers, Platt (1961) holds the essential requirement for aesthetic enjoyment to be a "pattern that contains the unexpected." "This," he says, "seems to be the heart of what we call beautiful." Peckham (1965) holds that art provides "protected situations, categorized by high walls of excited insulation," in which "disorientation" or "discontinuity of experience" can be savored, thus satisfying *Man's Rage for Chaos*, to cite the title of his book.

Representative of an opposite approach, which equates pleasure with conditions likely to allay arousal, is Helmholtz's (1863) statement: "The more easily we recognize an order in observed objects, . . . the more easily and pleasurable we take cognizance of it. But an order that it takes some trouble to discover—even when the event pleases us—joins to this pleasure a quota of fatigue and sadness." In Richards's *Principles of Literary Criticism* (1924), pleasure is identified with "successful activity of some kind." Lund and Anastasi (1928) conclude from introspective experiments that "typically, aesthetic feelings attend the realization of anticipated or expected reactions, and in no case do they appear apart from a certain preparedness in the reaction sequence" (p. 448). They observe that "it is pleasant to react when the response mechanisms concerned are in a state of readiness" (p. 448).

Wallach's (1959) definition of a work of art as "organization of information according to a set of rules, . . . where the construction, tracing or observation of this organization . . . serves to alter a person's motivational state in a way sought by the individual" has rather a different kind of starting point but the same general drift. The second part of the definition is a simple inference from the fact that human beings seek exposure to works of art. Conformity to rules means that certain combinations of elements will be excluded because they infringe the rules. As we saw in a previous chapter, failure to use all possible combinations of elements means correlational redundancy, which can become a basis for perceptual organization of a pattern and thus promote arousal reduction.

The insufficiency of these views is indicated by the way in which they fall into two more or less diametrically opposed classes. Some of these writers have, in fact, recognized that there is rather more to art than the factor on which they concentrate, and some, notably Peckham, were deliberately offering a corrective to prevalent conceptions that were lopsided in the opposite direction. Platt (1961) recognizes a "need for regularity or pattern" as well as a demand for "information—the changing, the novel, the surprising, and the uncertain." He amplifies his view by

stating that "what is beautiful is a pattern that contains uncertainty and surprise and yet resolves them into the regularity of a larger pattern" (p. 421). It is clear that the factors mentioned conduce to beauty or pleasure only up to a point, that there are other requirements as well, and that not everything that possesses the property in question is beautiful or pleasurable. Varied, unexpected, or emotionally stirring stimulation can lead to ugliness and unpleasantness. And there is now no lack of evidence (Berlyne, 1960, 1963b, 1966) that pleasure is generated not only by relief from difficulty or effort. Moderate exertion and even frustration can be enjoyable in itself.

### The disturbance-relief sequence

A distinction paralleling the one between our two hedonic mechanisms was recognized, with special reference to aesthetics, by Zeising (1855). He contrasted "formal (*prinzipiell*) perfection," embodied in "pure beauty," with "teleological perfection," embodied in tragedy. Both depend on the combination of unity with diversity, but, in the first case, similarities and differences are present simultaneously from the start, so that elements are "wedded together." In the latter, initial diversity and conflict is subsequently reduced to unity, so that there is "reconciliation."

Zeising's view of tragedy was clearly influenced by Aristotle's (in the *Poetics*) famous theory of "catharsis," according to which the aim of tragedy is the "purgation of the passions by pity and terror." This statement of Aristotle's has loomed over analyses of tragic drama for over two thousand years, but it has never been clear what he meant by it. Some have favored a moralistic interpretation, such as that men are made less apt to be led astray by their passions. Others have supposed the purgation to be something in the nature of a psychotherapeutic process, reducing the force of disturbing effects of the passions. Others again have simply taken the statement to mean that tragedy provides us with a rather harrowing experience (but, because of its unreality, not harrowing enough to be intolerable), which is subsequently mitigated because the hero's fate is seen to be deserved or required by the foreordained plans of the gods, or because relief comes by some sort of rebound when it is all over. In considering this last possibility, we can hardly avoid recalling the neurophysiological experiments (see Berlyne, 1967) in which termination of painful or frightening external stimuli or the cessation of electrical pulses delivered to aversive areas in the brain has strong rewarding effects, apparently through disinhibition of the primary reward system.

In tragedy, the motivating arousal that precedes catharsis or assuagement comes from the content, from what happens to the characters portrayed. Many writers have focused on the less violent, but more general,

disturbance resulting from the initial encounter with any unfamiliar pattern, from the uncertainties and conflicts that have to be resolved by perceptual processing. And the disburdenment that comes when the processing has been successfully completed is accordingly taken to be a major source, if not *the* major source, of aesthetic pleasure. This is of course the sequence of disorientation and orientation that was discussed earlier.

A motivational condition that results from disorientation and is relieved by prolonged inspection, accompanied by perceptual and intellectual analysis, is called *curiosity*, both in common parlance and in some of the psychological literature (see Berlyne, 1960). There is some experimental evidence (Mittman & Terrell, 1964; Nicki, 1970) to confirm that the satisfaction of curiosity through provision of appropriate information can have marked reward value. The appearance of a complete drawing after exposure to an incomplete version of the same drawing, the appearance of a clear picture after exposure to a blurred version of the same picture, and the appearance of a printed statement after exposure to a printed question that the statement answers have all been found to reinforce a human instrumental response more effectively than the same stimulus patterns when they are not preceded by these uncertainty-inducing conditions.

As Aristotle (*Poetics*, 1448b) wrote, "... learning is very agreeable not only to philosophers but also to other men; ... we take pleasure in the sight of pictures because we learn in looking at them and we deduce what everything represents, for example, that this figure is such and such." In the eighteenth century, Gerard (1764) wrote: "We have a pleasant sensation whenever the mind is in a lively and elevated temper. It attains this temper when it is forced to exert its activity and put forth its strength, in order to surmount any difficulty; and if its efforts prove successful, consciousness of the success inspires new joy."

Gerard appreciated that pleasure can issue not only from completion of efforts to apprehend the character of a perceived pattern but also from the efforts themselves. This, as we have noted, may be because the efforts and the external stimulation that accompanies them generate something approximating an optimal arousal increment. Alternatively, difficulties and exertions that would otherwise be distressing may become rewarding, and thus welcomed, if they are regularly and quickly followed by fulfillment. Fechner (1876, II, p. 238) laid down a "Principle of Aesthetic Reconciliation": "... an intrinsically displeasing stimulus may be... compensated or overshadowed by an intrinsically weaker pleasurable stimulus that follows it [through the affect of contrast], as long as the unpleasant stimulus is not of too great strength or duration." Dewey (1934, p. 41) made a similar point: "Struggle and conflict may be themselves enjoyed, although they are painful, when they are experienced as

means of developing an experience." Lipps (1903-06) mentioned four reasons why successful intellectual effort may be pleasant: (1) the activity as such, (2) the "inner effectiveness of our powers in us," (3) relief of tension through the reaching of the goal, and (4) the awareness that we can act through having acquired knowledge. Of these, the first two would seem to have more to do with moderate arousal increase and the last two with reward through arousal reduction. But we should not expect the central activity to be pleasurable if it meets with too many impediments or if the chances of success are too slight. "Pleasure comes about to the extent that a mental process finds favorable conditions for apperception in the mind or to the extent that it is concordant with the conditions of apperception that are present in the mind" (Lipps, 1903-06, p. 10):

In the spatial arts of painting, sculpture, and architecture, the consecutive phases of arousal and arousal reduction or, to use a widespread metaphor, of tension and relief may be generated in turn by a particular stimulus pattern or be generated by different patterns that the viewer inspects in turn. The composition of a work can influence the order in which portions are examined, but this order is under the control of the viewer and thus subject to variation. But in the temporal arts of literature and music, the artist determines the sequence in which elements are presented and can consequently design segments to create disorientation and subsequent orientation with maximum effectiveness. In literature, this is done largely through manipulation of content; arousal is induced and dispelled by successive incidents, comments on incidents, described scenes, and proffered arguments. The musical composer must rely on structure; on relations of similarity and dissimilarity; on compliance with, and deviation from, habitual sequences, for his management of the listener's affective responses. Meyer (1956), whose illuminating analyses of how this is done will be taken up in the next chapter, points out (p. 23) that music "activates tendencies, inhibits them, provides meaningful and relevant resolutions." And (p. 31), "Affect or emotion-felt is aroused when an expectation—a tendency to respond—activated by the musical stimulus situation, is temporarily inhibited or permanently blocked." He quotes a highly pertinent observation by Aiken (1950, p. 313), which is a fairly adequate summary of his own approach: "... the pleasure which we derive from style is... an immediate aesthetic delight in perception which results from the arousal and suspension or fulfillment of expectations which are the products of many precious encounters with works of art." Hanslick (1854, p. 135 in the translation) had likewise referred, a century earlier, to the "intellectual satisfaction which the listener derives from continually following and anticipating the composer's intentions—now, to see his expectations fulfilled, and now, to find himself agreeably mistaken." In McLaughlin's (1962) theory of music, "stresses... create a discomfort which needs to be relieved." The "stresses"

to which he eludes can result from chords containing dissonant intervals (i.e., frequencies whose ratios are not simple), from consecutive notes in a melody that would form a discord if sounded together, and from rhythmic accentuation. "We appreciate stress and resolution in other patterns," he writes, "because every action of our lives is full of such components. Every experience is a stress pattern."

The German information-theoretic aestheticians (Frank, 1959; Gunzenhäuser, 1962) have distinguished three stages of aesthetic perception:

1. *The selective phase*, during which the subject takes in information, which is coded with reference to a repertoire of first-order signs and brought into consciousness. If the intake of information exceeds what the nervous system can handle, attention is concentrated on part of the information.

2. *The synthetic phase*, which results from the "Birkhoff transition." The subject recodes the information into "supersigns." The formation of supersigns takes two forms. Distinct signals that have properties in common are treated as instances of the same signal, so that abstraction occurs and some differences are ignored. Secondly, several elements are grouped together and regarded as an instance of a composite signal. As a consequence of these processes, subjective information is generally reduced, but the influx may still exceed processing capacity, in which case the "Moles transition" ushers in the next phase.

3. *The analytic phase*, when the structure of the pattern is then analyzed in terms of the supersigns that are recognized. This is like the selective phase, except the units of analysis are larger and the subjective informational influx is almost bound to be smaller.

The selective phase is presumably a phase of uncomfortable and arousing disorientation, primarily due to information overload, which explains why steps are taken to replace it with the synthetic phase. Discomfort may also result, however, when one element fails to fulfill expectations generated by other elements. In other words, something occurs that, given what has occurred before, has a low conditional probability and thus a higher information content. This state of affairs forms the kernel of a theory of music that Coons and Krachenbuehl (1958; Kraehnenbuehl & Coons, 1959) have presented. Although they speak in terms of "information," they do not actually use conventional information-theoretic measures. Their concepts are nevertheless in line with those of information theory, as well as with Meyer's point of view. "If a composition is to be effective," they assert, "its pattern must be one, first of all, that attracts and holds the attention of the listener and, secondly, rewards the listener for his attention." Something with a high information content is acquired to attract attention, and reward through "information reduction" is then possible. The authors relate this hypothesis to the view that reward results from induction and subsequent reduction of

drive, or, as we are calling it, arousal. They define information as the ratio of "non-confirming tests of predictions" to "predictions tested." Thus, the musical passages that make for maximum information reduction and thus afford maximum pleasure are those that include, first, elements that fail to confirm expectations generated by preceding elements and, then, elements that coincide with expectations. They propose methods of calculating information content, and they deduce that the AABA form should be the "most generally effective," pointing out that "through the centuries it has been the most commonly employed form for the popular song."

### The arousal jag and the arousal boost

Elsewhere (Berlyne, 1960), the term *arousal jag* was introduced to refer to a kind of situation in which an animal or a human being seeks a temporary rise in arousal for the sake of the pleasurable relief that comes when the rise is reversed. The analogy that inspired the choice of the word "jag" was not that of a long-lasting deviation like a "drinking jag" but rather that of the "jags" that make up a jagged edge, the occurrence in quick succession of an upward and downward movement. To complement this term, another one is needed to denote the kind of situation in which a moderate arousal increment is pursued because it is satisfying in itself, regardless of whether it is promptly reversed or not. The term *arousal boost* might serve. So "*arousal-jag*" and "*arousal-boost*" situations form overlapping classes, since we have reason to believe that some situations afford both a pleasurable rise and a subsequent pleasurable drop in arousal. Then we may speak of an "*arousal boost-jag*."

The assertions reviewed in this chapter can be interpreted as ones emphasizing either the arousal boost or the arousal jag, although one or two seem to recognize a place for both.

Whether pleasure is the result of a moderate increase in arousal or of a return from a high, aversive level of arousal to a lower and more comfortable one, it depends on the interplay of factors that tend to drive arousal upwards and factors that tend to bring arousal down. When the arousal-boost mechanism is operative, arousal-raising and arousal-modulating factors must be present simultaneously to keep the arousal increment within the intermediate, rewarding range. But arousing and de-arousing factors must come into play successively to generate an arousal jag.

We must, therefore, review, without any hope at present of producing an exhaustive enumeration, the principal devices that the artist has at his disposal for generating and moderating arousal. This will be done in the next two chapters.

## 11

### AROUSAL-INCREASING DEVICES

What we are interpreting as devices for raising arousal are often spoken of as elements of "tension," "excitement," or "dramatic effect."\* There are, of course, distinctions among the meanings of these three terms and among the subtle variations and forms that each can take. These differences, which have received much attention from critics and philosophical aestheticians, must be held over till later stages of experimental research. In the meantime, it is more fruitful to concentrate on the heightened intensity of reaction that all such words connote.

### PSYCHOPHYSICAL VARIABLES

Arousal is not infrequently induced through high intensity of stimulation. The importance of spotlighting in the theatre does not need to be labored. Painters like Rembrandt, Caravaggio, and La Tour depicted human figures under brilliant illumination, partly by using white and near-white paints, which reflects more light, and patches of highly saturated colors; and partly by means of illusions based on simultaneous contrast. In musical works, passages that are meant to be particularly arousing or climactic are commonly louder than the rest. The traditional phrase of Western music typically undergoes a crescendo leading to a culminating point somewhere in the middle and then softens down as a cadence is approached. The orchestra became larger and larger, which meant that its music became louder and louder as well as more and more complex, as the Romantic and then late Romantic composers of the nineteenth century strove for more and more violent emotional effects.

The overpowering effects of size have often been utilized in architecture, sculpture, and painting, particularly among the ancient Egyptians, the Romans, and artists of the Baroque period, not to mention the huge Buddha statues of Japan, and the vertical immensity of Babylonian

\* For a discussion equating drama with arousal due to factors like uncertainty, ambiguity, and novelty, see Rosenberg (1969).

*ziggurats*, Gothic cathedral spires, Chinese pagodas, and the *sikharas* of Hindu temples.

The emotional value of saturated colors and colors in the "warm" half of the spectrum has been exploited not only in painting but also, at times, in sculpture and architecture. We have only to think of the primary colors applied to the surfaces of ancient Greek, Chinese, and Japanese temples; the pigments applied to ancient Greek statues; and the vivid mosaics covering the interior walls of Byzantine churches.

Timbre is often regarded as a auditory equivalent of color, and certain timbres, such as those of brass instruments, seem to be more "stirring" than others. The climactic point of a musical phrase commonly coincides with the peak of pitch, as well as loudness. A musical sequence, in which a motif is repeated at higher and higher pitches, can be overwhelmingly forceful. The most famous example is, no doubt, Wagner's *Prelude to Tristan and Isolde*.

### ECOLOGICAL VARIABLES

Events that raise arousal because of their ecological properties include those that are inherently either injurious and noxious or beneficial and gratifying. Works of art can hardly subject appreciators to events of this kind, unless perhaps cooking and eroticism are regarded as art forms not merely in the sense of "skilled performances" but in the same sense as painting or music.

Most ecologically arousing stimulus patterns in art, as in everyday life, are ones that have acquired learned associations with events or activities of biological importance. They may have accompanied such events, so that their impact may be ascribed, in older parlance, to "association by contiguity" or, in more modern terms, to "classical conditioning." They may, on the other hand, bear some sort of resemblance to biologically important events, in which case the impact is due to "association by similarity" or "primary stimulus generalization." And of course, both mechanisms may be operating: a stimulus may be arousing because it resembles something that has previously coincided with biologically significant events.

It is clear that the use of ecological variables belongs to the content rather than to the formal aspects of a work, i.e., to what is simulated or described. Ecological variables form the principal resources of the literary arts for manipulation of arousal, and their exploitation in painting or music, especially through reference to a connected scene or story, is frequently called "literary association" and almost as frequently decried.

As Dryden puts it, "The trumpet's loud clangor invites us to war,"

and drum beats create a funeral mood. These are clearly products of social conventions and could not be expected to have the same psychological effects in other cultures. The same goes for the religious significance, and consequent emotional impact, of particular colors, shapes, and objects in Renaissance painting and in Buddhist sculpture.

The Freudian theory of art as a means of sublimating, or indirectly expressing and discharging, sexual wishes has, no doubt, gone farther than any other in invoking association by similarity and by contiguity. Psychoanalytical writers have pointed to similarities between an immense variety of visual forms and the organs of the reproductive system and between various temporal patterns and the development of sexual excitement and consummation. These forms are held to be capable of arousing and symbolically gratifying erotic impulses. Apart from the difficulties of obtaining conclusive evidence for or against hypotheses of this sort and of dealing with the extremely broad range of phenomena that Freud classed as sexual, there is the obvious fact that, for example, long pointed objects and round capacious objects resemble many other things besides reproductive organs and that the temporal rhythms of sexual activity are also found in many high-arousal or emotional states of various kinds and origins.

Let us take, by way of example, the scoring categories introduced by Beardslee and Fogleson (1958) for measurement of sexual imagery evoked by music. Stories are held to have symbolic sexual content to the extent that they "(1) refer to motion of the body as a whole or of any part of the body below the neck; (2) include rhythmic repetition of any action, sound, or adverbial phrase; (3) embody a rise to a peak followed by a decline in the level of tension; and (4) represent forceful pushing through a restraint medium." But bodily movements and rhythmic repetition are by no means confined to sexual situations. A rise in tension to a peak followed by a fall characterizes all forms of pleasure or reward in which an increase in arousal or drive is followed by its reduction, e.g., any arousal jag. Forceful penetration characterizes aggressive behavior or the frantic efforts of a frightened person to escape through a barrier. Wallach and Greenberg (1960), offer evidence that imagery fulfilling these criteria is more prevalent after exposure to sexually stimulating material than in its absence. But comparison is needed between the frequencies of such imagery in response to sexual stimulation and in response to equally arousing stimulation of different content.

Painting, sculpture, drama, and novel rely chiefly on depiction of human beings and their interactions to produce arousal through ecological variables. Since most of the threats and satisfactions that occur in the ordinary course of events result from the actions of other people, representation of them and their actions is an effective way to generate

arousal in the form of fear, anger, elation, or whatever. And through identification, we can be made to share, if only in a blunted form, the emotions corresponding to their expressive acts, postures, and utterances or to react to disturbing events that they experience as if we were confronted with them ourselves.

## Dishabituation

Shklovski (1925), a leading Russian critic of the Formalist school, observes that our habitual reactions to familiar objects tend to become automatic, unconscious, and curtailed. "The goal of art," he says, "is to make us experience a thing in a way that is seeing and not merely recognizing. Accordingly, art uses two devices: alienation of things and complication of form in order to make perception more difficult and prolong its duration." In literature, for example, commonplace events may be described in detail rather than simply called by their usual names. Alternatively, they may be designated through unusual comparisons and figures of speech. In these ways, the routine habits of everyday life are set aside and replaced by more vivid and incisive reactions. The contrasts in rhythm, word order, and vocabulary between poetic speech and colloquial speech contribute likewise to the same end.\*

A South African writer, Sewell (1931), made a similar point and related it to the work of Shklovski's compatriot, Pavlov. When a conditioned response has been weakened (extinguished) through prolonged repetition without reinforcement, an unexpected, extraneous stimulus or some deviation from customary experimental conditions will often revive it. This is what Pavlov called "disinhibition." It is Sewell's thesis that art works by disinhibiting the original vigorous emotional and other reactions to words, sights, and sounds. After familiarity has dulled these reactions, the unwonted combinations of elements found in art will cause them to reappear.

So, the crux of these two views seems to be that the contrasts between the stimulus patterns encountered in art and those encountered in everyday life serve to heighten the arousal value of a work's content (semantic information), dependent on ecological variables, reviving habituated reactions, including the orientation reaction (see Crumrine, 1969).

\* Essentially the same observation was also made by the Czech Structuralists, e.g., Doležel (1965). As Doležel puts it, poetic discourse is characterized by "actualization" in contrast with the "automatization" of "informative speech." Consequently, if poetic discourse is to be effective, it must not only violate the norms of everyday language; it must also deviate from "prevailing poetic conventions."

## COLLATIVE VARIABLES

All the factors covered by the term "collative variables" involve comparison, and thus response to degree and nature of similarity or difference, between stimulus elements that may be present together or at different times. When we speak of an organism's response to a stimulus, we usually mean a response to something that contrasts with its background or with what has just preceded it, and how the organism will behave generally depends on how what we call the stimulus is related to its accompaniments or antecedents.

The presence of two discriminably different qualities side by side or the placing of one next to the other seems to be the simplest way of inducing arousal increment. The composer Hindemith (1952) said that "no musical effect can be obtained unless a tension between at least two different single tones has been perceived," and Graves (1951) speaks of the "aesthetic conflict or visual tension between opposing or contrasting lines, directions, shapes, space intervals, textures, values, hues." The twentieth-century French painter, Yves Klein, painted the "monochromes" for which he became famous because, as he explained (1968), "as soon as there are two colors in a picture, a fight is launched."

The simple juxtaposition of two distinct colors, or forms, or sounds generally keeps arousal increment within the pleasant range. Unless some additional source of arousal intervenes, it seems to be just about sufficient to avoid the tiresome effects of understimulation. Grainger (1955a) found that subjects were inclined to like a pair of colors more, the greater the difference in hue between them. Anthropologists interested in art have often remarked on the "horror of the vacuum": any blank surface, whether on the wall of a building or on a utensil, is apt to be broken up with representational or geometrical ornamentation. In our society, a wall of one color, unless it is in a room with walls of other colors, is quickly covered with pictures or knicknacks. And repetition or prolongation of a single sound is usually found excruciating.

We can safely suppose that the extent to which arousal is raised will increase with degree of change, rate of change, and range of variability. Soothing melodies tend to move either upwards or downwards in small steps for several notes before changing direction, and they remain within the bounds of an octave or not much more. Exciting and disturbing melodies are "angular": they include leaps from one note to another over wide intervals, they change direction frequently, they range over a wide register. Fast-moving tunes are more arousing than tunes in which each note is long drawn out. Similarly, jagged or tortuous lines are more arousing than smooth curves in painting, and strong contrasts in bright-

ness and color have a more violent effect than palettes restricted to a few neighboring hues.

## Novelty

An eighteenth-century aesthetician, Gerard (1764), recognized that "...when *new* objects are in themselves indifferent, the efforts that are necessary for conceiving them, exalt and enliven the frame of the mind, make it receive a strong impression from them, and thus render them in some measure agreeable." His contemporary, Home (1765), concurred: "Of all the particulars that raise motions, not excepting beauty, or even greatness, novelty has the most powerful influence."

The word "novelty" can, however, refer to several distinct states of affairs. A stimulus might be unlike anything that an individual has met before, in which case we may speak of *absolute novelty*. This is, however, highly unlikely to be the case except when a newborn baby or somebody just cured of blindness first receives visual stimulation. Otherwise, stimulus patterns can possess only *relative novelty*. That is to say, they consist of previously experienced elements in unprecedented combinations, or they are intermediate between certain familiar stimuli. It is possible to come across a shade of color or an odor for the first time, but it must be possible to locate it among others that are well known.

Then, there is the difference between *short-term novelty* and *long-term novelty*. A stimulus may differ from what has been produced during the last few minutes, or it may be unlike anything that has been encountered for a day or more. These are worth distinguishing, because any effect that is due to long-term novelty implies learning: if a stimulus evokes different behavior according to whether or not it occurred over 24 hours ago, a previous occurrence must have been capable of depositing a durable trace. Moreover, while there is evidence that both short-term and long-term novelty can affect the likelihood and size of an arousal increment, the effects of short-term novelty are much more important. Experiments on the orientation reaction show that a stimulus quickly loses its influence on the arousal system if it is repeated at intervals of a few seconds or minutes but regains much of it if it reappears after a short absence. On the other hand, the arousing effect of a stimulus that is repeated many times, but at long intervals, will undergo a rather slow day by day decline which, in some circumstances, may not even be detectable at all (see Berlyne, 1960).

In aesthetics, short-term novelty must be a matter of similarity or difference between an element and another element experienced during earlier phases of exposure to a work. It, and its arousing potentialities, are handled by introduction of material that contrasts with what has

gone before or with portions of the work that have been sampled earlier.

For example, a music melody is not only a sequential pattern of pitches but also a sequential pattern of novelty values. Apart from the first note, every note has the same pitch as the immediately preceding note, or a pitch that occurred previously but is now returning after other pitches have intervened, or a pitch that has so far not occurred at all in the melody. Analogously, such poetic devices as end rhyme, internal rhyme, and assonance create melodies of vowel sounds, as different degrees of novelty, familiarity, and repetition are intertwined (Lanz, 1931).

A work of art can offer long-term novelty either with respect to the appreciator's daily life in nonaesthetic settings or with respect to works of art to which he has previously been exposed.

Some measure of both of these forms of long-term novelty seems to be essential. An artistic experience must provide some contrast with the stimulation that the appreciator is accustomed to receiving at work and at home. But, as Peckham (1965) points out, "the artist's role ... requires him to innovate new devices." He must provide some "external discontinuity," which is "a discontinuous relation between a work of art and its predecessors in the same category." Nobody is accounted a major artist who has not produced works that differ in a striking way from anything that has been produced before, although the degree of innovation must not be excessive and a degree that wins posterity's approval will usually bring him into conflict with many of his contemporaries. There are times when anything but slight external discontinuities are all but universally frowned on, and other times, like the Romantic period and the present day, when artists must rack their brains to devise more and more outrageous breaks with precedent. Despite variations in the amount of external discontinuity that is tolerated or demanded, its indispensability explains (Peckham 1965, p. 222) "why art has non-functional stylistic historical dynamism, why one dimension of artistic behavior must be historical." A similar position has been taken by Martindale (1969) and will be discussed in Chapter 15.

## Expectations

The stimuli that human beings receive evoke, as well as motor reactions and other internal reactions, anticipatory representations of what is likely to come next. When the following stimulus comes along, behavior depends not only on the form that stimulus takes but also on the form that it was expected to take. If the anticipation and the following stimulus coincide, perception will be facilitated. If there is a slight discrepancy between the two, there may be misperception. If the discrepancy is so severe that it cannot be overlooked, an orientation reaction, with its

usual accompaniments of emotional disturbance, exploratory behavior, and thinking, will normally ensue.

Something does not have to be expected with complete confidence. An expectation can be associated with more or less confidence or "subjective probability." It follows from this that expectations of several mutually exclusive events can occur in the same individual at once. When this happens, it is perhaps more natural to refer to the coexisting expectations as alternative "hypotheses."

Expectations can originate in three main ways. The commonest way is by repeated experience of combinations or sequences of events in conditions that make for reinforcement or attentiveness. A form of classical conditioning will then cause one of the events, X, to evoke an expectation of what normally accompanies or follows it, Y, as a conditioned response, whose strength will reflect the reliability with which Y can be predicted when X is known to occur, i.e., the conditional probability of Y given X — $p(Y|X)$ . Secondly, a human being can come to expect something in a particular setting through having been told by some credible informant that it is likely to occur. Lastly, he can work out for himself what is to be expected through a reasoning process.

Expectations must play a no less vital role in art than elsewhere, and those that are of aesthetic importance may derive from everyday learning outside an aesthetic context or from the learning that accrues from exposure to works of art. Experience of human behavior and of inanimate nature must have equipped everybody with knowledge of what is likely to follow what and what is likely to accompany what. Novels, dramas, and representational paintings could hardly be appreciated without this knowledge. Familiarity with the sequences that are usual in spoken and written speech are likewise indispensable in the appreciation of poetry.

But there are also expectations peculiar to a particular category of art. They are brought on partly by accumulated exposure to artistic works. Others may result from verbal instruction, provided by books and courses on art appreciation. There are expectations peculiar to conventional forms or genres. These are what are generally called "rules," although, as we shall see, they do not have the invariability that this word might suggest. Everybody with rudimentary musical education knows that an eighteenth-century or nineteenth-century symphony is likely to consist of a fast first movement, a slow second movement, a minuet or scherzo, and a final fast movement. He knows, moreover, that the first movement, and perhaps also the second or last movement, will consist of an exposition in which two main themes or groups of themes are introduced, a development section, and then a recapitulation of the main themes. But he also knows that the works of the major composers of the period contain many exceptions to these rules. Likewise, anybody

accustomed to reading sonnets will have found out for himself, if he has not been explicitly told so, that he will find fourteen lines of equal length, with a definite rhyme scheme depending on whether the poet followed the Petrarchan or Shakespearian model. Furthermore, the art of a particular national tradition, period, and individual artist will have its own stock of expectations for the informed appreciator, and many statistical studies have confirmed that artistic styles have their own systems of transitional probabilities linking particular kinds of elements or groups of elements.

Although, much of the time, clear-cut expectations are induced and in due course fulfilled, the prevalence of expectations gives the creative artist three ways of inducing arousal. First, he may violate an expectation by replacing the expected element with one that is distinct from it. Secondly, he may introduce a pattern that could be continued in any of several different ways, so that several mutually contradictory hypotheses are entertained at once. Since the appreciator will generally invest a particular degree of confidence or subjective probability in each of them, he will have a certain quantity of subjective uncertainty, analogous to the objective uncertainty of information theory that depends on objective probabilities or relative frequencies. Thirdly, he can introduce a pattern that induces no specifiable expectations at all, so that the appreciator is at a complete loss to tell what might follow. All these possibilities are extensively utilized in all art forms.

*Surprise and incongruity* When a stimulus pattern fails to agree with an expectation that was aroused by what preceded it, we call it "surprising." Sometimes, a stimulus induces an expectation with regard to stimuli that accompany it rather than succeed it. When an expectation of this sort is violated or, in other words, when we are confronted with a simultaneous combination of elements that are unlikely to occur together, we have "incongruity." The distinction between surprise and incongruity is not a sharp one. Elements that are present at the same time are likely to be examined in turn, so that when we are, for example, looking at a large complex painting, what we see in one area arouses expectations that cannot be confirmed or disconfirmed until our eyes move to focus on another area. Similarly, when we are exposed to a temporal art form like poetry or music, immediate memory images of what has just passed may well linger to accompany perception of the next element. Nevertheless, the distinction is a convenient one. It corresponds to Meyer's (1956) distinction between "successive" and "simultaneous deviation."

Most of the time, what we expect is either a continuation of what we have just been receiving or a recurrence of what has occurred before in similar contexts. So, what is expected is often familiar and what is surprising is novel, and vice versa. Nevertheless, novelty and surprising-

ness are not the same thing. They are logically distinct qualities, and one can occur without the other. There are times when we expect something different from what has occurred before, so that what actually turns up will be surprising if it is *not* novel. It is often hard to convince people that novelty and surprisingness are not the same and to dissuade them from confusing the two. It is therefore gratifying to find that somebody saw the point quite clearly over 200 years ago:

... when a thing breaks in unexpectedly and without the preparation of any connection, it raises a singular emotion, known by the name of *surprise*. This emotion may be produced by the most familiar object, as when one unexpectedly meets a friend, who is reported to be dead; or a man in high life lately a beggar. On the other hand, a new object, however strange, will not produce this emotion if the spectator be prepared for the sight: an elephant in India will not surprise a traveller who goes to see one; and yet its novelty will raise his wonder: an Indian in Britain could be much surprised to stumble upon an elephant feeding at large in the open field; but the creature itself, to which he was accustomed, would not raise his wonder.

Surprise thus in several respects differs from wonder: Unexpectedness is the cause of the former; novelty is the cause of the latter (Home, 1795).

Surprising incidents can create much of the appeal of stories and plays. But it is evident that surprise is not indispensable. We may reread a novel or see the same play for a second or third time, when the plot is by now well known to us. Ancient Greek tragedies, medieval mystery plays, and classical Chinese and Japanese dramas often depict legends that were extremely familiar to their audiences even before their first performance. So other sources of arousal increment must be operating.

Surprise can also come from formal aspects of a work or, in other words, from the syntactic information that it conveys, as well as from content and semantic information. Meters, or regularly repeated patterns of stressed and unstressed elements, seem to exist in poetry and music largely so that they can be infringed. As Peckham (1965, pp. 202-203) demonstrates, a poem like Milton's *Paradise Lost*, which is supposed to be written in iambic pentameters, actually contains relatively few lines that conform to the prescribed alternation of unstressed and stressed syllables. In music, the rule that an accented note comes at the beginning of a measure and that there is a secondary accent on the third beat of each measure when a piece is in quadruple time is obeyed more regularly. But syncopations, or shifts of the accent to other places, occur at least occasionally in all metrical works and are particularly prevalent in certain kinds of music (e.g., Stravinsky, jazz).

Almost all musical cultures use scales of 5, 6, or 7 notes (although

scales of 2 and 3 notes are not altogether unknown), selected from a larger set of pitches. Once a listener has heard a long enough passage for the scale to be established, he expects subsequently to hear notes belonging to that scale. There is, moreover, (e.g., in Western major and minor scales, medieval Western modes, Arabic *maqamat*, Indian *ragas*) a tonic note that is expected to occur more frequently than others and to act as a center around which the music revolves, in the sense that its principal sections begin with it and return to it.

Western music, which has developed polyphony further than any other tradition, has until recently embodied comparable expectations regarding harmony. Certain chords, notably the tonic, dominant, and subdominant triads, normally appear more frequently than others, and certain chord sequences are usual: a dissonant chord is soon resolved by a consonance; a phrase ends with one or other of the recognized cadences. In past centuries, when the expectations were preponderantly fulfilled, an arousal increment could always be created by a note or chord that departed from these conventions. In the late nineteenth century, the emotional potentialities of chromatic notes and discords whose resolution was delayed or did not occur at all were so frequently exploited by composers like Wagner, Strauss, and Mahler that the expectations they were supposed to violate lost much of their significance and began to break down. It was therefore found necessary to devise completely new musical systems, with expectations of their own, such as the various forms of extended tonality and 12-tone serial music.

Like surprise, incongruity can characterize content. At times, it is the principal means of inducing arousal. We can instance the nightmarish creatures of Bosch's paintings, the *ready-mades* of the Dadaists (e.g., Duchamp's bottle rack which violated expectations both because it was found in an art museum and because it was suspended in mid-air), the distortions of common objects and the far-fetched juxtapositions of the Surrealists. Martindale (1969) has singled out what he calls "metaphor distance" as an essential ingredient of poetry. This comprises two variables. First, there is "depth of regression," which seems to mean incongruity since it involves presenting ideas in combinations with varying degrees of improbability. Then, there is "degree of elaboration," which can range from the "discursive" (e.g., "I looked over the table at a peninsula."), through the "analogic" ("A table is like a peninsula."), and the "equational" (e.g., "A table is a peninsula."), to the "juxtapositional" (e.g., "Tabeninsulable"). This latter variable evidently distinguishes different degrees of ambiguity and surprisingness produced by departure from ordinary logic and syntax.

Formal incongruity is also possible, particularly in music, since, when several voices or instruments are sounding simultaneously, what is happening in one part raises expectations about what will accompany it

in other parts, usually expectations of similarity. The development of Western medieval music shows a gradual liberalization of expectations of this kind. Each step in this liberalization must have introduced arousing incongruity as it progressed from unison, through note against note counterpoint, organum and descant, to the free contrapuntal textures of the Ars Nova and the Renaissance. Heterophony, or simultaneous presentation of different variations of the same melody, is the very essence of music belonging to several traditions, e.g., the Indonesian. Cross rhythms are of particular importance in African music and not infrequent in the music of Western Europe. In the twentieth century, composers like Milhaud introduced polytonality, defying the long-standing expectation that all melodic lines heard together will at least be in the same key.

*Uncertainty* A basic resource of all narrative art forms is what commonly goes by the name of "suspense." Several alternative outcomes are clearly indicated, each has factors militating in its favor, and the reader or spectator is left wondering which will be realized. Will the pursuer or the pursued win the chase? Will the hero or the villain achieve his objectives? Which of the battling forces in the hero's character will prevail?

A musical composer can also deliberately introduce a pattern of sounds that can be continued in several different ways. In pieces written in the key of C major, a G major triad can represent either an episode that is soon to be followed by a return of the tonic triad or the pivot of a modulation, soon to be followed by a chord including F sharp and indicating that the key of G major has now been entered.

*Absence of clear expectations* Authors of plays and stories often create situations in which no plausible outcome at all can be readily recognized. This device is so effective that it is readily resorted to by less sophisticated writers in default of more imaginative arousal-inducing operations. In the detective story, it is clear that the murderer must be somebody who was in the house at the time, but none of the people who were then in the house could possibly have committed the crime. At the end of this week's installment of the serial story, the hero is faced with a fatal danger that there seems no possible way of avoiding, and yet, since it is known that several more installments are to come, some way out must be open.

Meyer (1956, p. 160) gives several enlightening examples of "weakened musical shape." "A stimulus series," he says, "is well shaped when its progress, its articulation into phases of activity and phases of rest, its mode of continuation, its manner of completion and closure, and even its temporary disturbances and irregularities enable (the practiced listener) to envisage with some degree of specificity and accuracy what the later stages of a particular musical process will be." A listener can

generally tell how a musical passage is likely to be completed, because he is able to identify boundaries between major subdivisions and thus recognize that a particular kind of structure, whose overall course is familiar to him, is in progress. The perceptual processes that led Gestalt psychologists to speak of "*Prägnanz*," "good continuation," and "closure" are at work. But factors like uniformity and minimal differences can prevent him from seeing how long a musical pattern should be broken down into sub wholes. Prolonged repetition of a short melodic or rhythmic motif must sooner or later give way to something different, but there is no hint of what form this will take or when it will come. Most of the scales used by the major musical cultures have notes separated by unequal intervals. These inequalities define the note to be identified as a tonic, which can be expected to reappear frequently. Some musical cultures have scales whose notes are equally spaced (e.g., scales used in Indonesian and Thai music, and the whole-tone scale introduced by Debussy), and they are deprived of this anchoring point.

## Complexity

A pattern is considered more complex, the larger the number of independently selected elements it contains. In two patterns that consist of the same number of elements, that one will be less complex that has a greater degree of similarity among its elements or, more generally, a greater degree of redundancy of interdependence.

So a narrative can be made more complex by simply multiplying incidents and characters. In painting, the objects depicted or the areas of uniform color can be made more numerous and more dissimilar. The complexity of musical "texture" rises with the number of "parts," i.e., the number of voices or instruments that are allotted distinct sequences of sound. There have been times, such as the Baroque and Romantic periods, when artists have felt impelled to push complexity towards more and more unprecedented extremes, by crowding in more and more heterogeneous details.

Most of the means used by artists to increase complexity are classifiable as "ornamentation" or "embellishment." This means either addition of elements to a basic pattern—lines, colors, or small-scale representations of objects in the visual arts, subsidiary notes (e.g., passing notes, grace notes, accompanying motifs) in music—or introducing deviations from the basic pattern. As Meyer (1956) points out, variation around the pitch or timing prescribed by a score (written or unwritten) is, in many musical cultures, considered essential to "expressive" performance (cf. the *vibrato* of the modern violinist or operatic singer and the *rubato* of the pianist). He (p. 207) mentions two ways in which ornaments tend

to create "inhibition or tension" and, we may presumably add, arousal. First, "since most embellishments are not structural tones, they delay (inhibit) the arrival of the expected and anticipated structural tone." Secondly, "many ornaments tend to create doubt and uncertainty," however momentary, about which tone is a structural and which a subsidiary one.

## Conflict

It has been suggested elsewhere (Berlyne, 1954, 1960) that conflict probably underlies most of the motivational effects that depend on collative stimulus properties. "Conflict" is said to occur whenever processes are simultaneously initiated in the brain that do not fit well together, tend to disrupt one another, and tend to drive the organism towards different and mutually exclusive forms of motor behavior. Any novel stimulus pattern is apt to induce conflict because it probably resembles several disparate familiar patterns but is not quite like any of them. Surprising stimuli mobilize responses corresponding to their actual properties, which must be in conflict with the responses that were held in readiness for what was expected but did not materialize. Whenever there is subjective uncertainty, we can expect mutually exclusive responses corresponding to the alternative hypotheses that are mobilized. We may suppose further that a complex stimulus field will create conflict among the divergent receptor-adjusting and attentive processes that its various units instigate. And in general, the more numerous and the more dissimilar the units are, the greater the resulting conflict among the various kinds of response tendencies, overt and internal, associated with them, since they will not only be mutually incompatible and thus competitive, but also threaten to overstep the nervous system's limited information-processing capacity. However, we must consider some important ways, other than those already examined, in which art can induce arousal through simultaneous instigation of incompatible responses.

*Semantic and syntactic information* All art has an important formal aspect, giving rise to syntactic information transmission: the appreciator must to some extent be responding to relations between the physical properties of different elements. But many works of art also transmit semantic information, which is identifiable with what we call "content": it might be representational (as in painting, drama, ballet, and even some music) or linguistic (as in literature). To some extent therefore, the appreciator's responses must also be determined by properties of the objects or events that are depicted or described. There can therefore be conflict between responses dependent on syntactic in-

formation and responses dependent on semantic information. This is, in fact, no more than an inevitable consequence of the sign-significate relation, which, as we noted in Chapter 6, implies discrimination between a sign and what it stands for. There must be some overlap, as well as some divergence, between responses determined by the sign and responses determined by the significate.

A comprehensive theory of aesthetics was built around this duality by Konrad Lange (1907), who identified art with "conscious self-deception." He contended that every work of art has both "illusion-exciting" and "illusion-disturbing" aspects, coinciding, respectively, with the similarities and the differences between an art object and the real-life situation to which it corresponds. As he pointed out, there are always contrasts between art and the reality that it represents. Unlike the scenes that one is likely to encounter outside the museum, a painting is bounded by a frame, it is flat, and it is immobile. Unlike real human beings, statues are customarily motionless, white, and placed on a pedestal. Most poetry can hardly be mistaken for ordinary speech, which is not divided into lines of equal length with meter and rhyme. At the theater, we may witness convincing portrayals of human interaction, but various cues are there to remind us that they are being acted: they take place on a brilliantly lit stage, while we sit in darkness with rows of other spectators. Illusion-disturbing influences also come from our knowledge of how works of art are produced.

