approach having been made available, current theories of esthetics must be submitted to a rigid re-examination to determine the degree of their validity. Many of the theories of esthetics now current in the books will be swept away under the acid test, and in place of these there will gradually begin to accumulate new concepts, new organizations, new foundations for a scientific philosophy of the beautiful in music.

The above has been an interpretation in high relief, ignoring manifest limitations, qualifications, difficulties and discouragements, of which there are many. Instead of representing the view from peaks of success, I might well have prowled through the shadows and slues of despondency, calling attention to the limitless scope of the undertaking, the dangers involved, the heroic courage required in overcoming difficulties. All these phenomena in low relief are very real and abundant, but it has been my object and pleasure to limit myself to the pointing out of the vision gained from successive new vantage grounds in the infant science of acoustics and its subsidiary, the applied psychology of music.

THE EFFECTS OF AMERICAN ENVIRONMENT ON IMMIGRANTS AND THEIR DESCENDANTS

By Professor FRANZ BOAS
COLUMBIA UNIVERSITY

THE problem of the assimilation of alien populations transplanted into a new cultural medium in which they form a minority has given rise to much public discussion. Few attempts have been made to obtain verifiable data. The problem involves the answer to two questions. Knowing the importance of heredity in determining bodily form and function we have to understand the composition of the immigrant and native populations and their biological differences. Furthermore, we must try to differentiate sharply between what is hereditarily and what environmentally determined. In other words, we have to inquire whether and to what extent bodily form and function are constant or changing in different kinds of environment.

A study of this kind must necessarily cover a sufficiently long period during which assimilation may have been going on and requires, therefore, a long period of observations. I will try to sum up briefly the results of studies extending over a period of twenty-seven years.

The comparative study of alien and native populations had to be based on the degree of variability of each population; in other words, on the multiplicity of forms of the component individuals. We have known for many years that this variability is much greater in man than in pure-bred domesticated animals. This is due to the very slight amount of selective mating of man. We have also been able to show that in some zones in which different types came into contact the variability in regard to certain bodily features increases. Thus the variability of types in Italy is greatest in Central Italy, where the North Italians and South Italians who are very different in physical build mingle. This, however, is not true of all bodily features, some of which are quite uniform in mixed populations. On the basis of such observations it has been found by many observers that every large population is of very mixed origin, so much so that in Europe it is hardly possible to assign any individual with certainty to a particular part of the continent, because the variations in every type overlap. I have tried the experiment of identification in colleges. The new students who did not know one another were asked to designate the descent of their new fellow students. The most contradictory answers were received. Not only was it found impossible to distinguish between North European individuals, but Italians, North Europeans and Jews were misplaced in as many as 40 per cent. of the cases.

The variation of forms of individuals does not give a sufficiently clear picture of the genetic constituents of a population because we do not know how much may be due to outer conditions, how much to the presence of distinct genetic lines. The existence of diverse genetic lines is clearly proved by family resemblances between parents and children and between brothers and sisters. It is necessary to determine the degree of genetic complexity in a population. Obviously, if all families were genetically alike and uninfluenced by outer circumstances, there would be no family resemblances, because for any one member of a family, one of another family might be substituted. In a closely inbred population something of that kind might be expected, but no case is known in which an identity of family lines, such as is nearly attained in pure breeds of domesticated animals, is found. On small islands with inbred populations, among the isolated mountaineers of Kentucky and in other inbred communities a considerable diversity of family lines remains, and in the large areas of so-called uniform racial types great differences in bodily form of distinct

families are found. This quite agrees with our everyday observation of individuality of bodily forms in families in any one of our modern populations. The more precise, therefore, the anatomical description of what is to be called a race, the more diverse types will be represented in every population.

It is not by any means obvious that all these differences must necessarily be due to mixture, for the genetic character of each pair of individuals is such that it is capable of giving rise to forms that are not genetically identical. Still, there is no doubt that most of the great variability of each local type is due to intermingling of distinct local strains. This is evidenced by our historical knowledge of migrations, not only in Europe, where one wave of migrating peoples followed another, but in all parts of the world; in Africa, primitive America and Asia. Mankind has been on the move for thousands of years.

