INTER-SOCIETY COLOR COUNCIL

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TENTH ANNUAL MEETING

Plans for the tenth annual meeting, to be held in Washington on March 4 and 5, are nearing completion. Each of you has received a preliminary notice, and a final program should reach delegates and members about February 1st. Since this will be the Tenth Annual Meeting, it is peculiarly appropriate that the Discussion and Business Sessions on March 4 are to be held at the national headquarters of the American Pharmaceutical Association, 2215 Constitution Avenue. We expect that Professor Gathercoal, who called the color conference of the 1929 U.S.P. meeting which resulted later in the formation of the Inter-Society Color Council, will be with us. In fact we hope that all former Council Chairmen will be present: Prof. Gathercoal (U.S.P.), Mr. Munsell (O.S.A.), Dr. Jones (O.S.A.), Mr. Paul (A.S.T.M.) and Dr. Dimmick (A.P.A.).

On Tuesday evening, March 4, a dinner meeting has been planned so that delegates and members may become better acquainted and have an opportunity to discuss informally with each other matters of mutual interest. If you know of a talent for entertainment among any of our delegates and members, get in touch with Kenneth L. Kelly, 2215 Constitution Avenue, in charge of arrangements for this dinner, and perhaps he can arrange for the disappearance of the bushel that hides this talent from the rest of us. On Wednesday afternoon, March 5, we meet at Mayflower Hotel, jointly with the A.S.T.M. for a co-sponsored technical session on Color: Its Specification and Use in Evaluating the Appearance of Materials. Mr. M. Rea Paul is chairman of this session. The speakers are Deane B. Judd, Francis Scofield, R. H. Sawyer, I. H. Godlove, A. E. Parker and Richard S. Hunter.

The Popular Session, at which A.S.T.M. members will join us, will be held on Wednesday evening. The Washington-Baltimore branch of the I.E.S. and the Washington Colorists will meet jointly with the Council on this evening. There will be three demonstrations: Trends in Color Photography by Earl A. Trager, Bell and Howell Company; Paint Styling by members of the Council of Paint Styling of the National Paint, Varnish and Lacquer Association; Exploring the Magic World of Color, by Herbert Thompson Strong, color consultant of the Museum of Science and Industry, New York City, well called the "World's Greatest Color Magician."

CHANGES IN DELEGATES AND MEMBERS

We welcome the following delegates and members from the Optical Society: R. C. Gibbs, chairman; D. B. Judd, I. H. Godlove, voting delegates; Blanche R. Bellamy, R. S. Estey, H. P. Gage, W. C. Granville, A. C. Hardy, L. A. Jones, Dorothy Nickerson, non-voting delegates; from the A.S.T.M.: Wallace R. Brode (E-2) to succeed A. W. Kenney as voting delegate, and Allan E. Parker, non-voting delegate; as an individual member, William F. Talbot (General Printing Ink Corp.) to take the place of J. P. Mather, whose business connection no longer keeps him in touch with color. The resignation of Howard Ketcham has been accepted.

MUNSELL REPORTS

A copy of the December J.O.S.A., which contains five reports on the Munsell system, has been sent to each delegate and member of the Council who did not receive a copy through other source. The Munsell Color Company was interested and color-spirited enough to purchase a large extra supply of these journals in order that they might be made available to those who might wish to have them. They will supply copies to persons in the educational field for a handling charge of 10 cents each. To others copies will be supplied at the very low cost of 25 cents each. Or copies may be obtained in the regular manner from the American Institute of Physics at 60 cents each, the regular charge for back issues of the J.O.S.A.

COLOR BLINDNESS TESTS

Recently we noted in the News Letter the publication by the American Optical Company of "Pseudo-Isochromatic Plates for Testing Color Perception." Since that time two other recent tests have come to our knowledge: An American reproduction of the last edition of the Stillings charts (now unobtainable in this country) for Meyrowitz, who handled the distribution of Stillings charts in this country. There is also available a Russian test by Rabkin (text in Russian and English) with 20 plates that seem far more thorough for use in diagnostic work than any similar plates yet seen. The second edition, 1939 (1st edition 1936) is published by the State Medical Publishing House of the USSR: Polychromatic Plates for Testing Color Vision. In connection with color-blindness tests it should be noted that a short form of the Color Aptitude Test now being developed by a committee of the Council headed by Messrs. Dimmick and Foss, is being tried out by officers of the Navy Department with promise of considerable success. The test has the advantage over the Ishihara and Stillings type test that it can not be learned. Progress in this ISCC test will be reported at the annual meeting by the committee in charge of this work.

EXECUTIVE COMMITTEE MEETING

The Executive Committee of the Inter-Society Color Council met in Washington on January 10, 1941, all members but one being present, the chairman of the Problems Committee and the editor of the News Letter meeting with them. The following members of the Color Aptitude Test Committee were present during a part of the meeting: Comdr. Gordon, Mr. Granville, Mr. Kelly and Dr. Sloan.

BOSTON COLOR GROUP

Plans for a program of six meetings for the Boston Color Group were announced by their secretary, S. Q. Duntley, on November 26, in accordance with arrangements made by the committee appointed by the Group chairman, Prof. Frank L. Allen. All six meetings this season are to deal with the subject of color mixture. The meetings are scheduled for the second Wednesday of each month, and are to be held in the M.I.T. buildings, following dinner in the Emma Rogers Room. At the final meeting, on December 11, Prof. Arthur C. Hardy expected to discuss the physical principles involved in color mixture. Subsequent progress will illustrate the application of these principles to practical problems encountered in artists' colors, printing inks, plastics, house paints, textile dyes and theatre lighting effects. On January 3 the secretary invited all members of the Group to attend the Society of Arts lecture at M.I.T. to be given on January 12, in lieu of a separate January meeting. At this meeting the subject of color photography, replete with elaborate demonstrations and experiments, is to be presented by Prof. Hardy to the general public. It is of interest to note that the Boston Group find it advantageous to plan and arrange for their meetings by advance Sale of Season tickets, covering the cost of dinner for the series of meetings.