Lange asserts, next, that there will be oscillation between the sequences of ideas or, as we may put it, of responses governed by the two sets of factors. This oscillation is the main source of aesthetic enjoyment. It turns art into a kind of play, which is analogous to the pleasurable oscillatory movement of swinging or the amusement that comes from closing the two eyes in alternation. As he remarks, the behavior of people in the presence of art is often suggestive of vacillation between concentration on form and concentration on content. Visitors to art galleries are often seen to alternate between going up to a picture to examine the brush work and contemplating it from a distance where what it simulates is presented most vividly. In the audience of a symphony concert, eyes can often be seen to alternate between active examination of the conductor and players and a fixed glassy stare indicative of absorption in the music and in the thoughts and emotions that it conjures up.

Lange had some trouble in applying his theory to natural beauty. He concluded that we react to an aesthetically satisfying natural scene by imagining it to be the work of a human artist. This hypothesis drew vehement objections from Lange's contemporaries. Meumann (1911) objected to his whole approach, calling Lange's (p. 81), "the worst theory of aesthetic pleasure that has appeared so far." He indignantly denied that human beings have a need to be deceived and stated that he him-

self did not undergo any oscillation between acceptance and rejection of the illusion when exposed to a work of art. He rather gave himself up wholeheartedly to the work's representational powers.

Meumann surely misunderstood Lange's point, perhaps led astray by the ill-judged choice of terms like "self-deception." There is undoubtedly a special attractiveness in approximate simulations of natural phenomena when they could not possibly be mistaken for the "real thing" and their origins are clearly recognizable. People will readily go to see models of familiar objects that are small in scale, made of unusual material, or made to move artificially. They will attend circuses or variety shows where animals behave like human beings or human beings make noises like animals, whereas the more successful efforts of a human being to walk on two legs or of a dog to bark would scarcely draw a crowd. There is surely kinship between the pleasures produced in these ways and some of those due to art.

There must be some incompatible, and thus conflicting, responses associated with a sign complex, such as an art object, and a significate, such as what an art object depicts. Although they may seem remote from aesthetics, experiments in which incompatible response tendencies are simultaneously mobilized by stimulating corresponding points in the nervous system provide some clues as to what might happen. These experiments include those of Sherrington (1906), who studied the spinal reflexes, and those by von Holst and von St. Paul (1960), and Meyer (1959) on more highly coordinated systems of behavior corresponding to biological needs. The findings show that alternation between the competing kinds of behavior is a possible outcome, although there are others, presumably less likely to apply to aesthetic behavior, such as the suppression of one of the competing behaviors by another, compromise, or displacement to a third form of behavior that differs from either. Competing perceptual responses to ambiguous figures, such as Figure 11-1, are, one imagines, more closely akin to the internal responses evoked by art. Alternation between the two modes of perception, which is to some extent under voluntary control but also imposes itself spontaneously, is the invariable finding. So there seems to be some support for Lange's view that appreciators will oscillate between responses to form and responses to content. If so, each replacement of one by the other, at least until a work has become excessively familiar, can be expected to induce an arousal increment through change, as well as novelty and possibly surprise. It may be, however, that the mutually discrepant responses corresponding to form and content can to some extent occur simultaneously, in which case there would be an arousing-inducing situation classifiable as incongruity.

Vygotski (1965) made a point reminiscent of Lange's in more general

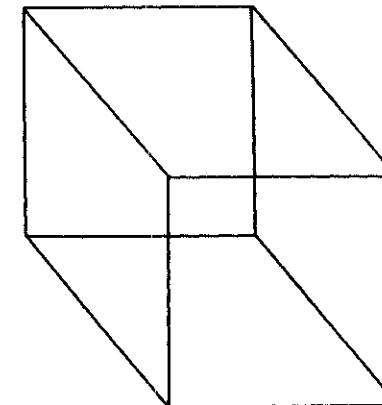


Figure 11-1 An ambiguous visual figure (the Necker cube).

terms. "The poet chooses a rhythm whose effect will be opposed to the effect of the content itself" (p. 280). "Every artistic product conceals within itself an internal conflict between content and form, and it is through form that the artist achieves that effect that the content eliminates or, as it were, extinguishes" (p. 281). As an illustration, he cites the disparities between the phonetic patterns prescribed by meter and those that are determined by the normal rhythms of speech. He also mentions the discrepancy between the two-dimensional form of a painting and its three-dimensional content.

Cohen (1966) has provided a particularly thorough and enlightening analysis of the role of various kinds of form-content conflict in verse. On the phonetic level, we have discrepancies between the habits and expectations coming from the exigencies of prosody and those that come from semantic content and from the use of language in ordinary prosaic discourse. Metrical forms require pauses of varying importance at the ends of lines, of half-lines (hemistiches), and of measures. But these pauses do not generally coincide with the divisions between major units of sense or with the pauses that would occur in conversation. Even when the locations are the same, the pauses dictated by the two sets of considerations do not have the same relative importance. Devices like rhyme, alliteration, and meter impose a phonetic similarity on words, or groups of words, that are not the most similar in meaning or grammatical function. In any case, the contrast between the pattern of stresses demanded by the meter and the pattern of stresses that normal speech habits demand (and that are likely to be used when a poem is read aloud) have already been touched on.

Turning to what he calls "the semantic level," although it might more appropriately be called the "logical and grammatical level," Cohen points out that poets often combine subjects and predicates in ways that run counter to nonpoetic usage. The resulting statements are often patently invalid if interpreted normally. An adjective like "rosy-fingered" is inapplicable to "dawn," since dawn has no hands. The assertion (which, although not taken from verse, is typical of how poets talk) that "man is a wolf to a man" is absurd, because man is an animal belonging to the order of Primates and the wolf belongs to the order of Carnivora. In prose, adjectives usually serve to specify what mathematicians call "proper subsets," to distinguish objects possessing a certain property from those without it. But in verse, an epithet commonly applies to all members of the class in question. When Homer speaks, as he repeatedly does, of the "wine-dark sea" he is not insisting on a distinction between seas that are and are not "wine-dark"; he surely regards all seas as equally "wine-dark." This kind of usage introduces redundancy, in both the information-theoretic and the everyday sense of the word. At other times, the poet creates uncertainty by omitting the specifications that are considered indispensable in most speech or writing. Byron says that "She walks in beauty as the night," without giving any hint of who "she" might be. It is usually deemed necessary to name or otherwise designate a person before using a personal pronoun like "she." In poetry, ideas and phrases commonly occur in combinations and in orders that would be quite out of the question in nonpoetic contexts. And the dissimilarities between normal word order and poetic word order are particularly noticeable in languages like English or French, which depend on sequence to establish grammatical function—more so than in languages like Latin that indicate grammatical function through inflections, so that word order can be more variable even in prose.

All these devices are, as Cohen observes (p.99), "paradoxically anti-functional." They confuse the message. Nevertheless, "the poet uses language because he wants to communicate, i.e., to be understood. But he wants to be understood in a certain manner; he aims to induce in the receiver a specific formal understanding, differing from the clear, analytic, understanding produced by the ordinary message" (p. 100). The level that poetry is intended to occupy is "as it were, halfway between understanding and misunderstanding." This certainly seems to fit in with what we noted about the dependence of aesthetic pleasure on the interplay of factors making for disorientation and for orientation.

Furthermore, Cohen (1966, p. 202) recognizes the importance of two successive phases in appreciation of a poem, namely "presentation of a deviation" and "reduction of a deviation." This, again sounds like the arousal-jag sequence of prior disorientation and subsequent orienta-

tion. By producing subdivisions that differ from those of the apparent sense of a message, by juxtaposing ideas that do not seem similar or closely related in meaning, and generally by disconfirming expectations, these deviations hinder understanding the first place. But the discrepancy is resolved when the initial interpretation gives way to another, less obvious one. The form may clash with what Cohen calls "denotative meaning" (which corresponds to semantic information content), but it is seen to tally with "connotative meaning" (i.e., expressive information content). As Burnshaw (1970, p. 108) says, "The poem is simultaneously both actual and non-actual, real and imaginary, . . . it makes both common and uncommon sense together."

So, to take the example, quoted by Cohen, of Verlaine's poem beginning

"Mon enfant, ma soeur  
Songe a la douceur.

the words *soeur* (sister) and *douceur* (gentleness) are similar in sound but do not seem to be close in meaning until it is realized that the poet might be implying that all sisters are gentle or that all gentleness is sisterly. "Man is a wolf to man" makes sense when it is taken, not as a zoological statement but as metaphorical statement, meaning that man is cruel to man. Homer was conveying that the "wine-dark" quality common to all seas was important to him and to what he was trying to communicate. He might, for example, have been thinking that wine and the sea are both liquids that attract some men irresistibly and draw them on to enlivening but perilous adventures. Or he might simply have liked the visual image of ships with white sails on a flowing dark background. In Byron's poem, it becomes clear on reflection that it does not matter who "she" is, that what he is saying may apply just as well to all women or, at least to a fair number of them.

For Cohen, then, the function of poetic discourse, with the peculiarities that he has reviewed, is to break down the usual immediate response to language, so that the unusual meaning can be communicated. We might go a little beyond what he said, to consider motivational processes. First, the two-phase disorientation-orientation sequence that he discusses should furnish pleasure in accordance with the arousal-jag mechanism. Secondly, the discrepancy and resulting difficulties in comprehension should attract attention towards points where something to which the poet attaches particular importance is reached. Furthermore, the disorientation and conflict should promote the perceptual and intellectual exertions that are necessary for the poet's message to be absorbed.

Lastly, discrepancies should in themselves, whether they are eventually resolved or not, be a source of pleasure in accordance with the arousal-boost mechanism, although messages in which this is the major sources of pleasure might well be dismissed as mere amusement.

### Ambiguity and multiple meaning

In our discussion of expectations, we took account of the arousal-raising possibilities of patterns that can have several alternative continuations and thus induce two or more divergent lines of expectation or hypothesis. But expectations are not the only constituents of "interpretation" or "meaning." We have already mentioned the theory offered by Kris and Kaplan (1962) that lays stress on "ambiguity" as "the instrument by which a content is *made* poetic through the process of re-creation" (pp. 258-259). They analyze "meanings" in terms of "verbal" and "other" responses. The meanings of a word (phrase, sentence, passage) for a particular person may be characterized by describing the responses that he makes (or would make) when asked for its "meaning." But even this concentration on verbal responses as a basis of ambiguity seems unduly restricted. Art can surely induce divergent responses or systems of responses of all kinds that play a part in perception and thinking.

Kris and Kaplan introduce an important classification of the kinds of relation that can obtain among the multiple meanings attributable to a pattern. Apart from *projective ambiguity* (which means variation of meaning for different interpreters and does therefore concern the motivation of an individual interpreter), they list (1) *disjunctive ambiguity*: there are several alternative and mutually exclusive meanings; (2) *additive ambiguity*: the meanings, while mutually exclusive, overlap to some extent, e.g., they vary in breadth; (3) *conjunctive ambiguity*: "the separate meanings are jointly effective in interpretation"; and (4) *integrative ambiguity*: the "manifold meanings evoke and support one another," so that they "interact to produce a complex and shifting pattern"—several fields are connected while remaining distinct—"they are integrated . . . into one complex meaning."

Ways in which a symbolic element (a word or an image) can emerge for several distinct reasons simultaneously and can belong to several intersecting trends of thought have been discussed by Skinner (1957) under the heading of "multiple causation" and by Freud (1900) under the headings of "overdetermination" and "condensation" (cf. Prescott, 1912, and Burnshaw, 1970, on the importance for poetry of processes akin to the "condensation" of dream symbols).

Kris and Kaplan were actually developing ideas presented by Empson (1931), in *Seven Types of Ambiguity: A Study of Its Effects in English Verse*. In this book, the following cases are analyzed with illustrations from leading English poets beginning with Chaucer:

" . . . the detail is effective in several ways at once, e.g., by comparisons with several points of likeness, antitheses with several points of difference, comparative adjectives, subdued metaphors, and extra meanings suggested by rhythm."

" . . . two or more alternative meanings are fully resolved into one."

" . . . two apparently unconnected meanings are given simultaneously" (e.g., puns, references to more than one universe of discourse).

" . . . the alternative meanings combined to make clear a complicated state of mind in the author."

" . . . a fortunate confusion as when the author is covering his idea in the art of writing . . . or not holding it all in mind at once."

" . . . what is said is contradictory or irrelevant and the reader is forced to invent interpretations."

" . . . full contradiction, marking a division in the author's mind."

Empson insists that "ambiguity . . . is not satisfying in itself . . . it must in each case arise from, and be justified by, the peculiar requirement of the situation" (p. 265). "Evidently all the subsidiary meanings must be relevant," he says, "because anything (phrase, sentence, or poem) meant to be considered as a unit must be unitary, must stand for a single order of the mind" (p. 264). "When you are holding a variety of things in your mind, or using for a single matter a variety of individual machinery, the only way of applying all our [sic] criteria is to apply them simultaneously; the only way of forcing the reader to grasp your total meaning is to arrange that he can only feel satisfied if he is bearing all the elements in mind at the moment of conviction; the only way of not giving something heterogeneous is to give something which is at every point a compound" (p. 269). However, we might once again offer the same points with regard to motivation as arose during our discussion of form-content conflict—the likelihood that ambiguity will impel perceptual and intellectual effort and lead to a pleasurable arousal reduction as the multiple meanings are reconciled, the likelihood that, in so far as the multiple meanings are not welded into a unity, arousal is raised through incongruity (if they are contemplated together) or sudden change (if they are recognized one after the other).

Venturi (1966) has argued that "ambiguity and tension" are no less essential to architecture. They result from "oscillating relationships, complex and contradictory" between contributions of elements to "form and structure, texture and material." "The calculated ambiguity of expres-

sion is based on the confusion of experience as reflected in the architectural program." This promotes "richness of meaning over clarity of meaning" (p. 29).

Some of Venturi's examples illustrate disjunctive ambiguity. He discusses buildings in which it is not clear whether the plan is square or not, whether pavilions are near or far, big or small, whether a surface is "more wall or more vault," whether we are looking at two buildings joined or a single building with a split.

But cases of conjunctive ambiguity seem to be more numerous. There is sometimes duality in the relation of a part of the whole or to its surroundings. Something may seem small from one point of view or in relation to one portion of a building, but it may seem large when seen from another angle or distance or when compared with another portion. Whereas many churches adopt a directional plan (e.g., the familiar Latin cross) or a central plan (the Greek cross or the radial plan), some combine suggestions of circularity with the suggestion of a central axis (e.g., the central dome, flanked by two half-domes, of St. Sophia and Istanbul, or the elliptical plan of many Baroque churches).

At other times, there is duality of function. A column or pier may be seen as a necessary support for the roof and as a necessary component of shape. A structure like the Ponte Vecchio at Florence serves both as a bridge and as a street lined with shops. A gallery may function both as a room and as a corridor. "Mannerist and Baroque buildings abound in drip mouldings which become sills, windows which become niches, cornice ornaments which accommodate windows, quoin strips which are also pilasters, and architraves which make arches" (p. 42).

Finally, it is worth mentioning the deliberate ambiguities introduced by twentieth-century painters. The Cubists present human faces partly in profile and partly looking straight at the viewer. There is ambiguity about relative distances in the third dimension, so that one plane seems alternatively in front of, and behind, another. Shapes overlap, so that one segment can seem to belong simultaneously to two objects and there is competition between two or more groupings. Black or white outlines do not coincide with edges of patches of color, so that the location of contours is in doubt. These competing interpretations may to some extent be registered simultaneously, resulting in incongruity and other forms of conflict. Alternatively, one may suddenly replace another, producing arousal from change and surprise. The Op artist deliberately exploits visual illusion (figure-ground ambiguities, moiré patterns, two-dimensional forms with strong three-dimensional appearances, and so on) to generate sudden shifts in appearance, apparent movement, or appearances of depth which clash with the realization that one is looking at a stationary, flat surface.

## Instability

Some writers on aesthetics have made much of the feelings of "tension" or "instability" or "imbalance" that arise when elements or patterns approximate certain privileged elements or patterns without quite coinciding with them. Music theorists, for example, speak of the sense of "restlessness" or "incompleteness" induced by the leading note, i.e., the seventh note of the diatonic scale, because it so insistently "points to" the tonic. A dissonant chord like the dominant seventh is described as a chord of "movement" or "transition," because it is drawn towards the tonic triad on which it usually resolves. Cooke (1959) brings in another factor: "the very behavior of the notes derives from the harmonic series" (p. 45). Note 7 (of the harmonic series) is a slightly flattened B flat, so there is a tension pulling B flat downwards, whereas its offshoot, B natural (note 15), pulls upwards. The harmonic series is well known to anybody who has studied the origins of musical scales, the overtones that distinguish the timbres produced by different instruments, or the techniques of constructing and playing brass instruments. The average listener has often heard notes of pitches corresponding to the harmonic series that make up, with varying relative intensities, the sounds coming from familiar instruments. Nevertheless, how far he actually perceives the harmonic series, so that its structure can influence his reactions to individual notes is open to debate.

With reference to visual art, Arnheim (1954) points to what seem like analogous phenomena. He discusses, for example, patterns consisting of a black solid circle on a white square (p. 3ff.). "If a disc is put in various places within the square, it may be found that at some point it looks solidly at rest; at others it exhibits a pull in some definite direction, or its situation may be unclear and wavering." If it is a little off center, the disc may be pulled towards the center. If it is near one of the sides of the square, it may seem drawn toward the contour. On the other hand, a pattern such as a square with a disc located precisely over its center seems balanced. ". . . balance is a state of distribution in which everything has come to a standstill. . . . No change seems possible, and the whole assumes the character of 'necessity' in all its parts. An unbalanced composition looks accidental, transitory and therefore invalid. Its elements show a tendency to change place or shape in order to bring about a state better fitted to the total structure" (p. 12).

These forms of auditory and visual imbalance seem sometimes to be explicable, at least in part, by the fact that the related "balanced" pattern is a particularly frequent one or to the fact that it frequently succeeds the unbalanced one. The tonic is distinctly more frequent than

the leading note, and it often succeeds it. The dominant seventh is, more often than not, followed by the tonic triad. Lopsided visual structures are, more often not, transitory, being quickly replaced in everyday experience by return to symmetrical equilibrium or collapse. It may be that we see more squares with features in the middle than with features just off center or that objects seen near the center of a framework often move towards the center (e.g., a fleck of foam gravitating towards the drain of a sink).

Arnheim does not believe, however, that learning is responsible for the phenomena under discussion. He favors the Gestalt view that they result from stresses inherent in three-dimensional patterns of excitation in the brain, which impel a change towards balanced networks of forces and the corresponding "good" perceptual configurations. Recent experimental and theoretical work on pattern perception, carried out by specialists in the neurophysiology of learning and in computer simulation, do not generally corroborate the Gestalt theory of brain functioning. Nevertheless, the brain could well be innately favorable to certain patterns, quite apart from their role in everyday experience.

Another significant factor that Arnheim stresses is ambiguity. When a pattern is unbalanced, he writes (p. 12), "the artistic statement becomes incomprehensible. The pattern is ambiguous and allows no decision as to which of the possible configurations is meant." In order to organize perception and select adaptive action, it seems that the nervous system needs to recognize, among other things, whether two stimulus patterns are to be taken as identical or as different.

Acute discomfort results when two patterns are so close together that this decision cannot be made with confidence. The two patterns may be perceived side by side or in succession, or a pattern may be perceived alone but perceived with reference to some pattern taken as a standard. The juxtaposition of two colors that are just a little different from each other is disturbing and displeasing. So is the juxtaposition of two rectangles that are just slightly dissimilar in their proportions or the sight of a single rectangle that just misses being a square.

It is impossible not to be reminded of the famous experiment performed in Pavlov's (1927) laboratory by Shenger-Krestovnikova. A dog had been exposed to circles, which reliably heralded the appearance of food and thus came to evoke conditioned salivation, and to ellipses, which indicated that food would not be forthcoming and thus caused salivation to be withheld. On seeing an ellipse that could be described as a slightly flattened circle, the dog succumbed to "experimental neurosis," which Pavlov attributed to "collision" between excitatory and inhibitory processes generalizing, respectively, from the familiar circle and ellipse that it simultaneously resembled. Neurotic breakdown is a rather extreme reaction, obtainable in dogs with what Pavlov called

"weak" nervous systems. Even in the absence of spectacular neurotic symptoms, a tone midway in intensity between tones that have served as positive and inhibitory conditioned stimuli can generate an aversive condition, which is sufficiently like that resulting from stimuli that have accompanied electric shocks to evoke learned avoidance responses by generalization (Fonberg 1956). It seems not unlikely that human beings are experiencing a milder version of the same kind of effect when faced with something that is not unequivocally like or unlike something else.

## 12 AROUSAL-MODERATING DEVICES

Before reviewing devices for curbing arousal, we must note, once again, that these devices can be used either concurrently with arousal-raising devices or in alternation with them. In the former case, they serve to ensure that an arousal increment will not go beyond the bounds of a pleasurable arousal boost. In the latter case, they serve to bring arousal down after it has undergone an increment that is large enough to be aversive. They may form the basis for perceptual organization after a period of disorientation and perceptual effort.

### Psychophysical variables, expectations, predictability

First, the artist can just do the opposite of what tends to raise arousal. He can paint miniatures. He can use subdued intensities and unsaturated colors, especially those belonging to the restful, "cool" sector of the spectrum. He can confine the notes of a musical passage to the middle register. His structures can be simple. He can raise clear, unequivocal expectations in one part of his work and fulfill them in another part. He can conform to rules restricting the kinds of elements and the kinds of combinations that can occur, so that the appreciator can readily recognize redundancies, both distributional and correlational. He can select low rates of change and low variability.

He can do all these from the start, so that arousal increments always keep within circumscribed limits, and his work may be describable as "serene," "gentle," or "restrained." He can, on the other hand, introduce all these qualities after their contraries, so that arousal relief follows arousal induction, and the work may then be judged "dramatic," "stormy," or "rhapsodic."

### Content and ecological variables

*Association* Much arousal moderation must come from restful or soothing content. Many narratives and symphonic works have serene endings after episodes of turmoil, strife, and uncertainty. Fechner (1876,

### Arousal-Moderating Devices

I, pp. 89-90) observed, in support of his contention that "so to say, half of aesthetics depends on association," that a red cheek on a youthful face pleases us more than a pale one because redness of cheek is associated with "youth, health, joy, blooming life." A nose tinged with exactly the same coloring cannot win the same approval because we have learned to attach a quite different significance to red noses. He also used the principle of association to explain why landscapes are so agreeable to look at. Art can represent situations that we should like to bring about or that we should like to be in. There is also, of course, a great deal of scope for substitute satisfaction through identification with characters, who are portrayed enjoying advantages that we should like to enjoy or acting in a way that we should like to act.

But in many instances, the comforting and stress-relieving role of content is much more complicated. We must here recall what Freud had to say and encouraged many others to say later, about "latent meaning," "substitute gratification," and "sublimation" in art.

The Freudian view of art and of many other phenomena that were held to have affinities with art embodied a number of assumptions, at least some of which some received support from other kinds of psychological research than those with which Freud contented himself.

Freud's theory of the wish (1900) started out from the fact that all forms of biological gratification, particularly those that put an end to internal upheavals like hunger, anxiety, and sexual desire, require the visible and audible presence of appropriate external objects. Consequently, the perception of these objects comes to be pleasurable in itself. When a particular drive or "instinctual urge" is induced, the absence of the objects associated with relief adds to the discomfort and prompts an active search for them. It will, however, often be difficult to make the wished-for sights and sounds reappear, especially for the infant with his limited power to act on the outside world. In that case, substitute satisfaction may be derived from sensations resembling those that would have come from the wished-for objects. Various external stimulus patterns can perform this function, those contained in works of art being prime examples. It is particularly easy, and therefore tempting, to supply oneself with internal replicas of what is sought, namely through imagination or fantasy. Occasionally, in psychosis or in dreaming or perhaps in the infant whose "ego functions" are too weak to make a clear distinction between fantasy and reality, they may attain a vividness that makes them indistinguishable from reality. The fantasies of the artist rarely possess hallucinatory strength. But they can often function as vehicles of substitute satisfaction and, since unlike most dreamers, he is capable of giving concrete embodiment to his fantasies through his works, he can produce stimulus patterns that supply substitute satisfaction for other human beings, in so far as their unfulfilled wishes resemble his own.

*Displacement.* The most characteristic feature of Freud's theory is his assertion that the wishes receiving symbolic or fantasied fulfillment are repressed infantile sexual wishes. Without pursuing all the contentious convolutions of psychoanalytic theory, we may concentrate on the implication that they are wishes whose expression has met with severe disapproval and threat or punishment, so that the entertainment of thoughts connected with them, let alone their direct satisfaction through action, occasions intolerable anxiety. As a result, the wish fulfillment will take on a disguised or distorted form, so that the individual in question will not be capable of recognizing that he harbors the wishes at all or how the satisfaction he experiences comes about.

Forms of behavior that constitute substitutes for normal, immediate expression of a directive motivational factor have been revealed by quite different lines of research from Freud's, notably by the ethologists' experimental and field studies of animal behavior and the psychological laboratory experiments of Lewin (1935) and N. E. Miller (1944). The resulting conclusions, though formulated in languages of quite un-Freudian flavor, show nevertheless some important convergences with points that Freud was making. Both the ethologists and Miller mention two conditions making for "displacement" (which is a term that they share with Freud, while using it to include phenomena that he would have classed under "sublimation" and other headings). One is the absence and inaccessibility of the stimulus situations needed for direct expression and satisfaction of a drive. The other is the blocking of direct expression through conflict between two antagonistic drives. These correspond to what Rosenzweig (1944) called "primary frustration" and "secondary frustration," respectively. In some, but not all, of the displacement behavior that the ethologists have observed on animals and in all the situations figuring in Miller's work on displacement, one of the parties to the conflict consists of fear and avoidance behavior learned under the influence of fear. So there is here some measure of concurrence with Freud's stress on "anxiety" (he actually used the German word *Angst*, which means "fear") as a factor causing one kind of action to be replaced by a more innocuous kind.

We must, however, draw some distinctions. Displacement and the substitute satisfaction dependent on it are sometimes impossible without some action on the part of the organism. So as Freud himself acknowledged (1915), there can be a change in the "goal," i.e., in the object towards which the behavior is directed, or a change in the "aim," i.e., the kind of activity towards either the original target or a substitute target. Sexual perversions like homosexuality and sadism, respectively, illustrate these two kinds of deflection. Similarly, ethologists know of cases where feeding or mating movements are aimed at unusual targets in the absence of the normal ones, as well as of cases where two drives are in conflict and behavior differing from the normal expression of either of them occurs.

For example, simultaneous arousal of fear and the aggressive drive or of fear and the reproductive drive may, in some species, give rise to fragments of nest-building behavior.

At other times, mere exposure to an object that in some way resembles the object of a wish may suffice for substitute satisfaction. Freud (e.g., 1900) described cases of "displacement of affect," where an emotional reaction, without instrumental or consummatory overt behavior, is all that the substitute object evokes. Miller reports one experiment (1948) in which rates displace bodily attack on other rates to a celluloid doll or to the wall of the experimental chamber, but his theory of displacement actually concerns a situation in which a substitute object is simply approached.

Early explanations of displacement behavior, including those of Freud (1915) and of the first ethologists (e.g., Tinbergen, 1951), assumed that "energy," finding its normal outlet blocked, would force its way out through an alternative outlet. It was impossible not to be struck with the similarity between displacement phenomena and what happens when a river, which would otherwise take the most nearly vertical and least resistant path down a mountainside, meets with an obstacle and consequently hollows out a new bed for itself along a more devious route. As psychological and neurophysiological knowledge advanced, such hydrodynamical analogies were seen to be misleading.

*Active displacement*, consisting of performance of one type of behavior in place of another, seems more likely to occur because (1) perception of a particular stimulus situation causes excitation to be sent to several centers controlling distinct forms of behavior; (2) the behavior controlled by one of these centers will normally be performed, while centers controlling competing behavior patterns will be inhibited; (3) if the performance of the normally preponderant behavior pattern is prevented, its inhibitory influence on other responses will be removed, so that one of them will be performed instead.

*Passive displacement*, in which an organism reacts, outwardly or inwardly, to some other object as it would to the normal goal object, presumably depends on the principle of stimulus generalization: a stimulus pattern tends to evoke responses, whether learned or unlearned, that are associated with a stimulus pattern to which it bears some similarity.

In the appreciation of art, passive displacement may constitute a prime source of hedonic value, but active displacement may well figure in the work of the creative artist as well as in the efforts of both professionals and amateurs in the performing arts.

Miller (1948), building on earlier theoretical proposals of Lewin (1935), has worked out an explanation of passive displacement as a response to conflict. His theory is applicable to situations which a stimulus object (original target) tends to evoke positive responses (e.g., aggres-

sive, sexual, or simply approach) but evokes fear even more strongly, so that the positive responses are inhibited and a tendency to avoid the object prevails. Positive and negative, or approach and avoidance, tendencies will generalize to an object resembling the original target commensurately with the degree of similarity. But the crucial assumption in Miller's theory is that the strength of the avoidance tendency will decline more steeply than that of the approach tendency as objects become more and more dissimilar from the original target (see Fig. 12-1). There is

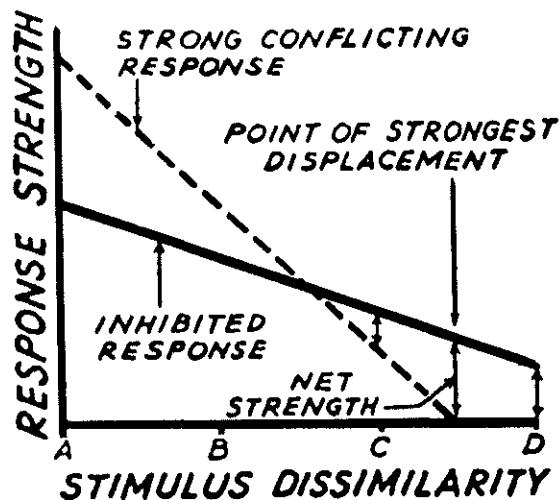


Figure 12-1 Displacement due to interaction of stimulus-generalization gradients corresponding to a response and inhibition of that response, according to N. E. Miller's theory. (From Miller, 1948).

therefore a range of similarity within which objects will, through generalization, evoke the positive responses more strongly than the negative responses, and these will be potential displacement targets. How close the displacement target will be to the original target depends on the relative strength of the positive and negative response tendencies associated with the original target. It will be closer if the positive tendency is relatively stronger and more remote if the negative tendency is. Miller's theory is derived from some plausible extensions of familiar principles of learning theory and has received substantial support in animal experiments. There is also evidence that it can account for the incidence and form of sexual (Clark, 1952) and aggressive (McKee, 1949) fantasy in human beings.

The theory is capable of explaining not only overt actions that bring an organism into contact with a displacement target but also the ability of displacement targets to elicit internal reactions generalizing from conflict-ridden original targets, including reactions of pleasure. So art objects can be expected to furnish plentiful opportunities for substitute satisfaction when attempts to wrest pleasure from objects in the real world are both strongly motivated and strongly deterred or frustrated.

Art objects are particularly suitable for this function when secondary frustration or conflict is at work because of the built-in contrasts between a work of art and what it represents, the contrasts between material and form discussed by Lange and other writers. Consequently, the "unreality" of art can readily weaken the fear component of the reaction to an original target. Besides interactions between the artist's own approach and avoidance tendencies, we must not forget pressures from his audience. Their distaste for more outlandish content, with its excessive ambiguity, novelty, or incongruity, is apt to narrow down still further the range of symbolic material that will be acceptable (Martindale, 1969). Some societies, e.g., Western society in the mid-twentieth century, are much more tolerant in this regard than others.

We can deduce from Miller's theory that the relative thoroughness with which approach and avoidance have been learned will determine to what degree a representational work must contrast with its significate for enjoyment to occur. We can understand why certain individuals and certain societies will demand realistic and detailed depictions of subject matter, whereas others will demand greater abstraction, distortion, and adherence to structural rules.

*Classical conditioning* So far, we have considered how substitute satisfaction can result from stimulus generalization or, as an earlier generation of psychologists would have put it, from "association by similarity." But there is even more evidence that "association by contiguity" or classical conditioning can also turn something inherently neutral into a rewarding agent and object of pleasure. Innumerable experiments on "secondary reward" or "conditioned reinforcement" have shown how a stimulus that has frequently accompanied or just preceded a satisfying state of affairs becomes pleasurable and rewarding in itself. And even if later learning makes a formerly satisfying stimulus pattern (the unconditioned stimulus or original target) frightening or aversive, the secondary rewarding stimulus (conditioned stimulus, substitute target) may well continue to be more pleasant than unpleasant.

In the days when, for many psychologists, reward and pleasure were inseparably equated with drive reduction, stimuli that became pleasurable through generalization or contiguity could be expected to moderate drive, both in the sense of general arousal level and in the sense of a specific tendency to engage in a particular kind of activity. Now, we

cannot assume this. As we have seen, there is reason to believe that rewarding situations can coincide with either a drop in arousal or a comparatively moderate arousal increment. Since substitute rewards seem to acquire the essential properties of primary rewards, we must expect the same to apply to them also. Sometimes at least, we can assume without too much audacity that substitute satisfaction due to displacement gives an artistic element an arousal-moderating property. At least some naturally rewarding events, such as drinking milk in a cat, produce one clear-cut index of lowered arousal, namely synchronized EEG waves (Clemente et al., 1964; Roth et al., 1967). And there is at least one experiment (Clemente et al., 1964) to show that a stimulus associated with a natural reward—a light going on 20 seconds before milk is delivered—will come to evoke through conditioning the same “postreinforcement synchronization.” There is likewise no lack of evidence that different kinds of EEG responses are subject to stimulus generalization, and there is no reason to doubt that this will apply to rewarding events that produce signs of lowered arousal.

## Familiarity

The arousing effects of novelty can be curbed or undone by introducing patterns that resemble what has been experienced before. Long-term familiarity is of course exploited through patterns that can be recognized, either immediately or after a certain amount of perceptual work, as representation of known objects or as modifications of something that has been encountered before.

Short-term familiarity means either *repetition* or *return* of something that appeared a short time before. In the visual arts, sequences of many identical elements either in one dimension (e.g., the Greek egg-and-dart pattern) or in two dimensions (e.g., wallpaper patterns) are common. Repetitive sequences are usually of limited duration in the temporal arts, since boredom threatens, whereas repetitive visual display can be apprehended in a relatively brief glance and then abandoned. Forms in which previously presented material reappears after an excursion into different material are common both in poetry (e.g. prosodic forms with a refrain) and music (e.g., the ABA form, the rondo form, the cyclic symphonic form of the late Romantics with themes from earlier movements reappearing in later movements).

But an aesthetic device of incomparably greater scope is *variation*, the presentation of elements that are alike in one respect, but different in another. A painting may contain patches of the same shape but of different colors, or vice versa, or of the same color but of different shades

or intensities. The same melody can recur with different rhythms or harmonies or with different forms of ornamentation each time. There can be a sequence in which the same melodic fragment is played in turn at different pitches or by different instruments. The theme-and-variations form is not only frequent in classical Western music. It is found in many other musical cultures, from the *piblaireachd* played on the Scottish bagpipe to the *danmono* played on the Japanese koto. These can all occur whether a work as a whole follows the theme-and-variations form, common to several musical cultures, or whether it is a matter of small-grain structure. In poetry, consecutive lines often consist of different words with the same number of syllables and the same pattern of stresses. If there is rhyme, the final words will end with the same phonemes but begin with different ones.

Distinct elements can be held together by *repetition of a relation*, as when a series of colors or pitches separated by equal intervals occurs or a series of intermediate shapes through which one shape gradually transforms itself into another.

Such are the devices through which art conforms most clearly to the “unity-in-variety” formula, although it will be apparent by now that this formula, even in its broadest possible interpretation, does not exhaust all the ways in which aesthetic satisfaction can be ensured, even with regard to formal aspects alone.

Geometrical transformations underlie some of the most widespread means of contriving contrast among otherwise identical elements. Side-by-side repetition makes use of translation, one of the so-called rigid transformations preserving Euclidean properties of space. But others, such as rotation and inversion, are also available, as well as the more far-reaching transformations associated with more comprehensive geometries, beginning with expansion and contraction. Alsleben (1962), following Woll and Wolff (1956), has drawn up an impressively complete enumeration and classification of the relations that can give spatial forms a greater or lesser degree of resemblance.

The juxtaposition of adjacent elements that are identical apart from spatial transformations constitutes the various forms of symmetry known to mathematicians and crystallographers. And the importance of symmetrical structures for art hardly needs to be emphasized.

Somewhat analogous transformations are found in music, where the space involved is not physical space (except to a limited extent in some avant-garde compositions). It is rather a space of which one dimension is time and the second pitch, although dimensions corresponding to other properties of sounds and of clusters of sounds take the place of pitch in some mid-twentieth-century compositions. Classical polyphonists made lengthening or shortening of durations of notes) and, occasionally, retro-much use of inversion, augmentation, and diminution (i.e., proportionate

gression (as in the *canon cancrizans*). Similarly, the tone row of contemporary serial music is subject not only to transposition but also to inversion and retrogression or both at once.

### Exemption from inhibition and exertion

Freud's book on jokes (1905a) is probably the least studied of his major works, but it anticipates in a remarkable way many of the pre-occupations and currents of thought in present-day motivation theory. He points out three devices that are central to "harmless wit," i.e., wit that plays with words or with thoughts and lacks aggressive or sexual content. All of them produce pleasure through "economy of psychic expenditure or alleviation from the pressure of reason."

First, he considers puns, which work by "directing the psychic focus upon the sound instead of upon the sense of the word." Children and psychotics often make much of similarities between words denoting different things, but normal adults have learned to ignore homonyms and to concentrate instead on similarities and differences in sense. This occurs, Freud surmises, "at the expense of a certain amount of exertion," which is why we enjoy jokes that afford us momentary relief from it. Secondly, there is unification of words or ideas that are normally kept distinct and distortion of familiar sayings or thoughts. Here, according to Freud, one "discovers something familiar where one expects to find something new instead. To discover the familiar is pleasurable and it is not difficult to recognize such pleasure as economy-pleasure." Thirdly, we can take pleasure in all kinds of absurdity and illogicality, because they enable us to "withdraw from the pressure of critical reason."

It is easy to see that these three techniques all appear in art as well as in wit. Their frequent use is, in fact, what has led many psychoanalytic writers to stress the importance of "regression" and "primary-process thinking" (i.e., thinking characteristic of dreams, psychosis, and childhood) in art.

Poetry draws our attention to phonological similarities between words, even when similar-sounding words are totally disconnected in sense. This is exemplified by rhyme (cf. the work of Cohen, 1966, discussed in Chapter 11). Concrete poetry even exploits visual similarities in printed form between otherwise unrelated words. The visual arts, likewise, point out resemblances in color or in shape between objects that have little in common with respect to their significance for our everyday behavior. Distortions of familiar visual, speech, or thought patterns, unfamiliar mergers of familiar but distinct elements, verbal formulas and visual arrangement that make sense in several different ways at once are all common resources of poets (cf. the work of Empson, 1930, and Martin-

dale, 1969, discussed in Chapter 11) and of painters. Absurdities and illogicalities abound in styles dominated by whimsy and fantasy, (e.g., literature and painting of the German Romantic movement and the Surrealist movement).

Freud's reference to the pleasure that comes from discerning something familiar behind something strange harks back to our discussion in the last section. But the possibility that "alleviation from the pressure of reason" may contribute to the appreciation of at least some kinds of art deserves some consideration. Our usual compulsion to speak, think, and act rationally, coherently, relevantly, evidently results from years of discrimination learning. Any responses that are irrational, incoherent, and irrelevant have been inhibited through lack of reward and perhaps through punishment due to social disapproval and other causes. But responses that have been subjected to inhibition do not disappear. They are simply relegated to relatively low positions in the response hierarchy. This means, first, that they are apt to reappear if ever the inhibitory forces are weakened (Mowrer & Kluckhohn, 1944). This can happen at times of stress (conceivably including the deep emotional disturbance in which at least some artists produce their work), when the newer, dominant responses are themselves blocked by inhibition or by competition, and in privileged situations where normal constraints are loosened. Situations that bear the stamp of "art" or "humor" are signal examples of this last category. As we have seen, art is distinguished by its "unreality," i.e., by its freedom from the dangers and the need to act that are attached to comparable stimulus patterns in other contexts.

Further, the constraints of normal logic entail conflict between rational, more mature responses and the irrational, immature responses that they displace. They also mean finer discrimination, attention to a wider range of cues, or, in other words, more information processing. These are conditions tending to drive arousal upwards, so that "restoration of old liberties" (to use Freud's phrase) by relaxation of logical constraints can bring arousal down.

The devices that we have just been considering were, however, mentioned in Chapter 11 as ones that can induce arousal increments through novelty, surprise, incongruity, and ambiguity. There is, of course, no contradiction. Any diminution of arousal due to temporary liberation from the restrictions of rationality can, we must suppose, counteract the arousal-raising potentialities of the anomalies that result. Consequently, the necessary conditions for the arousal boost or the arousal boost-jag can be realized. When we come across absurdities and incoherences in situations that are not clearly labelled as artistic, playful, or humorous, we are apt to find them not enjoyable but profoundly disquieting. The attendant arousal increment is too strong for an arousal boost, and there is no prompt relief to make possible an arousal jag. On the other hand,

childish whimsicality is generally found to be dull and tiresome when it fails to produce anything startlingly unusual or puzzling, i.e., when it lacks arousal potential. The obvious exceptions occur after periods of anxiety or extraordinary intellectual labor. Then, arousal may climb to aversive heights, so that any "light relief," however puerile, is welcome. But what comes up at such times is unlikely to be classed as art.

### Grouping and patterning

The early twentieth-century German aesthetician, Ziehen (1925), mentioned three means by which the "synthetic differentiation" that is necessary for aesthetic enjoyment can be achieved. The first two of these were "recurrence," permitting recognition, and "variation." These have already figured in our discussion. But Ziehen's third item was what he called "complexability," defined as "facilitation of synthesis."

When members of a stimulus compound tend to evoke numerous, disparate responses, and thus conflict, arousal can be lessened if the compound is treated as a unity evoking a coherent pattern of reactions determined by the collective properties and interrelations of its members. This will be an instance of what, in learning theory, is called "positive patterning" (Hull, 1943). This is said to exist when a subject learns to associate a response with a combination of stimuli in a particular sequence or arrangement and to withhold the response when any members of the compound are omitted or changed or when they appear in a different spatial or temporal arrangement.

The grouping together of elements, so that they can be perceived and reacted to as a unit, is one aspect of the formation of super-signs on which the information-theoretic aestheticians have placed so much stress. They direct attention to the compounds that emerge when an appreciator has had an opportunity to recognize the redundancies or internal constraints they contain and thus to notice which components tend to occur together. But learning can attach unitary responses to compounds in other ways also. A compound may have a biological significance that no portion of it would have alone, so that the response is reinforced only when the whole compound appears. And the Gestalt psychologists have presented their laws of perception through whose operation elements linked by similarity, proximity, common fate, and so on are likely to be apprehended as a single perceptual whole.