Populations have moved from one climate to another, and distinct cultures have been thrown together. The question arises whether such changes bring about any modification of bodily build and with that, perhaps, of bodily function. This question can nowhere be better studied than in the United States with its great influx of immigrants from all parts of the world. It has been known for a long time that the bulk of the body as expressed by stature and weight is easily modified by more or less favorable conditions of life. In Europe there has been a gradual increase of bulk of body between 1850 and 1914. Adult immigrants who came to America from South and East Europe have not taken part in this general increase. They have, so far as we can see, always kept on the same level, presumably because they were always selected from a body the social condition of which has not materially changed. Their children, however, born in America, or who came here young, have participated in the general increase of stature of our native population. With this go hand in hand appreciable differences in bodily form. Just in the same way as the proportions of body, head and face of animals born in captivity change when compared with their wild-born ancestors, thus the bodily proportions of man undergo minute changes in new environment. In some types the forms of head and face of immigrants are wider than those of their children. Dr. Shapiro has reported corresponding changes among descendants of Japanese born in Hawaii.

These changes do not obliterate differences between genetic types, but they show that the type as we see it contains elements that are not genetic but an expression of the influence of environment.

Physiological functions are naturally much more subject to environmental influences because they are in each individual modified in accordance with momentary conditions of life. Metabolism, heart rate, breathing all depend upon the momentary demands made upon the body and, therefore, also upon the general mode of life, thus overlaying the purely biologically determined function.

The rate of individual development offers an excellent method of studying the relative importance of the influence of environment and of genetic makeup. As an example we may follow the onset of puberty in different areas and different social groups. In New York the time of the onset of puberty is very much alike among Whites of most varied descent and among Negroes. There is a fairly considerable retardation among poor Negroes, which would presumably also be found among poor Whites. Contrary to current opinion, climate does not seem to have much to do with it, for West Indian Negroes and Southern Negroes mature considerably later than those in New York City, which agrees with the observation made in Europe that rural populations mature later than those of cities. It is, however, noticeable that the course of attaining maturity is slightly different in the Negro race as compared to the Whites, in so far as the process seems to be more energetic. Such differences, possibly of a hereditary character, may also be observed in the eruption of teeth among South African Negroes, whose permanent incisors develop later than those of white children, while the molars develop earlier. Racial differences that have been observed are always of such a character that on account of individual variability and the slight amount of average differences many individuals have similar or identical rates of development. Still, it is possible to prove that hereditary elements are involved in the tempo of development; for statistically the tempo of development of a group of brothers and sisters is so related, that if one of them develops quickly, the rest will also develop quickly. This has been proved for a large group of children living in the same institution, and therefore under the same outer conditions. Here, as in other cases, we should not forget that this is a familial, not a racial relation. There are sufficient evidences that the same familial, genetic relation determines the life span. This is indicated by the study of familial longevity, and better founded on Professor Bernstein's observations on the relation between the onset of presbyopia and length of life. According to his observations senile decay sets in early in those cases in which presbyopia develops at an early age. I believe this he has also proved to be of familial trait.

So far I have discussed anatomical and physiological data which prove that the human organism while genetically determined is modified by outer influences and that in man we must keep clearly apart familial heredity and race. On account of the great variety of

genetic lines contained in every population we can not speak of racial heredity except in a very restricted sense, namely, when we discuss traits that are common to every member of a population contrasted with others that lack this trait or have others in its stead.