ASSOCIATION FOR COLOR RESEARCH

Notices of the last three meetings of this active group were received, two of them too late for report in current issues of the News Letter. The first reported a dinner meeting at the Red Rooster, 820 North Michigan, Chicago, and adjournment to the 15th floor of the same building, where Mr. Lisanti, chemist and consultant, spoke on the subject: "So You Think You Use Color." Mr. Lisanti demonstrated, both by argument and practical demonstration, some of the little known fallacies of present-day color usage. The effect of such factors as film thickness, pigment concentration and crystal formation were demonstrated with the aid of special apparatus. The second ACR dinner was at Normandy House, followed by adjournment to the Art Center Building, 820 North Michigan, on November 29. Here the meeting was addressed by Dr. Isay A. Balinkin, of the Department of Physics, University of Cincinnati, who is well known to Color Council members. His subject, "Color -- From A,B,C, to X,Y, and Z", was illustrated with much special equipment, including demonstrations of color and light in camouflage and warfare. Dr. Balinkin, who is both teacher and industrial color consultant, is a skillful showman and excellent speaker, pointing his remarks through the exercise of a keen sense of humor, so we are sure that his address was both instructive and interesting. The third ACR dinner meeting was to be held at the same places as the second. Here the meeting was to be addressed by Mr. H. T. Johnson, on the subject "Debunking Color Bunk". Mr. Johnson is Assistant General Manager of the Martin-Senour Co. who attacked the problem of color harmony with the purpose of developing a simple practical solution for dealers and consumers. The announcement states that he was to discuss a "Color Directory", based on the ideas of Ostwald, containing more than 1500 graded pigment color cards.

CAMOUFLAGE IN WARFARE

A series of articles on this subject written by an anonymous writer or the editor of Nature and letters by correspondents, include some very severe criticisms of British camouflage as well as reports of considerable progress, perhaps in part because of a reaction to the criticism. The references are: Nature, Anon., 145, 949-50 (June 22, 1940); Anon., 146, 160-1 and C. H. Rowe, 146, 168 (Aug. 3); T. H. Merton, 146, 429 (Sept. 28); "J.S.H.", 146, 482-3 (Oct. 12); Anon. 146, 584-5 (Nov. 2). There is also an article "Colour Blindness and Camouflage" by the editor, Nature 146, 226 (Aug. 17, 1940), which we shall review in a later issue, and which, in response to news reports from America, suggests three ways in which certain color-blinds might see more than normal persons; but holds that on the whole the color-blind individual is at a marked disadvantage. The adverse criticisms are of two kinds: those dealing with organization and personnel, and those concerned with methods. Even so late as November, Nature quoted a report of a sub-committee on home defense services to a committee on "National Expenditures" recommending that four existing camouflage departments be united into a single organization under the Ministry of Home Security. An incidental remark is: "The testimony of departmental witnesses with the longest experience of camouflage of all kinds was emphatic that specimens of camouflage of fortified posts throughout the country are absurd and cannot be regarded as camouflage at all." Early criticism stressed the absence of biologists and great preponderance of artists in the reorganized Camouflage Committee and failure to accept advice, while calling attention to the admitted fact that "the underlying optical principles which govern visual concealment and deception are biological principles." Of 65 officers in the camouflage establishment, 61 were either artists or art students, none naturalists; but an artist was also critical of the current work. This was met in October, in a letter claiming great progress and renewed utilization of the biological principles, with the statement that artists "are now found indispensible both because of their gifts for design,

for observation and for capacity to see and memorize a site in terms of "color and tones" instead of in terms of objects of human significance and because of technical knowledge as executants." But their work is now carried out under the supervision of a physicist.

The application of the principles discussed was suggested by Sir John Graham Kerr in 1914. They were intensely studied by H. B. Cott and incorporated in lectures to officers as well as in his book "Adaptive Coloration in Animals" (1940). The principles which are discussed include counter-shading (compensative or obliterative shading and gradation), disruptive pattern (including "dazzle" and particoloring), deflection, coincident pattern and imitative coloring or mimicry. Resemblance may be general or special. General resemblance is commonly employed in the field, where mobile objects are colored so as to be as inconspicuous as possible against a variety of backgrounds. Special resemblance, say to grass, sand or woods can be produced at will. In biological mimicry, a harmless organism counterfeits the appearance of a dangerous one; in mimetic camouflage, an armaments factory may be disguised to look like a non-military object. In biological deflection, the attack of an enemy is drawn away by conspicuous pattern from a more vital to a less vital part of the body, or from a biologically more important individual to one less important to the survival of the species. In warfare, false targets are also designed. Disruptive pattern is most essential for large stationary objects such as buildings. A criticism was that this was on too small a scale to be effective against air attack. It has been claimed that "camouflage has become a sort of fetish, implying the application of green and brown blotches of one or two feet in diameter, whatever the object to be disguised and whatever its surroundings." Another criticism was neglect of "structural" methods and undue reliance on paint, which alone is helpless to disguise cast shadows and hard outlines. Colors are still too much "of one tone"; dazzle (disruption) at sea, effective on American destroyers in 1915-18, has been abandoned, and present methods are ineffective. Bus tops are painted green and brown; but the sides are often "brilliant red." Large hangars are painted with trees, whose lack of shading kills their effect at bombing range. Counter-shading obliterates appearance of relief and can be used for tanks, torpedo-tubes, guns, aircraft and buildings (Thayer's principle, known under other names to Leonardo da Vinci, Rembrandt and other artists). It is particularly appropriate to cylindrical bodies, as those of snakes, caterpillars and guns. As late as August, pictures of 12-inch coastal guns, bearing the official conventional pattern, according to Nature "a peculiarly senseless and ineffective thing", since it fails to break up surface continuity, obliterate outline or nullify the appearance of solidity due to light and shade, were published. In conclusion, however, we wish to recall the more optimistic and progress-reporting note sounded by J.S.H. and the observation by Rowe of the importance of aerial photography, which by use of special film, "nullifies the virtue of color", and finally to point out that the concealment of tanks and supply trains all over the desert before the surprise attack on Sidi Barani, did not indicate complete ineptitude on the part of the British camouflage service.