Lipps's (1903-06) theory of aesthetics included a "law of unitariness," pointing to a "tendency to gather together what is manifold into a unity or unified whole or a single act of assimilative activity (*Auffassungstätigkeit*), attention, apperception." We are likewise told by Moore (1917) that "beauty is at once seen to involve the mastery of complexities

by a mind which delights in combining, which refuses to allow things to be discrete, and determines wherever possible to assemble the various parts of the world into something intelligible" (p. 134-5). The role of "unification" in art was emphasized even more by Langfeld (1920).

. . . it does seem from what we know of perception that its chief characteristic is unification. It is through this unification of the object, relating of its parts one to another, that it is grasped by the mind. . . . Therefore, it is reasonable to expect that an arrangement of the elements of an object of contemplation which aids this unification will meet the requirements of the mind better and be more acceptable than an arrangement which does not do so. Unity can therefore, be considered a firmly established principle of beauty (pp. 30-31).

"Whenever we are able to adjust ourselves successfully to a situation, so that our responses are unified into a well-integrated or organized form of action, we call that situation beautiful, and the accompanying feeling one of aesthetic pleasure" (p. 279). He explains further, "whenever the organism is surrounded by one or more objects . . . it attempts to assume some form of motor attitude toward them. This is commonly known as directing our attention to the object, and the organism is then said to perceive it" (p. 158). But since it is impossible to assume more than one motor attitude at once, "we observe in ourselves a high degree of restlessness" (p. 159) when confronted with a multiplicity of objects. Consequently, there is a search for some way of imposing unity, and "the act of discovering the unity is in itself a pleasure" (p. 160). Unification signifies economy of effort, and, in view of this advantage, "aesthetic enjoyment . . . seems to be the most broadly useful and far-reaching of all our activities" (p. 168). Langfeld goes on to analyze examples from the visual arts of unity of form, unity of content, and unity between form and content.

### Dominance

Some of Langfeld's illustrations of aesthetic unification are not actually cases of positive patterning but of something rather different. Several elements are seen to have some property in common causing them to evoke a common response strongly, and, in this sense, the combination has a unitary effect on the appreciator. Severe conflict is obviated because a response evoked by several elements will be stronger than its competitors, which are associated with properties peculiar to single elements.

The replacement of a jumble of divergent responses, traceable to different stimulus elements, by a single response depending on a configuration as a whole is one way of alleviating conflict (cf. "swamping" as a means of relieving the conceptual conflicts that can motivate thinking—

Berlyne, 1960, 1965). Another way is to make the conflict unequal: one of the competing responses is made to surpass the others in strength so that it becomes capable of suppressing them (cf. "dis-equalization" of conceptual conflict—Berlyne, 1960, 1965).

"Monarchical subordination" was another of Lipps's (1903-06) principles. Subordination meant "the apperceptive assimilation or relative absorption of the subordinate by the supraordinate, the overflowing of the subordinate into the act of grasping the supraordinate, the relative inclusion of the former in the latter or comprehension in conjunction with the latter." Subordination had to occur to just the right degree (the "Principle of Equilibrium of Monarchical Subordination"). There could also be several hierarchically related dominating elements, such as the presence of a large tower and several smaller towers in a wall, the longitudinal and transverse axes of a cruciform church.

Arnheim (1954, p. 31) writes likewise that "... pictorial counter-point is hierarchic—that is, it sets a dominant force against a subservient one. Each relationship is unbalanced in itself; together they all balance each other in the structure of the whole work." And Graves (1951), after explaining the importance for design of "conflict or tension, also called opposition, contrast or variety," asserts that "unity demands that the conflict be resolved and integrated by dominance, the principle of synthesis. This integration is effected by subordinating competing visual attraction to an idea or plan or orderly arrangement." This sounds like positive patterning. But in many of the items of Graves's Design Judgment Test (1956), presence of dominance means that one form or color occupies a greater area or occurs more frequently than others.

Extensity and relative frequency are, however, not the only ways in which the response to a particular element can become dominant. All the components of arousal potential, including intensity, ecological significance, and collative properties, can be used to make an element or quality stand out and exert a preponderant influence on the appreciator's reaction.

Dominance can help to resolve conflict through *abstraction* (see Ch. 9), the selection of a stimulus *property* to control behavior. At other times, a conflict must be resolved through *attention*, the selection of a *portion* of the stimulus field to control behavior. For example, a complex painting imposes the problem of where to look first. Artists often (but not always) have ways of coercing the initial fixation (and perhaps most later fixations) towards a particular area. One object in the painting can be particularly large, bright, rich in powerful associations, or startling. Human figures may be depicted as looking or pointing towards a certain location. The principal lines of the composition may converge on one point or (as in paintings of the Flemish school or of De Chirico) on two or three points.

## 13

### EXPERIMENTAL EVIDENCE: The Old and the New Experimental Aesthetics

The tentative conclusions offered in the foregoing chapters were suggested partly by the writings of speculative aestheticians and partly by the experimental findings of psychologists and neurophysiologists not concerned with aesthetics. We are still a long way from the experimental investigations that will test our conclusions about art directly, tell us how much validity they possess, and enable us to replace them with more precise theoretical models. In the meantime, we must review what experimental evidence there is regarding the determinants of aesthetic appreciation.

As already noted in Chapter 2, some of the relevant experiments have presented subjects with specimens of genuine artistic material, such as reproductions of paintings, musical passages, and photographs of vases. These studies are necessary and valuable for the elucidation of sociological and social-psychological factors in aesthetic taste. But they have very limited usefulness for the study of the motivational foundations of aesthetic behavior. It is impossible to say which, or which combination, of the many variables distinguishing two works of art may be responsible for any difference that may be discovered between reactions to them. In any case, appreciation of such complex objects must be subject to all kinds of influences from semantic content and social custom.

So, for some time to come, we must rely primarily on simple, artificial stimuli, which can be designed to differ from one another in one respect only, leaving other variables rigorously controlled, and will certainly be quite unlike anything that could generate deep aesthetic satisfaction. We must brave the usual gibe that this kind of material is so remote from art that anything we may find out with its help can have nothing to tell us about aesthetics. We must recall, once again, that the physical sciences spent centuries on such odd subject matter as balls rolling down inclined planes and flasks of oxygen and that these sciences later worked their way towards phenomena even further removed from matters of pressing everyday concern, such as showers of high-energy protons and the behavior of liquid helium at temperatures near absolute

zero. Nevertheless, physics and chemistry can now provide much worthwhile information about rocks, textiles, animal tissues, and other forms of matter that are commonly encountered and of great practical importance. They can do this precisely because they did not spend most of their time examining rocks and textiles and animal tissues and waited quite a long time before paying much attention to them at all.

The stimulus properties that apparently govern aesthetic appreciation consist essentially of those that constitute what we have called "arousal potential." This term was introduced because of the evidence that they all affect arousal. Electrocortical, electrocutaneous, pupillary, and cardiovascular indices of arousal (components of the orientation reaction) are influenced by psychophysical variables, such as intensity (see Berlyne, 1960, p. 171), color (Gerard, 1958; Fére, cited by Valentine, 1962; Wilson, 1966; Sobol & Day, 1967), and auditory pitch (Misbach, 1932; Berlyne, McDonnell, Nicki, & Parham, 1967; Schönpflug, 1967). They are influenced by ecological variables, i.e., association with events of biological significance, especially those that are conducive to fear or require careful discrimination for selection of an overt action (see Berlyne, 1960, pp. 173-174). Above all, they are influenced by collative variables, including short-term and long-term novelty (Popov, 1953; Sokolov, 1958; Wilson & Wilson, 1959; Berlyne, Craw, Salapatek, & Lewis, 1963), surprise (Sokolov, 1958; Berlyne, 1961), complexity (Berlyne, Craw, Salapatek, & Lewis, 1963; Berlyne & McDonnell, 1965; Baker & Franken, 1967; Gibson, Baker, & Rathie, 1967; Bryson & Driver, 1969; Pratt, 1970), power to induce uncertainty (Berlyne & Borsa, 1968; Lovibond, 1965), and power to induce conflict (Lanier, 1941; Berlyne, 1961).

We must now survey experiments in which simple stimulus objects, representing constituent variables of arousal potential, have been used as experimental material. The dependent variables or measured effects on behavior have belonged to the following categories.

*Verbal judgments* These are most frequently judgments of "preference," "liking," "pleasingness," and other subjective properties that seem to reflect hedonic value. More recently, "interestingness," a property of comparable scope but evidently rather different from those just mentioned, has been receiving some study.

Reactions to art comprise, of course, much more than simply a greater or lesser degree of enjoyment. A particular work is expected to engender its own unique pattern of emotional flavors, images, thoughts, and ineffable experiences. These are what critics spend much of their time delineating, and experimental aesthetics must eventually strive to throw its own kind of light on them. In some experiments, subjects have been asked to choose adjectives descriptive of emotional states, such as "serene," "soothing," "sad," "triumphant," that seem applicable to par-

ticular patterns. But research in which subjects have to attach emotional labels to stimuli, whether they consist of aesthetic material, facial expressions, or anything else, has long been dogged with doubts about whether the name of an emotional state can have a precise meaning for most people and how uniform its meaning can be from person to person. The statistically significant effects that have been obtained from groups of subjects imply some consistency. But experiments of this kind, while not without scientific value, cannot carry us very far until a firmly anchored classification of emotional states has been worked out. So far, we cannot be sure how the states corresponding to the different terms are related to one another.

*Exploratory behavior* Of late, there have been more and more experiments in which exposure to various stimulus patterns is under the subject's own control, so that the effects of isolated stimulus properties on the duration of self-exposure and on direction of choice can be ascertained. As we shall see, there are several techniques in this category, and the findings that they yield do not all have the same implications. But experiments of this kind are of basic importance, since acts leading to contact with aesthetic patterns are essential components of aesthetic behavior and a comparison between the results of experiments using self-exposure and verbal judgments can help us to see how the latter should be interpreted.

## PSYCHOPHYSICAL VARIABLES

Valuable summaries of experimental work relating verbally expressed preferences and other judgments to psychophysical stimulus properties have been provided by Chandler (1934), Woodworth (1938), Valentine (1962), Francès (1968), and Child (1969). We can only touch on some of the main points here.

### Intensity

In carefully designed experiments using colored papers placed on a grey background (Guilford, 1934), brighter shades were judged to be pleasanter. However, the intensity of a patch of color is limited by the incident light. If greater intensities had been used, e.g., by presenting colored filters in front of sources of light, it is not unlikely that pleasantness would have been found to increase with brightness only up to a point and then to decline. The pleasantness curve for shades of non-chromatic colors had a curious shape, with black judged the most pleasing,

dark shades of grey judged "slightly displeasing," and lighter shades located around the indifference point. However, variations along the black-grey-white continuum obviously involve differences in quality as well as differences in reflectivity, and, in any case, colors like black have special associations.

Guilford (1934) also found the pleasantness of two tones to be inversely related to intensity, within the range used, but his report does not provide information that would permit his intensities to be translated into decibels or other standard units. Berlyne and others (1967) likewise found tones and chords at approximately 80 db to be rated more pleasing than the same sounds 10 db louder. Vitz (1971), asking subjects to compare pairs of tones of equal pitch but different intensity for "pleasantness," has presented curves showing a steady decline in pleasantness as intensity moves from 50 db to 90 db. There is also some indication that 40 db is less pleasant than 50 db. The suggestion of a peak of pleasantness around 50 db is, of course, compatible with the assumption that the intensity-pleasantness relation follows the Wundt curve.

### Size

In one experiment on exploratory behavior (Brown & Farha, 1966), larger polygons were viewed longer than identical polygons of one-quarter their size. Using a rating scale from "very much liked" to "very much disliked," Martin (1906) presented 26 circles varying in diameter from 1 mm to 500 mm. Her subjects were indifferent to the smallest circles. "Up to a certain size," she reported, "the liking for the circles increases with their size and beyond this size the liking decreases, the largest circles being much less liked than the moderate sized ones and in some cases actually disliked." It will be recognized that these results conform perfectly to our interpretation of the Wundt curve, provided that size is accounted a constituent of arousal potential.

### Color

There have been a large number of experiments, using vastly different techniques and populations of subjects, on color preferences. Widely different individual tastes have invariably been revealed, and signs of systematic variation with age, sex, duration of inspection, background color, and ethnic group have been reported. Nevertheless, there is some measure of consistency running through these findings. The most frequently preferred color has repeatedly turned out to be blue, and, when it is not blue, red or pink is likely to be in the lead.

More recent experiments, notably that of Guilford (1940), have been

carried out in more rigorously controlled conditions than some of the pioneering studies and, in particular, they have carefully separated hue, brightness, and saturation. Guilford confirmed that the curve relating pleasantness to the chromatic spectrum has a main peak in the green-blue area and a secondary peak at the red end, with a distinct trough coming between yellow and green. Pleasantness increased steadily with saturation, although another experimenter (Granger, 1955b) found preference to rise with saturation up to Munsell value 10 and then to sink. When patches of different colors are juxtaposed, degree of preference tends to be positively correlated with distance between the two in hue, but negatively correlated with their difference in brightness or saturation (Granger, 1955a).

In some recent investigations carried out at the University of Groningen in the Netherlands under the direction of Dr. W. J. M. Levelt (personal communication), subjects were required to rate pairs of colored chips on a seven-point "clashing-harmonious" scale. The relations between this kind of judgment and the more usual judgments of preference or pleasantness are, of course, uncertain. With paired chips of identical saturation, harmony was maximal when they also had the same hue. Blue, green, and especially bluish green were better able to enter into harmonious combinations with other hues than red and yellow. An experiment varying saturation with both high-harmony and low-harmony pairs of hues showed that, when the saturations of the two chips were equal, harmony was maximal with moderate saturation and declined markedly with the highest saturation. When saturations were unequal, judged harmony seemed to reflect an averaging of the values associated with the two saturations. Finally, harmony appeared to increase with brightness difference.

There is some concurrence between these findings and those of a more elaborate experiment by Helson and Landford (1970), who collected pleasantness ratings for small chips of 125 colors on backgrounds of 25 colors under five kinds of illumination. As these authors put it, "the chief single factor responsible for pleasant color harmonies was found to be lightness contrast between object and background colors." On the whole, a high saturation tended to increase pleasantness, but there were plenty of exceptions to this. Large differences in hue turned out to be relatively unimportant.

Sobel and Day (1967) let subjects look for as long as they wished at 20-sided random polygons in each of four colors. They tended to spend more time looking at figures in the colors they said they preferred, and there was also an overall tendency for red or blue figures to be inspected for a longer time than yellow or green ones. It will be recalled that red and blue regularly lead when color preferences are studied through verbal reports.

## Visual forms

Simple lines, curves, and shapes (Valentine, 1962) differ in judged pleasingness and are also judged, with some intersubject consistency, to express particular feelings or emotions. But, apart from complexity and variables related to complexity (which will be taken up later), there are no firmly rooted dimensional schemes to which all possible differences in form can be related. This naturally sets severe limits to what can be made of these findings, although attempts to metricize visual form are beginning to make headway (e.g., Elliott & Tannenbaum, 1963; Brown & Owen, 1967; Leeuwenberg, 1967; Brown & Andrews, 1968; Stenson, 1968). Attempts at mathematical analysis of sequential patterns, such as occur in music, are likewise beginning (Simon & Sumner, 1968; Deutsch, 1969; Restle, 1970).

There have been some interesting results relating to the golden section and to aesthetic balance. Since these results raise special problems, they will be postponed until Chapter 14.

## Auditory pitch

Guilford's (1954) finding that pleasantness is inversely related to the pitch of pure tones has been confirmed by other experimenters (Berlyne et al., 1967; Schönpflug, 1967). Schönpflug included in his experiment a tone of 80 cps, which was lower than any used by the other investigators, and his data showed pleasantness to increase as the frequency declined to 170 cps but to drop sharply with this extremely low tone. However, audio-generators tend to introduce a new quality of roughness or fluttering in tones as low as this, so that the apparent anomaly in the pleasantness-pitch curve cannot be confidently ascribed to pitch alone. An experiment by Vitz (1971) has also yielded an inverted U-shaped curve for judged pleasantness between 60 cps and 5,000 cps, the maximum being at 750 cps.

Experiments with simultaneous combinations of tones take us into the areas of simplicity-complexity and of consonance-dissonance, which will be taken up in Chapters 13 and 14. It is, however, worth mentioning at this point that the preference ordering of intervals between pairs of successively sounded tones approximates the ordering for simultaneous combinations (Valentine, 1914).

## ECOLOGICAL VARIABLES

Association with extrinsic rewards, or secondary reward value, can affect degree of preference. Preschool children come to express preference

for colors that are seen when a box containing a gift is presented rather than for colors coinciding with receipt of an empty box (Staples & Walton, 1933). Razran (1938) was able to increase expressed liking for pieces of music by playing them while subjects were eating.

Nunnally and his collaborators (Nunnally, Duchnowski, & Parker, 1965; Nunnally, Stevens, & Hall, 1965) have measured exploratory behavior as well as verbal evaluations. Particular visual stimuli (geometrical shapes, printed nonsense syllables) were associated with extrinsic reward in various ways; when a spinning pointer stopped next to the stimulus, a one-cent piece was given to the child, or the stimulus appeared on envelopes that could be picked up with a magnet and found to contain candy. These experimenters have found repeatedly that stimuli given such "conditioned reward value" become more and more likely to have favorable adjectives attached to them during later tests of verbal evaluation. They are also found to attract fixation more often when eye movements are observed and to be inspected for a longer time in an apparatus that allows each stimulus to be brought into view by pressing a corresponding button.

## COLLATIVE VARIABLES

Experimental work summed up so far corroborates the supposition that an endless variety of stimulus properties can contribute to the hedonic value of a work of art. But as we have been led to conclude in earlier chapters, aesthetic satisfaction seems always to depend at least partially on structural or formal aspects of stimulus patterns, which as we have seen, mean collative stimulus properties. Consequently, experiments on the motivational influence of collative variables must be of particular relevance to aesthetics. Strangely enough, these variables received little attention from experimental aestheticians for a long time. An increasing volume of experimentation has been devoted to them in recent years. We are therefore justified in speaking of the "new experimental aesthetics" with reference to this work.

## Animal behavior

We must naturally concern ourselves principally with experiments on human adults and, to a lesser extent, on children of school age, since these are the only organisms credited with "aesthetic taste" or "appreciation of art." Nevertheless, we must not forget that the aesthetic behavior of the human adult has emerged out of an evolutionary process lasting millions of years and out of an intricate, gradual unfolding of psycho-

logical functions in the individual. So we must not overlook the presages of aesthetic behavior that can be in the playful and exploratory activities of animals and human infants.

That much can be found in the plant and animal kingdoms to appeal to our aesthetic sensibilities has long been affirmed by both artists and naturalists. Souriau (1965) instances many ways in which nonhuman organisms display some of the salient characteristics of art. These are (1) unity and purity of style (defined by Focillon [1934] as a "coherent set of forms united by a mutual appropriateness"); (2) combinatorial inventiveness (e.g., the immense variety of devices by which plants disperse pollen); and (3) the importance of appearance, even in plants with their extremely limited sensibility to stimuli. Souriau discusses the aesthetically satisfying arrangements of shape and color in the bodies and movements of plants and animals, the creation of coherently designed artifacts (such as the web of the spider, the grandiose nests of the termite, the constructions of the bowerbird), and the prevalence of self-display (threatening postures, courtship ceremonials, the gibbon teaching its young to brachiate in the tree tops).

The bearing of Souriau's illustrations on human aesthetic behavior raises, of course, many questions. We may find animals and what they do aesthetically appealing, but do these patterns have anything like the same significance for the animals themselves, not to mention plants? Most of the characteristics in question are products of heredity, whereas aesthetic behavior depends on interactions between inherited properties of the nervous system and learning. Nevertheless, something resembling aesthetic motivation can be discerned in animals below the mammalian level. When a range of variation is open, what we might consider the most aesthetically satisfactory alternatives seem often to be favored. Even in insects, an imperfection in form often impels corrective action: the potter-wasp notices and repairs flaws in a pot that it has made; when a spider's web has been altered, the weaving begins anew. Souriau dwells particularly on cases of role-playing—appeasement gestures, birds that feign a broken wing, the offering of symbolic gifts in courtship, and mock fights (described, p. 34, as "a step towards art, a great step"). We are reminded of theories like Lange's which see the essence of art in simulation coupled with an ability to distinguish between the simulacrum and the represented object.

The animal activities that come closest to human art, at least by some commonly accepted criteria, are the scribbling and painting of apes (D. Morris, 1962). Schiller (1951) studied a chimpanzee provided with a pencil and sheets of paper with colored patches on them. It soon became evident that the scribbling was by no means chaotic and random. There were strong inclinations to confine pencil marks to the interior of a

colored shape or group of shapes on the paper, to balance an off-center figure by marking a gap in, say, a circle or matrix of squares.

Several later investigators have worked with apes that were fond of finger painting or brush painting. Their products look remarkably like those of painters belonging to the Abstract-Expressionist, Tachiste, and Action painting current. Successful exhibitions of apes' paintings have been held. When Rensch (1965) showed some to experts on modern art, they assumed them to have been produced by human painters and "even praised their rhythm, tension and balance rather enthusiastically."

Morris lays down six principles that "apply to picture-making as a whole" from ape to human artist: (1) self-rewarding activation; (2) compositional control ("steadiness—symmetry—repetition—rhythm"); (3) calligraphic differentiation (gradual development of marks and lines into distinct shapes); (4) schematic variation; (5) optimum heterogeneity; (6) universal imagery, depending on a muscular factor ("certain movements of the arm and hand are pleasing and motorically gratifying, whilst others are awkward and difficult to make"), an optical factor ("certain visual arrangements and impressions are more acceptable to the optical apparatus than others"), and a psychological factor.

As we already observed in Chapter 10, what Morris called "self-rewarding activities" actually means behavior that produces rewarding stimuli. It has been shown by J. J. Gibson and Yonas (cited by E. J. Gibson, 1969, p. 446) that the act of scribbling appeals to children only when it leaves a visible trace. Apes, like human beings, are partial to drawing and painting because, when paper and paints or pencils are available, their arm muscles are capable of sufficient coordination to produce a large variety of visual patterns readily and to control their characteristics so as to maximize aesthetic pleasure. Both apes and human beings have at their disposal many ways of seeking out, or creating, aesthetically rewarding stimulus patterns. Animals below the primate level are also, if perhaps not quite so markedly, susceptible to the rewarding effects of indifferent stimulation, but, being physically incapable of pictorial activity, they have to make use of other means.

The rat, which is still the animal psychologist's favorite subject although other species are studied with increasing frequency, will spend considerable time examining a novel environment into which it is placed (Berlyne, 1960, 1966). The vigor of its exploration will steadily decline as exposure to the environment continues, and, when the rat enters an environment, it will explore more intensely the longer it has been since it was last in a similar environment and the greater the contrast between the present stimulus situation and what it has recently experienced. So the influence of novelty is unmistakable. If, after spending some time in a maze, a rat is taken out for a few minutes and then put back again, it

will prefer, all things being equal, to enter alleys that have undergone some change since the last encounter with them. If there are two or more alternative paths to the same goal (e.g., a dish containing food) or equivalent goals, a rat will tend to vary its itinerary from trial to trial. A simple response like pressing a lever can be effectively reinforced by the sight of a light going on or becoming momentarily brighter or by the sound of a click or a buzzer. And the reward value of these indifferent stimulus events is found likewise to depend on novelty (Berlyne, Koenig, & Hirota, 1966); it can be reduced by repeatedly subjecting the rat to them shortly before the experimental session begins.

As one might expect, novel features of environment will attract exploration most powerfully when an animal does not have more pressing concerns, such as hunger or intimations of danger. However, even the feeding of a hungry rat can be interrupted or delayed if something unusual occurs. In rats, as in human beings, exploratory approach is always susceptible to competition from fear and withdrawal, which offers another way of relieving disturbance due to a novel or otherwise arousing stimulus. Fear is likely to oust exploration when an animal is plunged into the midst of novelty, when novel stimuli are particularly varied and widespread (e.g., when the animal is on an elevated maze runway rather than in an enclosed alley), and when rats belonging to a wild rather than tame strain are studied. In other words, fear is likely to predominate over curiosity when stimulation is extremely rather than moderately arousing, which, as suggested in Chapter 8, may have something to do with the point of transition between rewarding and predominantly aversive arousal increments.

The importance of novelty has been demonstrated with many other species of animals confronted with toys and other unfamiliar objects. An animal will generally pay less and less attention to a particular object the longer it has been together with it, but interest in the object will be renewed if it reappears after being removed for some time. When a novel object is paired with one that has appeared before, especially in the recent past, the novel one is more likely to be approached.

After novelty, complexity seems to be the most potent influence on the exploratory behavior of animals like the rat. Rats tend to spend more time examining a box containing varied objects, and thus offering a multiplicity of stimulation, than the walls and floor of an empty box. They also learn to go down an alley that leads to an assortment of objects rather than down an alley that does not. In general, the complexity (e.g., the pattern in which walls and floors are painted) of part of a maze determines how long a rat will spend there. The actual way which behavior is affected is however rather complicated. There are indications that rats will seek exposure to more and more complex stimulation after some acquaintance with simple patterns (Dember, Earl, & Paradise, 1957;

Williams & Kuchta, 1957; Walker, 1964; Sackett, 1967), and much seems also to depend on the complexity of other environments to which the animals had been exposed, particularly during their early rearing. There have been reports that complexity of form affects self-exposure to indifferent visual patterns, e.g., that rats will press a bar more often to see a cross than to see a square and to see a square than to see a circle (Barnes & Baron, 1961), and that they will spend more time in a half of a box decorated with circles than in a half decorated with squares (Harrington, 1966). If checkerboard patterns appear when a rat sticks his head into an aperture, patterns of intermediate complexity (number of squares per unit area) will be inspected longest (Sales, 1968).

In animals of other species, more capable of manipulating objects than the rat, there is clearer evidence that regularity or irregularity of form and diversity of stimulation, as well as novelty, govern exploration. Rensch (1965) presented a crow, a jackdaw, and two monkeys with cards bearing black and white patterns and found those possessing bilateral or radial symmetry to be picked up more often than others. On the other hand, young chimpanzees will handle multicolored rectangular blocks more often than blocks of uniform color and blocks of heterogeneous color and shape more often still (Welker, 1956). Butler (1954) demonstrated that monkeys will push open a heavy door repeatedly for hours on end if this enables them to look out of a box in which they are confined. He found the response to be performed more eagerly when a moving toy train came into view than when there was nothing to see but an empty room.

So it seems, on the whole, that sometimes more complex and sometimes less complex stimulus patterns are more attractive to animals. This is what we would expect if there were, at any time, an optimal level of complexity, whose location depends on several factors.

## Infant behavior

The exploratory behavior of human infants shortly after birth has, since about 1960, become a topic of quite intensive investigation using more and more sophisticated equipment. This line of research reveals a capacity for discrimination long before subjects can be questioned about what they see or trained to associate different learned responses with discriminative cues.

It also shows how early collative stimulus properties can have motivational and directive effects. By about three months of age, the gaze of an infant is more strongly attracted by visual patterns containing more internal contour, e.g., checkerboards of smaller grain (Berlyne, 1958b). The preferred degree of complexity in this sense has, however, been shown

to increase with age. Newborn infants tend to spend more time looking at a  $2 \times 2$  checkerboard than at a  $4 \times 4$  or  $12 \times 12$  one (Hershenson, 1964). An  $8 \times 8$  checkerboard is most readily inspected at 8 weeks, and a  $24 \times 24$  one at 20 weeks (Brennan, Ames, Moore, 1966). Infantile exploration is also attracted with particular effectiveness by novel stimuli (Saayman, Ames, & Moffet, 1964; Zaporozhets, 1965), surprising stimuli (Charlesworth, 1966), and shapes of greater irregularity (Graefe, 1963).

## Novelty

*Subjective novelty* When terms like "novelty," "surprisingness," and "complexity" are used in scientific discourse, problems of definition and measurement crop up. In everyday speech (and, unfortunately, in much psychological writing), words like these often have several overlapping meanings, and some of their meanings are not delineated with much precision. Since the motivational effects of the qualities denoted by these words, particularly in aesthetics, hinge on the exact degree to which they are present and can in fact take opposite directions according to whether there is a little more or less of them, the task of devising measures for them has to be broached at quite an early stage of research.

In general, two approaches offer themselves. One is to adopt an arbitrary, easily computable formula from which a measure can be derived for different stimulus patterns and to find out how response variables are related to this measure, without worrying unduly about how close it may be to the concepts of ordinary language. Information theory provides many measures of this kind, derived from probabilities or relative frequencies, which are easily worked out provided that a sample space has been identified. The other approach is to present a representative sample of subjects with stimulus objects and, using one of the many available scaling techniques, to have them judge how far each of the objects possesses the property denoted by a particular word. It boils down to finding out how ordinary people use the word in question and how far the subjective variable reflected in their usage is related to physically measurable attributes of stimulus objects. This approach has a long tradition in psychology, dating back to the work of the psychophysicists of the mid-nineteenth century, who sought mathematical relations between physicochemical qualities of objects and human judgments of "brightness," "heaviness," "length," and so on. Although we could do with more experiments aimed directly at this question, there are plenty of indications that the subjective measures obtained in this way bear simple, regular relations to measurable aspects of nonverbal behavior, even in lower animals (see Blough, 1966).

An attempt to identify determinants of subjective or judged novelty

was made by Berlyne and Parham (1968), who carried out two experiments in which irregular colored shapes were presented for 9 secs each in various sequences and subjects were required to rate each stimulus, as soon as it appeared, on a 7-point scale ranging from "very familiar" to "very novel." Figure 13-1 presents two of the graphs from this study. Both of them present mean novelty ratings for sequences comprising eight consecutive presentations of one stimulus, then one presentation of a different stimulus, four more presentations of the first stimulus, and, finally, a second presentation of the other stimulus. In the left-hand graph, all the stimuli were of the same shape, but the color was green on presentations 9 and 14 and red the rest of the time. In the right-hand graph, the stimulus appearing during the ninth and fourteenth presentations differed in both color and shape from the one occupying the remainder of the sequence. The graphs illustrate three of the principal findings:

1. Subjective novelty declines gradually as a stimulus is repeated several times in succession (cf. the first eight presentations).
2. A stimulus is rated less novel when it resembles one that has been

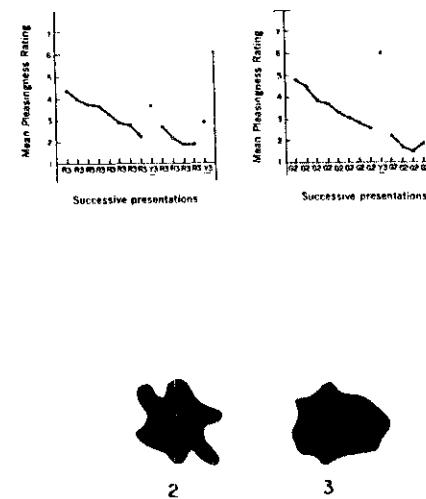


Figure 13-1 Some of the results from an experiment on subjective novelty. The numerals 2 and 3 labelling points on the horizontal axis represent the two shapes illustrated. The letters G, R, and Y represent, respectively, green, red, and yellow coloring (From Berlyne & Parham, 1968)

perceived within the last few minutes than when it does not (cf. lower values for the fourteenth presentation than for the ninth and higher values for the ninth and fourteenth presentations than for those immediately preceding and following them).

3. A stimulus is rated more novel the more it differs from what has just been experienced (cf. presentations 9 and 14 in the right-hand graph, involving change of color and shape, with presentations 9 and 14 in the left-hand graph, involving change of color only).

*Exploratory behavior* In an earlier experiment (Berlyne, 1958a), two animal pictures were projected on a screen side by side for 10 secs during each of ten successive trials. How long the subject's eyes were focused on each picture was recorded. On one side (the left-hand side for half of the subjects and the right-hand side for the others), the same picture (a distinct one for each subject) kept on reappearing, but different pictures occupied the other position for different trials. As Figure 13-2 shows, the subjects came to spend more and more time looking at the novel pictures and correspondingly less time looking at the recurring picture, which was becoming more and more familiar. A similar finding was obtained (Leckart, Briggs and Kirk, 1968) with choice rather than duration as the measure of exploration. Four- and five-year-old children were, on each of twenty consecutive trials, allowed to choose one of two windows behind which pictures could be seen. Different pictures appeared from trial to trial behind one window and the same picture repeatedly behind the other. Choice of the window offering the novel picture came

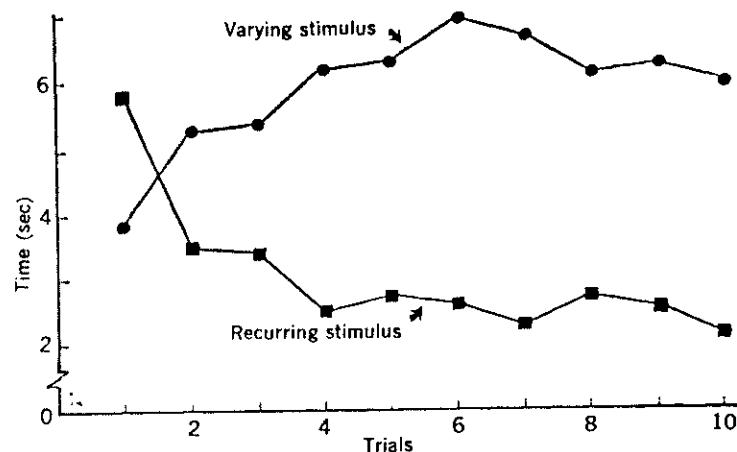


Figure 13-2 Mean time spent fixating novel (varying) and familiar (recurring) patterns when the two were presented side by side. (Adapted from Berlyne, 1958.)

to predominate more and more from the beginning to the end of the session.

These experiments illustrate the influence on the strength of exploratory behavior of novelty, manipulated through repetition. An experiment by Conners (1964) studied effects of varying the degree of disparity between the novel and the familiar. Adult subjects were first exposed repeatedly and intermittently to a particular "schema" stimulus, a black shape. This shape was paired on different trials with six other shapes representing six different degrees of discrepancy from it. The stimuli that drew the longest fixation were those that deviated to just a slight extent from the schema stimulus, suggesting that, as far as this aspect of novelty is concerned, moderate novelty attracts more exploration but extreme novelty attracts less. Developmental psychologists (e.g., Piaget, 1936) have noted that patterns differing just a little from well-known patterns seem most attractive to infants. Experimental observations of both apes (Hebb, 1946) and babies (Buhler, Hetzer, & Mabel, 1928) indicate that mixtures of familiar and unfamiliar elements can be violently disturbing and even terrifying. Relatively small discrepancies from familiar patterns can be expected to generate relatively strong arousal increments through conflict, and, in line with our earlier discussion, we should expect the extent of this arousal increment to determine whether the reaction takes a pleasurable or an aversive direction.

A study by Rabinowitz and Robe (1968) stands out because it was designed to isolate various forms of novelty, as well as other collative variables, and to reveal their separate effects. Fourth-grade children pressed any one of six buttons on each trial. One of six lights could be lit by any of five of the buttons, but pressing the sixth button (the response whose probability was the dependent variable of interest) had some different consequence. The results confirmed that choice of the sixth button was increased by having it operate a light of a different location from that operated by the other buttons, a light of a different color, or different lights on different trials. However, other predictions relating to effects of uncertainty, complexity (number of lights appearing at once), and stimulus change (a flickering versus a steady light), were not confirmed.

Several investigators (Haywood, 1962; Day, 1966; Leckart, 1967) have observed gradual decreases in exploration time as several pictures succeed one another. In other words, novel stimuli, after a succession of other novel stimuli, lose the motivating effects of novelty. Psychophysiological experiments (Kratin, 1959; Berlyne et al., 1963) have verified that successive novel stimuli become less and less able to revive a flagging orientation reaction.

On the other hand, there is an apparent disparity between the data

on exploratory behavior and the judgments of subjective novelty obtained by Berlyne and Parham (1968). Rated novelty was found by them to rise gradually, but to a statistically significant extent, over a series of patterns all differing in shape and color.

The experiments just cited all deal with short-term novelty. An experiment by Leckart (1966) shows that absence of long-term novelty can also depress looking time. Subjects who had been exposed to colored slides gave themselves shorter exposures to them 48 hours later than subjects who had not, and those who had seen each slide for 20 sec gave themselves shorter exposures than those who had seen each for 10 sec.

*Verbal evaluations* When the novelty of a stimulus pattern is progressively diminished through repetition, verbal judgments of pleasingness or expressions of preference are affected, but several different outcomes have been observed by different experimenters.

Two pertinent experiments (Berlyne, 1970c) resembled those (Berlyne & Parham, 1968) in which judgments of subjective novelty were obtained. Subjects were exposed to similar sequences of colored shapes, but, this time, some of them had to give a judgment of "pleasingness" and others a judgment of "interestingness" on every trial. On the whole, both subjective pleasingness and subjective interestingness varied directly with subjective novelty. In particular, both pleasingness and interestingness declined as an identical stimulus kept on reappearing. Cantor (1968) obtained a result pointing in the same direction. Children aged about 11 first saw 20 black and white patterns for 4 sec each and were later shown the same patterns together with 10 other patterns, being required to give each a rating between "strongly disliked" and "strongly liked." The patterns that had not been seen before were liked more than those that had been. A later experiment with preschool children (Cantor & Kubose, 1969) had a similar outcome.

However, some experiments by Zajonc (1968), as well as findings of other experimenters whom he cites, seem to have exactly the opposite implication, namely that familiar stimuli are more likely to receive a positive evaluation than novel ones. Various kinds of stimuli have been used and various kinds of judgments have been requested. For example, Zajonc himself has used Chinese characters and nonsense words mis-represented as Turkish adjectives, asking subjects to state whether each meant something good or bad, and photographs of male students, asking subjects how much they might like each man. Maslow (1937) obtained ratings of preference for paintings, miscellaneous items of office equipment, and Russian female first names. The results of these experiments were generally concurrent. Stimuli that had already been presented were judged more favorable the more frequently they had already been seen.

The experiments mentioned so far provided for a single judgment of each stimulus. Other experimenters, mostly with musical material, have

examined the trends that appear when a particular stimulus pattern is rated several times in succession. As Skaife's (1967) review of this literature shows, preference tends sometimes, notably when "popular" music is presented, to decline with increasing familiarity. But with repetitive hearing of jazz, classical, or contemporary music that violates traditional conventions, there is normally a rise in preference or a rise followed by a decline. Successive stages of unpleasantness, pleasantness, and indifference appeared when Alpert (1953) exposed subjects several times over to an unfamiliar rhythmic pattern. When experimenters have obtained a monotonic rise, the addition of further repetitions might very well have revealed the subsequent decline that other experimenters report.

On the whole, these experiments seem at first sight to support contradictory conclusions, namely a direct relation and an inverse relation between novelty and hedonic value. But other variables such as complexity might hold the key to this paradox. Skaife investigated this possibility with the help of repeated 16-note sequences that were designed to represent low, medium, and high levels of complexity. The low-complexity sequences were "composed to conform as closely as possible to regular melodies." The medium-complexity and high-complexity sequences were made up of eight notes each played twice, but, while the medium-complexity sequences started and ended on the tonic, the high-complexity sequences did not. It seems that the variable in question might more appropriately be called "surprise" than "complexity." A further limitation of Skaife's experiment, raising questions about how far the results can be generalized, is the fact that the initial preference ratings of the low-complexity sequences were higher than those of the medium-complexity sequences, while those of the high-complexity sequences were lower. Seven sequences of each class were presented during each of twenty sessions held several days apart. Subjects had to record judgments on a 7-point scale from "dislike very much" to "like very much." As the sessions succeeded one another, low-complexity sequences were liked less, high-complexity sequences were liked more, and there was no significant change for medium-complexity sequences.

The interaction between novelty and complexity was also investigated in two further experiments by Berlyne (1970c). The stimulus material consisted of black and white reproductions of more complex paintings (crowded canvases with many human figures), less complex paintings (portraits of single persons), more complex nonrepresentational patterns (containing many elements), and less complex nonrepresentational patterns (containing relatively few elements). The stimuli were projected on a screen for 4 secs at 4-sec intervals, and subjects had to mark a 7-point scale going from "extremely displeasing" to "extremely pleasing." In one experiment, subjects had to record a judgment every

time a picture was seen. The less complex stimuli were rated significantly more and more displeasing, while the ratings for the more complex stimuli did not change significantly on the whole, although, in one part of the experiment, liking for the more complex nonrepresentational pattern rose significantly. In a second experiment, for which a judgment was required only during the first and the tenth exposure to each pattern, the interaction was clearer: more complex and less complex patterns were liked about equally when first seen, but, after ten presentations, more complex patterns were liked more than at the start of the sequence and less complex patterns less. There were two subsidiary findings. There was a more pronounced tendency for ratings, even of more complex patterns, to decline when one pattern was repeated monotonously, rather than having its successive appearances interspersed with those of other patterns, and when subjects went through a second sequence that immediately followed a monotonous sequence.

Another way of manipulating novelty is to vary the degree of disparity between the stimulus of interest and some stimulus that has already appeared. This manipulation has likewise been found to affect preference ratings. For example, Haber (1958) made subjects immerse both hands in water of a particular temperature (the adaptation level) and then had them place their hands in water of different temperatures. They were to indicate which hand felt more uncomfortable. It turned out that water at the adaptation level, or very much warmer or colder, produced more discomfort than water of a temperature that exceeded or fell short of the adaptation level by 1 to 3 degrees. However, when adaptation levels were markedly above the normal skin temperature, any lower temperature was more comfortable than any temperature above it. Conners (1964), in the experiment already mentioned, had his subjects state which figure in each pair was "more aesthetically pleasing." He also observed eye movements. Verbal preference, as well as fixation time, was at a maximum for stimuli that differed slightly from the adaptation stimulus. These experimenters related their findings to McClelland's (McClelland et al., 1953) hypothesis that "positive affect is the result of smaller discrepancies of a sensory or perceptual event from the adaptation level of the organism; negative affect is the result of larger discrepancies."

One phase of Skaife's experiment was likewise designed to test this hypothesis, but the results did not accord with it very well. After hearing a sound sequence repeated over twenty sessions, Skaife's subjects were exposed to new patterns that deviated somewhat from those that they had been hearing repeatedly. The effects of the deviations depended on the trend that a particular subject's ratings of high-complexity sequences had so far shown: those whose ratings were "still rising on the twentieth day or had not declined after rise to a point of satiation" rated

the novel sequences unfavorably, whereas those "whose ratings had risen and then fallen almost to their initial level" rated them favorably.