From a sociological point the problem of hereditary determination of personality is much more important. Unfortunately no method has so far been devised that could give us a clear picture of a personality as biologically determined. The observation of pathological cases proves definitely that such a relation exists, but the individual is so much influenced by the experience of life, and the conditions under which his personality manifests itself are so elusive that, at the present at least, the attempt to describe the personalities composing a population, much less that of differentiating between hereditarily and environmentally determined elements, seems hopeless. Recently much stress has been laid on the observation of the behavior of identical twins, that of individuals genetically identical. It is true enough that biologically they are much alike, and it may be that for this reason they may respond, other things being equal, in similar ways to cultural stimuli. Much has been made of a few scattered observations of this kind, the validity of which is made very doubtful by L. J. Bossik's study of 130 pairs of identical[1] twins, for whose physiological behavior he finds a considerable amount of non-genetic environmental influence. It may be admitted that there is a greater likelihood that identical twins, or for that matter brothers and sisters, will react in ways more similar than individuals not genetically related, but this does not imply that identical twins exposed to different types of culture will not develop different personalities. Furthermore, it must not be forgotten that pairs of identical twins in a population represent very different genetic lines.

On account of these difficulties it seems best to attack the general problem in another way. If it is true that behavior is genetically determined, then it must express itself in very definite ways in fundamental traits. One of these that seems most closely tied up with the biological make-up of the body is found in the motor habits of people. Ethnological data prove that motor habits over wide areas are very uniform. Thus the modern American Indian cuts by drawing the knife towards his own body, the African or the American whittler cuts away from his body. The handles of implements stored in our museums are expressions of the motor habits of people. It seemed, therefore, possible to investigate the motor habits of various groups.[2] These are found expressed most clearly in their postures and gesticulations, and two groups were selected known for lively gesticulation and characteristic postures. The problem was first to establish their characteristics and, second, to investigate in how far these are changed in American environment. First of all it may be well to show that the common assumption that Americans do not gesticulate is not correct. Even aside from the well-known oratorical gestures we are fairly lively. Most of our gestures may be designated as descriptive. We supplement our speech with movements that indicate the form of what we are talking about. Nevertheless, on the whole our gestures are moderate as compared to those of Italians. Let me indicate how we investigated the character of the gestures. A moving picture giving posture in intervals of 1/16 of a second was projected frame by frame on a screen and the movements of arms and head were marked on a diagram so that the movement could be analyzed in detail. Italian gestures are characterized by a wide symmetrical sweep from the shoulders. Furthermore, they are symbolic. The gestures have definite meanings, many of which may be traced back to antiquity. "It is good," "I am hungry," "prison," are presented by definite symbols. For this reason Italians are able to converse in pantomime without uttering a single word. Their posture is characterized by an easy relaxation of the shoulders and a strong forward curvature of the lumbar region. At the same time the elbows are held backward, and there is a preference for holding the wrist of one hand with the other, both being held in the back. By contrast the Jewish gestures are jerky. The wide sweep of the Italian is absent. Generally the two hands do not move symmetrically. The elbows are almost stationary, close to the body, and the movements are made with forearm and fingers. They are emphasized by movements of the head. They are not graphic, but follow lines of thought. Since very few of their gestures are symbolic, pantomimic conversation without words is impossible. By contrast with the Italian the Jew tries to get in touch with his friend. He will even grasp his hand and gesticulate with his hand. The posture is characterized by a slump of the neck and relaxation of the knees.

These are the traits of the immigrant who has grown up entirely in the old environment. Their descendants, who have left the Italian or Jewish quarter and live in an American environment, change their habits completely. Naturally it depends upon the degree of their separation from the old environment. This is shown clearly by the contrast between the postures of students in an orthodox Jewish seminary and those of the same age in an advanced school attended largely by Jewish students. Conversely, we have observed how Englishmen who live in an Italian or Jewish environment

[1] Proceedings of the Maxim Gorky Medico-Biological Research Institute, Moscow, Vol. III, 1934, pp. 33–56.

[2] This work was carried through by Dr. D. Efron, Mr. Stuyvesant van Veen and Dr. J. P. Foley.

adopt their motor habits. We have one example of an Englishman raised in Italy and married to a Jewess, who has adopted the mixed quality of Italian and Jewish movements. It is also notable that occupations influence gesture habits. Thus many painters accompany their speech by movements which imitate the motions of the brush in painting. How little stable motor habits are may also be observed in a comparison of the modern repression of gestures in England which seems to have begun shortly before the Victorian era in contrast with the lack of restraint in Elizabethan times.