COLOR IN PAINTING THROUGHOUT THE AGES

VII

In the sections following our introductory ones, the art of primitive man was discussed in connection with mural paintings of caves. There were also rock engravings and sculptured and relief forms; but these are outside of our subject. As primitive art objects also are to be considered such decorated objects as pots, tools, weapons and amulets. The art of Paleolithic cave man was predominantly mural; but to consider the art of the men who followed him, we must trace the story largely through their

pottery. Cave art rose to its finest style, grew careless, degenerated and finally collapsed suddenly. This decline was brought about primarily by climatic changes, but not because the cave men died out from the cold. In that age, hunters found ample supplies of mammoth, reindeer, bison and horse flesh; and in fairly permanent camp sites, time to enjoy leisure and cultivate art. But with the passing of glacial conditions, food supplies diminished, and finally there were both little game to hunt and small space in which to hunt it. For the forests encroached more and more over the old hunting grounds, and the herds disappeared. There were also changes of land sinking and transgression by the sea; and pre-historians have correlated these with the climatic changes. In Africa, temperature changes were of less importance than amount of rainfall, "pluvials" occurring when this was great. The storm zone which during Paleolithic times had centered over the Mediterranean Sea, around 7000 B.C. shifted northward. The Sahara region, Arabia and Persia, which had been grassy steppe lands, dried up. This led to migrations into Europe. An exception to the decline of culture and art in Europe is furnished by Eastern Spain, which was rich in paintings, some of which have been already discussed. It has been maintained, and also denied, that this art was due to a wave of people from Africa. Other waves will be discussed later.

In this article it will be our purpose to show how the civilization which we know today arose in, and was diffused from, the East into Europe. We shall trace this diffusion; and in so doing, the pottery and other art-forms will be seen as important clues. Of course the colors of the ware will be particularly stressed. Occasionally, the people responsible for the cultures will be described, because of the thesis that the art of a folk cannot be properly understood unless these people and their life are known. We shall find that an important folk in our story are the "Painted Pottery Folk." It is further necessary to realize the antiquity and the richness of civilization in the Near East, and to contrast this, at any given time between, say, 6000 and 2000 B.C., with the poverty of the contemporaneous life of Western Europe. To do this we shall momentarily reverse the time scale, and go backwards; that is, downwards through the strata containing the remains of the cultures in the order in which they were revealed by excavation. We shall then pick a convenient date roughly midway between the dates just named and describe the diminishing scale of cultural zoning which is found on crossing from the Near East to Western Europe. Thereafter we shall follow roughly a chronological order, but in each epoch of time taking up first the East and second the contemporary West.

If we go back a thousand years before the start of the Christian era, we come to the approximate time of King David; another millenium brings us to the time when Abraham left "Ur of the Chaldees." Still another millenium brings us to the time of the First Dynasty of that city-state, the third after the Great Flood (Kish was the first and Erech or Uruk the second). Below the remains attributable to the dynasty Ur I, we find the Royal Tombs of Ur, in strata accounting for about three centuries. The richness and beauty of finds from these tombs have been already discussed. A uniform stratification can be worked out for Ur, Uruk and Kish. There are building and pottery layers; one contains a ware with a reserved slip, another with pottery painted red or pink on a light ground, and a third with polychrome pottery. The typical polychrome is found at Jemdet Nasr, near Kish. It is also found at the Second settlement at Susa (Susa II), the capital of ancient Elam (Persia), and in many other sites over an enormous area. The forms include compartment and animal-shaped vases decorated in a pronouncedly realistic style. The most prominent color is a rich purplish red, often on a black ground. At Jemdet Nasr was found also a remarkable example of sculpturing in the round of a woman's figure in alabaster with lapis lazuli (ultramarine) inlay forming a fillet outlining

the face, lapis lazuli and pink shell eyes, bituminous inlay for eyebrows, and hair in dark paint. At Erech, in the polychrome layer was found the ruins of a "Red Temple", a veritable cathedral adorned with friezes of clay beasts. This was twice remodelled; and since we do not rebuild cathedrals every few years we may safely go back another three centuries to date this stratum (see the table below). But below the Red Temple were the remains of a Limestone Temple. Here were found the relics of a highly organized civilization; layers at Ur corresponded. Below this was another stratum, then one containing another style of pottery called the El Obeid, because it was first found at Tell el Obeid near Ur. This is a fine, delicately thin, porous, dark-on-light ware, decorated, in contrast with the polychrome ware, in a geometric style with usually matt black designs on a light buff or greenish ground. The variant from the earliest layers at Susa (Susa I) exhibits a magnificent synthesis of pure geometric motives with highly stylized realistic designs. These two styles correspond to the First and Second Copper Ages of the Near East.