*Novelty, pleasingness, and the Wundt curve* The findings that we have reviewed from experiments on novelty seem in general amenable to interpretation in terms of Wundt's curve. (Fig. 13-3).

With regard to repeated presentation, the curve is best read from right to left: a stimulus will have maximum novelty, and thus maximum arousal potential, when it first appears and will then represent less and less arousal potential as repeated presentation diminishes novelty. We should thus expect a stimulus that is highly novel to be judged unpleasant. Repetition should make it progressively less unpleasant and finally more and more pleasant until, after reaching a peak of pleasantness, it should become indifferent. As we have seen, a curvilinear trend of precisely this kind has been recorded by several experimenters working with music. As Skaife (1967), and other writers have pointed out with documentation, such a course of development has occurred several times in the history of music: particular harmonic or melodic practices are considered objectionable and proscribed at one period; they stir up protest when a few innovators begin to adopt them; they are then regarded as acceptable and enjoyable; and they finally become banal and insipid. Parallels can, of course, be found in all the other arts and, although factors like social climbing and the calculated promotion of innovation by economic interests play their part, this is the course taken by the fads and fashions that characterize so much of human life.

On the other hand, some experimenters have found a consistent rising trend with repetition. In these cases, we may suppose that novelty fell only from the high region, C, to the medium region marked B in

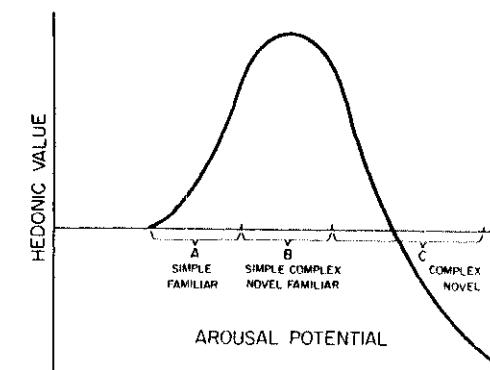


Figure 13-3 Effects of novelty and complexity on hedonic value interpreted in terms of the Wundt curve. (From Berlyne, 1970d).

Figure 13-3, so that the point corresponding to the peak was not passed, and that a further reduction of novelty would have introduced a reversal of the trend. At other times, a stimulus will begin with medium novelty (region B), so that the loss of novelty through repetition can entail only a steady decline in pleasingness to region A. This is what experimenters have sometimes found, e.g., with music that follows rather hackneyed formulas.

When novelty is manipulated through degree of deviation from the familiar, we can understand once again from the Wundt curve how an intermediate degree of deviation is preferred. And if a degree of deviation is related with approximate linearity to the scale used for the abscissa of Wundt's curve, we can see that the optimal degree of deviation would have to be rather slight, since the curve is asymmetrical and its peak comes relatively soon after the threshold has been crossed.

In line with our assumption that properties like complexity and surprisingness combine with novelty in raising arousal potential, we can expect a moderately novel stimulus that is complex or surprising to correspond to a part of the curve (region C in Fig. 13-3) where a decrease in novelty through repetition will increase hedonic value (presumably with a subsequent drop if familiarization proceeds further) and a moderately novel stimulus that is simple and not surprising to correspond to a point near the peak of the curve or to its left (region B), so that repetition reduces hedonic value. These expectations tally with the results of the experiments by Skaife and by Berlyne.

It will be remembered that Skaife, after presenting certain sound sequences again and again during sessions extending over several weeks, exposed a subject to variants of them. If ratings of the repeated sequences were still rising, the variants were disliked. If ratings of the repeated sequence had risen and then fallen, variants were liked. This again is precisely what the Wundt curve would lead us to predict. If hedonic value is still rising, which means that we are somewhere on the curve to the right of the peak, an increase in novelty will displace the corresponding point to the right, which means a drop in pleasingness. On the other hand, if a rise in pleasingness has been succeeded by a decline, the portion of the curve to the left of the peak must have been reached, so that an increase in novelty will mean a return towards the peak and thus an increase in pleasingness.

This interpretation has, however, a crucial implication. If familiarization were to proceed further, the hedonic value of complex patterns should reach a peak and then decline, whereas that of simple patterns should continue to sink steadily. This prediction was tested in a final experiment of the series by Berlyne (1970c) cited earlier. Subjects had to rate two simple and two complex patterns six times on a 7-point pleasingness scale. Between consecutive tests, they saw each of the patterns

eight times without having to record a judgment. The results confirmed that ratings of complex patterns rose and then fell after reaching a maximum at the third test. Ratings of the simple patterns fell throughout, with a final flattening out (Fig. 13-4).\*

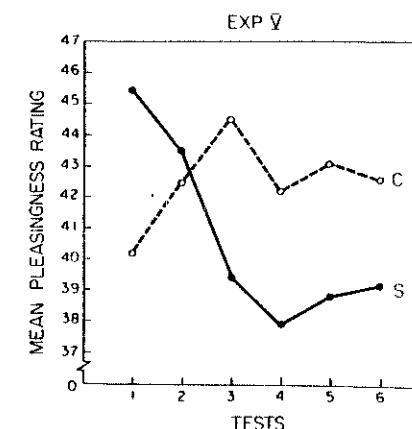


Figure 13-4 Mean pleasingness ratings for complex (C) and simple (S) patterns in successive tests. Consecutive tests were separated by eight presentations of each pattern. (From Berlyne, 1970d).

Despite these concordances, we must beware of imagining that everything can be so simple. There are at least two additional complications that can be expected to play a part.

First, the Wundt curve, as we are interpreting it, relates arousal potential to aversiveness or unpleasantsness and to the kind of reward value or pleasantness that results from a moderate arousal increment. In other words, as far as pleasantness and reward are concerned, the curve is pertinent to only one of the presumed mechanisms of reward, the one connected with the arousal boost and thus, we may conjecture, with direct activation of the primary reward system. Apart from indicating when the aversion system will be brought into play, and thus when something that reduces arousal will be rewarding, the curve has no bearing on the second mechanism of reward, the one connected with the arousal jag and disinhibition of the primary reward system through activation of the secondary reward system.

When novel stimulus patterns are perceived, we can expect the second as well as the first reward mechanism to come into play. Arousal due to novel stimulation can be reduced in either of two ways. First, there

\* Rather similar findings have been reported by Saegert and Jellison (1970).

is relief through habituation, through sheer dulling of the impact by repetition. Secondly, there can be relief through perceptual and intellectual processing, in consequence of which the conflicts induced by a novel pattern are resolved.

Furthermore, if a stimulus continues to recur after the point of indifference, corresponding to the left-hand extremity of Wundt's curve, is reached, the aversive effects of boredom due to monotony are likely to supervene, and these, we have noted, seem to involve resurgence of at least the noncortical aspects of arousal.

### Uncertainty, information content, surprise

Maddi (1961) has carried out an experiment that seems at first glance rather like Skaife's study of affective reactions to sounds. But this time, the focus was on effects of varying the order in which printed items of two kinds occurred. So novelty was not the only operative factor; there must also have been variations in the degree with which a particular item confirmed an expectation. In other words, uncertainty and surprisingness must have been involved. Subjects received booklets whose first 24 pages bore eight phrases to be used as sentence-completion stems and sixteen numbers. For one group, a number-number-phrase cycle was repeated regularly. "Hedonic tone" (which was judged from the content of the sentence completion) was negative at first (when uncertainty about what would follow each item was at its maximum), then positive (when uncertainty and surprisingness were declining), and finally negative again (when uncertainty and surprisingness must have been at a minimum). For another group, the order of items was irregular, and their hedonic tone remained slightly negative throughout. The uncertainty and surprisingness of the items must for them have remained about what they were for the other group towards the beginning of the sequence. After the first 24 pages, different subjects in the former group received sequences deviating to differing extents from the number-phrase order that had previously been maintained. A relatively small deviation (and thus a relatively small degree of surprisingness) generated more positive affect than a more marked deviation or no deviation at all.

Predictability-uncertainty and expectedness-surprisingness seem also to have been the operative dimensions in an experiment by Crandall (1967). Subjects were exposed repeatedly to sequences of nonsense words. The items had to be rated on a good-bad scale. There was evidence that words that aroused moderately strong expectations regarding what would come next (i.e., items of moderate subjective uncertainty) were rated higher than items permitting no prediction at all or items that left the subject in no doubt about what would follow. Moreover, there was a

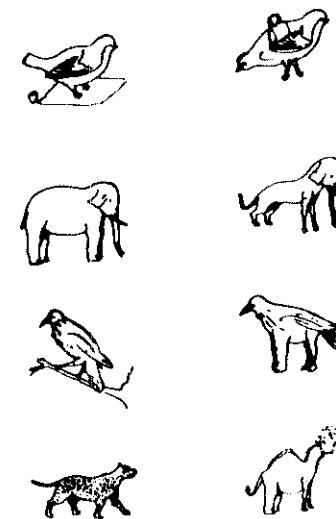


Figure 13-5 Patterns representing absence and presence of incongruity. (From Berlyne, 1958).

tendency for lower values to be assigned to items whose time of occurrence could not be predicted.

The incongruity variable is closely related to surprisingness, and several experiments (Berlyne, 1957, 1958, etc.) have shown incongruous pictures like those in Figure 13-5 to be inspected for longer than their normal counterparts. Nunnally, Faw, and Bashford (1969) have actually designed sets of pictures representing four different degrees of incongruity. They have confirmed that, when pairs of such stimuli are projected on the screen and eye movements are observed, the more incongruous the picture the greater the proportion of time for which it is fixated.

Cinematography of eye movements has shown that the gaze tends strongly to focus in turn on the areas of a picture that bear the highest load of information, on details that are unusual or surprising, on elements that indicate most clearly the nature of the scene or incident that is depicted (Yarbus, 1965; Mackworth & Bruner, 1966; Mackworth & Morandi, 1967). When subjects have to determine, either by vision or by touch, which of a known set of objects is placed in front of them, their eyes or fingers go to the parts of the pattern where differences among the alternatives are to be found (Sokolov, 1960; Zinchenko & Ruzskaia, 1966).

This concentration on informative points is, of course, likely to be preceded by an initial scanning, which runs diffusely over the whole

picture or object and enables the informative points to be identified. And it does not occur spontaneously in children until about the age of five.

## Complexity

*Subjective complexity* The experimental literature on motivational effects of visual complexity is by now quite voluminous, and many different kinds of stimuli material have been used. In the writer's laboratory, the patterns shown in Figure 13-6 have served in experiments with a diversity of techniques. These patterns were designed to sample a fair range of different kinds of patterns and the principal variables that the word "complexity" seems to cover. It will be seen that the patterns are arranged in pairs, whose right-hand members are more "complex" or "irregular" than their left-hand members. The precise property distinguishing the two members varies however from one category of pairs to another and is denoted by the caption under each category.

The variables corresponding to the different categories are logically distinct, in the sense that variations in one could occur without concomitant variations in another. Nevertheless, the effects of these variables tend, on the whole, to have similar motivational effects. The last three categories (XA, XB, XC) were introduced later than the other four categories, because all the patterns in categories A-D were relatively simple and it seemed desirable to add patterns representing a higher order of complexity.

Although the attributes sampled by these patterns were defined objectively in terms of physical and spatial characteristics, it is important to know how these characteristics relate to subjective or judged complexity. Day (1965) asked subjects to rank-order patterns in this collection according to their degree of complexity. He ascertained that the patterns could be divided into four classes, which represented progressively greater degrees of subjective complexity and had mean rankings differing significantly from one another. These four classes comprised (1) the left-hand members of categories A-D, (2) the right-hand members of categories A-D, (3) the left-hand members of categories XA-XC, and (4) the right-hand members of categories XA-XC (see Fig. 13-7a).

This line of investigation was carried further by Berlyne, Ogilvie, and Parham (1968), using the Shepard-Kruskal multivariate-scaling procedure. Subjects were required to examine the patterns in all possible pairings, decide which member of each pair was more complex, and rate the degree of difference in complexity on a 7-point scale. The difference ratings were then treated as geometrical distances and subjected to an analysis which, like factor analysis, locates the items with reference to a system of independent dimensions. After a principal-axes rotation

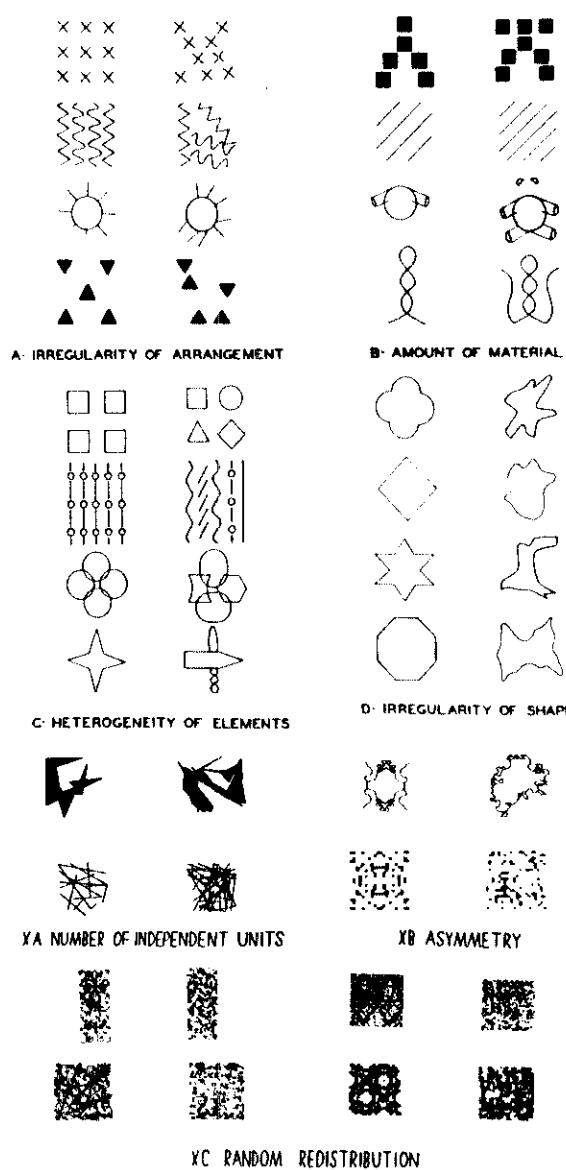


Figure 13-6 Patterns sampling complexity variables (From Berlyne, 1958, 1963).

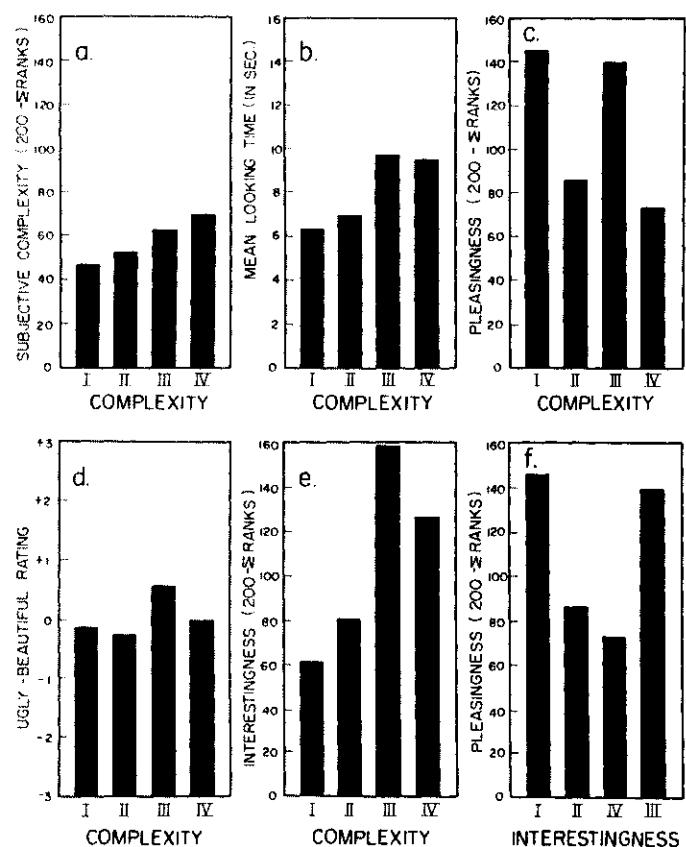


Figure 13-7 Bar graphs from various experiments on motivational effects of complexity. The Roman numerals labeling the horizontal axes represent: I left-hand (less complex) patterns from categories A-D, II right-hand (more complex) patterns from categories A-D, III left-hand (less complex) patterns from categories XA-XC, IV right-hand more complex) patterns from categories XA-XC (see Fig. 13-3). (a, c, e, and f after Day, 1965; b after Day, 1966; d from Berlyne & Peckham, 1966).

(a mathematical treatment designed to maximize the discriminative power of the first dimension), one dimension was found that accounted for 67.4 percent of the variance. The location of a pattern along this dimension depended both on the number of elements it contained and on the degree to which its elements were heterogeneous.

As we saw in Chapter 5, the information content of a pattern increases with the number of independently selected elements and is decreased by similarities or other interdependences (such as those imposed

by symmetry) among them. The findings, therefore, indicate that subjective complexity depends primarily on the two principal determinants of information content.

The Berlyne patterns have the disadvantage that each type of material is represented by two patterns only, so that only two points on a continuum are sampled. Other investigators have used collections of patterns that enable many points along a particular dimension to be probed, though at the cost of concentrating on one type of material and on variations in one particular attribute or at most one or two attributes. Munsinger and Kessen (1964) initiated the use, which has become more and more widespread in this line of research, of randomly constructed polygons with differing numbers of sides (Attneave & Arnoult, 1956) (see Fig. 13-8). Day (1967) has verified that subjective complexity, scaled by means of paired comparisons, increases with the number of sides up to at least 160 sides. If polygons are used, it is possible to introduce redundancy, while holding number of sides constant, in the form of reflectional symmetry. When Day (1968a) did this, he found that a symmetrical polygon was generally rated (on a 7-point scale) less complex than an asymmetrical polygon with the same number of sides but more complex than one with half as many sides (i.e., with the same number of independently located sides).

Another useful kind of material consists of variations on the checkerboard. On a surface of fixed area bearing black and white squares or rectangles, the number of elements of uniform color can easily be varied by varying their size. Redundancy can be manipulated by making the probability that a particular patch will be black or white depend on the color of an adjacent patch. It can vary from maximum redundancy (exemplified by the standard chessboard in which, once the color of a particular square has been identified, the color of every other square can be told) to a completely randomized distribution (in which the blackness or whiteness of each square may be determined by an independent coin toss). As expected, rated complexity has been found to increase with the number of elements and to vary inversely with redundancy (Houston, Garskof, & Silber, 1965; Karmel, 1966).

The extension of complexity scaling to sounds of equal subjective loudness (Berlyne, McDonnell, Nicki, & Parham, 1967; Parham, 1971) has yielded findings in line with what one might expect. Judged complexity increases with the number of component tones in a combination: chords of two or four tones are rated more complex than single sine-wave tones, and white noise more complex still. Judged complexity also increases with the extent to which component frequencies approach equal amplitude: white noise (in which all frequencies within a wide band are represented equally) is rated more complex than square-wave tones (each of which has a predominant frequency but many overtones).

and these in their turn are rated more complex than sine-wave tones in which one frequency appears alone. Judged complexity decreases to the extent that redundancy is introduced into sequences through statistical constraints (Mindus, 1968). It increases with the number of sounds in a sequence (Mindus, 1968) and with the number of different pitches, loudnesses, and durations represented in a sequence (experiments by J. B. Crozier—see Berlyne, 1971). So, with sound sequences as with visual patterns, subjective complexity reflects information content.

If subjective complexity depends on number of elements and on redundancy, we must expect it to vary not only from pattern to pattern but also from subject to subject with the same pattern. How many elements there are must depend on how the pattern is perceptually organized and on what groupings are formed (cf. the notion of "super-signs" to which we keep on returning). Redundancies may take some time to recognize, and, until perceptual processing has proceeded far enough, they can hardly play a part in determining how complex the pattern seems.

*Interaction of novelty and complexity* Random polygons that have not been seen before are judged to be more complex than polygons with the same number of sides that have already been exposed (Goldstein, 1961), and more complex polygons (i.e., those with more sides) are rated more novel (Eisenman, 1968). At first glance, these findings may seem to be two sides of the same coin, namely a close relation between novelty and complexity. But it must be noted that the former result concerns short-term novelty (whether or not a pattern has been seen within the last few minutes), whereas the latter refers to long-term novelty (i.e., the extent to which similar patterns have been seen before at all). It seems likely that familiarization reduces complexity through the perceptual processing that imposes organization on patterns, e.g., by grouping of elements (formation of super-signs). On the other hand, it is conceivable that objects with shapes resembling many-sided random polygons are seen less often in everyday life than shapes resembling simple polygons.

*Related measures* What has been said about relations between subjective complexity and redundancy lends significance to Götz's (1968) work. He began with a picture of a human face, composed of black and white squares, which can be assumed to have high redundancy. Black and white were then reversed in differing proportions of the squares, randomly selected. Subjective redundancy was calculated by exposing the component squares of each picture in order and asking the subject, after the color of each square had been revealed, how confidently he could guess whether the next square would be black or white. It turned out to be closely related to objective redundancy, which depended on the amount of distortion introduced into the original picture. Subsequently, the subjects were asked to rate the pictures for complexity. Subjective com-

plexity and subjective redundancy were inversely related as shown by a correlation coefficient of  $-.94$ .

Driscoll and Sturgeon (1969) prepared circles, containing segments of different numbers of colors and with different distributions of area among colors. According to our criteria, the circles should have been more complex the greater the number of colors and the more even their distribution. Treating proportions as probabilities, these experimenters computed an uncertainty value for each stimulus. Subjects were then asked to report, on a scale ranging from 0 (no uncertainty) to 100 (highest uncertainty) the amount of uncertainty they felt when confronted with each stimulus. They were told that "uncertainty is analogous to chaos or complexity. The more complex a stimulus the higher the uncertainty you will experience." Subjective uncertainty increased with objective uncertainty up to value of 2.8 bits, which, according to previous work, represented a limit of channel capacity. Beyond that level, it seemed to vary inversely with the proportion taken up by the predominant color.

*Exploratory behavior* Three different techniques have been used to find out how long human subjects will spend looking at patterns when they have no special reason to do so, i.e., no act to perform depending on the nature of the patterns and no expectation that they will later be required to recall information about them:

1. The subject is given control over a key that operates a tachistoscope. Every time the key is pressed, a pattern is visible for a fraction of a second, and the subject gives himself as many brief glimpses as he wishes before calling for the pattern to be replaced by another (Berlyne, 1957).

2. A pair of patterns is displayed on a screen side by side, and eye movements are observed or recorded, so that the amount of time spent fixating each pattern can be ascertained (Berlyne, 1958).

3. The subject is given control over a button operating an automatic projector. Each pattern remains on the screen continuously until the subject presses the button, causing it to be replaced by another pattern (Berlyne & Lawrence, 1964).

Experiments using all three of these techniques with the Berlyne patterns have shown that more time is spent viewing the complex member of a pair (Berlyne, 1957, 1958a, 1958b; Smock & Holt, 1962; Berlyne & Lewis, 1963; Minton, 1963; Berlyne & Lawrence, 1964; Clapp & Eichorn, 1965). Day (1966) compared looking time for the four classes of material, representing progressively greater complexity, that his rank-ordering experiment had distinguished (see Fig. 13-7b). The means increased with complexity, except that the mean for class 4 (more complex members of category XA-XC), was slightly lower than that for class 3 (less complex members of the same categories). There is thus a hint that, at least in some conditions, looking time may level off or even decrease when com-

plexity becomes extremely high. Findings have been equivocal on this point (cf. Berlyne & Lewis, 1963; Berlyne & Lawrence, 1964; Day, 1965).

A tendency for looking time (measured with the automatic projector technique) to increase with complexity has also been confirmed with other kinds of material. Displays bearing several polygons dotted about a white field attract longer inspection the more numerous the polygons (Brown & O'Donnell, 1966; Brown & Gregory, 1968a). Looking time also tends to increase with the angular variance of the polygonal components (Brown & Lucas, 1966; Brown & O'Donnell, 1966). Day (1968) found that time spent inspecting polygons increases steadily as the number of sides rises from 4 to 90. He also discovered that symmetrical polygons were viewed for a shorter time than asymmetrical polygons having the same number of sides.

It may be objected, especially by somebody primarily interested in aesthetics, that these experiments are of doubtful relevance to everyday life, since both the stimulus material and the conditions which the data were collected were highly artificial. The force of this objection has, however, been somewhat blunted by a number of findings. In an experiment by Murray and Brown (1967), looking times obtained with the usual automatic-projector technique were compared with those of subjects who saw the patterns on the pages of a looseleaf binder and did not know that they were being watched. The looking times were very similar whether the laboratory technique or the more natural situation was used. Faw and Nunnally (1968) observed children's eye movements through a one-way screen without their knowledge, and the tendency, revealed by earlier experiments, for looking time to increase with incongruity was demonstrated once again. Monotonic increases in looking time with complexity have also emerged in experiments using pictures of landscapes, urban environments, or objects, and reproductions of non-representational paintings, which had been previously scaled for complexity by other subjects (Leckart & Bakan, 1965; Leckart, 1966; Wohlwill, 1968).

Experiments studying exploratory choice, rather than exploratory duration, with visual patterns have verified that complexity is once again an influential variable. But subjects do not always select exposure to the most complex stimulus that is available. Hoats, Miller, and Spitz (1963) used some of the Berlyne patterns and some similar ones that they designed themselves. Their technique required children to look at the two patterns of a pair for 3 sec each and then to select one of the two for further viewing. Both normal and retarded children chose the less complex items significantly more often. Berlyne (1963) modified this procedure somewhat. The patterns belonging to a pair were first exposed in succession on a screen (with the more complex preceding the less complex and vice versa equally often), and the subject was then to choose

one of the two patterns to see again for as long as he liked. Subjects chose the less complex member of a pair significantly more often after initial exposures lasting 3 sec, but the more complex member was more likely to be chosen after initial exposures of 0.5 sec. Kiekheben (1966) constructed an apparatus in which shapes underwent gradual changes. Subjects were allowed to press a button, causing the changes to cease for a while, whenever they wished. It was found that they tended to keep the patterns stationary at times when they had reached regular, symmetrical forms.

Two possible explanations of these findings suggest themselves. First, the situations in which less complex patterns were chosen predominantly were ones in which subjects had no cause to wonder what the patterns they could choose to see would be like. This was either because they had already had enough exposure to them to become acquainted with them or because (as in Kiekheben's experiment) the patterns were undergoing progressive changes that enabled future configurations to be anticipated. In these conditions, exploration will not be motivated primarily by perceptual curiosity. It will therefore be classifiable as diversive exploration (see Ch. 9), and the degree of complexity that attracts most diversive exploration may well be relatively low. In Berlyne's experiment, the group with 0.5-sec preliminary exposures can hardly have had time to identify the patterns before making a choice. They will therefore have been left with appreciable curiosity, and their inclination to choose the more complex pattern for further viewing might be attributed to the greater uncertainty, and therefore curiosity, generated by the tantalizingly brief glimpse of this pattern.

However, some recent experiments (Berlyne & Crozier, 1971) implicate the arousal potential of prechoice stimulation as a decisive factor, even when it differs markedly from what will follow the choice. The procedure required the subject to press either of two keys on each of 50 trials. One key always exposed a highly complex pattern on a screen, and the other key a markedly simpler pattern, the two alternatives being the same throughout the 50 trials. When a 3.5-sec period of near-darkness preceded the choice, subjects performed the response exhibiting the more complex pattern on almost 70 percent of the trials. This was so whether the postchoice exposure lasted 1.5 sec or 5 sec, and one can safely assume that curiosity about the patterns had been quenched after a few trials. Nevertheless, the tendency to choose the more complex pattern persisted. The outcome was much the same when the choice was preceded by 3.5 sec of exposure to the same two patterns, side by side. When, however, prechoice stimulation was enriched, the probability of choosing to see the more complex pattern decreased significantly. After exposure of a colored picture of a tourist attraction, the same for every trial, the percentage of responses producing the more complex pattern

went down to 62 percent. It went down still further to just over 50 percent when the novelty of the prechoice stimulation was continually renewed by displaying a different colored picture before each successive choice.

Subsequent experiments (unpublished) indicate that the effects depend on the information-processing demands of the prechoice stimulation. The proportion of more complex choices is reduced by listening to excerpts from a tape-recorded story but not by bursts of white noise or light music.

Be that as it may, the upshot is that lack of stimulation or excessively familiar stimulation before the choice will make a subject more likely to seek exposure to relatively complex patterns. In this kind of situation, the operative motivational condition is classifiable not as curiosity but as boredom. It is known that several hours of sensory deprivation strongly incline human beings to seek out complex, variable, and unpredictable stimulation (e.g., Jones, Wilkinson, & Braden, 1961). It now seems, however, that even a few seconds of low arousal potential can impel a compensating search for rich stimulus input, as if a moderately high average level of stimulation had to be maintained even over short periods. The same conclusion is supported by a finding that Leckart and others (1970) have reported. Subjects were left in darkness lasting for periods from 2 to 44 sec before viewing an irregular 18-sided polygon for as long as they wished. Looking time increased significantly with the duration of prior darkness.

Although most research on exploration by far has concentrated on visual stimulation, a few investigators have turned to sounds. Simon and Wohlwill (1968) presented four musical passages and two variants of each, representing two degrees of simplification resulting from melodic, harmonic, or rhythmic changes. Subjects chose to hear the original, most complex versions more often than the simplified versions. Overmier (1962) permitted subjects to switch freely from one of five sequences, each comprising 15 tones, to another. The sequences were of varying complexity, ranging from 15 repetitions of one pitch through uneven distributions to a sequence of 15 different pitches. Listening time rose from the simplest to the second most complex sequence and then declined at the highest complexity level. In an experiment by Duke and Gullickson (1970), children chose to hear sequences of alternating pitch more often than repetitions of one pitch.

In our laboratory, two of the techniques that have been used with visual patterns have been adapted for use with auditory stimuli. Listening time is measured by exposing a subject to a succession of sounds or sound sequences and allowing him to hear each for as long as he likes before pressing a button to replace it with the next. Exploratory choice is recorded by presenting two sounds or sound sequences in turn and requir-

ing the subject to decide which sound to hear again or which sequence to hear resumed, pressing one of two buttons to put his choice into effect. With sound sequences, both listening time and the probability of exploratory choice increase with variability (information content) and rated complexity, although there are hints of a decline in both measures towards the upper extreme of complexity (experiments by J. B. Crozier—see Berlyne, 1971). There is, however, no relation between complexity and either of the two exploratory measures when single sounds (tones, chords, and white noise) are used (Parham, 1971). Then, the two measures, which turn out to be quite highly correlated with each other, depend rather on factors like consonance and pitch, lower sounds tending to attract more exploration.

When subjects are exposed to visual patterns or to sequences of sounds, the components are recognized and can be related to one another, compared with one another, and grouped together. We may assume that these activities occur during exploratory inspection and that they will take longer the more complex the pattern is. A simultaneous sound combination is, however, likely to be perceived as a unity (like a simultaneous color combination); its components will be discriminated only in unusual circumstances and to a limited extent, e.g., when a musician is attempting to identify the constituent notes of a chord or the individual instruments in an orchestral passage. So the processes responsible for the link between exploration time and complexity will be lacking.

*Verbal evaluations* Two kinds of verbal evaluative judgments have been investigated in connection with complexity. Some experiments have required subjects to indicate how "pleasing," "good," or "beautiful," patterns are or how much they "like" or "prefer" them. These words seem, on the whole, to produce rather similar results (Berlyne & Peckham, 1966; Day, 1968a; Day & Crawford, 1969; Evans & Day, 1971; Berlyne & Boudewijns, 1971), whereas judgments of "interestingness," solicited in other experiments, behave differently. Only the first kind of judgment might at first glance seem relevant to aesthetics. But we must give due consideration to Chernyshevski's (1855) contention that "the sphere of art is not limited only to beauty . . . but embraces everything in reality . . . that is of interest to man." Much innovative modern art is generally judged to be "interesting." This is admittedly sometimes meant as a noncommittal, patronizing evaluation that conceals reservations, but not always. Many contemporary artists would not expect their works to be classed as "beautiful" and might even take umbrage if they were. But they would surely want them to be considered interesting.

Judgments recorded in early experiments (Berlyne, 1963; Berlyne & Lawrence, 1964) with the Berlyne patterns indicated that more complex members of pairs tend to be more interesting but less pleasing or "preferred." Eisenman (1966) has reported congruent results. He used poly-

gons of 4, 12, and 24 sides. Those rated most pleasing had, on the average, fewer sides than those rated least pleasing, and the opposite held for ratings of interestingness.

Day's (1965) subjects rank-ordered Berlyne patterns for pleasingness or for interestingness. Approximately equal peaks of pleasingness appeared in the first and third of the four complexity classes (Fig. 13-7c). A rather similar picture emerged when Berlyne and Peckham (1966) had subjects rate the patterns on a 7-point "ugly-beautiful" scale (Fig. 13-7d). However, Day's interestingness distribution showed a single peak in the third class (see Fig. 13-7e).

Experiments by Garner (Garner & Clement, 1963; Handel & Garner, 1966) have related judged "goodness" to redundancy. The patterns with

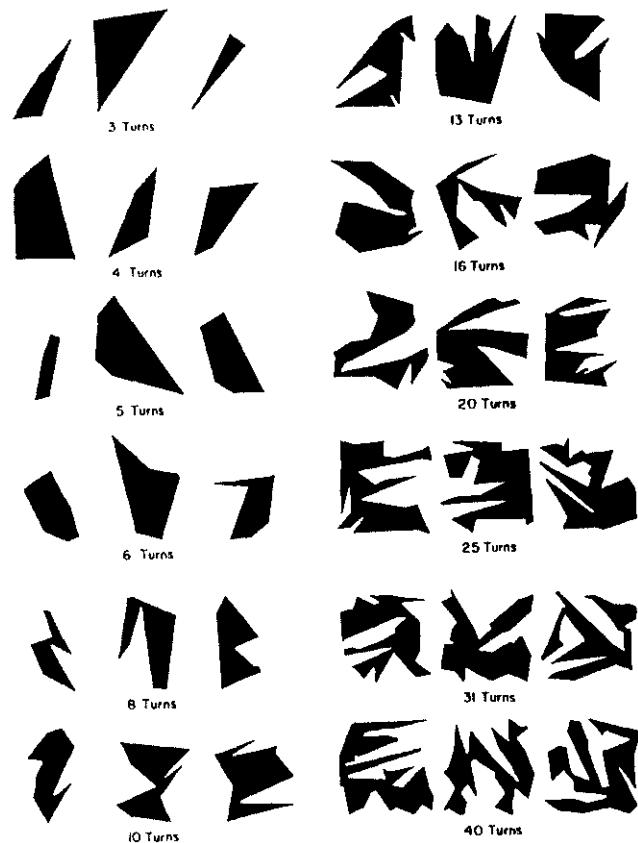


Figure 13-8 Random polygons used in experiments by Munsinger and Kessen. (From Munsinger & Kessen, 1964).

high ratings were those that are placed in large groups when subjects are told to place similar patterns together, and they tend to be ones left unchanged by rotation and reflection. Prinz (1964), presenting dot patterns to German-speaking subjects, found judged "goodness" or "*Prägnanz*" to be positively correlated, and judged "interestingness" to be negatively correlated, with redundancy.

Munsinger and Kessen (1964) used paired comparisons and rating scales to measure degree of liking for polygons of 3 to 40 sides (Fig. 13-8). In several experiments, peaks were found at 3 sides, 10 sides, and towards the top of the range (Fig. 13-9). The uppermost peak seemed to be connected with "meaningfulness. When this variable was measured by having subjects list objects of which each shape reminded them, and the

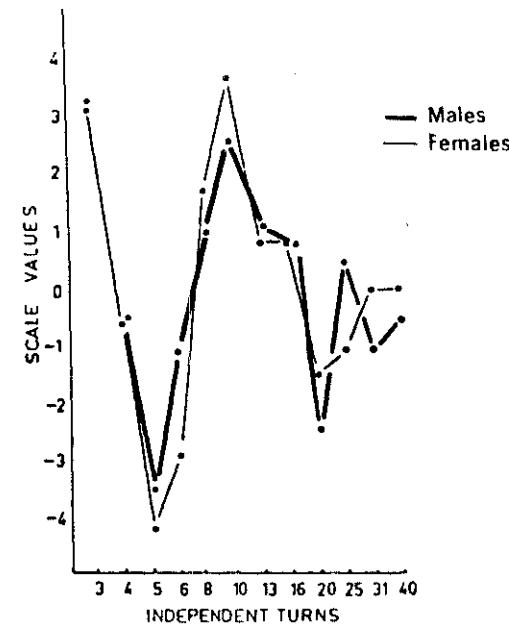


Figure 13-9 Mean preference ratings of random polygons with varying degrees of complexity. (From Munsinger & Kessen, 1964).

evaluative ratings were corrected accordingly, this peak disappeared. Further, symmetrical polygons turned out to be more meaningful in this sense than their asymmetrical counterparts, and, as far as they were concerned, the preferred levels of complexity tended to be high. But the partiality for triangles could not be explained in this way.

Other experiments (Hershenson, Munsinger, & Kessen, 1961; Munsinger, Kessen, & Kessen, 1964) showed the most liked degree of complexity to increase with age up to six or seven years. Thomas (1966), however, obtained findings that did not tally with those of Munsinger and Kessen, even though he used similar stimulus material. Up to sixteen years of age, liking, measured through paired comparisons, increased monotonically with complexity up to 40 sides. From seventeen to nineteen years, the curves were nonmonotonic, with a single peak that moved further and further away from the upper extreme of complexity. Some differences in procedure or subject population must presumably have been responsible for the disagreements between the data from the two laboratories. But it is not clear what they are. Thomas did not find evidence of a secondary peak with very simple shapes except for one nineteen-year-old group.

Day (1967, 1968a) has extended this work, introducing polygons of up to 160 sides and soliciting judgments of interestingness as well as pleasingness. He has likewise obtained pleasingness curves with several peaks, although the highest pleasingness ratings tended to come within the middle range. Interestingness continued to rise as complexity rose, although there was something of a tendency to level off or decline as the upper extreme of complexity was approached. Symmetry increased both interestingness and pleasingness. That symmetrical shapes are generally preferred to asymmetrical ones has also been confirmed in two investigations by Eisenman (1967a, 1967b).

With yet another kind of material, namely subdivided squares, a bimodal curve relating judged pleasantness to complexity was obtained by Terwilliger (1963), although there was also evidence of a generally inverse relation between the two variables.

Curves shaped roughly like an inverted U, with intermediate levels of complexity preferred to the highest and lowest levels, have emerged from experiments with a great variety of stimulus material. Dorfman (1965; Dorfman & McKenna, 1966) obtained one with matrix patterns differing in size of grain; Vitz (1966b) with random combinations of line segments; Wohlwill (1968) with pictures of physical environments and reproductions of nonrepresentational paintings that had been scaled for complexity; Rump (1968) with reproductions of Mondrian paintings and designs composed of quadrilateral units; Vitz (1966a) with tone sequences differing in numbers of frequencies, numbers of durations, and numbers of loudnesses; Werbik (1969) with tone sequences constrained by differing

degrees of redundancy; and Kamman (1966) with poems.

In Kamman's experiment, complexity was estimated with help of the Cloze procedure: every fourth word in a poem was deleted, and subjects had to guess the missing words. Complexity was taken to be higher, the fewer the correct guesses. This procedure seems actually to measure redundancy, the extent to which a word can be predicted from its context. Evans (1969) has found a close positive correlation between ratings of prose paragraphs for complexity and the number of incorrect insertions of words in a Cloze test. He also obtained inverted U-shaped curves relating judgments of pleasingness, preference, and interestingness to the complexity of paragraphs. In two experiments by Eckblad (1963, 1964), the attractiveness of a guessing game bore an inverted U-shaped relation to uncertainty.\*

Experiments by Walker (1970) revealed an inverted U-shaped relation between degree of liking and previously scaled complexity for black and white graphics. But liking increased monotonically with complexity for stage sets and modern paintings and decreased monotonically with black and white reproductions of tartan patterns. Similarly, Osborne and Farley (1970), using reproductions of well-known nonrepresentational paintings, found both art students and educational-psychology students to express greater preference for the pictures that were judged to be more complex. Such findings can, of course, be reconciled with the assumption that the underlying function for all these kinds of material had the shape of an inverted U but that, in some cases, only part of the range of possible complexity was sampled, so that only monotonic increasing or monotonic decreasing portions of the curve appeared.

An experiment by Hubbell (1940) represents a rare application to an aesthetic problem of Fechner's method of production. Subjects were shown some visual patterns and were required to change them in such a way as to make them maximally "pleasing" or "good." Since 94 percent of the changes constituted additions of features, it can be said that they tended to make the patterns more complex in our sense. However, Hubbell concluded that the added features introduced greater "differentiation . . . balance, unity, simplicity, symmetry. They emphasized natural subdivisions and regularities." It seems clear therefore that the increase in number of elements was offset by increased organization and structure.

Mindus (1968) found rated interestingness to increase with redundancy for 8-tone sequences but to be inversely related to redundancy

\* Humor has many affinities with aesthetic phenomena (Berlyne, 1960, 1969) and has not infrequently been subsumed under "aesthetics." There is therefore some interest in the finding (Zigler, Levine, & Gould, 1966, 1967) that children's "mirth" responses reach maximum intensity when jokes are moderately difficult to comprehend and are thus "at the upper limits of the individual's cognitive capacity."

for 4-tone sequences. This result may signify that sequences with a moderate information content are most interesting, so that highly redundant short sequences contain too little information and randomized long sequences contain too much. As for single sounds (Berlyne et al., 1967; Parham, 1971), interestingness increases, on the whole, with judged complexity. White noise, however, is rated distinctly less interesting than musical sounds even though it is rated more complex. Ratings of interestingness also resemble ratings of complexity when applied to sound sequences differing in variability or information content (experiments by J. B. Crozier—see Berlyne, 1971).

Techniques of multivariate statistical analysis have their own contributions to make to this area of inquiry, although they allow only monotonic relations between variables to emerge and mask the kinds of curvilinear relation that we have been discussing. The application (Berlyne, Ogilvie, & Parham, 1968) of the Shephard-Kruskal procedure to subjective complexity has already been mentioned. In the same experiment, other subjects were asked instead to judge the degree of difference between the patterns either in pleasingness or in interestingness. With respect to interestingness, the first dimension accounted for 61.4 percent of the variance, and, with respect to pleasingness, it accounted for 51.6 percent. One important finding was the high consistency of judgments among subjects. Furthermore, the locations of patterns along the first pleasingness dimension and the first interestingness dimension were highly correlated with each other and with locations along the first complexity dimension. These findings indicate that, although subjects vary in taste and thus in degree of preference for particular patterns, they generally agree about the properties on which pleasingness and interestingness depend. Where patterns are located with respect to these properties has a great deal to do with where they are located with respect to complexity, so that, at least with the kind of material sampled by the Berlyne patterns, complexity is confirmed as an outstanding determinant of pleasingness and interestingness.