The problem of the adjustability of behavior may also be established on entirely different lines. We have studied the incidence of psychoses in immigrants and their descendants.[3] Owing to the varying age distribution of the incidence of mental diseases, the data which are commonly used are entirely misleading. Mental disturbances among the young are very rare. Since the native population embraces a large number of children, the immigrants comparatively few, the incidence appears much smaller among the former. It is necessary to know for each psychosis the age distribution of its incidence and to reduce the crude figures accordingly. By doing so it can be shown that there are considerable differences between the two generations. We have carried through this study for Italians, Irish and Germans. It will be seen that, rather unexpectedly, we find a considerable reduction in most cases in the second generation and on the whole an approach to the general American standard. The Irish have a number of peculiarities that deserve special study. The importance of considering the age distribution has been pointed out years ago by Dr. Landman and has been worked out more accurately by Dr. Malzberg. It is worth remarking that the complete exclusion of imbeciles among the immigrants does not seem to have affected the incidence of imbecility among their descendants, although, on account of the lack of a strict definition of imbecility it is difficult to give numerical proof. The number, however, is large and shows how little effect exclusion of an affected group, either by immigration laws or by sterilization, has upon the incidence of partly hereditary diseases.

It seems that these various approaches to the problem show first of all that no race can be treated as a unit, but that in every case the individual must be evaluated according to his own characteristics. It follows, furthermore, that at least so far as the aspects studied are concerned, the descent of the individual plays an insignificant rôle in his behavior, that the organism is so plastic that in its physiological, mental and social behavior it follows the pattern of culture with which he becomes identified.

[3] This work was carried out by Dr. Bruno Klopfer.

OBITUARY

ALFRED McLAREN WHITE

THE North Carolina section of the American Chemical Society adopted on September 25 a minute in memory of Dr. Alfred McLaren White. The minute, drawn up by Edward Mack, Jr., *chairman*, F. H. Edmister and E. C. Markham, reads:

On Wednesday morning, September 23, 1936, in the Presbyterian Hospital in New York City, Alfred McLaren White died of acute nephritis. Dr. White was born at Ann Arbor, Michigan, on July 1, 1904. He received the B.S. degree from Michigan in 1925, the M.S. degree from the University of California in 1926 and the Sc.D. from the University of Michigan in 1928. He served as assistant professor of chemical engineering at the Georgia Institute of Technology from 1928 to 1930. In the fall of 1930 Dr. White came to the University of North Carolina as associate professor of chemical engineering, and when this was made a separate division, he became the director. Under the inspirational teaching and guidance of Dr. White, the enrolment of the chemical engineering department increased about fourfold over a period of five years. Always popular with his students, both in the classroom and outside, his interest in them was manifested by his enthusiastic teaching and his participation in numerous student activities. This September he was to take up his duties as director of the chemical engineering work in the University of Virginia.

Dr. White was an associate member of the American Institute of Chemical Engineers, a member of the American Chemical Society, Sigma Xi and the Elisha Mitchell Scientific Society.

McLaren White was known to many people outside the chemical profession for his versatility and accomplishments. He spent a part of several summer vacations in the Artist Colony on Monhegan Island, and a number of his friends have visible evidence of his ability as an amateur artist. He was also a musician. During his stay in Chapel Hill he was an active member of the Choral Club and the University Concert Orchestra.

The untimely death of Dr. White at the virtual beginning of a promising scientific career is a great loss to both the professions of chemical engineering and chemistry. The North Carolina Section of the American Chemical Society deeply mourns a leader and an ever helpful member. Your committee offers this statement as a resolution to be spread on the minutes of the section, with instructions to the secretary to forward a copy to the family.

ALBERT B. REAGAN

DR. ALBERT B. REAGAN, special professor of anthropology at Brigham Young University, Provo, Utah, died on May 30, following a brief illness.