Table of Rough Chronology*

B. C.					
3200	Ur I	Thermi I	Troy I	Nuzi 3	Thessalian II
3300	Gawra 7	Anau II	Egypt I	Early Minoan I (Crete)	
	Royal Tombs of Ur	Kum Tepe	Nuzi 2	Susa II	
3500	Alisar A	Ras Shamra 3	Tel Asmar 5	Cretan upper Neolithic	
	Gawra 8	Nuzi 1	Thessalian I		
	Jemdet Nasr (polychrome)		Fara I		
	Erech I (Uruk)		Semainian (Egypt)		
	Kish I	Anau I	Cretan Neolithic		
4000	Sumerian	Persepolis	African (Capsian) Neolithic		
	Great Flood		Mersin 16		
	Proto-chalcolithic		Gerzean (Egypt)		
4500	El Obeid	Jericho lower Neolithic	Gawra 13	Ras Shamra 4	
	Lowest Erech and Eridu	Tepe Musyan	Susa I		
	Shell-mounds	Gawra 16	Western Neolithic		
5000	Tel Halaf	Mersin upper Neolithic	Teheran	Amratian (Egypt)	
	Jericho Mesolithic	Badarian (Egypt)	(bread wheat)		
	Samarra ware	Gawra 20	Ras Shamra 5	African Neolithic	
6000	Natufian (Palestine)	Tasian (Egypt)	Mersin lower Neolithic		
	(wheat in Palestine)		Maglemosian (West Europe)		
7000	Exodus from Sahara region		Azilian-Tardenoisian		

* Note: Roman numerals indicate dynasties and culture phases; Arabic numerals, stratiographic layers (and usually also culture phases).

The El Obeid stratum is interrupted at some points by the alluvium deposited by the Flood which Noah survived; and both the polychrome and the dark-on-light geometric wares have been traced back to a start below this.

But the El Obeid farmers who settled near the Tigris and Euphrates brought with them a culture already old, as very recent work has shown. In the thirteenth of twenty strata at Tepe Gawra in Assyria (Tepe and Tell mean "mound"), were found the relics typical of the El Obeid phase. But the layer already contained a cluster of three monumental temples, beautifully designed and grouped in rare good taste around a court and decorated with painted buttresses and niches. And below Gawra XIII came settlements of the so-called "Tel Halef culture", found also at Ninevah, Arpachiyah and Chagar Bazar. We may date this culture roughly at 5000 B.C. But it exhibits elaborate monumental buildings and cobbled streets, delicately and beautifully painted vases, carved stone beads and stamps used for sealing property, indications of an advanced economy and craftsmanship and a well-organized society. These people at some sites but not at others had begun to use metals, and they cultivated einkorn and had wheeled vehicles; their typical pottery was a red-on-white ware. But the end is not yet, for the oldest Tel Halaf foundations rest on ruins of villages having painted pottery of a style found at Samarra and Ras Shamra in Syria. This pottery was a highly polished black ware ornamented with incised markings, sometimes filled in with white. Moreover, at Mersin near Tel Halef, in the Cilician district of Turkey, below a Hittite fortress, a level containing fortified buildings corresponding to El Obeid and Uruk strata, and a Copper Age layer containing polychrome Tel Halef ware, were recently found "Upper" and "Lower Neolithic" strata containing black and brown pottery; while at other sites there were painted wares and local styles of unpainted ware side by side, and at Jericho evidences of early settlers with the pygmy flint tools often characteristic of the Mesolithic period.

It is now known, contrary to a belief long held, that there was no completely desolate hiatus between the Old and the New Stone Ages of Europe. There were many survivors of the ancient folk; and modern European civilization arose from the grafting onto the old stock of new races of invaders from the South and especially from the East, who brought with them agriculture, metallurgy; the practice of organizing cities and commerce; writing and art. On the way across Europe, part of the knowledge was lost; but it is intended to outline some of the steps here. In various articles and books, H. J. Peake has traced the cultivation of wheat from Palestine to the cultures we have named and through Europe and Asia; but that fascinating story is outside our subject. In most of these places, it was the inferior varieties emmer and einkorn; the "bread wheat" which arose by hybridization in Persia reached Western Europe only after crossing Turkestan, the Eukraine and the Baltic region. It was once believed that pottery nowhere preceded the cultivation of grain. But sickles have been found in cultures without pottery, and pottery in cultures without sickles. In an East African Mesolithic culture have been found pots with well-made rims, some of the pots being decorated. In the same region were found pieces of pottery in a Paleolithic layer having a lithic culture corresponding to that of the artistic Cro-magnons of Europe. Claims for pottery from other Paleolithic sites have been made and disputed.