Eysenck (1968) arranged for 160 industrial apprentices to rank-order polygons, taken from Birkhoff's (1932) book, for degree of preference and carried out a factor analysis of the results. He extracted a third-order factor, which opposed "simple" polygons ("characterized by right angles, small number of nonparallel sides, and familiarity") to "complex" polygons ("characterized by angles other than right angles, large number of nonparallel sides, and lack of familiarity"). This finding also implies a strong connection between complexity and preference, although the actual correlation between the mean preference for a particular pattern and its loading on the complexity factor was significant but moderate—+.29. Eysenck asserts that his findings fit the formula he had proposed earlier (1941) for prediction of preferences, namely  $O \times C$  (where  $O$  or

order is identified with the presence of symmetry and  $C$  is complexity [see Ch. 10].

*Uniformity in variety* We saw in Chapter 10 how many writers have resorted to "uniformity in variety" and other, equivalent expressions to capture the essence of beauty or aesthetic appeal. Such expressions can have several different interpretations. But one meaning, which corresponds to an extremely widespread feature of works of art in all media, is the juxtaposition of elements possessing both similarities and differences.

In a series of experiments (Berlyne & Boudewijns, 1971), designed to study effects of this feature on hedonic judgments, visual patterns composed of two elements were presented on a screen. Each element could be either square or circular, red or green, large or small, and solid or pierced. Consequently, the two elements could differ in 0 to 4 properties, resembling each other in the remainder. When the two elements constituting a pattern were displayed side by side for 5 sec, pleasingness tended to vary inversely with a number of differences between the elements, whereas interestingness varied directly with the same variable and judgments on a "dislike-like" scale were not significantly affected by it. When, however, the two elements of a pattern appeared successively in the same location for 5 sec each, interestingness still increased with the number of differences, but both pleasingness and liking followed inverted U-shaped curves.

Other subjects were required to rate the patterns for complexity. With both simultaneous and successive presentation of elements, the complexity curves rose with some negative acceleration as the number of differences increased. The curve for successive presentation was parallel with that for simultaneous presentation but significantly lower.

Some synthesis of these findings can be achieved by plotting the mean hedonic ratings against the mean complexity ratings for the five categories of patterns in both sets of experiments. This is done in Figure 13-10. It will be seen that the curve for pleasingness is bow-shaped, and the liking curve is close to it but more irregular. Interestingness, on the other hand, shows a rise with a leveling off. There is thus some support for the view that pleasingness and liking are maximal when both similarities and contrasts are present. A connection is thus established between the time-honored aesthetic principle of "uniformity in variety" and the experimental literature in which curvilinear relations between hedonic judgments and complexity have so often turned up.

### Interrelations of pleasingness and interestingness

Some of the studies that have been reviewed suggest that pleasingness and interestingness vary inversely with each other, and some suggest

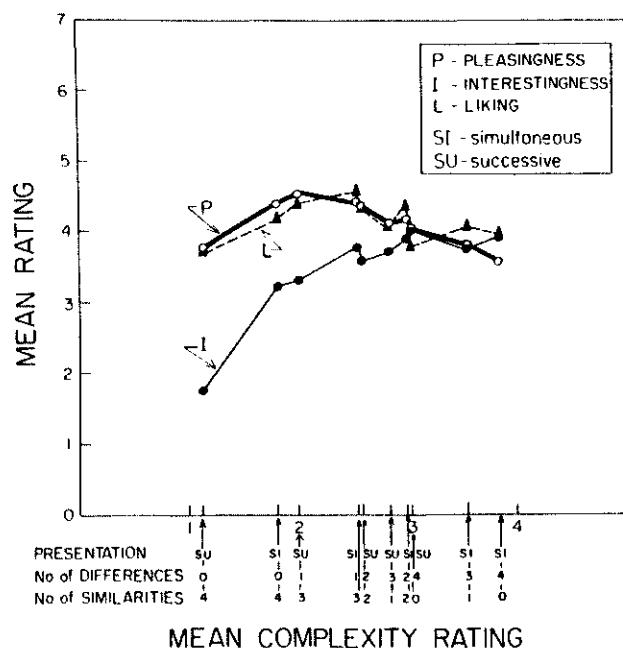


Figure 13-10 A synthesis of results from experiments on hedonic effects of uniformity in variety. (From Berlyne & Boudewijs, 1971).

that they vary directly with each other. But those that have investigated the relation between the two most thoroughly make it clear that pleasingness and interestingness are not the same thing and that the relations between the two are complicated. We must make at least some tentative efforts to unravel them.

An initial clue may be gathered by going back to Day's (1965) experiment and rearranging Figure 13-7a, placing the four classes of patterns in order of increasing interestingness instead of in order of increasing complexity. Figure 13-7f is then obtained. As will be seen, there is now a U-shaped distribution, suggesting that a pattern can be judged highly pleasing for either of two reasons—because it is very interesting or because it is very uninteresting. Miss G. Smets of the University of Louvain in Belgium also found two peaks of judged pleasantness coinciding, respectively, with high and low interestingness. She used patterns made up of black or white squares, which were designed to represent redundancy levels from 0 percent to 100 percent. To scale redundancy, subjects were shown a pattern for 2 sec, and the percentage of errors when they were later required to reproduce it was ascertained.

In the curves that Day (1967) derived from his studies of polygons, one pleasingness peak seems usually to be found in the vicinity of the peak of interestingness, but the simplest polygons are rated relatively high for pleasingness and low for interestingness.

So it seems that visual patterns that are extremely simple or high in redundancy—i.e., those that the Gestalt school would presumably have classed as "good" or "*prägnant*"—are pleasing but uninteresting. On the other hand, patterns that are found both pleasing and interesting are ones that possess a great deal of complexity but also a great deal of internal organization, so that perceptual effort can make something of them.

We are thus encouraged to speculate that a pattern will be judged interesting if it induces a certain amount of disorientation and cannot be assimilated immediately but there is promise of success for attempts to process the information contained in it. In other words, such a pattern has some internal structure waiting to be apprehended and redundancies, similarities and other relations among its elements that take some time to be recognized.

For example, in symmetrical patterns, there are clearly relations between parts that will become apparent if they are inspected for long enough. Munsinger and Kessen (1964) found, it will be recalled, that symmetrical patterns are more "meaningful," and Day (1968a) found symmetry to increase interestingness as well as pleasingness, although extremely simple symmetrical shapes were still judged to be rather uninteresting.

In Berlyne's (1963) experiment, the general tendency for more complex members of pairs to be judged more interesting was reversed in the case of category XC (see Fig. 13-6). The more complex items in this category are extremely chaotic, so that even protracted inspection cannot make much sense of them. They are, in fact, so complex that they begin to look simple and uniform.

The foregoing speculations relate interestingness primarily to the arousal-jag or arousal-reduction mechanism of hedonic value. We may surmise, on the other hand, that simple patterns, which are considered pleasing but not interesting, produce arousal boosts and activate the arousal-increase mechanism of hedonic value. Their impact raises arousal moderately, but their nature is apprehended so quickly that there is no disorientation to be relieved.

As a simple visual stimulus (an irregular shaped patch of color) appears repeatedly, the interestingness curve, like the pleasingness curve, undergoes a rapid decline and then flattens out (Berlyne, 1970d). With more complex material, the pleasingness curve (as mentioned earlier in this chapter) has a quite different shape, showing a rise followed by a fall. It is conceivable that, at higher levels of complexity, interestingness

also goes up and then down as familiarization proceeds. Be that as it may, the prospects of further extraction of information must virtually disappear after a few exposures of a simple pattern, which can account for the steep drop in interestingness.

Experiments with single sounds (Berlyne et al., 1967; Parham, 1971) reveal no clear relation between pleasingness and interestingness. The latter is correlated with judged complexity, but the former is not. With regard to single sounds, there seems to be nothing quite corresponding to the "good *Gestalten*" of vision, no low level of complexity making for relatively high pleasingness combined with low interestingness. This may be because pure tones, the simplest sounds of all, possess no perceptible structure, whereas any simultaneous combination of tones will, as was noted earlier, normally merge into a perceptual unity. With regard to sound sequences, however, significant positive correlations have been found to link ratings of complexity, pleasingness, and interestingness (unpublished experiments by J. B. Crozier—see Berlyne, 1971).

*Pleasingness, interestingness, and exploration* Turning to exploratory behavior, we recall that specific and diversive exploration seem likely to depend, respectively, on an arousal-reduction (relief-of-curiosity) mechanism and an arousal-increase (arousal-boost) mechanism.

Looking time, measured for example with the automatic-projector technique, seems to reflect largely the duration of efforts to assimilate and organize a visual pattern on first encountering it. Consequently, it can be regarded primarily as a measure of specific exploration. Its close relation with interestingness is apparent. The bar graphs or curves that relate looking time to complexity are rather similar to those that relate judged interestingness to complexity (Day, 1965, 1966, 1967, 1968). The Berlyne patterns producing both the longest mean looking time and the greatest mean interestingness are those in complexity class 3 (cf. Fig. 13-7b and 13-7e). When polygons are presented, both looking time and interestingness rise monotonically as complexity increases, with hints of a flattening out or slight reversal as the upper extreme of complexity is approached.

An enlightening factor-analytic study by Evans and Day (1971) ties several threads together, supports some hypotheses suggested by previous work, and, in addition, establishes much needed links with Osgood's dimensions of affective or emotional reaction (see Ch. 7). It must be remembered, however, that factor analysis and other procedures using product-moment correlations reveal only linear relations among variables, so that variables that are nonmonotonically related (e.g., by inverted U-shaped curves) may well appear to be unrelated. These experimenters exposed subjects to random polygons of varying numbers of sides (4 to 90) and elicited a number of verbal and nonverbal reactions to each. A varimax rotation was applied, which means that the resulting factors

or dimensions were located so as to run, as far as possible, through closely intercorrelated clusters of variables. One cluster that emerged was evidently very close to Osgood's *activity* factor, since the rating scales indicative of that factor (passive-active, relaxed-tense, and calming-exciting) possessed high loadings on it. Other members of this cluster were objective complexity (number of sides), subjective (i.e., rated) complexity, looking time, arousal increment (as measured by GSR), interestingness (i.e., ratings on an interesting-boring scale), and definite-uncertain and hazy-clear ratings (which presumably denote something like ambiguity or uncertainty). A second cluster, independent of the first, was more or less identifiable with Osgood's *evaluative* factor: it included good-bad, ugly-beautiful, pleasing-displeasing ratings, as well as ratings on likable-dislikable and meaningful-meaningless scales.

With regard to the relations between pleasingness and exploration, the evidence is inadequate and even perplexing. This is rather ironic in view of the heavy reliance of experimental aesthetics on judgments of pleasingness, preference, liking, and so on, over the last century and the importance of exploration as a constituent of aesthetic behavior. The question is certainly muddled by the complicated relations that have been found to obtain between pleasingness and interestingness. As we have seen, there are circumstances, and in particular levels of complexity, where relatively high degrees of pleasingness and interestingness coincide. However, interestingness may continue to rise, while pleasingness sharply declines, when moderate degrees of complexity are exceeded. On the other hand, there are simple visual structures that are judged to be quite pleasing but uninteresting.

Several experimenters have found positive associations between pleasingness and measures of visual exploration. After 3-sec preliminary exposures to visual patterns, Berlyne's (1963) subjects chose predominantly to see the less complex alternatives, which were those that had been rated significantly more pleasing but less interesting in another experiment. Subjects have been found to spend more time looking at polygons in colors that they later said they preferred (Sobol & Day, 1967). Bechtel (1967) has introduced a device that holds out great promise for experimental aesthetics. He calls it the "hodometer." It enables the footsteps of museum visitors to be recorded without their knowledge. A study carried out in a room where some modern prints were exhibited revealed a significant positive correlation between the time a subject spent in front of a work and how high the work ranked in his order of preference.

But other findings show subjects to be seeking exposure to stimuli that are liked relatively little according to verbal judgments. After 0.5-sec preliminary exposures, Berlyne's (1963) subjects tended to expose themselves to the more complex member of a pair, the one that other subjects

had judged to be the less pleasing, but more interesting, one. Likewise, after a few seconds of near-darkness or of exposure to patterns that had been viewed repeatedly, Berlyne and Crozier's (1971) subjects tended to switch on a more complex pattern in preference to a simpler one that had been rated more pleasing in earlier experiments. Harrison (1968) carried out three experiments, using nonsense words, Chinese characters, and photographs of men. These items were rated for "liking" by one group of subjects and inspected with the automatic-projector technique by another group. The correlations revealed liking and looking time ranged between  $-.60$  and  $-.70$ . However, the stimuli that attracted longer inspection were, it was concluded, that those more productive of conflict as judged by the difficulty of supplying verbal associations to them. This work is complemented by that of Matlin (1970), who showed that, as words lose their novelty through repeated presentation, degree of conflict, measured through delay in free association and through delay and errors in recall of previous free associations, diminishes concomitantly.

When single sounds are presented (Parham, 1971), more pleasing sounds tend to attract more exploratory choice and longer listening time. But no relation is apparent between either of these measures and interestingness. With Vitz's sound sequences of varying complexity, listening time is positively correlated with ratings on displeasing-pleasing and uninteresting-interesting scales (unpublished experiments by J. B. Crozier—see Berlyne, 1971). But correlational analysis reveals that interestingness has about four times as much influence on listening time as pleasingness has. Exploratory choice of sound sequences is likewise closely related to interestingness and more remotely related to pleasingness.

While we are faced with this confusing evidence and have to await the subsequent research that is urgently needed to clear it up, the following hypotheses may be ventured. First, it seems likely that, in most circumstances, stimulus patterns that are rated highest with respect to pleasingness, preference, or liking will most readily attract diversive exploration. But there seem to be two kinds of conditions in which subjects seek out, and prolong exposure to, stimulus patterns possessing high complexity and, presumably, interestingness, even when they are rated distinctly less pleasing than other patterns that are accessible. One is the presence of uncertainty, conflict, and perceptual curiosity, fostering specific exploration. The other is boredom, fostering diversive exploration but driving it towards stimuli other than those on which it would normally concentrate.

Some suggestive, but by no means conclusive, evidence for the hypothesis that specific exploration is more closely related to interestingness and normal diversive exploration to pleasingness comes from individual differences. Slankis (1965) found a correlation of  $+.51$  over subjects between tendency to rate more complex patterns more interesting

and tendency to choose more complex patterns for further viewing (in conditions presumably conducive to diversive exploration) and a correlation of  $+.50$  between tendency to rate more complex patterns more interesting and tendency to spend more time looking at more complex patterns with the automatic-projector technique (presumably conducive to specific exploration). As the hypothesis would lead one to expect, these correlations were higher than those found by Day (1965) between the tendency to judge more complex patterns more pleasing and tendency to view more complex patterns longer ( $+.24$ ) and between tendency to rate more complex patterns more interesting and tendency to choose more complex patterns for further viewing ( $+.27$ ).

Experiments with the automatic-projector technique have studied effects of varying instructions, and, although their results are not altogether easy to interpret, they are of some pertinence. Brown and Farha (1965) asked different subjects to look at visual patterns (triangles and polygons) "according to how pleasing" and "according to how interesting" they were. More complex polygons were viewed for a longer time after the interestingness instruction and for a shorter time after the pleasingness instruction. This tallies with the results of experiments on verbal evaluation (e.g., Berlyne, 1963). When, however, these experimenters told subjects to look at each pattern "as long as he liked," which is the kind of instruction given in most automatic-projector experiments, looking time increased with complexity and was considerably longer than with either of the other instructions. Day (1968b), using symmetrical and asymmetrical polygons of 4 to 90 sides, found that subjects told to look at each pattern "as long as you care to," "as long as a slide is interesting to you," and "long enough to recognize it later" did not differ significantly in looking time. But a group told to look "as long as a slide is pleasing to you" had significantly lower looking time.

These findings are consonant with the view that neutral instructions favor inspection until the information in a pattern has been absorbed (e.g., so that the pattern can be recognized later) and that the process of absorption of information underlies judgments of interestingness. They are also consonant with the view that pleasingness can reflect the arousal value of the initial impact, whereas interestingness has something to do with the perceptual processing that follows the initial impact. However, the kinds of patterns used in these experiments will probably lose their pleasingness to satiation much more rapidly than the many more intricate patterns that figure in everyday decoration and art. There is reason to believe that, with other material, pleasingness can reflect the hedonic value that persists after the bulk of perceptual and intellectual processing has been completed.

*Complexity, pleasingness, and the Windt curve* If we are right in suggesting that interestingness reflects a disorientation-orientation

sequence and is connected mainly with the arousal-reduction mechanism of hedonic value, the Wundt curve should not have much relevance to it. But the curve should be relevant to judgments of pleasingness.

We have seen that many experiments with a wide variety of material have produced inverted U-shaped curves, in which maximal pleasingness or preference coincides with intermediate complexity. To this extent, their results are compatible with the Wundt curve. But the several experiments that have yielded pleasingness curves with several peaks are not. They suggest, rather, the superimposition of several Wundt curves with different peaks.

Since complexity is a matter, among other things, of the number of subunits in a pattern and since the number of subunits depends on how elements are grouped together, multiple peaks in the curve might reflect multiple levels of organization, with more and less inclusive subunits (cf. formation of super-signs). Apart from that, we must remember that pleasingness is sometimes associated with interestingness, and we have reviewed reasons for hypothesizing that interestingness reflects hedonic value due to promise of arousal reduction. As repeatedly pointed out, the ranges of arousal potential in which arousal induction and arousal reduction may give rise to hedonic value can overlap. But in certain circumstances, they may well not overlap much, if at all, with the result that the two mechanisms will be most effective in distinct regions of the arousal-potential dimension. This could conceivably account for the presence of distinct peaks in pleasingness curves, particularly when they are associated with low and high interestingness respectively.

The validity of the Wundt curve is compatible with wide variations from individual to individual in the location of the peak. In most of the experiments that we have been considering, the focus has been on mean ratings or rankings over groups of subjects. In view of the wide differences in taste that are known to distinguish human beings, it is rather remarkable that significant differences can be obtained, at least for certain kinds of material, with groups of a few dozen subjects. Experimenters (Vitz, 1966a; Lane, 1968), who have examined curves for individual subjects in experiments yielding inverted U-shaped group curves, have nevertheless confirmed the presence of substantial individual differences. Some subjects show monotonic increases in preference, and others monotonic decreases, as complexity goes up. Evaluations will obviously vary still more from subject to subject when we study reactions to works of art, which will represent markedly higher degrees of complexity and embody associative (ecological, semantic) factors affecting appreciators strongly but in vastly dissimilar ways. This is a reason for caution in generalizing to art the findings that have accrued from experiments on simple, artificial material. But it is also a reason for doing a great deal of research with simple, artificial material at the present time.

## 14

### SPECIAL PROBLEMS: Proportion, Balance, Rhythm, Consonance

In this chapter, we shall take up a few topics that are intimately connected with the matters that were under discussion in the last three chapters but nevertheless call for some individual attention.

#### PROPORTION

The various kinds of proportion or ratio that can exist between two magnitudes, such as lengths, were analyzed by mathematicians of the classical Greek and Hellenistic epochs, notably by Euclid in the third century B.C. and by Nicomachus of Gerasa in the first century A.D. In the sixth century B.C., Pythagoras is believed to have first pointed out the fundamental relevance of proportions to one phenomenon of aesthetic interest. He noted that, when one vibrating string is twice as long as another, the notes they produce are an octave apart, that they are a fifth apart when the lengths are in the ratio of three to two, and so on. The point was not simply that ratios between lengths govern intervals between pitches but also that certain intervals corresponding to "simple" ratios (i.e., ratios between small integers)—the octave, the perfect fifth, the perfect fourth—are of exceptional importance in musical composition.

Through the influence of Pythagoras, as well as later influences, many have been encouraged to seek the secret of aesthetic value in numerical relations. The Pythagorean tradition was one of the main sources of Plato's and Aristotle's thought. They both vacillated somewhat between regarding art as essentially *mimesis* (imitation or simulation of external objects) and a more formalistic view that emphasized relations between elements and particularly quantitative exactness. Plato (in the *Philebus*) wrote that "in all things, measure (*metriotes*) and proportion (*symmetria*) constitute beauty as well as virtue"; and Aristotle (in the *Metaphysics*) listed order (*taxis*), quantitative fittingness (*symmetria*), and completeness (*horismenon*) as the mathematical bases of beauty.

The ancient Greeks spoke a great deal of *symmetria*, which had a

much wider meaning than is now given to the word "symmetry." Composed of the roots *sym* (with) and *metron* (measure), it meant something like "commensurability" or, more generally, "fitting together well." The notion thus anticipates the point that so much recent experimental work has forced on the consideration of contemporary motivation theorists, namely that relations between sensory inputs can have motivational effects: when certain elements are juxtaposed, the resulting neural processes interact in such a way as to generate pleasure and reward; when other elements are perceived in contiguity, the resulting pattern of neural processes is disturbing and aversive.

Which proportions conduce to aesthetic satisfaction has been the subject of many treatises. The most famous are no doubt those of Vitruvius in the first century B.C., devoted to architecture, and of Dürer in the sixteenth century, devoted to portrayal of the human body. Since ratios between low integers are such outstanding components of melody and harmony in music, there has inevitably been a temptation to find comparable roles for these ratios in other arts. Ratios of 1 to 2 and 1 to 3 are clearly more frequent than others in musical and poetical meter. Lines that equal other lines in length, or are two or three times as long, are certainly not uncommon in painting and architecture. But despite ancient and modern (e.g., Gestalt) views that might incline one to expect otherwise, there is little evidence that these simple ratios underlie pleasing spatial form.

### The golden section

There is, however, another ratio for which great claims had been made through the centuries. This is the ratio that obtains when we have two lengths A and B, such that  $A/B = B/(A+B)$ . Solution of the simple quadratic equation yielded by this definition reveals that the fraction satisfying the requirement is  $\frac{-1+\sqrt{5}}{2}$  or, to three decimal places, 0.618.

In other words, the lesser or minor length bears the same relation to the greater or major length as the major length bears to the sum of the two.

This ratio has possessed several names. It is what Euclid called "mean and extreme ratio." In the Middle Ages, it went by the name of "the divine proportion." For the last 100 years or so, it has most usually been called "the golden section" or "golden number."

Fra Luca Paciolo di Borgo devoted a treatise to it in 1509, and Kepler in 1596 described it and Pythagoras's theorem as the two "jewels of geometry." The suggestion that the golden section holds the key to all

form of beauty in at least the visual arts, if not more generally, is commonly attributed to a nineteenth-century aesthetician Zeising (1855, 1884). But reference to his main work (1855) shows this not to be quite accurate. He admittedly attached enormous importance to the golden section. It was the basis for what he called "proportionality," representing a superior form of "pure beauty" to "regularity," which is achieved by symmetry and likeness between parts. But a still higher form was "expression," which involves no similarity of parts or relations at all and corresponds to moderate deviations from regularity.

In the present century, several authors (e.g., Ghyka, 1931, 1938; Borissavliévitch, 1952; Hagenmaier, 1963) have reviewed the pervasive role of the golden section in aesthetic theory and illustrated its presence in individual works of art. The golden section is the core of Le Corbusier's *Modulor* (1951), his scheme for ensuring that objects designed for human use or habitation will be both aesthetically satisfying and adapted to characteristics of the human body.

The golden section, which is often represented by the Greek letter  $\phi$  (phi), has attracted attention in the first place because of its interesting mathematical properties (Huntley, 1970). The best known one is its relation to the Fibonacci sequence: 1, 1, 2, 3, 5, . . . In this sequence, each number after the first two is the sum of the two preceding numbers, and the ratio between successive pairs of numbers comes closer to the golden section as the sequence proceeds: this ratio alternately exceeds and falls short of  $\phi$  by smaller and smaller amounts. Actually, the same holds for any "generalized Fibonacci sequence," i.e., any sequence beginning with two arbitrarily chosen integers and continuing in such a way that, from the third element on, every element is the sum of its two immediate predecessors.  $\phi$  can also be expressed as a continuing fraction:

$$\frac{1}{1 + \frac{1}{1 + \frac{1}{1 + \dots}}}$$

Then, various unusual equalities follow from the definition of  $\phi$ :  $1/\phi = 1 + \phi$ ,  $1 - \phi = \phi^2$ , and so forth.

Line segments with lengths related according to the golden section are found in projections of the five regular polyhedra and, among plane figures, in regular convex or stellate pentagons and decagons (cf. Fig. 14-1, where  $AB/BC$  and  $DE/EC$  are both equal to  $\phi$ ). The edges of a regular icosahedron and a regular dodecahedron inscribed in the same sphere are related according to  $\phi$ , as are the sides of regular stellate and convex pentagons inscribed in the same circle.

Pairs of distances exemplifying the golden section have been pointed out in many vegetable and animal forms. Pentagonal shapes are com-

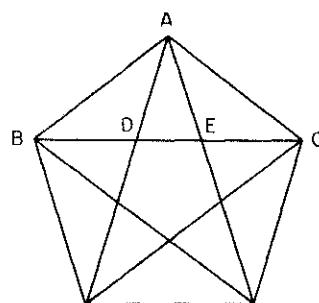


Figure 14-1 Regular convex and stellate polygons.

mon in the flowers of dicotyledonous angiosperms, which include many familiar plants.  $\phi$ , it has been asserted, expresses the proportion between successive segments of a poplar twig, the width and length of an oak leaf, and the successive diameters of spiral mollusc shells. Approximations to  $\phi$  are found in the number of grains encircling a pine cone in two perpendicular directions, and D'Arcy Thompson (1917) has shown mathematically why this must of necessity be the case.

Instances of the golden section have also been detected in mammalian, and particularly human, bodies. To take just two out of many possible examples, the navel is held to divide the line joining the crown of the head to the soles of the feet according to the golden section, and, in faces reputed to be beautiful, the golden section is held to relate the distance between the chin and the eyebrows to the distance between the eyebrows and the crown.

Finally, and of greatest concern to us here, is the fact that golden sections galore have been spotted in the plans and façades of buildings ranging from the ancient Egyptian pyramids through classical Greek temples, Gothic cathedrals, and Renaissance palaces to the creations of Le Corbusier, and in the composition of paintings from the Renaissance to the twentieth century. There have also been assiduous attempts to demonstrate the presence of the golden section and related mathematical structures, such as the Fibonacci sequence, in poetry and music (Ghyka, 1938; Dénéréaz, 1939; Duckworth, 1962).

An immense documentation has thus been mustered to support the claim that the golden section has a deep aesthetic significance. Various methodological questions naturally obtrude themselves. First of all, we are faced once again with the limitations of the case-history argument. Can we be sure that the illustrations cited are typical? Or might structures exemplifying the golden section be relatively unusual? Then, in

patterns containing a large number of features, such as a complex painting or the human face, there are many pairs of points whose distances can be measured and compared. Is it possible that pairs of distances conforming to the golden section might very well be found somewhere or other by chance?

There is a cautionary tale of a theorist called Wolfe (Langfeld, 1927) who was convinced that the relation of equality, rather than the golden section, was at the root of beautiful form. Needless to say, he contrived to find corroboration in Greek temples (taking the distance between the middle of one column and the edge of another column, if necessary) and in the human body (dividing it vertically at the crotch rather than at the navel).

When an author claims that the main subdivision of a pattern conforms to the golden section, would other judges locate the main subdivision where he locates it? Finally, the illustrations can show conformity to the golden section only within a certain approximation. Is the approximation close enough to bear the significance placed on it?

In an experiment (Berlyne, 1969a) designed to overcome some of these limitations, reproductions of pictures were taken from European art of the eighteenth, nineteenth, and twentieth centuries and from Indian, Chinese, and Japanese art. The European pictures were selected by a strictly random procedure from post cards on sale at museums in Paris. Twenty subjects, who were not professional specialists in art, were asked to indicate the principal line of subdivision in each picture along its major dimension. Wide divergence, amounting to three bits of uncertainty, appeared among the responses of different subjects to a particular picture, and the most frequently chosen lines of subdivision varied widely from picture to picture within the same category. There was no firm evidence that either Western or Eastern artists prefer subdivisions far away from the center. The subdivisions usually lay within the general vicinity of the golden section. But there was no support for the view that the golden section has a privileged status within that general vicinity. Nevertheless, the golden section turned up again, as it so often does, in a way that is tantalizing and difficult to interpret. When the grand mean of all the modes (the most frequently chosen lines of demarcation) for the different pictures was calculated, it came to within 0.01 of the golden section.

It is noteworthy that most of the ratios between lengths of passages and lengths of groups of books in Virgil's *Aeneid* that Duckworth (1962) has tabulated conform to the golden section only very approximately. But here again, the means for 28, 18, and 16 consecutive entries, taken haphazardly from Duckworth's tables, come to .615, .615, and .617 respectively, which are impressively close to the golden section.

## Experiments on preferences

Data supporting the claims to attention of the golden section were among the earliest fruits of experimental aesthetics. Fechner (1865) was the first of a line of experimenters who exposed subjects to rectangles with sides of varying proportions and asked them which one they liked best. There was extremely wide variability, so that every kind of rectangle was liked best by somebody, but the rectangle closely approximating the golden section was selected by more subjects than any other. Several later investigators (Witmer, 1894; Lalo, 1908; Thorndike, 1917; Eysenck & Tunstall, 1968), using this and other methods of recording group preferences, have likewise found the peaks of rather flat and widely distended curves to correspond to the golden-section rectangle. Many writers have regarded the low consistency among subjects as a reason for discrediting the golden section, and it is true that some experimenters (Haines & Davies, 1904; Weber, 1931; Thompson, 1946) have obtained curves with peaks some distance away from it. Thorndike (1917), although he found the golden-section rectangle to be the first choice of more subjects than any other, did not find it to receive the highest mean ranking. Nevertheless, the occurrence in so many experiments of a central tendency coinciding with the golden section is at least suggestive.

Angier (1903) asked subjects to move a dividing strip along a horizontal line segment to the position that produced the most pleasing division other than the mid-point. Once again, judgments, while widely scattered, yielded a group mean at the golden section. It is worth taking note of Fechner's (1876, I, p. 192) assertion that "with reference to the division of a horizontal . . . length, the golden-section ratio is at a decided disadvantage as compared with equal division." On the other hand, preferred ellipses (Witmer, 1894) are rather wider than those whose semi-axes are related according to the golden section.

In everyday life, rectangular objects, such as sheets of typing paper, commonly approximate the golden-section rectangle very roughly. However, when Fechner (1876) applied his "method of use" to the shapes of paintings, he found them generally to have their sides more nearly equal than the golden section would imply.

## Explanations

We are thus left with two questions. The first is how much the golden section contributes to aesthetically satisfying form. We cannot yet feel in a position to answer this question with any assurance. There is certainly a case for taking seriously the possibility that the golden section

has a special aesthetic significance, at least in Western art, although the more farfetched and mystical statements about it warrant skepticism. Secondly, how can we explain whatever importance the golden section may have? We cannot hope to make much progress towards answering the second question before we have satisfactorily answered the first. Nevertheless, it seems safe enough to suppose provisionally that the golden section has at least some importance in the visual arts, so that it is worth our while to consider some possible hypotheses.

1. Borissavliévitch (1952) offers no fewer than four explanations, based largely on alleged physiological facts which are hard to judge without further amplification and documentation. For example, he asserts that the overlap of the visual fields of the two eyes and the convergence of the optical axes cause the width and length of binocular field to exemplify the golden section. The binocular field actually has a shape resembling an oval with a small vertical constriction in the middle (Dubois-Poulsen, 1952, p. 309).

Essentially the same explanation has been advanced more recently by Stone and Collins (1965). They examine the ratios of sides in the longest rectangle that can be drawn within the binocular visual field and in the smallest rectangle that includes the field. The mean of these two ratios, they find is 0.665. So, the golden section is approximated only roughly. An experiment designed to test this "perimetric" hypothesis (Schiffman, 1966) produced one finding consonant with it: of 36 subjects who were asked to draw the rectangle that they found most pleasing, 35 made the longer sides horizontal. However, the mean proportion of the shorter to the longer side was 0.525, which is a considerable distance from the golden section.

Hintz and Nelson (1970) have compared the ratios of length to breadth in the preferred rectangle and in the optometrically measured visual field for different subjects. No significant correlation between the two ratios appeared.

In any case, this kind of argument cannot explain reactions to a single line divided according to the golden section, as in the Angier experiment and in many illustrations from painting, sculpture, and architecture.

2. What has been said about the detection of unity or similarity amid diversity as a source of aesthetic pleasure supports Borissavliévitch's (1952) emphasis on what he calls "harmony" and defines as "similarity between two proportions." As he points out, this can be achieved by four magnitudes, provided that  $A/B$  equals  $C/D$ , but the golden section is the only way of producing the same proportion in two different ways from two magnitudes. If, therefore, a viewer compares the major with the whole,  $A + B$ , he will be able to perceive the same proportion twice, and he may be thus confronted the second time with just the right admix-

ture of novelty and familiarity or difference and similarity. It is not unreasonable to suppose that, when we perceive two juxtaposed line segments (collinear or at right angles), we compare their lengths and respond to the ratio between them. But do we compare the longer line with the sum of the two? The reasoning advanced by Zeising (1855) and other writers implies that we do. Borissavliévitch (1952) denies it and quotes a letter from the leading French aesthetician, Souriau, in support of his denial. The experimental evidence that would settle this matter is lacking.

3. Another conceivable explanation depends on what Piaget (1961) calls "transportation," i.e., transferring representations of one part of a display to another part for comparison (as when one compares the lengths of two lines that cannot be included in a single glance). Does a subject confronted with a rectangle imagine each of the larger sides sectioned at a distance that is equal to the length of the smaller sides? If so, he might perceive a square next to a rectangle resembling the original rectangle except for a 90-degree rotation and a smaller size (see Fig. 14-2a). This rectangle may produce a pleasing, moderate degree of difference. Likewise, does someone perceiving a line divided according to the golden section imagine the length of the minor segment marked off along the major segment? If so, he would be confronted with a pattern resembling the original pattern apart from a 180° rotation and a reduction in scale (Fig. 14-2b). This also might produce an optimal combination of similar-

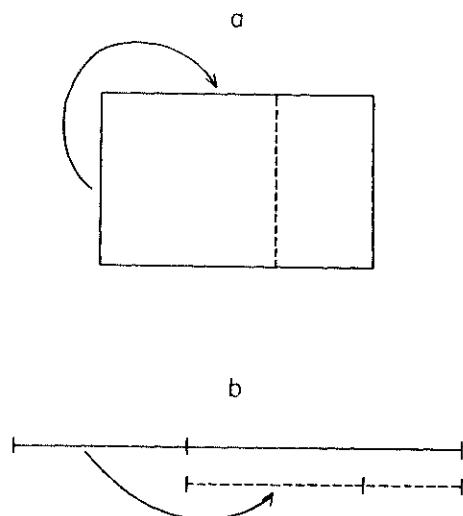


Figure 14-2 A possible explanation of the aesthetic appeal of the golden-section rectangle and the golden-section subdivision of a line segment.

ity and difference. But this possible explanation leans on assumptions that remain to be experimentally verified.

4. Some writers have attributed the appeal of the golden section to avoidance of extremes of too much or too little. The term "golden section" was adopted, in large measure, because of vague associations with the "golden mean." Witmer (1894) believed that the golden section ensured just enough variety. Külpe (1893) claimed that it made A and B just different enough. If the difference were smaller, there would be some difficulty in discriminating between the two, whereas, if the difference were larger, it would be difficult to build up a unified impression. Lipp (1903-06) invoked his "Principle of Monarchical Subordination," holding that the major element of the golden section dominates the minor but not too strongly. Arnheim (1966) pointed out that, if the sides of a rectangle are too close together in length, it is difficult to decide whether it should be regarded as square, whereas, if the lengths are far apart, there is a danger that the shape will break up into two squares. The golden section steers clear of these two opposing pitfalls.

The line of thinking exemplified by all these explanations implies that the ideal proportion between two lengths should be somewhere between equality and doubling, but that a fairly wide range of intermediate values should be acceptable and fulfill the conditions stated. This, we must acknowledge, may very well be the true state of affairs. The golden section may actually not be any more important than many neighboring proportions. If something of importance happens precisely when the golden section is reached, such explanations are clearly adequate.

5. It is noteworthy that discussions of the golden section with reference to individual works of art, while covering a wide range of styles and periods, have been confined to art of the early Mediterranean civilizations and their offshoots, and that the many experiments on preference with regard to rectangles and other forms that are commonly cited have all been carried out with European or American subjects. Only cross-cultural comparisons can enable us to determine whether the appeal of the golden section depends on certain deep-seated universal characteristics of the human nervous system and optical apparatus or whether it may be a cultural and therefore learned factor characteristic only of certain social settings. The experiment already mentioned (Berlyne, 1969a), in which subjects were asked to locate major subdivisions of Western pictures of three periods and Eastern pictures of three cultures, revealed no significant differences between West and East, except for one point: the Chinese paintings (all taken from the Yüan and later dynasties) were apparently more unified than the other works, since subjects' judgments with regard to them were significantly less variable. A further experiment (Berlyne, in press), carried out in collaboration with Professor G. Hatano of Dokkyo University, studied the preference rankings of rectangles

among Japanese high-school girls from a rural area. There was no sign whatever that the golden-section rectangle has a special attraction for this population. On the contrary, rectangles were ranked first with significantly greater probability and received a higher mean ranking the more nearly equal their sides. Since the experiment was completed, Professor Hatano has found references to two earlier investigations showing that "Japanese tend to prefer rectangles nearer to the square than the golden section." When the experiment was repeated with a demographically similar group of Canadian high-school girls, there was again no indication of a special preference for the golden-section rectangles. But the Canadian subjects gave the highest mean rankings to rectangles in the general vicinity of the golden section. On the whole, they liked more elongated rectangles more, and less elongated rectangles less, than their Japanese counterparts.

It is possible that members of our own society are partial to the golden section, to the extent that they are, because they encounter many instances of it, or approximations to it, in works of art or industrial artifacts. The prevalence of forms complying with the golden section may result from a tradition going back several centuries and originating in special attractions of this proportion for the creative artist.

We have been assuming that many sources of pleasure and reward are common to the creative artist and the appreciator. But we have noted that the artist is also affected by certain kinds of reinforcement and satisfaction that are peculiar to his role. Apart from the obvious consequences of fame and fortune that successful artistic activity may yield for the artist but not for the appreciator, the artist often derives intellectual pleasure from procedures that he uses in constructing his works and that are not readily apparent to anyone who simply perceives the finished product.

Ever since Euclid, several geometrical constructions for conveniently producing golden sections have been known. These can facilitate the task of the architect, painter, or industrial designer and incline him towards this proportion rather than other, neighboring ones that cannot be generated so readily. The artist may also enjoy the networks of relations that connect elements of a structure based on the golden section. These relations may be obvious to him, because they are implicit in his working methods, but beyond the ken of the ordinary appreciator, unless he has studied the geometrical analyses of individual works with which books on the golden section are replete. Finally, artists who have a bent for mathematics, as so many have had, particularly during the Renaissance and during the present century, may well be attracted by the unique mathematical properties of the golden section.

6. One last possibility to be considered is that something of unusual psychological importance happens in the neighborhood of the golden

section, but that some other proportion that is very close to it is actually the crucial one. For example, if Arnheim and some of the other writers are on the right track, we might expect proportions intermediate between 1/1 and 1/2 to be optimal in many conditions. Even if a range of them will be acceptable, they will cluster around some central tendency. The Weber-Fechner law implies that the perception of differences between quantities such as lengths depends on logarithmic relations, in which case the best ratio between a given length A and a length to accompany it might plausibly coincide with the geometric mean of A and 2A, namely  $\sqrt{2}A$ .  $A/\sqrt{2}A$  is equal to .707, which is not very near to the golden section.

An information-theoretic quantity to which Frank (1959, 1964) has drawn attention deserves some consideration, because it brings us nearer still to the golden section and there at least preliminary grounds for suspecting that it may be of psychological, and particularly aesthetic, significance. The measure in question is what Frank called "strikingness" or "penetrance" (*Auffälligkeit*). He reasoned that the psychological impact of an element or signal,  $i$ , should depend on its information content,  $- \log p_i$ . And the impact of a particular kind of element should depend, moreover, on the relative frequency in which it occurs,  $p_i$ . A measure of strikingness is obtained by multiplying these two quantities and obtaining  $- p_i \log p_i$ . This expression is familiar to anybody who has ever dabbled in information theory. It is the quantity that must be computed for each of the alternative classes of elements and then summed over all of them to produce a measure of uncertainty. It presents, in other words, the contribution made by a particular class of elements to uncertainty or average information content. It can easily be shown that the quantity  $- p_i \log p_i$  reaches a maximum when  $p_i = 1/e$ . This is equal to 0.368 and may be compared to  $1/\phi$ , the ratio of the minor to the major element in the golden section, which is equal to 0.382.

Frank presents some experimental findings in support of the alleged psychological importance of his strikingness measure. It has been known (since Attneave, 1953) that estimates of the relative frequency of an event do not follow actual probability of occurrence very faithfully; high frequencies tend to be underestimated and low frequencies overestimated. Frank shows that the estimates fit the curve for strikingness quite well. Then, he has performed experiments in which subjects are asked to select squares from a collection offering several colors and to arrange them so as to make one color as "striking" as possible. When they are allowed to correct patterns with which they are dissatisfied after making them, the color of interest appears, on the average, between 37 percent and 38 percent of the time. Frank also offers some pertinent examples from the arts. The proportion of the total area of certain paintings (by Monet, Feuerbach, and Franz Marc) taken up by one color, the propor-

tion of syllables containing a short *e* sound in Poe's poem "The Bells," and the proportion of measures containing syncopation in the third movement of Bach's *Brandenburg Concerto* no. 5 are all quite near to 1/e. The usual objection that what is found in isolated works cannot safely be generalized to art as a whole hardly needs to be emphasized. It is, however, worth considering whether the golden section may have been so popular, at least partly because it allows the minor element to occupy a proportion of the whole that makes it maximally striking.

### BALANCE

The visual arts present many instances of symmetry about a vertical axis. Symmetry about horizontal or oblique axes occurs, but much less frequently. Identical forms, or forms that are identical apart from reflection or rotation, occur side by side either contiguously or with other material between them. Symmetry is, however, often felt to embody excessive similarity and is thus apt to be rejected as boring or facile. When this is so, sub-units that are distinct, but in some way equivalent, are likely to be located on either side of the central focus. In other words, *balance*, of which symmetry is merely a special case, is what is sought. The role of balance is most obvious, and has been most intensively studied, in connection with the visual arts. It is worth bearing in mind, however, that balance—similarity and equivalence, but not identity, in corresponding locations—is often felt to be an essential formal element in the temporal arts, e.g., balance between earlier and later incidents in a novel or drama or between earlier and later portions of a symphonic movement.