We turn now to Europe and pass over various survivals in the Arctic, in Poland, and after 7000 B.C. the Forest Folk who illustrate by their specialized tools adaptation to the new environment, and who about 6500 to 5000 B.C., spread all over the North European plain from England to Finland. These folk left no painting, but decorated their bone implements with geometric patterns made of series of points. We pass lightly, too, over the "Azilian-Tardenoisian" group of Mesolithic peoples,

apparently due in part to invasion from Africa through Spain. With them, conventionalization in art had reached its acme. We find only apparently meaningless designs which may stand for human figures, or "tectiform" drawings which may represent tents or huts. Azilian culture differed from Tardenoisian by the presence of peculiar painted pebbles; these were painted in a thick coat of red ocher, probably mixed with fat, forming lines and simple patterns. By comparison with the petroglyphs on the cave walls in Spain, we may perceive the figures as conventionalized standing and seated male and female figures. Comparisons with only hieroglyphics have also been made. In the typical Azilian site in the Pyrenees were found bones of two Azilians, painted with red ocher, along with the painted pebbles, while pottery was found in layers above these. Another famous site is the cave at Ofnet, Bavaria, where were found 27 skulls arranged like eggs in a nest, faces all to the west, without bodies but with red ocher.

A more complete adjustment to the changing forest conditions is exhibited by the "Maglemosians", as shown by their antler adzes and chisels. The whole plain from Yorkshire to Esthonia was occupied by these food-gatherers. They had ice-picks, and arrow-heads shaped to kill the fur animals with least damage to the pelts, and perhaps the oldest vehicles in their dog-sleighs. Their typical sites are in Zealand and the East Baltic region. In Russia are found the remains of Maglemosians surviving until 2000 B. C. Their widespread culture varied in the different stations, depending upon borrowings through contacts with descendants of the Paleolithic South Russians or with the Tardenoisians on the west.

Still further adaptation is illustrated by the shell-mounds of Denmark, which are the kitchen refuse of a people still in the food-gathering stage and subsisting largely on shellfish. Here were found fragments (sherds) of a coarse pottery, large jars of nondescript clay color. These belong to a time (5000-2500 B.C.) when a "Littorina Sea" had isolated Britain, and continued into the following period (to 1500 B.C.) Innovations of the latter period include Finnish skis and traffic in the magical amber. The pottery, uniform in shape from the Baltic across Russia, was built up in rings, ovoid in shape, and decorated with one or more horizontal rows of pits. These types are mostly associated in Central Russia with "pit-and-comb"-ornamented pottery (prevalent about 2000 B.C.), where agriculture and herding were introduced by the "Battle-axe ocher-grave folk." The makers of the other pottery were the Finno-Ugrian-speaking peoples, whose ancestors were thus probably the Maglemosians. Art was even more rare among the shell-mound folk than among the Maglemosians; and for an analogous present-day culture, we would have to look to the Strandloopers of South Africa. These pottery styles have little direct color interest. Rather they serve as foils with which to contrast the contemporary and earlier types of the East, where painted pottery was common. The self-colored pots derive their color from the mineral content of the baked clay, so the colors vary with the locality in no significant way; and the connections with red ocher are the chief point of color interest.

It is illuminating to jump now to the Near East, where, at any point in the time scale up to the Bronze Age, we find a far more advanced picture than that of Europe. In the East we find painted pottery distributed over a wide area. It is not to be supposed that everywhere and at all times the makers were a single ethnical unit; their distribution in space and in time was too great. Painted pottery has been found in shell heaps of Japan; with the early Yang Shao culture of China; at Anau in Turkestan, in Khorasan and in Seistan (Baluchistan); and in European centers in Russia, Transylvania, Bulgaria, Thessaly and South Italy. These are all north of the great mountain spine of Eurasia. But south of the mountain

axis painted pottery is also found in the Punjab (India), Elam, various sites in Mesopotamia and Sumer, Cappadocia, Syria, Palestine, Egypt and Crete. The spatial distribution gives an important clue to the racial derivation of the painted pottery folk. Broadly speaking, the "Mediterranean race" had its homeland south of the great mountain spine; the Alpine and Nordic races grew up north of it. The Alpines were broad-heads, the other two long-heads. In the various sites enumerated, both brachycephalic and dolichocephalic skulls are found. Space does not permit giving the evidence; suffice it to say that the present writer believes that the bearers of the painted-pottery cultures were a blend of peoples who were the forerunners of the modern Alpine and Mediterranean races, with the former predominating. The Alpines were particularly the tall variety with highly domed heads known as the Armenoids; the blend of the two races is similar to that called the "Prospectors" by ethnologists. We believe the great endowment of these people affords an excellent example of heterosis (hybrid vigor). Their origin may be traced somewhere in Asia near the great mountain spine where the two racial stocks came into contact. In relatively late periods there is evident some enrichment and reinvigoration by Proto-Nordic blood; and in early times we may look to an as yet undifferentiated stock which later gave rise to both Mediterranean and Nordic long-heads. In the early civilization of the Far East, these races were represented by four groups. First there were the Elamites, round-headed hill-folk, and the people called Semites (really a language term), who in an ethnical sense were either mainly Mediterranean with some proto-Nordid blood or the undifferentiated stock. Then there came, almost simultaneously, the El Obeid race of Sumerians, who, though broadly Mediterranean or Arab-like, were more of the Iranian than Semitic type; and the pigtail-wearing Hurrians, who were closely related to the Elamites, but probably with some Nordic blood. The First Copper civilization and black-on-buff geometric ware of El Obeid and Susa I is connected principally with the Elamitic or the "Prospector" stock. The Second Copper Age of Jemdet Nasr and Susa II was borne by the Hurrians. The Sumerians, though a race with a great civilization, made unpainted pottery. At Tepe Gawra, the two styles appeared simultaneously; but there was a "Semite" stratum intermediate between painted pottery and Sumerian layers, and this also contained no painted pottery.

It may be questioned whether the painting of pottery is enough of a criterion to distinguish the ethnic unity of a people. The answer involves two considerations. First, it is no simple matter, especially for a people with a primitive economy, to paint clay with a permanent indelible color which will not be destroyed but fixed on firing; and the secret is not apt to be discovered twice in any period. Second, there are about ten ways, other than painting, in which pottery may be decorated; and in fact many if not all of these were practiced before the dawn of even the Iron Age. Moreover, along with the painted pottery (which, as we have said, took various forms), there were usually found certain other elements in a composite culture complex: the polishing of stone, the use of copper, tilling of the soil, domesticating animals, the use of perforated pear-shaped or spheroid stone mace-heads, clay female figurines for use in promoting the fertility of crops. Over large portions of the great area, the relations within any given region are even closer; throughout the region from the Euphrates to the Indus, including Syria, Iraq, Persia and India, Sir Aurel Stein traced figurines of the Mother Goddess and the humped bull. The parallels between the prehistoric Sumerian and Indus civilizations go much further (though the closeness of the two was no doubt exaggerated in the first enthusiasm): the use of brick for building, interments of contracted bodies in brick cist graves, decoration with shell inlays, mace-heads and pestles, beautiful seals for stamping property-ownership marks engraved with the same animals in the two civilizations. The local differences can be best illustrated in Europe by contrasting the oldest

culture of Thessaly with that of the North Balkans. In the north we find polychromy, spiral and meander motives, thick ware with true handles unknown; in the south, monochrome, rectilinear designs, very fine vases equipped with neat handles. But these cultures are late in date compared with the painted-pottery cultures of the Near East, and more opportunity for outside influences had been given in the interval.

Let us now compare the picture in Europe about 4000 or 3500 B.C. with the contemporary one in the Near East. We find an East-to-Northwest series as follows: (1) in Mesopotamia and Egypt, true cities of a walled area of two square miles, with organized commerce, public works, artisans and artists, officials and scribes; (2) in Syria, smaller cities less richly equipped and less literate; (3) in Anatolia and lower Greece, copper-age townships with a walled area of a few acres, with smiths and other craftsmen well provided by trade with metal and other raw materials; (4) in Thessaly, Macedonia and the Morava-Maros region beyond the Balkans, neolithic villages permanently occupied by experienced farmers content to get along without metal; (5) in Eastern Hungary and Slovakia, herdsmen and troglodytes, grazing and tilling patches of loess and then moving on (but making pottery and exporting obsidian); (6) still farther north, "Danubian I" hoe-cultivating peasants shifting their hamlets of a score of huts every few years to fresh fields until they reach the edge of the loess; (7) on the north European plain, only scattered bands of food-gatherers, hunting, fishing and collecting berries, nuts and shell fish. That is surely a steadily descending series of culture levels! But it constitutes a picture which must be perceived before any adequate understanding of ancient (or modern) art may be had. Otherwise, description of the art-forms and colors of these cultures becomes merely a catalog of names, places, objects and colors.

THE MEASUREMENT OF ART

An interesting article of this title, by F. Ian G. Rawlins of the British National Gallery, appeared in Nature 146, 292-4 (Aug. 31, 1940). The author refuses to adopt the defeatist attitude which assumes that art cannot be measured. In any branch of art, there are two categories of esthetic experience, the "formal" and the "connotative". The first relates to such properties as symmetry, balance and harmony; the second to significance or meaning. For example, a supreme picture will be perfectly composed in design; its function, however, will not be completely fulfilled until its intention (meaning) has exerted its maximum effect. The proper enjoyment depends upon some degree of formal as well as connotative training. The article attempts to set up a system of art metrics, such that personal predilections may be somewhat disciplined, without doing violence to their essentially intuitive nature. In the formal category, the object is to set up an equation capable of numerical solution which will enable objects, as tiles, vases, decorative designs, melodies or poems, to be arranged in order of esthetic merit M. Here, as Birkhoff of Harvard (Aesthetic Measure, 1933) assumed, the basis is largely geometrical. The "elements of order" may not be always positive. Ambiguity may introduce a negative sensation into formal esthetic experience. An example is a rectangle which is nearly, but not quite, a square; another, a grouping of figures just too haphazard to balance, and yet not free enough to be natural. (Is this the reason why "intermediate" hue pairs of colors fail to harmonize, while complementary and analogous pairs are often pleasing? -- Ed.) Birkhoff's equation is $M = O/C$, where O is the order (symmetry, harmony) and C the complexity of the subject. C is proportional to the preliminary effort of attention made by the beholder. The present author illustrates in detail the determination of the numerical values of the variables by examining the outline of a T'ang vase. Here C is the number (8) of points upon which the eye would naturally rest in its attempt to follow the contour. However restricted and arbitrary, it is