### Experimental evidence

Whether two elements will balance each other or not depends both on their characteristics and on their distances from the center. Which characteristics are of importance in this respect and how they interact with distance are questions that several early experimenters took up. The first of them was Pierce (1894). He used a black background with a fixed vertical line in the center. One figure was placed at a fixed position on one side of the central line, and the experimenter moved another figure across the other half of the background until the subject judged the whole display to be "balanced." Lines that were shorter or narrower than the fixed line tended to be placed farther out. Lines and stars were placed farther from the center than squares, empty areas farther than

filled areas, and blue, green, or maroon lines farther than white, red, or orange lines.

An experiment by Puffer (1903) introduced a few changes in method. There was no fixed central line, so that the center of the display did not receive so much emphasis. Furthermore, the subject, rather than the experimenter, moved the variable element, and he was told to aim at a "pleasing" rather than "balanced" appearance. Once again, smaller elements were generally placed further out than larger elements. Blank rectangles were further from the center than rectangles bearing outline pictures, stamps that were different on each trial than stamps that reappeared on successive trials, a two-dimensional picture (a railway tunnel closed off by a door) than one favoring three-dimensional perception (an open railway tunnel), and bulging forms suggestive of movement away from the center than other forms suggesting movement toward the center.

The stimulus properties that were shown by these experiments to govern aesthetic balance seem, on the whole, to be ones that we should expect to govern arousal increment or attention. And the general conclusion seems to be that more arousing or attention-catching stimuli must be placed closer to the center if balance is to be realized. The influence of another component of arousal potential, namely complexity, is indicated by Angier's (1903) findings. It may be recalled that he found the preferred subdivision of a plain line segment to coincide with the golden section. When he used the pattern in Figure 14-3 with a portion made up of parallel lines and a portion (offering greater complexity) made of squiggles, his subjects preferred a distribution that allotted less space to the squiggles. But when the squiggles were packed together more densely (making for an even greater difference in complexity between the two portions of the pattern), they took up even less room in the preferred distribution.

Two small pilot experiments were carried out in the writer's laboratory (see Berlyne, 1966a) with pairs of figures taken from the material in

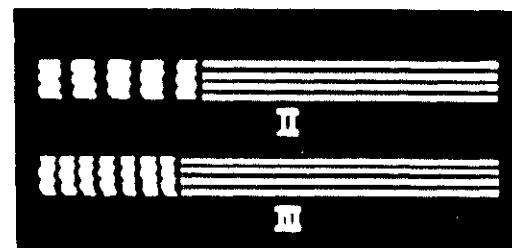


Figure 14-3 Pattern used in an experiment by Angier. (From Angier, 1903).

Figure 13-6 (p. 199). The patterns of a pair were placed on a black background with a white thread running down the middle, and, while one pattern remained in place on one side of the thread, the subject had to move the other pattern until the most pleasing arrangement was found. With respect to patterns of categories C and D there was some support for the expectation that the less complex members would be placed farther out than the more complex members. Further, there was some confirmation that the tendency to place less complex members farther out was less marked in categories XA-XC than category A-D. As mentioned in the last chapter, the more complex members of categories A-B and the less complex members of categories XA-XC tend to be judged more interesting. So these results, tentative as they are, favor the hypothesis that more interesting patterns must be placed closer in if they are to balance less interesting patterns.

### Explanations

When one attempts to account for all these findings with regard to perceptual balance, analogies with physical balance obtrude themselves immediately. Stimuli that are more interesting or arousing or likely to attract attention may be thought of as possessing greater psychological "weight." When elements of greater and lesser psychological weight are in balance, the evidence shows that the latter are placed farther out, just as the pan containing a heavier object must be nearer to the fulcrum than a pan containing a lighter object if a pair of scales is to be in equilibrium. Since experience has so often shown us that, when conditions for physical equilibrium are unfulfilled, sudden and startling changes are apt to ensue, generalization might cause us to be disturbed when we perceive visual patterns suggestive of imbalance.

But the mechanical analogy cannot be pursued too far. It is true that perceptual balance, like physical balance, requires small objects to be placed further out than larger objects and that weight and size are usually correlated. But the positions selected in experiments on perceptual balance are not generally those that would ensure mechanical equilibrium if size were indicative of weight. And many of the stimulus properties that have been found to play a part in perceptual balance have no association with physical weight.

Introspective reports obtained by Legowski (1908) revealed that the responses of individual subjects in experiments on perceptual balance can be determined by factors that might be overlooked. For example, when he used patterns like that in Figure 14-4, he found that some subjects sought to equalize distances  $a$  and  $b$ , whereas others wanted to make angles  $\alpha$  and  $\beta$  equal, which meant placing the small rectangle, A, further

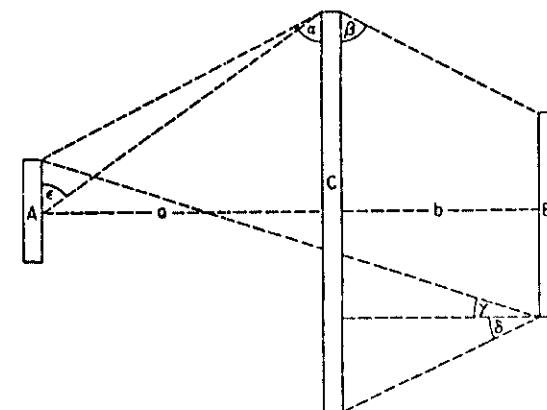


Figure 14-4 Patterns used in experiment by Legowski, illustrating his explanation of perceptual balance. (From Legowski, 1908).

out. When the two lateral rectangles were of the same height but differed in width, subjects often tried to equate the areas of the imaginary rectangles that extended from the center of the display to the outer edges of the lateral rectangles.

Earlier writers speculated that aesthetic balance will occur when "both parts call forth eye movements of like energy" (Pierce, 1894), when there is "equal expenditure of attention" on both sides, attention being identified with "measure of motor impulses directed to an object" (Puffer, 1903), when there are "equal sensations of energy of movement coming from the two sides" (Angier, 1903).

There cannot be much hope of evaluating these explanations, or of accounting for perceptual balance fully, until neurophysiological knowledge has made more headway. It is worth noticing, first, that all the experiments and discussions of perceptual balance refer to balance along a horizontal dimension. When one element is placed above another, rather than side by side with it, the same principles do not seem to apply. And we know that the human brain and optical apparatus are symmetrical about the vertical axis. Stimulus elements in the left-hand and right-hand halves of the visual field must evoke distinct responses, internal and external. If the relative distances of two stimulus elements from the center can determine whether the combination is pleasing or disturbing, we must look for responses that can be oriented to the left and to the right and surmise that satisfaction results when the responses are instigated with comparable strength in both directions but not when they are instigated disproportionately on one side.

Two kinds of response that might fulfill these requirements come to

mind. One consists of receptor-adjusting responses, which mean principally eye movements but may also involve the head and trunk. It is clear that these movements cannot be directed to the left and to the right at once. But conditions tending to draw them in both directions at once may occur and initiate corresponding neural processes.

It seems plausible that, as Pierce suggested, an object seen peripherally will draw the eyes towards it with a strength proportional to its distance from the present fixation point, its size, and its brightness. As the gaze wanders over a pattern, objects come nearer to the fixation point, but, as they do so, they may seem larger (because of the illusion due to "centering"—see Piaget, 1961) and brighter (because of the greater sensitivity of the central regions of the retina), and attention-attracting details may come into view. A balanced pattern may be one in which, wherever the eye comes to rest, changes in distance are compensated by these other changes, so that the eyes are not tugged preponderantly in one direction.

The second possibly relevant kind of response is the one that figures in Werner and Wapner's sensory-tonic field theory (1949, 1952). These authors present evidence that generalized muscular tensions occur on the two sides of the body when a visual stimulus is perceived, and that spatial properties, such as tilt, may cause them to predominate on one side. Such a predominance may well be uncomfortable, and it is possible that balanced visual patterns are capable of relieving or preventing such a state of affairs.

We certainly cannot reject out of hand the Gestalt view that satisfaction can come from spatially balanced patterns of electrochemical activity in the brain. But available neurophysiological knowledge provides no support for this hypothesis. Nor does it help us to understand how such brain processes could activate more readily than others the structures on which hedonic value depends.

## RHYTHM

Like "balance," the word "rhythm" has both a wide and a narrow sense. Sometimes, it refers to temporal distribution in general, to the pattern of durations allotted to the notes of a melodic sequence, to the distribution of time among the syllables of a verbal utterance. By extension, the same notion is often applied to the visual arts, denoting the succession of deflections undergone by a line, the relative areas of adjacent patches of distinct coloring, or the disposition in space of elements that possess some resemblance.

But the same word often refers to meter or periodic rhythm, to the division of time or space into equal intervals, to schemes of recurrent

spatio-temporal organization. So, if somebody is questioned about the rhythmic characteristics of the first movement of Beethoven's fifth symphony, he might, first, answer in accordance with the broader meaning; he might point out the prevalence of sequences of four notes, of which the first three are equal in duration and pitch and the fourth is a minor third lower as well as of greater intensity and often of longer duration. But he could also understand the question to concern meter and mention that the movement is marked *Allegro con brio* and that it is written in 2/4 time, which means that it is divided into measures of two rapidly succeeding stresses, which are alternately weaker and stronger.

In the broader sense, every work of art possesses rhythm, and its rhythmic characteristics are among its most important components. Much art is also metrical. This applies to most music of all cultures, although there are exceptions, notably those arising out of twentieth-century experiments (Messiaen, Boulez) with serialized and other non-periodic ways of organizing duration. It applies to much poetry in many languages, but not, for example, to the balanced and asymmetrical phrases of the Bible, to *vers libre*, and verse using "sprung rhythm." It applies to some repetitive forms of visual ornamentation (e.g., the egg-and-dart, head-and-reel, and dog-tooth mouldings on ancient Greek temples) and even occasionally to paintings (e.g., Orozco's *Zapatistas*, many Op art and Hard-Edge paintings).

As Fraisse (1956) points out, rhythm, even in its more restricted sense, has two aspects. First of all, successive groups of events occupy equal temporal or spatial extents. The grouping is likely to be hierarchical, so that there are equal groupings within equal groupings. In music, there are small-scale groups bounded by bar-lines and often larger-scale groups corresponding to phrases (e.g., the four-bar phrase of much eighteenth-century music). In verse, there are the small-scale groups corresponding to metrical feet and the larger-scale groupings of lines (perhaps strengthened by end rhyme, which is said by Lanz, 1931, p. 235, to create a regular "super-meter") and stanzas. Secondly, there is similarity of internal structure between these groups. The structure may be a distribution of intensities (as in music and in English poetry), of durations (as in music and in classical Latin poetry), or of qualities (as in bodily movements of gymnastics or the dance). In the simplest cases, where one event is monotonously repeated, the internal structure is simply an alternation between an occurrence of the event and an interval between successive occurrences. The harpsichord and the Scottish bagpipe permit little or no variation in loudness. In music intended for these instruments, grace notes are commonly used to distinguish stressed from unstressed notes. They introduce, of course, an increase in complexity. It seems therefore that metrical accentuation means a rise in arousal

potential, and we have another interesting piece of evidence that the constituents of this variable are often interchangeable and equivalent in their effects.

Early experiments, reviewed by Fraisse (1956), show that human subjects tend to hear monotonous series of equally spaced sounds or flashes of light divided up into groups of two, four, or, somewhat more rarely, three. There is a tendency for the interval separating two groups to seem longer and for the initial element of each group to seem more intense. The boundaries within groups can, as is well known, change either voluntarily or involuntarily. But the group is likely to begin or end with an element that is more intense than others or with one that is different in pitch. If one element lasts slightly longer than the others, it is likely to start a group. If it lasts much longer, it is likely to become a concluding element.

Fraisse's own experiments demonstrate that, when a subject is asked to carry out a repetitive movement, such as tapping with a finger, most of the intervals between consecutive responses approximate a constant duration very closely. This is so whether he is instructed to tap rhythmically or as arhythmically as possible. When he is asked to reproduce unequally spaced frequencies of sounds, there may be "dissimilation," such that longer intervals are overestimated and shorter ones underestimated, or "assimilation," such that differences between intervals are lessened. The former is more in evidence with groups of three sounds and the latter with groups of four.

In view of observations like these, temporal periodicity and subdivision into similarly structured groupings can be expected to characterize many of the acts by which the painter, sculptor, draftsman, or carver produces his work, as well as the motions of the dancer, performing musician, or reciter. The rhythms of bodily movement and of speech will naturally extend to music through its close affinities with dancing and singing. And we can see that the appreciator would often perceive periodic rhythms even if the creative artist had not embodied them in his work.

This is obviously one more topic that calls for research, but we can enumerate some likely roles of periodic rhythms in the dynamics of arousal:

1. As we have seen, one of the tasks of perceptual activity is to group perceived elements into larger units (super-signs). When there are several possible ways of doing this, and none of them clearly preponderates, there are the makings of conflict. Perception of a grouping unequivocally imposed by a rhythmic structure minimizes these difficulties.

2. The differentiation that appears within a rhythmic grouping, whether introduced by the artist or superimposed by the perceptual proc-

essing of the appreciator, can reduce conflict accruing from confrontation with stimuli that are hard to distinguish.

3. Successive presentation of patterns that are alike in temporal (or spatial) arrangement, but unlike in other respects, is an easy and effective way of combining similarity with differences or, in other words, of ensuring unity in diversity.

4. Establishment of a repetitive rhythmic scheme induces an expectation that the scheme will continue, so that some characteristics of what will follow can be foreseen and uncertainty reduced.

5. Periodic rhythm sets up expectations that can be violated, thus presenting opportunities for arousal increment. As pointed out by Meyer (1956) with reference to music and by Cohen (1966) with reference to verse, there are usually many momentary deviations from a metrical pattern. And subdivisions dependent on other criteria (grammar, sense, various aspects of musical structure) often fail to coincide with metrical subdivisions. The same holds for patterns of stress or intensity. The sudden replacement of one metrical scheme by a quite different one (e.g., Stravinsky's *Rite of Spring*) can also be particularly startling.

6. Repetitive stimulation can either be stirring and arousing or have a calming or even soporific effect. Neurophysiological experiments (Gellhorn, 1967) show how a train of electrical pulses applied to the brain stem may either raise or lower arousal. High-frequency trains tend to be arousing, and low-frequency trains de-arousing.

7. The alternation of stressed elements (i.e., elements of relatively high intensity, duration, and arousal potential in general) and unstressed elements may produce a sequence of arousal increase and arousal reduction that conforms to the arousal-jag pattern (Herbart's *arsis* and *thesis*, i.e., the successive rising and falling accents that mark the passage of any disturbing stimulus). Even if the final element of a passage is accented, arousal must drop when silence follows.

8. It has been known since the work of Müller and Schumann (1894) that metric organization makes it easier to remember verbal material. And at least short-term memory of earlier portions of a work is required if such essential components of form as repetition, reinstatement, variation, and contrast are to be appreciated.

## CONSONANCE AND DISSONANCE

With "consonance" and "dissonance," we come once again to terms with two overlapping but different meanings that have created a great deal of confusion. On the one hand, simultaneous combinations of sounds are said to be "consonant" if they are pleasant. On the other hand, the

word is also used to describe combinations that are characterized by "simple" frequency ratios, i.e., ratios that can be represented by pairs of low integers, such as  $\frac{1}{2}$  (the octave),  $\frac{3}{2}$  (the perfect fifth), and  $\frac{4}{3}$  (the perfect fourth). As long as only "consonant" intervals in the second sense were considered acceptable, as at the very beginnings of medieval counterpoint, the two senses were equivalent. But as more and more harmonic freedom was achieved, this ceased to be so. Thirds and sixths, which were initially eschewed, came gradually to be accepted. Even the most sedate classical music of the eighteenth century and the most conservative music of the present age is liberally sprinkled with dominant-seventh chords, which contain dissonant intervals. Even the most fervent admirers of late Romantic music will recognize an unprecedented prevalence of dissonances in the work of Wagner, with his frequent postponement of resolution and his habit of sliding gradually from one concord to another through passing notes and suspensions, and in that of Richard Strauss, who frequently omitted to resolve discords altogether. But he would not agree that such music is painful to listen to. And as the innovations of the twentieth century have increased still further with Debussy's use of chords as equivalents of timbres, with the *bruitisme* of Russolo and Pratella, with the tone clusters of Cowell, and, finally, with the use of noises of all conceivable kinds in concrete and electronic music, the identification of consonance with acceptability has become absurd.

If dissonances are found to be at least as essential to musical enjoyment as consonances, the distinction between the two is still of interest. In the traditional musical theory that grew up gradually through the Middle Ages and Renaissance and began to be questioned in the twentieth century, certain intervals, notably octaves, fourths, and fifths, were classed as "consonant" and others, notably seconds and sevenths, as "dissonant." An intermediate class of "imperfect consonances," including thirds and sixths, was often recognized as well. Chords containing dissonant intervals were called "discords." They were not regarded as objectionable, but rather as marking points of instability or movement. They were subject to certain rules, such as the necessity of prompt resolution or replacement by a perfect concord. Consonant intervals predominated in harmony, not only because concords were relatively frequent, but because concordant intervals occurred together with discordant intervals in the widely used discordant combinations. The special importance of the octave, the fifth, and the fourth, is, significantly enough, not confined to Western music. Such rudiments of harmony as are found in more exotic cultures tend to use octaves and fifths. Fourths and fifths are likewise prominent, not only in the modes and scales of the West, but in many (but by no means all) other modal systems, e.g., the pentatonic scales of the Far East and the heptatonic scales of classical

Indian music. This means that consecutive notes of a melody are separated by these intervals particularly often.

### Experimental evidence

The two senses of consonance and dissonance seem to be identified more often by laymen than by subjects with special training, and experimental findings tend to confirm this. Malmberg (1918) asked a panel of musicians and psychologists to rank-order two-tone combinations for smoothness, purity, and blending. The three orderings were highly correlated and, when put together, yielded a consonance-dissonance series, with the octave coming first, followed by the perfect fifth and the major sixth. Musicians studied by Guernsey (1928) produced a similar ranking with respect to consonance, but, when they were asked to make judgments of pleasantness, the ordering was quite different, with sixths, thirds, the perfect fourth, and the minor seventh heading the list. This latter order was similar to that obtained by Valentine (1914), who asked students not specializing in music to rate intervals on a 7-point displeasing-pleasing scale. The major third came first, followed by the minor third, the octave, the major sixth, and the minor sixth. Valentine (1962, p. 211) states that the "average order of popularity was almost the same as mine," when Ortmann obtained judgments from subjects ranging from 7 years of age to adulthood and from 0 to 5 years of musical instruction.

In the light of these results, it would seem that trained musicians tend to use the words "consonance" and "dissonance" in accordance with the definitions to be found in musical textbooks, while their preferences do not tally with these definitions but rather resemble those of musically naive subjects. Untrained subjects tend, on the other hand, to equate consonance with pleasingness and to have tastes that diverge from traditional theoretical notions. This last point is corroborated by van de Geer, Levelt, and Plomp (1962), who asked nonspecialists to rate simultaneously sounded pairs of tones on a number of 7-point scales, including "consonant-dissonant," "beautiful-ugly," and "euphonious-noneuphonious." Scores of these three scales were highly correlated with one another, and factor analysis showed them to reflect a common evaluative dimension. The highest locations along this dimension were occupied by sixths, thirds, and fourths.

There are, however, some differences between the preferences of musicians and laymen. The experimenters just mentioned found that musicians gave lower ratings than laymen to the octave and the fifth. Francès (1958), who compared two series of 5-tone chords, one largely consonant and the other very dissonant, found preferences to be about

evenly distributed between the two in musically untutored subjects, while eleven professional musicians all rejected the consonant series. It should perhaps be borne in mind that several decades of musical innovation separated this study from some of those mentioned earlier.

Additional measures have been used in the author's laboratory to compare consonant (perfect-fifth) and dissonant (major-second) two-tone chords. Dissonant pure-tone pairs were found to evoke longer EEG desynchronization but not significantly so (Berlyne et al., 1967). Parham (1971) found no difference in complexity ratings or in listening time between concords and discords. With square-wave but not sine-wave components, concordant pairs were rated more interesting, and, after a 3-sec exposure to a concord and a discord, the concord was more likely to be chosen for further listening. Both sine-wave and square-wave concords were rated more pleasing than the corresponding discords.

## Theories

The various attempts that have been made to explain the different psychological effects of consonance and dissonance have been reviewed by Lundin (1953), Wellek (1963), and Plomp and Levelt (1965). The principal and most frequently mentioned theories are as follows.

1. Helmholtz (1862) invoked two factors. First, the harmonics or partial tones that invariably accompany a sound of a particular pitch when it is played, for example, by a musical instrument will coincide to a considerable extent in the case of consonant combinations but not in the case of dissonant ones. Secondly, when a dissonant pair of tones is heard, they will be sufficiently close to produce a beat frequency that is rapid enough to be perceived as a rough or intermittent quality but not rapid enough to produce a difference tone.

2. Stumpf (1883-90) cited evidence, in objection to Helmholtz's second factor, that there can be dissonance without beats and beats without dissonance. He showed experimentally that, when subjects were required to state whether one tone or two tones were sounding, they were able to make the discrimination less accurately with consonant pairs. He therefore attributed the effects of consonance to this fusion or tendency for the components to merge into a unity.

We are still left with the question of why combinations that fuse are preferred to those that do not or, more generally, why they have peculiar psychological effects. Towards the end of his life, Stumpf came to recognize that his explanation was not altogether satisfactory. There are also some experimental data that tend to refute it. In Malmberg's

(1918) experiment, rankings of intervals for fusion were markedly different from the rankings for smoothness, purity, and blending, which were highly correlated with one another and capable of yielding an overall consonance ranking. And in the experiment by van de Geer, Levelt, and Plomp (1962), the fusion factor, derived from the "simple-multiple," "rough-smooth," and "active-passive" scales, was independent of the evaluation factor, on which the "consonant-dissonant" scale had a high ranking. Fusion tended to rise monotonically with the size of the interval.

3. Krueger's (1903-04) theory bore some similarity to Helmholtz's but laid the primary stress on difference tones, the perceived sounds whose frequencies correspond to the differences in frequencies of simultaneously presented tones and between their harmonics. Painstaking experiments and calculations led him to the conclusion that, the more consonant an interval is, the more often successive difference tones coincide, giving rise to an overall sensation with fewer components.

Some support for theories based on interference, like Helmholtz's and Krueger's, comes from experiments in which two tones are presented simultaneously to different ears (Sindig, 1939; Levelt & Plomp, 1968). Intervals that would otherwise be considered dissonant, notably the major second and the major seventh, are then judged to be more consonant and more unified than when both tones are heard by both ears.

4. Lipps (1885) held that acoustic vibrations are unconsciously counted and that we prefer those combinations in which simultaneous vibrations coincide most often, as they do in the case of consonant intervals. Later writers have expressed essentially similar views, but, apart from the initial implausibility of such discrimination of individual sound waves, this approach fails to explain why preferences should be governed in this way. Furthermore, consonant relations are not eliminated, as they should be according to Lipps's theory, when tones are slightly mistuned (Peterson & Smith, 1930).

5. Finally, Lundin (1947) has put forward a "cultural theory," according to which consonance-dissonance judgments and preferences are determined primarily by the relative frequencies with which such combinations appear in the music of a particular society and on prevailing attitudes to them. The transmission of cultural norms is attributed mainly to learning, but earlier writers, like Ogden (1909) and Moore (1914), invoked inheritance of acquired characteristics, which is, of course, irreconcilable with modern biological knowledge. Even without this feature, theories that rely on frequency of exposure to account for differences still leave us with the problem of why certain combinations predominate over others in several cultures.

## Recent work

A major advance in our understanding of dissonance has resulted from experiments carried out in the Netherlands by van de Geer, Levelt, and their associates. The initial, factor-analytic study by this group has already been mentioned. In a later experiment (Plomp & Levelt, 1965), judgments on a 7-point consonant-dissonant scale were obtained for simultaneous pairs of tones differing not only in frequency ratio but also in mean frequency. Their curves relating consonance to frequency difference resembled those that had been obtained by Guthrie and Morrill (1928), with a U-shaped initial segment and relative flatness thereafter. However, they were able to show in addition, collating their own data with those of other investigators, that the frequency difference corresponding to maximum dissonance increased with mean frequency.

This conclusion was considered to be generally compatible with Helmholtz's theory of dissonance, apart from the variation with mean frequency. It was suggested that dissonance depends on the "critical bandwidth." There is evidence that, when sound of a particular pitch is heard, a corresponding region of the basilar membrane in the cochlea of the ear is maximally excited but that a fairly extended neighborhood around this region is also stimulated to a large extent. The critical bandwidth is the difference in frequency beyond which the regions of excitation corresponding to two tones will not overlap. It is known to increase with mean frequency.

It seemed that intervals were judged less than maximally consonant when their differences fell short of the critical bandwidth, with greatest dissonance at about 25 percent of this interval. As regards complex tones, it was assumed that the total dissonance of an interval equals the sum of the dissonances of pairs of adjacent harmonics. This assumption yielded figures assigning maximum consonance to the unison and the octave, followed, in order, by the perfect fifth, the major sixth, the major fourth, the minor third, and the major third. These conclusions were further substantiated by a statistical analysis of chords in works by Bach and Dvorak, showing the interval between adjacent harmonics to fall mostly between 25 percent and 100 percent of the critical bandwidth and to vary with frequency as predicted. Furthermore, as mentioned earlier, a pair of tones that was judged dissonant when presented to the same ear was no longer so judged when the two tones were presented to different ears, in which case there could not be interference between overlapping patterns of excitation on the basilar membrane (Levelt & Plomp, 1968).

Subsequently (Levelt, van de Geer, & Plomp, 1966), pairs of tones, all averaging about 500 cps, were presented three at a time. Subjects were

required to state in each case which two pairs of the three were most similar and which two were least similar. The data were then subjected to a Shepard-Kruskal multivariate analysis. The experiment was done first with pure tones and then with complex tones (consisting of all harmonics up to 4,000 cps with equal amplitude). The results were rather similar in both instances. The intervals located themselves along a horseshoe-shaped curve on a plane. There seemed, the authors say, to be a single dimension that was "curved in a psychological space." The location of an interval along this curved dimension was highly correlated with the difference in frequency between the fundamental tones, the variable that previously had been found to underlie judgments of consonance-dissonance. The curvature could be explained if a particular interval, apparently somewhere between a perfect fourth and a perfect fifth (i.e., about half an octave), served as a reference point.

The authors make this point clearer by citing the analogy of somebody whose political views favor the center. For him, political parties might well be arranged along a left-right continuum, but the extreme left and the extreme right would appear similar because of their common extremism. For combinations, the reference point seems to have some connection with frequency of occurrence, since very narrow and very wide intervals appear less often in music than those of the middle range. Although the outcomes for simple and complex tones matched surprisingly well, there were signs that pairs of complex tones, but not of simple tones, are differentiated according to both interval width and the complexity of the frequency ratio (i.e., the size of the numerator and the denominator when the ratio is expressed as a simplified fraction).

## Tentative conclusions

There are now sufficient grounds for believing dissonance to depend, at least to some extent, on physiological properties of the human ear and, in particular, on interferences related to critical bandwidth. This can account for the special role that certain intervals, like the octave, the perfect fifth, and perfect fourth, have had for so long and in so many musical traditions.

Since dissonant combinations apparently differ from consonant combinations in having more detectable components and more fluctuations (beats, roughness), we may suppose them to have greater complexity in a sense that links up with visual and other nonauditory forms of complexity, as distinct from the more restricted concept of "complexity of ratio" that has often figured in discussions of musical intervals. Judged complexity, it will be remembered, increases as the number of component tones in a chord goes up from one to four, and it is higher for discords

than for concords (Berlyne, McDonnell, Nicki, & Parham, 1967; Parham, 1971).

It is, however, equally evident that frequency of exposure and learning play their parts also. In the multivariate experiment by Levelt, van de Geer, and Plomp (1966), the bending of the interval-width dimension was connected with the greater incidence of moderate intervals than of small and large intervals, in music. It can be seen both from experimental findings and from the development of music over the centuries that people can become accustomed to chords to which they initially object and that, by dint of repetitive exposure, they can come to like them. Experienced musicians differ from laymen, not only in separating the concepts of consonance and of unpleasantness, but in acquiring a taste for passages containing a great deal of dissonance (Francès, 1958).

So once again, we can see signs of an interaction between complexity and novelty. The fact that disliked chords can be liked once they have acquired some familiarity illustrates the greater hedonic value of moderate novelty than of extreme novelty. The progressive introduction of, and partiality for, a wider and wider selection of chords illustrates the depression of hedonic value as simple patterns lose their novelty and the tendency for patterns that are at first unpleasantly complex to be liked as they become more familiar. Once again, the Wundt curve seems relevant.

We may wonder whether, as in the case of the golden section, practical problems peculiar to the creative artist might not have originally contributed something to the high incidence of the octave and the fifth.

In the West, Pythagoras is credited with the discovery that, if the length of a plucked string is halved, the resulting note will be raised by an octave and, if the length is reduced by one-third, the note will be raised by a perfect fifth. Progressive shortening of a string by one-third gives rise to the cycle of fifths, through which all the notes of the classical and medieval modes and the diatonic and chromatic scales can be produced. Techniques coming into use later gave these notes the slightly different but more convenient values of the Aristoxenes-Zarlini scale (Philosophic pitch) and of the equal-temperament scale that facilitates modulation from one key to another and is incorporated in many modern instruments such as the piano. The generation of scales by the cycle of fifths is also said to have been discovered in ancient China, but there bamboo pipes rather than strings were progressively reduced in length by one-third.

In Europe, the beginnings of counterpoint can be traced back to the organum of the tenth century, in which different voices sang the same melody a fourth, a fifth, or an octave apart. It is rather easy to accompany another singer at a distance of a fifth or an octave, and parallel-fifth singing is not uncommon in other cultures. So this is another way

in which frequency of use may stem from ease of technique. But in Europe, contentment with simple organum did not last long. Free forms of counterpoint, involving separation of voices by a greater variety of intervals and abandonment of note-against-note simultaneity, launched the progression towards greater diversity and complexity.

The role of the consonant intervals in music seems rather like that of regular, geometrical shapes in the visual arts. Both represent something like an extreme of simplicity, and theoretical preconceptions have misled many writers into thinking that they also represent the acme of aesthetic satisfaction. But even in its beginnings, experimental research into preferences has cast grave doubt on this assumption. When presented in isolation, neither geometrical shapes nor the most consonant pairs of tones are judged most pleasing. Patterns exceeding them moderately, but not excessively, in complexity are preferred to them. Concords appear frequently in music, just as circles, triangles, and squares appear frequently in the visual arts. But their contribution to aesthetic satisfaction depends chiefly on the higher-order structures that they form when they occur in sequences and on their juxtaposition with elements of quite a different nature.

## 15

# STYLE, PERSONALITY, CULTURE

The preceding chapters contain some faltering initial steps in the search for characteristics that may be common to all works of art and for principles that may be valid throughout the domain of aesthetics. We sought, above all, to link artistic creation and artistic appreciation with other psychological, and particularly motivational, phenomena. These tasks were undertaken, not because they represent the only worthwhile approach to the study of art, but because the aims of scientific inquiry impose them on us. Science, like art, must look for unity in diversity.

The proceeds of this discussion, especially when so many recalcitrant problems have been barely broached, must seem disappointing and meager to those who are impressed above all by the endless heterogeneity of art. They will feel more attracted by the immense literature in which critics, art historians, and philosophers have invited their readers to savor the peculiarities of individual works.

We have felt obliged to insist continually that works of art can contribute to many different goals, call upon many different psychological functions and sources of pleasure, and exploit many different devices to accomplish their objectives. In their eagerness for generalization and summary statement, builders of abstract aesthetic theories have often paid scant attention to the contrasting styles of different artists, civilizations, and historic periods. Writers whose approaches are remote from those of scientific investigation, and who reply primarily on aesthetic sensibility and intuition, seem often to be aware of little else. They have accordingly provided minute analyses of particular works and styles, relating them to the personalities of particular artists and the structures and values of particular societies as they perceive them.

This activity has evidently attracted an interested audience throughout the centuries. But most of it has little to contribute to the peculiar aims of science, apart from spotlighting problems or suggesting hypotheses.

First of all, there are difficulties over classification. Classificatory schemes take up a great deal of energy and excite controversy when a field of inquiry is in its infancy. This was so in the early days of chemistry and biology, which have now passed. It is so in the early days of

personality study, anthropology, and sociology, which are still with us. A proposal for a new taxonomy can be an epoch-making contribution when things are at this stage. A classificatory scheme can certainly perform a service in pointing to similarities, differences, and affinities that were not previously recognized. But a set of heterogeneous phenomena can inevitably be divided up in many different ways, and different writers inevitably propose different classifications whose claims cut across one another. We therefore need an objective basis for preferring one classificatory scheme to another or for telling which taxonomy groups together entities that can be profitably treated in combination for scientific purposes. Systems offering a few mutually exclusive categories must be replaced sooner or later by multidimensional systems of measurement, which alone are capable of providing fully informative descriptions. Ways of determining which classificatory schemes are to be preferred on objective grounds and of identifying fruitful forms of measurement are available, principally in the form of multivariate statistical techniques. But their application to aesthetics is only just beginning.

Second, detailed analyses of individual works or artists have all the limitations of the case-history method, which we have more than once had occasion to note. These difficulties are intensified when a writer, painter, or composer is not accessible for questioning and may even have died long ago. Studies of this kind usually base their claims to validity on their ability to make a reader feel that they "ring true," that he is being enlightened. But these are not the criteria by which scientific validity is judged. The psychobiology of aesthetic behavior seeks to relate characteristics of aesthetic reactions to characteristics of aesthetic patterns. It cannot find these relations, and tell when it has found them, by examining particular cases in isolation. It has rather to compare reactions to patterns that possess a certain characteristic with reactions to patterns that do not.

It is, however, obvious that aesthetic reactions will reflect differences between individual human beings and between human societies. We must thus consider some of the problems that pertain to personality and culture and some of the evidence that scientific approaches are beginning to gather on these problems.

### STYLE

There have already been a few attempts to use multivariate scaling procedures for classifying works of art. A notable example is the factor-analytic study of Choynowski (1967). He had subjects rate 42 highly varied paintings on each of 46 7-point scales. Correlations between judgments on different scales revealed eight factors or dimensions. They were

named as follows (with the scale possessing the highest loading on each factor mentioned by way of elucidation): "artistic value" (banal-original), "interpretation" (false-genuine), "mood" (heavy-light), "composition" (chaotic-organized), "tonality" (cold-hot), "elaborateness" (sketchy-elaborate), "content" (devoid of content-full of content), "geometricity" (nongeometric-geometric).

Such pioneering efforts are important, but much depends on the choice of the scales from which the dimensions are derived. It is hard to be sure that the most informative distinctions have been included. Furthermore, it would be good to have dimensional schemes that are applicable to all art forms, especially since the literature, music, and visual art of a particular epoch or civilization are generally believed to possess deep resemblances.

Pending the research that will eventually reveal the most advantageous descriptive concepts, our earlier discussions point to some ways in which works of art must necessarily vary. We can list some of them and suggest tentative correspondences with the distinctions that art historians and critics customarily recognize between schools, movements, and currents.

### Sources of information

As noted in our earlier discussions (e.g., Ch. 5 and 6), the properties of an element or subunit of a work of art are subject to four principal kinds of constraints. They can depend on (1) characteristics of some external object or event, (2) characteristics of processes going on within the creative artist, (3) characteristics of a social group with which the artist identifies himself, and (4) characteristics of other elements or sub-units of the same work. Put differently, the information that a work transmits to the sense-organs of the appreciator can include (1) semantic, (2) expressive, (3) social, and (4) syntactic information. Of these, semantic information may be lacking, as it is in nonrepresentational art and absolute music. There may be little or no social information if the artist is an extreme individualist and nonconformist who abjures the aesthetic and other norms of his society and refuses to act as spokesman for any subgroup (although in the literary arts and in music he must represent his culture to the extent at least of using a conventional vocabulary). But there will always be some expressive information, since, as we have observed, a work of art communicates at least some of the preferences of its creator. There will also always be some syntactic information. Aesthetic pleasure always depends to some extent on the collative variables, on relations of similarity and dissimilarity among elements.

There may occasionally be pleasing or interesting chance juxtapositions if elements are selected completely at random, so that there is no structure, no redundancy, and thus no syntactic information. But the aesthetic satisfaction that can be gained in this way is very limited.

When semantic, social, or syntactic information is present, it will generally interact with expressive information. For one thing, processes within the artist determine which external objects, social values, and structures will figure in a work. And further, objects and group norms appear as "seen" or "interpreted" by the artist. In other words, the characteristics of a work depend on combinations of conditions inside and outside the artist. One must know something about the artist and something about his physical and social environment to predict what the work will be like.

With these reservations, one can recognize that different styles are characterized by a predominance of one or other of the four main sources of information. Semantic information predominates in Realism and Naturalism, and expressive information in Romanticism and Expressionism. Social information predominates in "academic," "official," or "ideological" art. There is little but syntactic information in geometric decoration, Constructivist sculpture, Concrete painting, and much of the Neo-Classical and serial music of the twentieth century. Classicism generally means dominance of interacting syntactic information and social information (particularly pertaining to aesthetic norms): it presents forms or combinations that are in accord with the canons of taste characterizing a particular society.\*

Although these four have always outweighed other sources of information, certain styles, particularly in recent art, introduce information from yet other sources. For example, much is made to depend on "chance" in the "drip paintings" of Pollack, the mobiles of Calder, the "aleatoric music" introduced by Cage, and the "stochastic music" of Xenakis. Here, "chance" means allowing some set of unpredictable external events to determine the selection of art elements.

In the past, little information has generally come from the material of which a work was made, because the material for a particular art form was usually strictly prescribed and did not admit of much variety. But properties of materials have become more crucial as more and more substances have become available to architects and sculptors and as composers abandon the timbres of standard musical instruments and begin to exploit the endless possibilities of naturally occurring and artificially

\* Knapp (1964, 1969) has developed a procedure for rating paintings along three dimensions and reports that it produces stable judgments. The dimensions are "expressionism," "geometricism," and "realism," which presumably reflect degree of expressive, syntactic, and semantic information content, respectively.

produced sounds in concrete and electronic music. Paintings have also ceased to be confined to materials like canvas, wood, and plaster, which do not show through layers of paint. So expressive information and the information embodied in properties of material interact in the collages of the early Cubists, in the assemblages of the Dadaists, and in the efforts of Still, Burri, and Tápies to draw attention to the nature of paint and canvas with tears, folds, burns, and rough textures.

The performing arts have always left some room for variability of execution, so that performing artists have contributed their own quota of information to the channel that links the creative artist with the appreciator. This quota is, of course, particularly large when improvisation is expected, as in classical Indian and Islamic music and in jazz, as well as in some recent experimental drama and film. Contemporary avant-garde composers like Boulez and Stockhausen have deliberately allowed the performer more discretion than has been customary, by requiring him to decide the order in which sections of a work will be played, whether certain sections will be included or not, and which of several possible readings of a score shall be adopted. Finally, some kinetic sculptures are meant to be manipulated by the viewer, so that his own actions add to the information that he absorbs.

To revert to the four principal sources of information, further distinctions are also worthwhile. Semantic information, for instance, can be transmitted with more or less abstraction and thus information rejection. Classicism and Cubism concentrate on the general rather than on the particular. This means that details and other features bestowing individuality on persons or objects are omitted, so that they are represented by some preferred form (as in Classicism) or regularized schema (as in Cubism) to which they approximate. In contrast, more of the input information is preserved in Realism, where completeness of portrayal is the goal, and in Romanticism, with its concentration on local color and on the individuality of the unique person or event. Semantic information may originate in perceptible features of external reality (e.g., the twentieth-century Neo-Realist novels of authors like Hemingway and Robbe-Grillet) or in the inferred subjective experiences of human beings (e.g., the psychological, and especially the stream-of-consciousness, novel). Then, regardless of the amount of abstraction, external reality can be depicted with more or less distortion, which means interaction between semantic and expressive information. Distortion to fit emotional reactions appears in the representational forms of Expressionism (e.g., Van Gogh, the *Brücke* school, Fauvism). Other styles show distortion to fit decorative tastes, as in the Symbolist art of the late nineteenth and early twentieth centuries (e.g., *Art Nouveau*, the Synthetism of the *Nabis*).

Although part of the expressive information content of a work must concern the artist's values--his conceptions of what is worth attending

to, both within aesthetic form and outside it--other psychological processes are often mirrored as well. Unfortunately, there is no exhaustive classification of psychological processes that is generally accepted. There is, in fact, a tendency to shun such classifications as vestiges of the discredited "faculty psychologies" of previous centuries. Lucas (1951) has correlated Classicism, Realism, and Romanticism, respectively, with predominant influence of the Freudian superego, ego, and id. Read (1943) has distinguished eight aesthetic styles corresponding to the four psychological functions recognized by Jung (thinking, feeling, sensation, and intuition), each which can predominate in extraverted or in introverted form. But the categorizations from which these schemes are in dissociable are highly controversial.

However, psychological processes of four kinds can be distinguished without inviting too much dispute, and any one of these can certainly dominate the expressive content of a work of art. Thought processes tend to do so in the Metaphysical poetry of the seventeenth century, the late nineteenth-century problem play (e.g., Ibsen, Shaw), Brecht's "epic drama," and, to some degree, all Classicism and Neo-Classicism, while perceptual processes preponderate in Impressionism, emotional processes in Romanticism and Expressionism, and imagination (free-associative or autistic thinking) in those forms of Romanticism (particularly German) that were partial to fairy tales and to the supernatural and in Dadaism, Surrealism, and their recent offshoots.

Social information is closely related to expressive information, since it informs about, and transmits the influence of, psychological processes that the artist shares with other members of his social group. It can reflect cultural peculiarities of thought and belief, perception, emotional reaction, and imagery. It can be transmitted through form or through content and, if through content, through selection, abstraction, or distortion. Communicated cultural values can be essentially static, as in those styles of Western and non-Western art that are labelled "classical" or, pejoratively, "academic." They are, on the other hand, often political or religious, as in the many periods when art has been made into a vehicle of indoctrination. At least as often as not, art has been used for the promotion of piety and the propagation of official theologies or else for the glorification of established regimes and perpetuation of their hold. On the other hand, there have been times of ferment when the social information content of art is representative of a dissident minority.

#### Relative prominence of arousal-raising and arousal-moderating devices

Although both arousal-raising and arousal-moderating devices appear to be essential for pleasure and thus for aesthetic satisfaction, artistic

styles differ in the extent to which the one or the other is present. Art biased towards heightening of arousal is called "dramatic," "dynamic," "stirring." If the arousal-moderating devices have the upper hand, art is said to be "static," "harmonious," or "serene."