found that by means of the indicated analysis, a collection of vases can be arranged in order of merit M; and such sequence is found to correspond with common esthetic judgement. In the connotative, and more difficult, category, Rawlins (An Experimental Philosophy of Paintings, Science Progress, Oct. 1939, pp. 263-76) has as his purpose the search for meaning, and assignment of a value to it. He starts by asking which branch of knowledge incorporates an essentially integrative property of form with the basic element of significance. The answer, he says, is modern Gestalt psychology. (In this connection, the Editor remembers long talks with a well-known dancer in the art colony at Woodstock who was pleased to discuss the relation of Gestalt to that form of the then "modern" dance which attempts to create an integrated perception in which the audience is not allowed to be too conscious of the component elements of motion; for example, the integrated "illusion" of violent motion and emotion without use of violent efforts of specific gestures.) Setting out to find the mathematical function connecting what can be perceived with some elemental property of the art object, independent of the observer, Rawlins applies the physical-chemists' doctrine of energy. Discussing the creative energy of the artist, the intrinsic energy E of a picture, for example, at any time, and the free energy F when completed, and assuming the total energy constant, it is found, as we do in thermodynamics, that the free energy reaches a minimum; further, that free energy here is the measure of the picture's connotative stability (its power to give lasting satisfaction), in short, its "meaning." From Gestalt he takes the "law of prägnanz", which states that the "psychological organization" will always be as "good" (symmetrical, satisfying, stable, significant) as the prevailing conditions allow. An equation is then obtained by relating free energy to psychological organization. The latter is quasi-geometrical in nature, suggesting a parallel to Birkhoff's "order"; in addition, the equation implies the characteristics of a potential in physics. This does not yield a method of calculation; but leads to a connection between organization and the energetics of an object of art. An estimate of the effort involved in creation may be obtained, and a glimpse of the cost to be faced in the conveyance of meaning. It is not meaning itself which has been measured; it is the price of meaning to which a token value has been given. A statue by Michelangelo possesses vast intrinsic energy; its majesty, however, resides in its (connotative) changelessness, or low free energy, a reminder of the creative energy outpoured in its fashioning. On examining the dimensional equation of the complexity C, it is found that it has the same dimensions as the surface density of free energy F. Esthetic value M increases the lower the density. This brings the Birkhoff equation and the Gestalt equation into harmony, though the two were derived from totally different postulates.

THE STORY OF COLOR

We have received, just too late for inclusion in News Letter No. 32, advance proof of an announcement of Faber Birren's new book of this title, to be published January 15, 1941. The book, we are told, is to contain 150,000 words, 344 pages, 230 line and halftone illustrations including 20 portraits of the world's foremost colorists and 8 full-page engravings in color. The announcement states that the book has taken several years to write, "many hundred" literary sources having been consulted; though it is stated that the relation of color to the ancient and modern traditions involved in man's conception of the universe, his religion, culture, art, health, science and mastery of life is dealt with, and the greater bulk of this material has never before appeared in the literature of color. The color contributions of Aristotle, Goethe, Schopenhauer, Gladstone and Havelock Ellis are cited, though the color interests of the last three of these has not been generally known. The partial list of topics given in the announcement shows the book to be very inclusive in character. A more complete review by our Editor for Science is to appear in an early issue.

The price of the book, of size 9 x 12 inches, bound in red water-proof cloth, is $7.50. It is published by The Crimson Press, 40 Gorham Avenue, Westport, Conn.

ANATOMICAL SUPPORT FOR YOUNG-HELMHOLTZ THEORY OF COLOR

In a letter to Nature 146, 558-9 (Oct. 26, 1940), entitled by the editor "Anatomical Basis of Colour Vision", the well known British anatomist W. E. LeGros Clark gives new evidence tending to dispel a common criticism of the Young-Helmholtz trichromatic theory of color vision. Much has been made of the lack of any anatomical evidence for the three sets of sensory receptors in the mammalian retina postulated by the theory, or for the three sets of optic nerve fibers which presumably connect them with the brain. Clark now finds a possible anatomical basis for the latter. The lateral geniculate body (hereafter abbreviated LGB), that is, the center through which the retinal impulses are projected on the cerebral cortex) is composed of 6 well defined layers of cells in man and the higher apes. Many years ago it was shown by Minkowski, on the basis of transneuronal degeneration following section of the optic nerve, that crossed retinal fibers end in layers 1, 4 and 6, and uncrossed fibers in layers 2, 3 and 5. More recently these observations were confirmed and amplified (Clark & Penman, Proc. Roy. Soc. B 114, 129; 1934) by the study of the effects of small intra-ocular lesions of the retina in the monkey. In the course of this work it became apparent that the smallest retinal lesion which leads to a detectable change in the LGB always involves a group of cells, of approximately equal size, in all the corresponding three layers, these cells being disposed as a straight band radiating from the hilum of the LGB to its convex surface. In other words, it appears that the receptive unit of the LGB with respect to each retina is a narrow band of cells radiating from the hilum and involving either the cell laminae 1, 4 and 6 (heterolateral fibers) or 2, 3 and 5 (homolateral fibers). From this observation, it may be inferred either: (1) that each single retinal fiber on arrival at the LGB divides into three terminals, each passing to one of the three corresponding cell laminae, or (2) that the conducting unit in each optic nerve in relation to the LGB consists of three fibers arising from adjacent ganglion cells of the retina, and that of these three fibers (in the case, e.g., of crossed fibers), one terminates in cell lamina 1, a second in lamina 4 and a third in lamina 6. It may be said at once that there is no neuro-histological evidence for the first alternative, and that the second, therefore seems probably correct. But the Young-Helmholtz theory also postulates that the conducting unit of the optic nerve, so far as color vision is concerned, should consist of three fibers, related respectively to the sensations of red, green and violet. Thus the present studies provide quite definite anatomical support for the theory. Pending further direct evidence, the implication that each set of three cell layers in the LGB is related to the fact that normal color vision involves a three-component mechanism (Clark says "is trichromatic" -- Ed.) can be regarded only as a speculation. If specimens of the LGB's of color-blinds could be obtained, their histological study might lead to definite results. Two further interesting points however are made by Clark: (1) the fully developed 6-layer formation is found only in the primates, and the primates are the only mammals so far known by properly controlled testing to have full color vision; (2) in the monkey and in man, the full development of the six layers is found only in that part of the nucleus concerned with central vision. In the rostral portion and the lateral and medial borders of the caudal two-thirds, the six laminae merge into each other to a considerable extent, and these regions are concerned with extreme peripheral vision where the recognition of color distinction, of course, is not possible.