The arousal-raising capacity of a work depends mainly on information content, complexity, number of subunits and details, and richness of ornamentation. These are, on the whole, markedly greater in, say, Islamic and Indian visual art and music than in those of China and ancient Greece, although all these cultures have known fluctuations. In Western art, they have been relatively high during the Gothic, Baroque, and Romantic periods and relatively low during the Romanesque and Classical periods. Similarly, arousal moderation depends in large measure on redundancy, of which there is a great deal whenever there is conformity to explicitly stated rules and importance is attached to symmetrical or otherwise restrictive structure. These features form the very substance of certain styles but are deliberately shunned in others.

### Preferred means of arousal manipulation

Quite apart from the degree to which arousal may be raised and lowered, the large number of ways in which both can be done offers further scope for variation. For example, late Romantic music built up arousal through complex texture, large orchestras, frequent chromatic notes and dissonances, sudden jumps into remote keys, long melodic lines with protracted development and upward progression of pitch, and sheer length. Novelty and surprise came from progressively bolder deviations from accepted rules and customary practices, such as Wagner's postponed resolutions of discords and Strauss's failures to resolve at all. Relief of arousal came mainly from copious repetition of themes, with or without variation, and subsidence after powerful climaxes.

This was followed by the Impressionist music of Debussy, whose works were more moderate in length and called for fewer instruments. But they had their own ways of raising arousal. There was a great variety of sound qualities, with chords and short motifs used as equivalents of timbres or of colors in painting. There was a vagueness of shape or outline, a tendency for elements to blend in creating an overall impression or mood. There was also indefiniteness of direction or uncertainty regarding what was coming next, due to the use of brief, disconnected melodic motifs and the whole-note scale with its lack of a clear reference point. The "evocative" or "atmospheric" quality was generated by conjuring up faint and multiple imagery (through association by contiguity or by similarity) or, in other words, through ambiguous and indistinct semantic content.

The Neo-Classicism of Stravinsky and of the French group "*Les*

*Six*" reacted against both late Romanticism and Impressionism. Textures became relatively clear and simple, works were relatively short, and small ensembles were favored. But arousal was induced with the help of violent and complex rhythms, sudden changes of meter, "angular" melodies with wide intervals and abrupt changes of direction, copious use of wind instruments, polyrhythm, and polytonality.

The Abstract-Expressionist, Tachiste, or Action painting of the 1950s induced arousal through extreme complexity, with abundance of minute details, lack of representational meaning or recognizable structure, use of techniques with unpredictable results such as allowing paint to drip or splashing paint from cans onto canvases, and suggestion of energetic bodily movement. The principal arousal-moderating devices were similarity of details, approximate parallelism of lines in at least parts of the painting, and concentration of shapes of a particular color in certain regions of the canvas, as well as the often noted fact that extreme complexity and randomness generate an impression of uniformity (as in the sands of the desert or the waves of the sea). All these features are absent from the Perceptual Abstraction, including Hard-Edge painting, Op art, and Minimal art, that has succeeded this style. Here arousal results mainly from highly saturated color, often coupled with the large size of uniformly colored areas, apparent movement, shifts in figure-ground relations, and unusual shapes of canvases. The extreme simplicity of composition, introducing a few areas of geometrical or near-geometrical shape, has arousal-reducing potentialities, but these are partly compensated by the startling novelty of this degree of simplicity, which contrasts so markedly with all previous styles of painting (except for the style's Constructivist and Neo-Plasticist forebears).

## INDIVIDUAL DIFFERENCES

### General factors

Some people, it is generally believed, are endowed with more aesthetic "taste" or "sensitivity" or "appreciation" than others. Two standards measuring this variable have been adapted. One is the extent to which the preferences of a particular subject agree with the general consensus of the group to which he belongs. The other is the degree to which his preferences agree with those of a group of expert judges.

There have been several studies of the extent to which averaged judgments of large nonexpert groups tend to resemble those of experts and, with some kinds of material, evidence for convergence has sometimes been obtained (see Eysenck, 1947), but the evidence from other investigations (e.g., Child, 1962) has been negative. When the two criteria

are not concordant, questions may well be raised regarding the grounds for ascribing validity to expert opinion. The judgments of those who have had specialized training in art reflect intensive exposure to works of art and also intensive exposure to the attitudes that have for historical reasons become implanted in art schools.

If an individual's judgments come close to group means with one kind of material, they are likely to do so also with other kinds of material. The degree of agreement with expert evaluations also tends to be constant from one kind of material to another (Eysenck, 1947; Child, 1962). Correlations have sometimes been found, and sometimes not, between judgments of experts belonging to different cultures, and the same holds true when judgments of laymen have been compared across cultural boundaries (Child, 1969).

Child (1965) has looked for personality characteristics distinguishing those who are most concordant with experts in their ratings of art reproductions. His findings point to five principal traits: (1) tolerance of complex situations; (2) tolerance of ambiguity of feelings or perceptions; (3) "exploration (scanning)": i.e., breadth of attention and the accuracy with which details of objects or events are noted; (4) independence of judgment; and (5) "regression in the service of the ego"; i.e., a capacity to escape momentarily from the usual logical restraints of adulthood and take an interest in playful, imaginative, and unusual aspects of things. These traits are unmistakably related to the processes on which we have held aesthetic appreciation to depend. The first three indicate a willingness to approach situations that are conducive to uncertainty and curiosity and to react to them with specific exploration rather than withdrawal. The fifth suggests a propensity for diversive exploration.

Experiments using nonartistic material have repeatedly shown an overall tendency for subjects to spend more time looking at more complex patterns. But the extent to which mean looking time for complex patterns exceeds mean looking time for simpler patterns naturally varies from person to person. The proportion of time for which the gaze is directed towards the more complex pattern of a pair turns out to be a stable trait (Day, 1965, 1966). In other words, those who show most concentration on more complex items one day are likely to focus most on more complex members of quite different pairs of patterns the next day.

Degrees of preference for asymmetry, multiplicity of elements, and heterogeneity of elements were not intercorrelated in a study by Rump (1968), which led the author to question the existence of a general factor of preference for complexity. On the other hand, Eisenman and others (1969) report a high positive correlation between liking symmetry and liking simplicity.

### Bipolar factors

Besides a general factor or dimension of overall aesthetic sensibility, statistical studies have often revealed bipolar factors, representing tendencies for individuals to lean towards one kind of art or towards its opposite. They have been variously characterized as a dimension opposing "Classical" to "Romantic" art (Dewar, 1938; Williams, Winter, & Woods, 1938), as degree of choice between "detailed naturalism" and "good composition" (Peel, 1945), and as a "technical" factor contrasting "rhythm, sentimentality, representational accuracy" with "atmospheric effect, symbolic expression, tension, brilliance of coloring" (Pickford, 1948). According to Knapp and Ehlinger's (1962) data, those who like "restless and troubled" music rather than calmer music tend also to like "turbulent and diffuse abstract art" and "curvilinear architectural forms."

Finally, there is Eysenck's (1941b, 1947) K factor, to which we shall have to come back later. This distinguishes those who are partial to the "simple, highly unified, vividly colored, modern type of picture," the "poem with the obvious rhyming scheme and the definite, unvarying, simple rhythm," the "polygon with the simple, straight forward outline," and the "strong, obvious odor" from those preferring the "complex, less 'poster-color,' more diversified picture, the complex polygon, the poem with the less obvious rhythm and a more variable and looser rhyming scheme, the more subtle odor."

### Personality correlates of bipolar factors

*Prevailing arousal level* Experiments with both animals, particularly rats, and human beings as subjects (see Berlyne, 1967) suggest that unusually high arousal reduces the normal tendency to seek out novel or complex stimulation. This effect has appeared after arousal has been raised by such varied agents as, in animals, injections of methamphetamine, injections of adrenaline, white noise, electric shock, and hunger, and, in human beings, subjection to frustrating tasks. It is as if, when arousal is high, the whole Wundt curve is displaced towards the left, so that the most pleasurable and rewarding amount of arousal potential is lower than it would otherwise be.

There seem to be indications that, when arousal is unusually high, the orientation reaction or arousal increment resulting from a particular stimulus may be of larger amplitude than otherwise. A relatively active reticular formation may, it seems, be a relatively excitable reticular

formation. If this is so, the effects under discussion may occur because a stimulus that normally produces a moderate arousal increment, within the rewarding or pleasant range, produces an increment large enough to be aversive or unpleasant when arousal is high.

We might therefore expect that subjects whose prevailing level of arousal is higher than average, whether through chronic anxiety or through a particularly high sensitivity of the arousal system to stimulation, should be averse to relatively complex, novel, and generally arousing forms of art. Several studies using personality tests have, in fact, revealed negative correlations between measures of anxiety and measures of tendency to seek out novel or variable stimulation (McReynolds, 1958; McReynolds, Acker, & Pietila, 1961; Zuckerman, Kolin, Price, & Zoob, 1964; Penney, 1965).

**Introversion** A great deal of research on aesthetic and other questions has centered around the personality dimension of introversion-extraversion. These terms were first introduced by Jung (1921) but have since been used by Eysenck (1947) to designate a dimension brought into prominence by his own research. With a variety of other labels, other authors' attempts to classify personality have repeatedly drawn attention to equivalent dimensions or oppositions.

According to Eysenck (1947), introverts are characterized by a "more subjective outlook," a "higher degree of cerebral, as compared with behavioral activity," and a greater "tendency to self-control (inhibition) than extraverts."

Recent years have seen an accumulation of evidence (Eysenck, 1967) that introverts have, on the whole, higher arousal levels than extraverts. There are reasons for suspecting that this is because introversion (which seems to coincide largely with what Pavlov and his followers have called the "weak" type of nervous system) means relatively high arousability, a tendency to respond to a given stimulus with a particularly high arousal increment.

In view of what was said earlier about the inverse relation between arousal level and the most rewarding or pleasurable amount of arousal potential, we should expect the preferred level of stimulation (arousal potential) to be lower for introverts than for extraverts. This is precisely what Eysenck claims to be the case (1967) on various grounds. Introverts, he says, are especially apt to be frightened or disturbed by overstimulation, which is why they tend to withdraw from social to solitary activity, whereas extraverts are more susceptible to understimulation and boredom, making them more addicted to sensuous and gregarious pleasures. Since extraverts are fond of strong stimuli in general, Eysenck (1965) deduced that they would be more partial than introverts to "strong and vivid colors." Support for this came from an experiment in which subjects were first asked to indicate their order of preference among black-on-

white shapes and then their order of preference among colors. Subsequently, they were asked to rank colored shapes. In this phase, the rankings of introverts showed more dependence on their form preferences and those of extraverts on their color preferences.

There are, however, some apparent anomalies between Eysenck's present position and some of his earlier findings. He reported (1941, 1947) a correlation between introversion-extraversion and his bipolar K factor, such that introverts tend to prefer the more "academic" paintings and the more complex polygons or poems while extraverts are drawn towards "modern" paintings and simpler, more straightforward shapes and verse forms. The paintings classed as "modern" included bright colors and distortions of familiar objects, which are presumably arousing properties, so that there is some concordance with the view that optimal arousal potential is greater for extraverts. On the other hand, the tastes of introverts are inclined towards more complex patterns, and, as we have seen, there are grounds for expecting more complex patterns to be more arousing. A study by Barron and Welsh (1951) indicated likewise that individuals who say that they like more complex visual forms tend to have introverted personality traits. On the other hand, Day (1965) obtained a significant positive correlation between extraversion and degree of preference for complex patterns, measured by the Barron-Welsh test.

Perhaps the situation is complicated by an additional difference between introverts and extraverts. There are scraps of evidence (see Berlyne, 1960, 1968) that introverts are more likely to react to problematic stimulus patterns with exploratory activity and thought, while extraverts are more prone to avoidance and withdrawal of attention. According to Eysenck (1954), there is evidence that persons with a high "intolerance of ambiguity," a trait that has received a great deal of study from specialists in personality, tend to be extraverts. Pathological caricatures of the two opposite modes of reaction may be recognized in the endless brooding and concern with niggling details of the obsessive-compulsive neurotic and in the repression and insensitivity, amounting at times to anaesthesia, of the hysterical patient. Introverts may therefore like complex patterns because their superior cerebral control enables them to handle them effectively.

A further possibility, namely that introverts, with their partiality for solitary and symbol-manipulating activities, spend more time in contact with works of art and that their tastes become more sophisticated in consequence is worth considering. But a study by Sisson and Sisson (1940) failed to support it.

Knapp (1964) reported a correlation between extraversion and preference for representational over nonrepresentational paintings. His representational and nonrepresentational paintings differed, however,

in other respects also. Roubertoux and Carlier (1971) used pairs of pictures, each consisting of a representational and a nonrepresentational member, that were carefully designed to be as alike as possible in all other respects. They failed to find any confirmation for Knapp's assertion. In a later study (Roubertoux, Carlier, & Chaguiboff, 1971), these authors found a tendency for those who preferred nonrepresentational paintings to be more dominant and sure of themselves, more open to change and flexible in their taste and, surprisingly enough, more conservative.

*Conflict and displacement* Some people appear to be constitutionally more susceptible to fear than others, and some life histories contain more experiences conducive to acquisition of learned fear than others. What was said earlier about displacement in art, with special reference to Miller's theory, would lead one to expect that, if a certain subject matter is both attractive and frightening, individuals in whom the element of fear is stronger will be drawn towards art that is relatively free from realistic simulation. This means art with a high degree of abstraction or distortion or else art in which formal requirements or the peculiarities of the material are dominant. Those in whom fear has been conditioned to, or has generalized to, many different sources of gratification might well come to prefer such art in general and not merely when certain themes are treated.

Another way in which learning experiences conducive to fear can affect preferences is revealed in an investigation by Knapp, McElroy, and Vaughan (1962). Subjects whose image of the conscience was "hostile," "ego-alien," and "severe" tended to like melancholic rather than "blithe" art. Why this should be so is a question that calls for further research. It may be that, as Freud held, some satisfaction can be derived from self-punishment as a means of assuaging guilt. Even rats, it has been found (Sidman & Boren, 1957), may give themselves electric shocks rather than suffer prolonged fear. But there may also be the kind of compromise that so often underlies displacement, if art with sad content affords contact with conflict-ridden themes, e.g., sexual. On the other hand, what is at work may be the tendency for subjects to like art in tune with their own characteristic emotional reactions that Cardinet (1958) has demonstrated. Other art may be shunned because it induces conflict between the emotional condition that a work of art tends to create and the subject's usual emotional reactions.

Roberts and Ridgeway (1969) have extended to music the "conflict-enculturation" theory with which Roberts and other collaborators (see Berlyne, 1969b) have explained the prevalence of different kinds of games in different societies. According to this theory, a person whose upbringing has generated approach-avoidance conflict in relation to a particular area of life will be attracted towards activities that can serve

as "expressive models" of this area. This was deduced from Miller's theory of displacement (see ch. 12 and Fig. 12-1), which predicts deflection of behavior on to stimulus situations with an intermediate degree of resemblance to the situation giving rise to conflict. Roberts has suggested that curiosity due to conflict and the utility of displacement activities as training devices for overcoming fear and acquiring the pertinent skills may also play a part. It is argued that music can be regarded as "model speech" and that progressively greater degrees of dissimilarity to speech are represented by popular songs (in which the words are clearly intelligible), opera (in which there are words, but they are usually difficult to follow), and symphonic and chamber music (in which there are no words). Roberts and Ridgeway used various questionnaires to establish a subject's degree of conflict over the amount of talking that he would like to engage in and whether he had simultaneous approach and avoidance attitudes towards public speaking. Subjects who were more prone to conflict over speech were found to spend more hours per week listening to music attentively. Furthermore, those who spent more time listening to music were more likely to prefer large orchestras and string quartets to musical comedies and hit songs, which suggested greater displacement away from speech.

*Neuroticism* Payne (1967) had subjects name their favorite musical composers and used these data to classify them according to their degree of predilection for "romantic" music, marked by "mystery, abnormality, and emotion," or "classical" music, which is music in which "a small degree of specific emotion penetrates the music indirectly or as a spill-over" or in which emotion is "symbolized deliberately and objectively to produce stylized expression" or for which the label "absolute" music is appropriate. A significant association was found between liking for romantic music and neuroticism, another of Eysenck's personality dimensions. "Unstable" individuals, who have high scores for this trait, have relatively poor control over their emotional processes, which may very well be due to relatively ineffective restraint by the cerebral cortex of the brainstem structures that govern arousal (see Nebylitsyn, 1964; Berlyne, 1968).

### A threefold classification

Morris (1957) has related aesthetic preferences to Sheldon and Stevens's (1942) threefold scheme, in which temperament and physique are held to be correlated. The overall conclusion was that there is "a tendency for persons to prefer and to appraise positively paintings which symbolize a situation that satisfies their constitutional needs." Mesomorphs, who like vigorous bodily activity, tend to prefer "athletic,

"muscular, tactful" paintings showing mesomorphic persons in situations where they are "actively dominant." Endomorphs, who are relaxed and receptive, prefer "imaginative and meditative" paintings, in which "persons and things are in close rapport." Ectomorphs, who are sensitive and self-protective, prefer paintings with "self-contained" composition, in which "persons and objects keep their distance." This conclusion fits in with the suggestion that one function of art is to supply simulations of conditions from which satisfactions can be derived. But it does not tell us in what conditions contact with art would be sought rather than direct contact with the depicted situations. Nor does it take account of variations in the preferred degree of approximation to the depicted situation.

### Previous experience

There are many reasons for expecting those who have had more exposure to art, or more exposure to complex and challenging stimulation in general, to have different aesthetic tastes from those who have had less. The contributions of uncertainty and surprise to aesthetic pleasure can be realized only when the appropriate expectations have been acquired. These necessitate sufficient acquaintance with art to learn the redundancies and transitional probabilities that characterize particular art forms, styles, and cultural traditions. However, explicit instruction in the principles governing artistic construction will also help. Moreover, if an individual has been exposed to a rich assortment of stimulation, whether through art or otherwise, many combinations of elements will have lost their novelty and thus their appeal. Finally, diversified experience is likely to improve capacity for processing disorienting patterns promptly and effectively, so that it takes more complexity and irregularity to create the conditions for enjoyment.

These assumptions are borne out by experimental evidence. Several investigators have compared nonspecialized subjects, usually students of disciplines other than art, with art or music students or professional artists (e.g., Barron & Welsh, 1952; Eisenman & Coffee, 1964; Munsinger & Kessen, 1964; Vitz, 1966b; Simon & Wohlwill, 1968; Crozier—see Berlyne, 1971). Artistically sophisticated subjects are found to favor more complex visual forms and less predictable sound sequences than other subjects. And, while there seems to have been no experimental work to test Aesop's portrayal of the town mouse and the country mouse, Singh (1968) has compared town and country monkeys. He showed that the wild rhesus monkeys that roam the streets of Indian cities are more inclined to approach relatively complex stimulus patterns than their conspecifics from the jungle.

There are, however, two experiments that point in the opposite direction. Brighouse (1939b) presented polygons taken from Birkhoff's (1933) book and reported increasing preference for simpler items with increasing age and artistic training. The peculiarities of Birkhoff's criterion of "complexity" (see Ch. 10), which differs from those adopted by the other investigators under review, make this isolated, anomalous finding difficult to interpret.

Eysenck and Castle (1970) likewise report that subjects who had studied art preferred less complex polygons than those who had not. But it is worth mentioning that all the polygons used in their experiment had either rotational or reflectional symmetry. If constraints are introduced by such factors as symmetry, patterns with more components may possess greater relative redundancy (i.e., an uncertainty value that is a smaller proportion of the maximum possible uncertainty value) than a pattern with fewer components. It could thus, paradoxically, take less perceptual effort to organize them.

Although some of the experiments relating looking time and evaluative judgments to complexity have been done with children, most had student subjects, who must have had a fair measure of exposure to complex and varied stimulation and experience of puzzling out difficult symbolic material. The few extensions of this kind of work to other populations caution us against underestimating the difference that socio-economic variables can make. Francès (personal communication) has presented more and less complex visual patterns, differing in number of elements, regularity of arrangement, or presence or absence of incongruity, to students and to workmen. The students, but not the workmen, showed the frequently reported tendency to spend more time inspecting more complex patterns. They judged the more complex patterns more interesting, but the workmen expressed preference for the simpler patterns and judged them to be more interesting. We may suppose that the students had had more experience of encountering, and coping with, complex visual material, although differences in native intellectual capacity might also have played some part. "Culturally deprived" children spend less time looking at patterns than "culturally enriched" children and are, in particular, less inclined to spend more time on incongruous pictures (Lore, 1965). Their greater restlessness constitutes a further indication that the pictures engage their attention less thoroughly.

In another study by Brighouse (1939a), pictures were exposed repeatedly for  $\frac{1}{4}$  sec until subjects were able to record hedonic judgments (of pleasure, indifference, or dislike) and state the bases for them. Of the children and artistically untrained adults who participated, 75 percent gave a hedonic judgment after the first exposure, whereas only 55 percent of the artistically trained adults did so by the fifth exposure. What

is more, the "artistically trained observer," wrote Brighouse, "shows far greater mental activity of a carefully directed kind." For example, all of the subjects in this category, but very few of the others, noted "relations between previously observed features." The artistically sophisticated were evidently more inclined to engage in perceptual processing and to withhold hedonic judgment until it had made some headway. We may speculate that, for them, the sequence of events underlying the arousal/jag was relatively important, while the faster-acting mechanism of the arousal/boost dominated the reactions of the other subjects.

### Personality and self-exposure to art

The voluminous literature relating personality to aesthetic reactions has focused more or less exclusively on what happens after an investigator has presented stimulus material with a view to measuring looking time or recording verbal evaluations. But outside laboratories, people decide for themselves how often they will be exposed to works of art and what kinds of works they will be. The vast and important topic of how personality affects self-exposure to art is barely beginning to receive the study that it warrants.

In the economically and technologically advanced countries, amount of exposure to art in general and to particular forms of art is clearly subject to wide variation depending on age, wealth, occupational group, and education. The influence of these factors on leisure occupations has been analyzed statistically by sociologists (e.g., DeGrazia, 1964; Toffler, 1964; Bourdieu & Passeran, 1966). But psychological factors must also carry some weight.

Pioneering work on relations between personality variables and access to art has been done by Roubertoux. In a study on high-school students (1970), he distinguished a group that went to the theater to the exclusion of other artistic activities, a group whose only artistic outlet was to visit exhibitions of visual art, and a third group that did not engage in any form of artistic leisure activity. After administering two tests (the IPAT Anxiety Test and the Guilford-Zimmerman Questionnaire), incorporating measures of several personality traits, the author concluded that subjects with artistic interests were distinguished by higher guilt proneness, ergic tension (i.e., pressure from drives), and, generally, by traits indicative of anxiety and instability. These findings are in keeping with the view that, as one of its functions, art provides opportunities for substitute satisfaction through displacement when direct gratification of some strong motive is blocked by fear and moral scruple. The group interested in visual art showed a particularly high tendency to restraint, which can be expected to produce conflict in

combination with ergic tension. The theater-goers were apparently more impulsive and weaker in factors making for restraint. On the whole, there were some indications that the art gallery may be more likely to attract introverts and the theater extraverts.

### SOCIAL DIFFERENCES

Factors of two kinds have been cited in explanation of the prevalence of different styles of art in different parts of the world and at different periods of history. Social conditions vary with time and place and impose their characteristic biases on the techniques of the artist and the tastes of the appreciator. There are, however, often held to be endogenous forces bound up with the very essence of artistic creation, that make for continuous change and variation.

### Endogenous trends

"Stylistic dynamism" is for Peckham (1965, p. 71) part of the very definition of art. "External discontinuity" is indispensable if the appreciator is to be prevented from foreseeing with excessive accuracy what a work will be like, which would render aesthetic perception impossible. "The artist's role . . . requires him to innovate new devices" (p. 221). In the middle of the twentieth century, we are living through a time when it is very hard to find anything that no visual artist or composer has thought of doing, or attempted to, in the past. In the unlikely event of somebody stumbling on a possible innovation that has been overlooked, he feels compelled to seek notoriety by doing it. But this has not always been so. During the 2,500 years of Chinese art and the 3,000 years of ancient Egyptian art, there were certainly swings of style and taste, but nothing like so much diversity as Europe and America have known in the last fifty years.

Munro (1963) holds that art, like so many other phenomena, tends to evolve in the direction of increasing complexity, which, in line with Spencer's definition, is taken to mean "differentiation" together with "integration or coherence." There can be complexity either in the sense that a particular work of art has "many different parts or qualities which are organized in some unifying way" or in the sense that "various arts and their products . . . have become very different from one another, and yet are socially interrelated" (p. 290). But it is admitted that there are many apparent reversals of this trend: there may be a return to greater simplicity when a civilization undergoes catastrophic disillusion, when a society deliberately reverts to a more primitive mode of living,

and when the stresses of advanced civilization encourage fantasies of simpler and earlier times.

Martindale (1969) has worked out an extremely ingenious theory of stylistic progression, which he applies in detail to poetry but considers applicable to the arts in general. He argues that, since art is a creative activity and creation means innovation, the poet finds himself under unremitting pressure to produce something original. This entails recourse to more and more unusual juxtapositions of ideas (increasing "depth of regression") as the possibilities of milder novelty are used up. This trend is eventually halted as either the imaginative capacities of the poet or his audience's capacities for tolerance reach their limits. The push towards increasing "depth of regression" will then be reversed somewhat and replaced by a loosening of logical and syntactical structure (a drop in "degree of elaboration"). Martindale buttresses his theory with content analyses of the course of English and French poetry in recent centuries. But one might question the applicability of his assumptions to the art of all periods and cultures. It is true that novelty is always demanded to the extent that the artist must produce something other than an exact replica of previous work. But there have been times and places when spectacular deviation from the work of his predecessors was not expected of him. As mentioned, throughout the three or four millennia of ancient Egyptian art, detectably different styles succeeded one another but there was much less stylistic change than during any decade of recent art history. And there have been times, such as the Renaissance and the eighteenth century, when many artists strove to approximate the aesthetic norms of a long departed Graeco-Roman antiquity, as they perceived them, rather than to break with all precedents.

## Cultural influences

On the causal influences that social differences exert on artistic style, there is a boundless wealth of scholarly material but a dearth of solid evidence.

The only satisfactory way to test hypotheses linking cultural factors and characteristics of art is to use the statistical method of cross-cultural analysis that was introduced by Murdock (1949) and has since been applied to a wider and wider range of anthropological problems. It means taking a sample of societies about which adequate information is available and deciding by some objective and precise criterion in which of them some characteristic is or is not present. It is then determined with similar objectivity whether or not the aesthetic style of each society falls into a certain category. Finally, standard statistical

techniques must be used to determine whether art of the category in question is more likely to be found in societies that possess the characteristic of interest than in societies that do not. This is how support is routinely gathered for generalizations in fields ranging from medicine to astronomy. Such studies are no less feasible and no less indispensable in aesthetics. So far, there have been just a few investigations of artistic style in which cross-cultural comparisons have been made with the appropriate precautions.

Pending the much needed growth of this kind of research, we must fall back on studies using the methods of criticism and art history, with all their richness of resources and inconclusiveness of outcome. There have been countless discussions of particular societies with reference to their artistic preferences and of particular works with reference to their social backgrounds. There have also been important attempts to synthesize, including Hauser's (1951) historical review of interactions between social conditions and art from the Old Stone Age to the present, Duvignaud's (1967) description of eight aesthetic attitudes that are held to receive encouragement in particular types of society, and Munro's (1963) account of parallel evolutions in society and in art. Kavolis (1968) has endeavored to derive some tentative conclusions from all accessible sources of evidence, whether historical, critical, ethnological, statistical, or experimental. All these contributions are extremely valuable, but mainly as sources of hypotheses that remain to be tested by experimental and statistical techniques, especially of the cross-cultural variety.

*Complexity* The few cross-cultural analyses of art that have been done so far and many of the comparative studies using less rigorous methods have, significantly enough, confirmed the importance of a simplicity-complexity dimension of style. It is evidently a matter of "complexity" in a broad sense, including all the factors covered by this term in the theories of Birkhoff and Eysenck. It really amounts to what we have called "arousal potential."

Barry (1957) took 30 nonliterate societies, which had already been classified according to their child-rearing practices, and asked subjects to rate ten or more works of art produced by each society on eighteen different 7-point scales. According to the judgments, there was a cluster of stylistic characteristics that showed a strong tendency to be present or absent together. They were "many repeated figures to form complex organization of design," "enclosed figures," "lines oblique to each other," "sharp figures," "curved lines," "representativeness," "lines oblique to edge," and "crowdedness of space." All of these attributes could thus be treated as indices of overall complexity, and a measure derived from all jointly as found to be significantly correlated with severity of socialization. In particular, complexity of artistic style was

found in societies in which "oral satisfaction" was low, which meant that food (including mother's milk), affection, and protection were withheld with relative stringency during childhood. There was also some indication that societies favoring complex art are ones in which there is relatively harsh training for independence. Knapp, Brimmer, and White (1959) made the congruent finding that middle-class American students, who have presumably been subjected to "severe socialization and impulse control," prefer "fine and complicated designs characterized by generally somber coloring."

Another cross-cultural investigation (Fischer, 1959) revealed that societies with a hierarchical structure are more likely than others to produce designs containing many dissimilar elements, little irrelevant space, and enclosed figures.

Evidence of a positive relation between complexity of style and complexity of social interaction was actually the principal outcome of the most ambitious cross-cultural study in aesthetics to have been undertaken yet, namely the "Cantometrics" project on folk songs and folk dances (Lomax, 1968). Taking a large sample of cultures from all continents, the Cantometrics team first distinguished five stages of progressively more complex economic activity, ranging from extraction (gathering, hunting, and fishing) to agriculture with irrigation. This index of the economic complexity turned out to be positively correlated with other indices of social complexity, namely (1) size of local community, (2) form of settlement (nomadic bands to stable and compact settlement), (3) number of extra-local hierarchies, (4) degree of class stratification, (5) incidence of complexly organized and variable tasks, and (6) incidence of control of work products by management and ownership. The more complex a society by these criteria, the more complex its folk songs were found to be, as evidenced by (1) wordiness (infrequency of repetition in text), (2) precision of enunciation and moderate delivery (with level of volume and stress kept close to those of normal speech), (3) presence of solos, (4) use of narrow melodic intervals, (5) use of melody with accompaniment rather than unison, (6) presence of polyrhythm and counterpoint, (7) presence of embellishment and (8) alternation between solo and chorus. In the dance, cultural complexity goes together with (1) complexity of transitions between movements, (2) number of bodily parts involved, (3) variation in intensity of effort, and (4) variety of shape.

"The principal discovery in Cantometrics," says the report, "is that a culture's favored song style reflects and reinforces the kind of behavior essential to its main subsistence efforts and to its central and controlling social institutions" (p. 133). For example, it is suggested that, in complex societies, people need to have things explained to them with restraint and moderation, which engenders a preference for mod-

erate delivery in a singer. Furthermore, a leader has to hold the center of the stage in order to exhort his followers and coordinate their activities, and members of the society must learn to listen for long periods without replying. This behavior is facilitated by the experience of listening to solo singing. At least, this direction of causal influence is suggested in the Cantometrics report, but it is not impossible that causation works in the opposite direction.

The data reveal affinities between the organization of singing and the organization of economic activity. Where people carry out work in teams, there tends to be high tonal cohesiveness and rhythmic cohesiveness. Diffuse and individualized singing is found where there are temporary or compulsory teams, but voices blend well when work teams are stable and voluntary. Where there is division of labor between men and women, with women making essential contributions to subsistence, there is likely to be rhythmic and melodic polyphony. In general, "gross synchrony," the ability to sing together cohesively, is apparently reduced by masculine aggressiveness, diffuse organization, rigid stratification, masculine dominance over production, and repressive control of feminine sexual activity (p. 202). All these factors, it is suggested, cut down the "frequency of gross paralleling in inter-communication" and reduce the "frequency, amplitude, and duration of the synchronous behavior permitted by the culture as a constant feature in the stream of communication."

The attributes of song and dance that are thus viewed as aspects of complexity and correlated with social complexity are all factors that increase information content. They increase the number of distinct elements occurring together or in succession and thus the information that the singer or dancer must absorb in order to perform correctly and that the listener must absorb in order to appreciate the song or dance. If he is to merge his own voice successfully into a chorus and keep his timing and pitch in line with those of his companions, a singer must likewise absorb a great deal of information from the behavior of other individuals, as with all collective human activities that require division of labor and coordination among distinct tasks. In polyrhythmic or polyphonic singing, the information load is still greater, since information about what others are doing or singing and about what the individual himself must do or sing have both to exert control over behavior.

Literature reviewed by Kavolis (1968) leads him to hypothesize that more complex forms of art are preferred in more prosperous societies, in urban rather than in rural communities, and in groups that are in contact with other groups rather than isolated. These, it will be recognized, are the kinds of societies whose members are likely to meet with the most varied stimulation.

The liking for complex art in complex societies provide support

for the notion of an "arousal tonus" (Berlyne, 1960), in some ways analogous to muscular tonus, the tension that is maintained in the skeletal musculature even when resting. It seems that the human organism must strive to keep up a certain rate of information intake or, more generally, level of arousal potential. This would be a level that is not high enough to push arousal up to the aversive region. It is also not so low that an aversive condition of boredom supervenes, producing at least some manifestations of high arousal. The arousal potential is presumably such that the arousal increments or orientation reactions resulting from incoming stimuli are within the rewarding and pleasant range. Maintenance of an appropriate tonus will, we may imagine, keep the central nervous system at peak efficiency and enable it to respond with a minimum of disturbance to the demands that may be made on it, just as muscle tonus facilitates effective bodily movement. And, just as the muscles have to adjust their tension to the kind of environment in which the organism finds itself and particularly to the calls for motor activity that it is likely to present, we may suppose that arousal tonus will gravitate towards a higher or lower level, according to how arousing the environment is.

Complex social environments shower the individual with unremitting stimulus change, much of it unpredictable, and require information to be taken in from the environment in large quantities in order to guide intricate, skilled movements and make possible close coordination with activities of other members. Complex social structures necessitate different reactions to different individuals in accordance with their social roles. These likewise demand fine discrimination between individuals and between cues indicating status, which means, once again, a heavy intake of information. Even when these requirements are attenuated, as they will normally be when somebody has the leisure to enjoy art, enough arousal potential to maintain the tonus is apparently still needed.

Societies with complex art tend, as we have seen, to be ones with harsh early training for independence and later training for collaboration in complicated collective activities. These kinds of training teach one to process plentiful influxes of environmental information—to take account of fine differences between environmental events in selecting actions. They also instill an ability to withstand conflict and to restrain impulsive responses, which is a prerequisite for effective perceptual and intellectual processing of information.

The Cantometrics project brings out the similarities between the elements and structures that characterize art and those that characterize the work-a-day occupations of a society. The components of art must obviously be taken from the stuff of everyday life. The poet uses words that belong to ordinary conversation, and the painter or sculptor draws

on the objects around him, however strange the ways in which he combines them or modifies them. This is partly because the actions of the artist must depend largely on generalization from learning that has occurred in nonartistic situations. It is also because familiar elements evoke responses that enable them to serve as symbols, that can fit together to form new unified structures or jar with one another to produce surprise, uncertainty, and conflict.

Nevertheless, art must provide some things that everyday life does not provide or, at any rate, does not provide in sufficient quantity. The contrast between art and the nonartistic world must be important as well as the similarities. One cross-cultural study (Robbins, 1966) warns us against overlooking the role of art as a source of novelty. The investigator actually began with the hypothesis that "the shape of a society's cultural art style would be related to the shape of its primary house type," in accordance with the general principle that "an art object will be cognitively preferred if it contains form or characteristics similar to those normally experienced." The results pointed, however, to exactly the opposite conclusion: societies with circular houses had the least curvilinear art, and those with rectangular houses had the most.

*The dynamic-static dimension* Kavolis concludes that "dynamic patterns" tend to occur in the art of societies with dynamic economies. A dynamic pattern is "a pattern which stimulates in the onlooker an idea of motion, action, conflict, disequilibrium, etc." (Kolaja & Wilson, 1961). "A dynamic economy may be a consequence either of rapid growth or of an unsettled, adventurous mode of existence (nomadism)," (Kavolis, 1968, p. 20). Aesthetic styles, on the other hand, are said to reflect the "invariant quality of life" found, for example, in agricultural communities. This dimension, like the complexity dimension, seems to involve differences in arousal potential.

*Rigidity-spontaneity* Another dimension discussed in Kavolis's review is rigidity-spontaneity. This corresponds, it seems, to the relative weight of cultural and expressive information, the extent to which certain forms and characteristics appear in the works of all artists or different artists can stamp their works with their individuality. "Formal rigidity," as distinct from "spontaneous dynamism," is stated to characterize static economies (as compared with dynamic economies with a great deal of trade and free competition) and societies with high internal cohesion, religious authoritarianism, or low social mobility. Rigidity tends to appear where there is an active aristocracy and spontaneity where there is a functionless aristocracy. These tentative correlations are compatible with the not very surprising conclusion that spontaneity sprouts when original initiative is required or permitted in the course of daily work and in the expression of opinions about political or religious matters.

A related question to how much freedom the artist is allowed is how much variability of response is allowed among appreciators. According to Kavolis's material, autocratic societies produce works of art that are organized around a dominant focus, that have a strict, hierarchical arrangement of elements, that have an overall scheme to which details are subordinated. This is likely to mean coercion of the appreciator into giving certain portions of work the bulk of his attention, examining the elements in a particular order, grouping elements in a particular way. The art of democratic societies is, we are told, less likely to have these characteristics. The opposite extreme is apparently reached by much contemporary art, in which the appreciator is expected to take most of the responsibility for determining how a work will be viewed or interpreted. The artist makes his work deliberately ambiguous, so that it can have different meanings for different appreciators in accordance with their different experiences and personalities. Serial composers make a point of refusing to give any of the elements of music—pitch, duration, timbre, or intensity—or any note of the octave predominance over others. Even the order in which elements of a piece are heard, which has hitherto been determined by the composer, is left to vary with the whims of the listener or performer.

*Geometricism-naturalism* A fourth dimension that is prominent in Kavolis's review is geometricism-naturalism. The term "geometricism" seems to cover both nonrepresentational art and art that is representational with distortion or abstraction. Both of these involve a reduction of semantic information content in comparison with naturalism. Kavolis deduces from the evidence he presents that naturalism is typical of advanced hunting-gathering societies and urban-commercial societies, whereas early hunting-gathering, agricultural, and industrial societies lean towards geometricism. Geometrical stylization tends also to coincide with autocracy and feudalism. It is found in the art of the peasant class, especially when it is actively self-assertive or relatively independent, and in that of a militantly self-assertive, urban working class.

Attempting to explain these correlations, some of them admittedly tentative, Kavolis (1968, Ch. 8) offers a number of rather divergent hypotheses. He argues that a preference for naturalism should typify groups with "instrumental roles," i.e., roles that are "oriented toward . . . adaptation to the external environment" and require a "predisposition to deal, both in action and fantasy, with *things*." Abstraction should be preferred by groups with "expressive roles," which are "oriented toward the internal integration of the collectivity of which they are part" and imply dealing "with feelings or attitudes toward things, with the word of intrapsychic objects." Men and elites actively engaged in leadership have, for example, instrumental roles, whereas men and elites having a predominantly ornamental, symbolic function have expressive roles.

Kavolis concludes also (p. 20 ff) that "static and formal art styles" are to be found in static economies. He notes that the beginnings of the hunting-gathering economy and the Agricultural and Industrial Revolutions all introduced spectacular increases in man's control over nature, whereas the advanced hunting and urban-commercial stages of economic development "give indications of a stable, or only gradually improving, pragmatic adaptation to the environment." These considerations, he feels, explain the association that he detects between geometricism in the visual arts and radical advances in mastery over nature. Geometricized outlines are "suggestive of analysis, planning, and purposive organization" (p. 144). Geometricism means a tendency for "man to impose a pattern of his own making, an artificial order, on the objects (whether naturalistic or not) depicted in his art" (p. 177).

This latter view seems open to question. Geometricized art is found all over the world in societies, whether of hunters and gatherers, pastoral nomads, or settled cultivators, whose techniques for drawing the necessities of life from the external world have not changed for centuries. The original Agricultural Revolution that initiated the Neolithic age may have been radical and sudden in comparison with the hundreds of millennia of relatively slight technological change that preceded it. But, like the Industrial Revolution of the late eighteenth and early nineteenth century, it must have been quite gradual in relation to a single lifetime and quite compatible with the subjection of generation after generation to unvarying work routines. And if economic changes must of necessity depend on problem-solving activities, in which new ways of doing things with hitherto unrealized benefits are conceived and in which methods of putting them into practice and of overcoming obstacles are worked out, comparatively few individuals must have been involved in these intellectual manipulations.

It is as well to differentiate various phenomena that may be covered by the term "geometricism." All of them mean reduced semantic information, and the channel capacity that is made available as a result will inevitably be taken over by information from other sources. It may be taken over by syntactic information, as when a natural object is given a more regular or redundant shape than it actually possesses. This may make it more aesthetically pleasing. It may give the object a form that is easier for the artist to conceive, remember, and replicate and also easier for the appreciator to apprehend.

Alternatively, semantic information may be replaced by expressive information: the natural appearance of an object may be distorted, and some of its features exaggerated, to compel attention to particular characteristics or to evoke particular emotional reactions more strongly. This happens in the caricaturing style that so often appears when groups of individuals are discontented with the state of society (Bosch, Hogarth,

Daumier, Grosz) and that makes its targets appear hateful or contemptible. Other forms of the same device appear in religious art, in which proportions, postures, or facial expressions of iconographic figures are distorted to bring out feelings of filial affection, humility, compassion, fear, or guilt.

Finally, semantic information can be replaced by social information. A depicted object may perform a collective symbolic function, so that members of the group recognize a meaning conferred by tradition and react accordingly. When this is so, detailed, naturalistic representation is not required. A simplified version will do just as well and may be favored by other considerations. For example, a simplified version may be more satisfying aesthetically. Much of the world's visual art represents gods or other supernatural beings, who are supposed to resemble animals or human beings in some respects but not in others. Abstraction and distortion can serve to emphasize the distinctions. So can an incongruous combination of elements or properties. Bodily parts characteristic of different species may be juxtaposed—the hawk-headed Egyptian god, Horus; the elephant-headed Indian god, Ganesha; the winged angel of Christian iconography. Coloring may contrast with that of nature, e.g., the blue Krishna of Indian painting, the colors of the ancient Mexican gods. Visible elements may symbolize qualities which would not be visible in nature. This may occur through distortion, as in the *ushnisha* (cranial bump) and *urna* (frontal wisp of hair) symbolizing Buddha's wisdom and insight, or through selection, as in the blue and red clothing of the Renaissance Madonna, standing for purity and love.

Although attempts at realism are found in many regions and periods, highly developed naturalism—sculpture with full anatomical detail, painting with three-dimensional illusion, sustained narrative without supernatural content and with believable human behavior—are rather exceptional and belong only to the most elaborate civilizations—ancient Greece, Europe since the Renaissance, India, China, Japan. In the sculpture of West Africa, the Ife and Benin styles stand out because of their remarkably successful attempts to portray human beings realistically. It is surely no accident that this art came from societies whose high degree of political and economic complexity distinguished them markedly from others in the region. They had an elaborate hierarchical organization, headed by a monarch assisted by a council of state, and brought together several distinctive tribes in a federal arrangement, so that they began to resemble European absolute monarchies and empires.

Naturalism requires minute observation and precise reproduction, which means absorption and processing of a high density of information from the external world. It seems likely that, like other stylistic characteristics incorporating high complexity and arousal potential, it will

characterize a social environment in which individuals encounter rich and varied stimulation and must learn to observe fluctuations in external nature both attentively and precisely if they are to behave effectively. But societies where these conditions obtain can foster abstraction and distortion if they are dominated by religious or other ideologies that impose stylistic conventions or if their art reflects interaction with non-perceptible entities, such as the abstract and supernatural beings of religious and metaphysical thought or the mathematical and scientific concepts of twentieth-century technology.

It is worth remembering Barry's (1957) finding that "representativeness" (i.e., depiction of objects with greater or lesser naturalism) is highly correlated with several indices of "complexity," so that it can justifiably be regarded as simply one more aspect of complexity. Further, in so far Kavolis is right to associate geometricism with agricultural societies and naturalism with hunting and gathering, it is worth recalling Barry's further finding that complex art styles tend to appear when there is severe training for independence and self-reliance. In another study, Barry, Child, & Bacon (1959) showed that hunters and fishermen train children to be independent and assert themselves, whereas training for obedience, compliance, and respect for elders is stressed in agricultural societies.

*Quantity and quality of art* Wolfe (1969) had experts rate 53 African societies for the quantity and quality of artistic production and examined correlations between these ratings and a large number of other characteristics that could be objectively assessed. The most evident correlates of artistic accomplishments were the existence of voluntary associations (sodalities) of men cutting across kinship relations, the existence of fixed "nucleated" settlements, and the existence of economic surpluses.

It is not at all easy to interpret these findings. Wolfe himself is inclined to "put emphasis on the affective component" and to believe that art provides means of handling the disruptive emotions that are apt to result from social barriers. This hypothesis, however, surely needs more elaboration and corroboration. As we have seen, several different views have been mooted regarding the relations between art and emotion, and many of them are at least debatable. It is surely significant that the artistically advanced societies are ones that possess a surplus of economic resources, including time, that can be devoted to aesthetic pursuits. Men who belong to sodalities must have enough leisure to participate in their activities. Finally, it is well known that the art objects of African societies, as of many nonliterate societies of other continents, are to a large extent intended for religious and other ceremonies, many of them organized by sodalities. Even in the major civilizations, much artistic effort has been

concentrated on religious objects and sites. On the other hand, there have been periods and societies, including our own, where art is largely separated from any religious, political, or ethnohistorical ritual. So the close connections between art and ceremonial that are found in Africa and elsewhere may have much to tell us about the beginnings of art, but perhaps not so much about its inseverable psychobiological roots.

## 16 USES AND FUNCTIONS OF ART

An inquiry into the uses and functions of art may seem to call for evaluative judgments, for normative discussion of what is "good" and how art may contribute to it. It may seem a reversion to one of the traditions that were blamed in Chapter 3 for obstructing progress in aesthetics, namely the failure to seek facts about art while refraining from approval or disapproval.

Nevertheless, there are some vital questions that can be framed in terms of use and function and yet are essentially empirical. They can, that is to say, receive answers that depend on observable facts and do not boil down to propaganda for the preferences of the investigator.

For example, to inquire into uses might mean to find out what people actually do with objects classified as works of art or to find out what they say if asked why they produce them or acquire them. We should undoubtedly obtain a great heterogeneity of answers varying with time and place. We should be told that, in European civilization, paintings and statues have been made and sold at different times to be placed in churches for the strengthening of religious faith, to decorate houses and public buildings, to be exhibited in museums. Music is performed to occupy people during their leisure hours or to form a background for other activities. On other continents, specimens of local art are designed to serve as receptacles for the spirits of ancestors or to be worn or manipulated by shamans in ceremonies that are necessary to ensure successful hunting.

To ask, further, why human beings pursue some of these activities, to which art objects are expected to contribute, would take us far outside the limits of aesthetics. But why buildings need to be decorated or why people have to be kept busy during their spare time are questions that lead us to the very core of the aesthetic problem. In any case, we must ask why objects and actions that serve so many dissimilar aims are so often made to take on an aesthetically pleasing form, why they are felt to necessitate the right assemblage of collative stimulus properties. The patterns to which they give rise evidently have other important effects and tap other sources of satisfaction besides those that are cited in the first place as reasons for their existence.

If the immediate uses of art may be identified with its intrinsically rewarding immediate effects on the central nervous system, the secondary uses to which art can be applied must be limitless. After all, art is a means of communication. We have considered the sense in which it must communicate at least the artist's values. It conveys information about what the artist deems to be worthwhile objects of attention, perception, emotional attitude, and thought. But artistic media can be used to communicate virtually anything. In other words, any message can be formulated artistically. Since art exploits stimulus properties that effectively control attention and reinforcement, it can help to promote many kinds of learning. A political or legal speech can apparently fulfill its aims more fully if it is eloquent, as can an advertisement if it is well designed. So any communication that is skillfully clothed in artistic form (or perhaps presented in a context that causes it to be labelled as "art") will be all the more effective in gaining access to its intended recipients and winning their sustained attention. Its burden will, in all likelihood, be more thoroughly understood and remembered and more persuasive in changing attitudes and beliefs. At any rate, such is widely believed to be the case, although these effects could actually do with more experimental verification. The pedagogical value of blending instruction with aesthetic pleasure could, for example, stand more examination.

We are, however, bound to go further and ask not only about uses but about functions. In the sense that is relevant here, to assert that *B* is the function of *A* means to assert that *B* is a consequence of *A* without which *A* would not have come into existence. Clearly, different explanatory systems have different ways of going about the search for the effects of art that account for its existence. The theologian would ask what art contributes to the Deity's plans for humanity. The metaphysician would ask how art fits into his cosmic scheme. The political ideologist or historian would ask how art favors the interests of competing countries or social classes. But the psychobiologist, like other biologists, must ask how art is related to adaptation, which means ultimately to survival.

As pointed out before, this may mean finding ways in which the pursuit of art continues to help adaptation. Alternatively, it may mean finding ways in which the inborn characteristics of the human being that make artistic pursuits inevitable are bound up with the requirements of adaptation. It may, of course, mean both at once, since characteristics that originally promoted survival in one way often have by-products that later contribute to adaptation in quite different ways. This approach is, of course, not incompatible with that of the anthropologist or sociologist who asks how art may aid the integrity and smooth running of society or that of the clinical psychologist or psychiatrist who asks how art may foster psychological health. There are problems in deciding precisely

what constitutes social and psychological well-being (although it is not difficult to list conditions that these terms must exclude), but, however they are characterized, it is generally agreed that they consist of conditions conducive to biological adaptation. These are, however, rather specialized lines of inquiry and so can only be touched on peripherally here.

## RECURRENT VIEWS

We might as well begin by glancing at some views on the functions of art that have been repeatedly advocated. These views have not always been inspired by biological considerations, and many of them date back to long before the Darwinian revolution. Nevertheless, they can all be brought into relation with biological adaptation.

### Possible accompaniments of effective adaptation

Lipps (1903-06) speaks of the "feeling of one's own worth" (*Selbstwertgefühl*) that art gives us, the "pleasure in power, richness or breadth, inner freedom, concordance and unity of my action in itself." Berenson (1948) looks to art for "life-enhancement." By this, he says he means "the idealized identification of ourselves with a person, the idealized participation in a action, the idealized plunging into a state of being, a state of mind that makes one feel more hopefully, more zestfully alive; living more intense, more radiant a life not only physically but morally as well; reaching out to the topmost peak of our capacities, contented with no satisfaction lower than the highest" (p. 129). Dewey (1934, p. 14) tells us that "Life itself consists of phases in which the organism falls out of step with the march of surrounding things and then recovers unison with it." Art helps to restore integration with the environment: "Desire for restoration of the union converts mere emotion into interest in objects as conditions of realization of harmony" (p. 15). For Howell (1957) likewise, "the fundamental desire activating a man's life is for *aesthetic unity* between himself and his environment." And Burnshaw (1970, p. 180) relates poetry to "the drive to recover primary organic unity with the rest of creation."

Feelings of living a rich life and of being at one with the environment certainly sound desirable. We should certainly like to have such feelings ourselves and can fervently wish that others would have them too. And it is not hard to believe that such feelings coincide with conditions of mental, physical and psychological well-being, in which adaptive

capacities are at their peak. But whether this is actually so, as well as how often and for how many people art engenders feelings of this kind, are questions on which more experimental evidence is needed.

Many a rhapsodical page has contended that art supplies biological benefits indirectly, by promoting the stability and cohesion of society. There may well be some substance to this kind of view. But before we can evaluate it, we need more agreement on precise yardsticks and more reliable knowledge about the effects of art on social interaction and about the kinds of social interaction that are most conducive to viability.

### Surplus energy

Spencer (1870) offered the same explanation for art as he did for play, namely that it is a collection of devices for getting rid of accumulated energy. He actually invoked a neurophysiological hypothesis to the effect that, when a nerve center has been unused for some time, it will take on a "state of excessive readiness to decompose and discharge." Rather more recently, Vygotski (1965) has represented art as a safety valve, permitting what is unexpressed within us to be expressed, so that balance can be preserved.

The weaknesses of this sort of explanation have often been denounced. There is no good evidence that the human nervous system is apt to accumulate excessive energy that has to be discharged from time to time if dire consequences are to be avoided or that activities like play and art carry out this function. In addition, if Spencer's neurophysiological assumptions were valid and responsible for artistic activity, art should either assume a random and chaotic form or lead to behavior that contrasts as much as possible with what the individual has recently been doing. But it surely conforms to neither of these descriptions.

### Functional pleasure

The idea that use of any of our capacities is pleasurable and that art is pleasurable because it exercises some of our capacities with particular intensity has attracted many writers (Döring, 1890; Lipps, 1903-06; Dessoir, 1906; Jerusalem, 1906). The one whose name seems to be most often associated with a theory of aesthetics emphasizing "functional pleasure" is Utitz (1911). However, he actually denied the sufficiency of this principle, holding that there must also be an element of "tension" or "pushing forward."

The notion of "functional pleasure" is plausible enough at first sight.

Physical and psychological capacities have presumably evolved because their use aids adaptation, so that we are better off using them than not using them. Consequently, it makes sense for us to enjoy using them. But we obviously cannot and do not use all our capacities all the time. So we still need some additional principles to tell us why certain of them are used at certain times and why in one form rather than in another. As earlier chapters have shown, study of arousal processes may take us some distance towards filling this gap.

### Exercise

A slightly different view, which is nevertheless open to the same objections as the notion of functional pleasure, is that we enjoy using our capacities because exercise of the underlying bodily (including neural) structures is necessary for them to be kept at maximum efficiency. Nissen (1951, p. 357) has suggested that "the inherited nervous structure contains within itself the 'need' for functional expression just as the inherited muscular structure requires exercise." Spencer's exposition of his surplus-energy theory contains a hint that the use of nerve centers improves their performance. The admittedly subtle distinction between the exercise view and the functional-pleasure view resides in the additional assumption made by the former that lack of exercise has deleterious effects requiring corrective measures.

Lange (1907) maintained that play and art are "substitutes for life." An instinctive need makes them occur "when life lacks ideas, feelings, thoughts and actions that belong to the human essence." We are told likewise that "play and art provide the organism with that balanced excitement that it needs in order to remain healthy" (Müller-Freienfels, 1923).

In presenting his "Principle of Measure and Change in the Degree of Occupation," Fechner (1876, II, pp. 250-1) suggested that "Man, in order to thrive, needs not only a certain alternation between waking and sleep but also a certain measure of occupation during the time of waking." He added that "both too much and too little occupation in a given time causes displeasure." This last statement recalls the hypothesis of optimal arousal increment to which we paid so much attention in earlier chapters. Exercise theories generally include a recognition that the exercise must not be excessive so that the danger of fatigue and overstrain can be avoided. "Pleasure is the concomitant of the healthy action of any or all of the organs or members supplied with afferent cerebrospinal nerves to an extent not exceeding the ordinary powers of recuperation possessed by the system" (Allen, 1877, p. 21).

## Catharsis and personality improvement

Despite the impossibility of knowing for sure what he meant by it, Aristotle's pronouncement (*Poetics*, 1449b) that tragic drama serves to promote "purgation of the passions through pity and terror" has been echoed with different variants and interpretations through the centuries that have since elapsed, and it has inevitably been extended to art in general. The crux seems to be that art, by inducing strong emotions, has some sort of psychotherapeutic or morally improving effect, that it releases human beings from the evil consequences of inappropriate and uncontrollable emotions. In the *Politics* (Book VIII), Aristotle makes it clear that he had a medical analogy in mind: those who experience a particular emotion in a powerful form are "restored as if they had found healing and purgation . . . their souls [are] lightened and delighted."

This is reminiscent of the catharsis theory of psychotherapy that Freud favored early in his career but later abandoned. As we know, there appear to be neurophysiological mechanisms through which inhibition supervenes after arousal has been kept for a time at a high level—Pavlov's supramaximal inhibition, the intervention of parasympathetic processes (Gellhorn, 1967), bulbar and cortical inhibition of the reticular formation (Dell, 1963; Bloch, 1965). But it is not clear that these mechanisms permanently weaken a particular emotional reaction.

Later conceptions of psychotherapy—Freud's "return of the repressed" and "anamnesis," Rogers's (1942) "clarification of feelings"—rest on the assumption that a patient will be released from incapacitating emotions if he becomes fully aware of the nature of his motives and emotional attitudes. Several aestheticians have supposed that art exerts some comparable beneficial influence by enabling us to examine our own emotional processes and thus understand them better. As Dewey (1934, p. 77) put it, "expression is the clarification of turbid emotion; our appetites know themselves when they are reflected in the mirror of art, and as they know themselves they are transfigured." Collingwood (1938, p. 114) wrote that "the artist proper is a person who is grappling with problems of expressing a certain emotion, 'I want to get this clear.'" According to Vygotski (1965), art helps us to get rid of "potentially balance-disturbing emotions" by "presenting them to the mind." It "formulates feelings for the mind that would otherwise be indefinite and inert." Langer (1942) argues that music does not evoke emotions but rather symbolizes them, with the aim of providing "insight"; the choice of a term that is often used in connection with psychoanalysis and related kinds of psychotherapy is surely significant. Dollard and Miller (1950) presented reasons why it should be helpful to become aware of one's emotions, notably that the ability to apply verbal labels to them opens

the way to rational thinking about the problems that they present. Contemporary behavior therapists are, however, expressing skepticism about the contribution of repression (exclusion from consciousness of psychological processes) to the genesis of neurosis and about the adequacy of insight therapy as a form of treatment.

Finally, there are those who think, that, since art integrates elements into unitary patterns, exposure to art will promote harmonious relations or equilibrium among potentially divergent psychological forces. ". . . the unmeasured disappears more and more in life and measure increasingly permeates everything" (Schleiermacher, cited by Gilbert & Kuhn, 1954). "Finer adjustment, clearer and more delicate accommodation or reconciliation of impulses in any one field tends to promote it in others" (Richards, 1924, p. 234).

Analogies linking, on the one hand, the harmonious relations between components of a work of art and, on the other hand, the harmonious relations between components of a healthy personality and between members of a morally healthy society have caused art to be extolled as a supreme means of ethical education. ". . . the absence of grace, rhythm, harmony, is closely allied to an evil style and an evil character; whereas their presence is allied to, and expressive of, the opposite character, which is brave and sober-minded" (Plato, *Republic*). ". . . as in the enjoyment of beauty or of aesthetic unity, there takes place an actual union and interpretation of matter with form and of receptivity with activity, this very fact demonstrates . . . the possibility of the most sublime humanity" (Schiller, 1793–94, Letter 25). "It is only in so far as group activities take on the aesthetic patterns and organic vitality of the groups spontaneously formed by children themselves (and by adults when they are playing like children) that these activities will achieve a moral and intellectual superiority over more authoritarian forms of education" (Read, 1943, p. 283).

## Learning

Last, we come to writers who prize art above all as a means of improving our ability to handle the difficulties of life. "An acquaintance with the various things that may affect us, and with their properties, is essential to our well-being; nor will a slight or superficial acquaintance be sufficient; they ought to be so deeply engraved on the mind as to be ready for use upon every occasion" (Home, 1765, p. 255).

Art, says Vygotski (1965), prepares us for action. "Art, as an adaptational mechanism, is rehearsal for those real situations in which it is vital for our survival to endure cognitive tension, to refuse the comforts of validation by affective congruence when such validation is inappro-

priate because two vital interests are at stake; art is the reinforcement of the capacity to endure disorientation so that real and significant problems may emerge" (Peckham, 1965, p. 134).

Some see art conferring its main benefits by making the world seem orderly and intelligible. According to Worringer (1908, p. 18), primitive man uses art "to divest things of the external world of their caprice and obscurity in the world-picture and to impart to them a value of necessity and a value of regularity." Meier (1942) traces the origins of art to the "discernment of consistency in nature" which "was probably one of the first factors in changing an uncertain existence" and "marking the beginnings of an ordered world." That art serves principally to make the phenomena of the world clear and unified was a cardinal tenet of the "pure visibility" school of aesthetics, founded by Fiedler (1887).

Others have placed the emphasis on what we should nowadays call emotional learning, on the implanting of motives and attitudes that will supply the driving force for desirable action. Art is said by Collingwood (1938) to be akin to magical activity, which is a "kind of dynamo supplying the mechanism of practical life with the emotional current that drives it." ". . . *Artistic content* has the function of helping man to develop an emotional involvement with the objects of his social and cultural environment . . ." (Kavolis, 1968, p. 5). The immense power of art to motivate by presenting appropriate heroes (including, at times the artists themselves) for the appreciator to emulate has, of course, been fully appreciated from Plato to Mao Tse-Tung.

## RELATED ACTIVITIES

At this point, we may seem to have come dangerously near to another of the errors that were denounced in Chapter 3. We must bear in mind that aesthetic behavior is not sharply marked off from other kinds of behavior and that its functions cannot be altogether distinct from those of other phenomena to which it is closely related. And if we are adopting a psychobiological point of view, we must beware of ignoring the cognates of aesthetic behavior that are found in lower animals. So we must take at least a cursory look at some categories of activity with which the aesthetic category overlaps and consider what indications they may give us with regard to the functions of art.

### Expressive behavior

Art, as we so often hear, is a form of self-expression for the creative artist and for the performing artist. They are sensitive people, who have

strong feelings and thoughts about which they are very excited, and they experience a strong pressure to express them. Even the appreciator, it is often hinted, may have feelings and thoughts akin to those of the artist, and his need to express them may be vicariously satisfied by partaking of their expressive products.

Expressive acts are acts that correspond to the emotional, or more generally motivational, condition of the organism emitting them. They are therefore capable of transmitting information to other organisms about the motivational condition of their originator. There is a fair-sized literature on expressive movements in animals (Darwin, 1872; Andrew, 1963) and another on human expressive behavior with special reference to personality (Allport & Vernon, 1933) and to the possibility of recognizing emotions experienced by other individuals (e.g., Frijda, 1964).

The first question we must ask ourselves is why expressive behavior occurs at all. And there seem to be only a limited number of possible answers. At any rate, these are the only ones that have so far been offered. To begin with, expressive acts may have biologically useful consequences. Alternatively, they may be by-products of processes that are useful, i.e., the organism would lose nothing if they did not occur, but they occur because of the way the nervous system is constructed.

An expressive act can be useful in either of two ways. Its execution might help to relieve the disruptive effects of excessive emotion. As Burnshaw (1970, p. 34) puts it, the poet has "a unique psychophysical constitution which cannot maintain normal balance without discharging the burdens that it accumulates periodically." There have been a few hints that vigorous motor activity reduces arousal, and we are reminded once again of the notion of catharsis through verbalization and discharge of bottled-up emotion that has figured so prominently in the history of both aesthetics and psychotherapy. Evidence on this point is at best fragmentary and anecdotal. There is at least as much evidence that motor activity increases arousal and that verbal and other forms of expression induce or intensify emotion. Intense emotional upheaval seems often to be followed by tranquillization, presumably through the inhibitory processes that were mentioned in our earlier discussion of catharsis.

Expressive behavior often makes essential contributions to adaptation by presenting stimuli that evoke appropriate behavior in other organisms. This behavior sometimes resembles the behavior of the originator of the expressive act and results from sympathetic induction in others of a motivational condition resembling his own. A cry of alarm or a fearful posture may induce a herd of animals to flee together or to engage in a concerted defense against a dangerous intruder. At other times, the induced behavior is complementary. Aggressive "intention movements" may elicit submissive behavior. Manifestations of sexual drive in a male animal may cause the female to play her part in the courtship and mating

sequence. Other expressive responses may have a protective function that is of particular value when a disturbing and therefore potentially threatening sight, sound, or smell has occurred. Darwin (1872) mentions the erection of hair which may make a frightened animal look bigger than it is and thus scare off an enemy. Andrew (1963) traces many forms of emotional expression back to "protective responses," defending "major sense organs and other sensitive areas against possible noxious effects." They include vocalization, which is held to result from protective closure or narrowing of the glottis, combined with violent expiration.

Other expressive responses, especially in human beings, are now useless, except secondarily as possible means of drawing helpful behavior from other human beings, but they can be explained as vestiges of "serviceable associated habits," to use Darwin's famous phrase. Extreme terror, for example, makes the hair of the head stand on end and goose pimples appear on the skin through the action of mechanisms that produced the valuable pilo-erection response of our animal ancestors.

Then, some behavior indicative of emotion may be part of the diffuse, uncoordinated activity that accompanies strong excitation. Darwin (1872) classed some forms of expression as overflow phenomena. Many of the indices of high arousal, as we have seen, are helpful, if only in preparing the organism for information absorption and for action. But they also include uncoordinated muscular contractions that contribute nothing to adaptation and may hinder it. Inappropriate responses may be released from inhibition, e.g., the "displacement" phenomena so often observed in animals.

Finally, Darwin put forward his "principle of antithesis," according to which an emotion is sometimes expressed through behavior that is as different as possible from that which expresses the opposite emotion. For example, the physiological pattern of laughter was held to be diametrically opposite to that of weeping.

What does all this have to do with aesthetic expression? Since non-human mammals seem rarely if ever to undergo emotional arousal without making it visibly and audibly manifest, and since their expressive behavior is so often biologically valuable either as a means of protection or as a means of communication, it might well be thought that the artist's urge for self-expression is no more than a persistence of an inherited tendency. This calls for closer scrutiny. The expressive reactions of animals that have been so intensively studied and discussed are unlearned responses, examples of "instinctive" or, to use the term that is now preferred, "species-specific" behavior. There may well be inherited forms of emotional expression in human beings, and they may well have something to do with art. Some of the changes in pitch, intensity, and timbre that characterize speech or nonlinguistic vocalization in particular emotional conditions seem to appear in early infancy and to be common to

all humanity. These may well have influenced song, and through song, instrumental music. Music is similarly influenced by the rhythms of dancing, which may be related to those of unlearned expressive motor actions. There may be an inherent correspondence between certain colors or visual shapes and certain emotions, either because of similarity in structure, as the Gestalt school would have contended, or for some other reason. These correspondences may affect the constructions of visual artists.

On the other hand, many aspects of vocal, motor, and visual expression clearly vary from society to society and must be products of learning. This is most obviously so when we consider expressive verbal utterances. We must never forget that all behavior, even if learned, is partly dependent on inherited characteristics. But the notion of an inherited tendency to express oneself or an inherited need for self-expression does not help us to understand why different individuals resort to different forms of expression or why expressions with aesthetically satisfying structure are selected. As Langer (1942, p. 175) rightly remarks, "sheer self-expression requires no artistic form." To explain learned expressive behavior, we have to assume that their consequences—either their internal consequences or their effects on other organisms—are rewarding. It is all very well to suggest that we are innately inclined to feel better when we have given expression to our emotions. This does not tell us how we come to recognize that our emotions have been effectively expressed and how the completion of a particular learned mode of expression acts as a reward.

Before we leave the topic of expressive behavior, Darwin's (1871, Ch. III) hypothesis regarding the origin of "sense of beauty" calls for some comment. He traced it to the characteristics and behavior through which animals attract the opposite sex. Twentieth-century ethological research has certainly confirmed that stimuli coming from the changes in appearance and the bodily movements of a male during the mating season can inhibit the aggressive or fearful behavior that is otherwise paramount in the female and induce cooperation in reproductive activities. As Groos (1924) explained, one can see how the various human art forms could have grown out of mating behavior. Courtship movements could have given rise to the dance, courtship vocalizations to music and lyric poetry, the assumption of striking or beautiful colors and shapes to self-adornment and thence to painting and sculpture.

Groos went on, however, to offer some interesting arguments against Darwin's hypothesis. First, the use of adornment and vocalization in courtship is most highly developed in birds. Mammals seem to rely more on fighting than on display to compete for mates. Second, one would expect aesthetic activities to appeal much more strongly to males than to females since males are usually the active parties in courtship, but this does not seem to be the case. Lastly, Groos points out that sexual content

is more characteristic of the art of advanced than of primitive societies. Self-adornment in primitive societies is used mainly to instill fear or religious awe or to enhance social status. Primitive dance and song are connected predominantly with religion and with hopes of success in war, hunting, and agriculture. So they seem more closely concerned with survival, eating, and drinking than with sexual motivation.

The expressive acts of animals may be considered origins of art in the sense that they constitute some of the earliest phenomena that at all resemble art. But to assert that human artistic enterprises are truly homologous with these kinds of largely unlearned animal behavior means to assert that the learned responses on which art depends use the same neural structures. Evidence that this is so would be hard to obtain in the present state of knowledge, and it is in any case hard to conceive in anything more than the vaguest terms how this could be.

### Play and entertainment

Another class of behavior with which art has clearly much in common is "play" (Berlyne, 1969b). Play and art are both extremely miscellaneous categories—play even more than art—and the psychobiological significance of both of them is rather mysterious. Both playful and artistic activity are said to be pleasurable "in themselves," which means that their immediate internal effects on the nervous system are rewarding, regardless of whether they contribute to ulterior ends or not. Both kinds of activity are carried out primarily for the sake of the "indifferent" stimulation, external or internal, that results from them, although sheer muscular exercise may well be an important element in at least some varieties of play.

There are, however, some contrasts. Art is commonly revered and credited with some of the most estimable accomplishments of humanity, whereas play is regarded as frivolous and relatively unproductive. But even this distinction is not an absolute one. Artistic creation is combined with light-heartedness at many times and places, and it is difficult to think of anybody more deadly serious than football fans, gamblers, or even playing children. Artistic creation and performance certainly require action, but most of those who derive enjoyment from art do so by simply exposing their sense organs to its products. Play, on the other hand, generally means doing something, but there are such things as spectator sports. Finally, art is expected to generate something permanent; even if an artistic performance comes and goes, the same work can be performed over and over again. Play, on the other hand, gives pleasure for the moment but then disappears without a trace. The distinction is being challenged, notably by recent experiments on "ephemeral art" (e.g.,

Heizer's furrows in the desert sand), but even here video-tape recording has been used to produce a lasting record and, in any case, the spectator is expected to bear some permanent impact.

A long-standing current of thought emphasizes the kinship between play and art. Its outstanding representatives have been Schiller, Spencer, Groos, and Lange. Many aestheticians have repudiated their views with indignation. Gilbert and Kuhn (1954, p. 543) wonder whether we can overlook "the ultimate identity of toy-shop and art-gallery." But Collingwood (1938) scornfully rejects any identification of art with "amusement." In amusement, he says, the emotions aroused by an act are discharged by the same act, but art arouses emotions that have to be discharged on later occasions in "real life."

"Amusement" or "entertainment" are notoriously troublesome when it comes to distinguishing them from art. Art is expected to entertain, among other things, and there are undoubtedly individuals, even in our society, who do not expect any more from it. For others, the distinction is an essentially subjective one of quality; some songs, theatrical plays, novels, and pictures are simply not classed as art because they are not "deep" or "great" enough. Perhaps the essential basis for the feeling that art should be differentiated from play or entertainment is the belief that art should help to provide a valuable learning experience. Whether or not a tangible and durable object is engendered—a marble statue, a manuscript, or a score—something lasting should at least be left behind in the form of change in the nervous system and thus in the ways in which the artist or the appreciator thereafter perceives, feels, and thinks.

### Exploratory behavior

There is, as we have seen, a large overlap between aesthetic behavior and exploratory behavior. All the activities of the creative artist, performing artist, or appreciator that lead to the stimulation of sense organs by an art object must inescapably be classified as exploratory behavior. And the perceptual, intellectual, and emotional processes that follow stimulation and are responsible for its hedonic value are such as typically occur when exploratory behavior has completed its tasks.

So we must expect some of the chief functions of art to be those of exploration with the proviso that, since aesthetic behavior and the stimulation resulting from it are singularly complex, art is likely to achieve the aims of exploratory behavior with singular thoroughness.

There are grounds for suspecting that an essential difference in function underlies the distinction that we have felt compelled to draw between specific and diversive exploration (see Ch. 9). Specific exploration is a response to conflict and uncertainty resulting from incomplete percep-

tion. Since the selection of an adaptive or optimal course of action depends on information about conditions in the external environment and conditions inside the organism, it is easy to see that uncertainty (lack of information) and conflict among competing courses of action, none of which is strong enough to prevail over the others, threatens adaptation. Consequently, it is useful for an animal to find uncertainty aversive, so that it takes steps to gather the missing information, and for relief of uncertainty to be rewarding. Because of the considerable hedonic value with which satisfaction of curiosity is invested, an organism that is equipped to do so (as the human organism is) can be expected to seek out situations productive of perceptual disorientation, uncertainty, and curiosity when they hold out prospects of orientation and clarification without too much cost or delay. Art affords such opportunities, as does the behavior of the rat that enters novel, changing portions of a maze in preference to others. So do other human intellectual activities, such as philosophy, mathematics, and science, as well as crossword puzzles and games of chess.

Through diversive exploration, animals seek out stimulation from any source that has the right collative properties. This presumably means stimulation that yields an arousal increment within the rewarding range. Such behavior is particularly strong when the arousal potential of the environment has been inordinately sparse for some time. Diversive exploration must surely be connected with the fact that the human nervous system is made to cope with a certain influx of information or rate of stimulus change. The normal environment of mammals, at least during waking hours, generally makes fairly stiff and constant demands on the information-handling capacities of the nervous system.

The optimal level of arousal potential varies, of course, from species to species. It also varies widely among the condition of life, including social conditions to which human beings may be exposed, and it seems that the nervous system can adjust its arousal tonus accordingly. If the arousal potential or information content of the environment is markedly above or below the optimal or tonus level, we know that several human capacities, including perceptual and intellectual capacities, are impaired. The impairments that have been detected in experiments on sensory restriction (Schultz, 1965) seem to be removed rapidly and completely after normal levels of stimulation have been restored. This may be because those experiments are not carried on for longer than a few days. Nevertheless, it seems that people can even recover from prolonged periods of punitive solitary confinement. There are, however, plenty of signs that deprivation of arousal potential early in life can have lasting harmful effects (see Riesen, 1961; Bennett, Diamond, Krech, & Rosenzweig, 1964). So it is understandable that higher animals should make for environments that approximate optimal arousal potential. Human beings, with their

superior manual and vocal resources, may find it easiest to create environments that satisfy this requirement or to add stimulation of their own making to environments that fall short of it.

Then, we must bear in mind that many animals, including undomesticated primates, are likely to find food and perhaps other vital necessities in unforeseeable places. If they did not have a strong inclination to explore unfamiliar environments, they could not survive. At the same time, the unfamiliar may well be dangerous. As was mentioned in Chapter 9, a tendency to seek out mild stimulation and to shun highly arousing stimulation (Schneirla, 1959) may well be nature's way of handling this difficulty. Such a tendency is, of course, implied by the Wundt curve.

Finally, both specific and diversive exploration may have an important by-product. Some of the information that is absorbed in consequence of them may be stored against future need. They may, in other words, promote learning that can facilitate the selection of appropriate courses of action on future occasions.

## MATTER, ENERGY, AND INFORMATION

According to modern science, the universe is composed of three basic constituents: matter, energy, and information. Einstein's Special Theory of Relativity and the experiments on nuclear fission and fusion that have confirmed it imply that matter and energy can be changed into each other. But they and information are not mutually convertible. Information concerns the distribution of matter and energy in time and in space.

Human beings are, like everything else, made up of matter, energy, and information and must ensure themselves of adequate supplies of all three if they are to preserve their integrity as organisms. Matter and energy are replenished mainly by eating and drinking. But there are two distinct ways in which information is necessary for human life.

## Two roles of information

First, the human being is complex and orderly. He represents (Schrödinger, 1945) a local and temporary island of resistance to the "degradation of energy" that, in accordance with the Second Law of Thermodynamics, is inexorably increasing the total amount of entropy or disorder in the universe. He constitutes a rare and improbable pattern, given the universal tendency for composite entities to dissolve into a uniform chaotic mixture. So, in view of the reciprocal relation between probability and information content, the human being localizes in him-

self far more than his share of the information in the universe. Furthermore, he is made of parts that have great coherence and interdependence of form, which implies a great deal of internal constraint, redundancy, and syntactic information.

The combination of order and complexity, or of unity and diversity, gives the human organism the prerequisites of aesthetically pleasing form. This is one of the reasons why human figures and characters, as well as other living creatures, make up such a large part of the subject matter of art, quite apart from the emotional resonances that stem from human interactions.

There is, however, a second and quite different way in which information is indispensable. To survive, the human being must behave. This means that he must continually undergo changes in correspondence with environmental events that threaten his existence. To ensure this correspondence, he must take in information through his sense organs. This information is necessary in the first place to influence the action of the moment. But it can also be stored in the nervous system to aid defense against future threats.

Although these two roles of information in human life must not be confused, there is a connecting link between them. Information originating in perception is generally stored in the form of coherent structures, possessing order and complexity. These structures, which form the bases for remembering and for thinking, combine flexibility with consistency, so that they can be potentially useful in the most varied contingencies (Piaget, 1947; Piaget & Inhelder, 1959; Berlyne, 1965). The intellectual systems that are erected by philosophers, mathematicians, and scientists are often judged to be "beautiful," "elegant," or aesthetically satisfying. Likewise, the best functioning personalities are both rich and stable. They are lavishly equipped with stored information conducive to adaptive behavior; they are fortunate in their heredity, and they have learned copiously from what they have experienced. Their constituents—attitudes, beliefs, goals, traits—are harmoniously integrated with one another. So it is no wonder that the consistent, purposeful, effective styles of life immanent in certain individuals should have an aesthetic value for those who contemplate them. The structural excellences of the human personality are accordingly portrayed in drama and the novel, just as those of the human body are portrayed in painting and sculpture.

### Requirements of differing urgency

The principal requirements of biological adaptation have been enumerated often enough. Their priorities differ according to the length of time that an organism can survive without taking care of them. Re-

moval of obstructions to breathing and defense against imminent injury must have overriding urgency. Reproduction and care of the young are ultimately the most important of all, since, without them, attention to other biological needs will be of no avail in the long run. Protection of offspring often takes precedence over self-preservation. On the other hand, reproduction can be delayed months or years without ultimate loss. Nature usually handles this problem, at least in lower animals, by giving courtship and mating a high priority at certain periods (mating seasons) but neglecting them from the rest of the time.

Collection of information, in the form of specific exploration or directed thinking, must take precedence over everything else when lack of information constitutes an immediate threat. Fleeing animals may pause and look back from time to time, and a meal may be postponed if something unusual, and thus potentially dangerous, calls for investigation. But the accumulation of information in storage, which will increase the margin of safety with which the future can be faced, can generally be left until more urgent needs have been met. As we have seen, this is likely to be one function, but not the only one, of aesthetic behavior and play. These activities tend to occur when time can safely be spared from more pressing business—during the leisure hours of adults, in childhood when vital needs are looked after by adults, and in abnormal conditions such as imprisonment or enforced idleness, when other occupations are prevented.

### Intake of food versus intake of information

Apart from the fact that one can tolerate less delay than the other, the intake of food and the intake of information show some important similarities and differences. In both cases, the relatively rare nuggets that will do any good must be picked out from among the useless, or even harmful, mass with which they are usually intermingled. Edible objects have characteristic chemical compositions and physical consistencies, so that smells, tastes, and tactal and kinesthetic sensations coming from the mouth and jaws can determine what will be ingested and what will be rejected. Conditioning, and perhaps to some extent also innate mechanisms, enable these to be supplemented by visual signals, so that a non-nutritive substance can be recognized before it enters the mouth. Valuable items of information are, however, not distinguishable by physicochemical properties but rather by their relations to what has been experienced before. So their recognition requires a higher level of analysis, in which comparison is made with the contents of short-term or long-term memory and their collative properties are taken into account.

Food and water may be found day after day in the same localities.

Advanced human societies have contrived to set up regions where acceptable information is constantly renewed, e.g., libraries, schools, cinemas that change their programs twice a week. But a fresh supply of information is usually best assured by making for places and stimulus situations that have never been encountered before.

Food is consumed and ceases to be available once it has done its work. But stored information can be utilized again and again. In computer jargon, there is non-destructive read-out. Information tends, in fact, to be retained longer and more completely, the more often it is used. The capacity of the body sets severe limits to the amount of food that can be stored at any time, and harmful effects supervene some time before these limits are reached. That is, no doubt, why there is a satiation center in the hypothalamus that switches off hunger and feeding when an adequate quantity has been taken in. But there seem to be no practical limits to how much can be learned, or, at any rate, there is no reason to believe that any human being has ever approached what limits there may be. Stored information is sometimes false and thus conducive to maladaptive action. Its elements may conflict with one another, so that they act at cross purposes and aggravate the difficulties of adopting a course of action. These can be serious disadvantages, but we are equipped with ways of minimizing them. Generally speaking, the more we know the better; the more information learning processes deposit in storage, the greater the chances that something to suit a future difficulty will be found among our stock of familiar ready-made solutions, and also the greater the pool of elements out of which new solutions to new problems can be constructed by reasoning (Berlyne, 1965).

Both foodstuffs and sensory information may require elaborate processing before they become digestible and can merge with what is already inside the organism. But as far as food is concerned, it is generally not possible to benefit from the digestive activities of another organism, apart from the suckling of the mammalian infant or the feeding of larvae by the regurgitating ant. There are, in contrast, many advantages to taking in information that has already passed through another individual and been reorganized by his brain. His perceptual and intellectual mechanisms are likely to yield something close enough to information that is already within us to combine with it readily and yet sufficiently different to be a worthwhile addition. This is, after all, the secret of the cultural transmission that enables human beings to make use of what previous generations have learned. Information received from another brain has originated, at least partly, in experiences that we have not been able to have. The processing abilities of the other brain may be in many respects superior to our own. Without aping the awe-struck adulation that has so often been lavished on the creative artist, we can recognize that he often possesses rare sensibility, taste, breadth of experience, depth of thought,

or moral earnestness. He is also exceptionally skilled in manipulating collative variables to enhance the impact and penetration of his communications. This skill will, on the other hand, turn the artist into a particularly pernicious menace when his messages are invalid and misleading.

### Informational needs

The human being is an organism whose abilities for storing large amounts of information efficiently, for letting stored information join with the perceptions of the moment in determining behavior, and for methodically seeking and acquiring information are unique. Since every scrap of retained information might help one day and thus adds its quota of security against future perplexity, frustration, and helplessness, it is easy to see that moments of freedom from more urgent claims (including those of sleep and rest) can hardly be better occupied than with activities that add to the nervous system's holdings in this commodity.

Aesthetic behavior is a prime example of such an activity. The human nervous system depends so much on learning, and benefits so much from learning, that readiness to learn should be one of its outstanding characteristics. It is understandable that an opportunity to learn anything, even if it has no immediate prospect of being useful, should be pleasurable. Opportunities to learn mean opportunities to encounter new combinations of stimuli in conditions that act on the arousal system. We can see why there should be an "instinctive urge to experience everything" (Lange, 1907) when it is not suppressed by adverse circumstances.

Informational needs have two separable aspects. To have information about a particular object or event means to identify which of various forms it might take if actually realized, which of several alternative characteristics that it might have it actually has. But there is also the problem of selecting the objects or events about which to inform oneself. It is not only necessary to find answers to questions. It is necessary to select questions. Science is capable of providing precise and dependable answers to many questions. But it does not tell us what questions we should raise, except insofar as a particular question is a means of answering another question that has already been raised. Art can complement science by helping to fill this gap. It can turn our attention in particular directions, intimating what should be of concern to us, what regions of reality contain information that we should do well to absorb. It can, as we have seen, recommend subject matter for our perception, feeling, and thinking, and it can hold up goals for our action. In this regard, some importance attaches to the fact that art, like science, is a public activity. Many members of a society have access to its products

and are therefore open to their influence. So art, insofar as it is effective, tends to favor social synergy by instilling the same values into many individuals at once and pushing their attention into the same directions.

Art does not monopolize this role. It shares it with religion and philosophy, including metaphysical, ethical, and political philosophy. It has often been the ally, if not the handmaiden, of all of these. Art, religion, and metaphysics were inextricably bound together when they originated, and the ends they serve have always had much in common. But different brands of religion and philosophy exclude one another. And they tend to focus on abstract or supernatural entities. Art is not restricted in its content, and its messages can be endlessly diverse without being contradictory.

Nevertheless, it has its limitations that call for correctives and safeguards. It caters to all manner of tastes, growing out of different life experiences and personalities, but it has no way of arbitrating among them. It cajoles, exhorts, persuades, and exemplifies, but it does not verify or prove.

The aim of all intellectual pursuits, including science, philosophy, and art, is to seek unity in the midst of diversity or order in the midst of complexity. Their ultimate task is to fit multifarious elements into some kind of compact, cohesive, apprehensible scheme. Science must give priority to reflecting physical reality both faithfully and fully, and physical reality is not always conspicuously tidy or beautiful. Art is free to achieve formal beauty by concentrating attention on selected portions of the external world, transforming portions of the external world, setting aside jarring features of the external world by misrepresenting it or abstracting from it, and building structures of imagined rather than existing entities. It is easy to see why the products of art should be so alluring and why we should so often look to them for restorative relief from those parts of life where discordance, puzzlement, and unsightliness are not always kept within bounds. There can be grave dangers in mistaking what art is doing and, particularly, in confusing what art is doing with what science is doing or vice versa. But as long as art and science refrain from usurping each other's functions, they have their mutually supportive and equally indispensable ways of helping us to understand the world and to change it for the better.

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