PHYSICAL SOCIETY COLOUR GROUP

We have learned from the pages of Nature (146, 427; Sept. 28, 1940) that a group of this title was formed at a meeting under the authority of the Physical Society, held on May 16 and attended by a number of those interested in color problems. It was thought that the Group should be regarded as a meeting ground for all in science and industry who have a common interest in color, rather than as a self-contained and independent society. Accordingly, a number of societies have been invited to become founder societies of the Group and to cooperate in its activities. The objects will be to provide an opportunity for the various groups of people concerned with color -- physicists, chemists, industrialists, etc. -- to meet and become familiar with each other's problems, and to enable a representative opinion to be formed on various questions of standardization, specification and nomenclature, and generally to encourage colorimetric investigations and to ensure that Britain shall keep abreast of developments abroad. At the meeting Dr. W. D. Wright was elected Chairman; the Committee includes Messrs. H. W. Ellis, J. Guild and J. G. Holmes; the Hon. Secretary, Mr. H. D. Murray, Physical Society, 1 Lowther Gardens, Exhibition Road, London S. W. 7, from whom information can be obtained. It was stated that it was hoped to hold the first general meeting, to be followed by the first scientific meeting in the middle of October. The general subject for discussion was to be "Colour Tolerance." The ISCC takes particular interest in the formation of this group, for its leader, Dr. Wright, is a member of the ISCC, and the group seems to be patterned in organization along lines similar to our own, in order to bring together scientific, technical and industrial color interests into a single group. That such a Group should be formed in the midst of present difficulties, is of added interest. We wish the Group a long, full and profitable life. Our Secretary has already written to them and will keep in touch with their activities as more is learned of them.

COLOR OF THE MAIDEN'S CHEEK (AND HER BLUSH)

We learned only recently that C. H. Cartwright, J. Daniel and A. Petrauskas of M. I. T. had reported, at the April 22-3 meeting of the U. S. National Academy of Sciences, on the spectral transmission and reflection of the human cheek in the visible and infra-red (up to 12,000 A.) Your Editor-in-chief became interested in the subject following a remark of his in a column he writes for the DuPont Dyeworks News, that an assistant thought our recording spectrophotometer "so sensitive it could measure the blush on a maiden's cheek." The Editor called what he thought our bluff. The ultimate result was a feature article in the October 24 issue headed "The Dye-Gest" and captioned: Girls Still Blush; Lab. Machine Proves It! A photograph of one of the Technical Laboratory beauties with her cheek against the integrating sphere was shown along with spectrophotometric "before" and "after" blushing curves. The former clearly showed a "cupid's bow" dip in a curve otherwise steadily ascending toward the red. The editor admitted to being puzzled by the I. C. I. before and after tristimulus specifications, but remarked that the biggest puzzle was how, in this modern age, it was possible to get a girl to blush. It was no puzzle to us, for our column-editing function is largely story-telling; and of course our friends are neither highly sophisticated nor blasé; for them life is too colorful. The maiden must have been fair, for our curves went rather higher than the reflection maximum of 50 percent in the red recorded by Cartwright, Daniel and Petrauskas. They state that the reflection gradually decreases for wavelengths longer than those of the visible red. The cheek (10 mm. thick) was found opaque below 6050 A. and increasing in transmission linearly to about 2 percent at 7000 A. Between there and the water absorption band at 10,000 A., the transmission is rather uniform. Beyond 10,000 A.

it rises, reaching a maximum of about 3 percent at 11,000 A. and decreasing to zero beyond 13,500 A. due to the water absorption.

EXTENSION OF THE G. E. SPECTROPHOTOMETER TO THE INFRA-RED

The foregoing item reminds us that more serious problems of the moment led us to extend the range of the DuPont Technical Laboratory recording spectrophotometer so as to take rapid readings of transmission or reflection in the infra-red up to or slightly beyond 800 millimicrons. With the advice of Mr. Fanter, General Electric engineer well known to many of our readers, we added a very simple mechanism which permits us to quickly set manually the successive wavelengths, say at ten millimicron intervals, at which the instrument may take automatic photometric readings. The attachment constructed for making this extension and the method of its use are extremely simple. After completing the automatic recording of the visual part of the spectrum, the wavelength mechanism is thrown out of gear and set exactly at 700 millimicrons. An inexpensive micrometer is then swung into place on a bar hinged at one end and fitting into a slot at the other end so as to be rigidly held. The end of the micrometer pushes against a lug clamped onto the rod which rides on the wavelength cam, pushing it away from the cam. The distances it must be moved for various wavelength settings were obtained from the known constants of the optical system. Only a few minutes are required to take readings at ten millimicron intervals from 700 to 800 millimicrons and back again to 700. The sensitivity of our photo-cell, as judged by the precision of readings, was surprisingly good out to the end of that range. Purity of the spectrum is increasingly sacrificed, since the slit width is maintained constant at its value for 700 millimicrons. This leads to no serious error in the transmission or reflection measurements on any of the substances we have examined, since none of them were found to have steep curves in the extended interval. We may conclude this item with the suggestion that anyone interested in making the same extension, may obtain a sketch of the micrometer holder by writing to I. H. Godlove, Box 386, Wilmington, Del.

FLUORESCENCE

A very extensive investigation of fluorescence was carried out by R. G. Franklin and A. J. Allen, J. Franklin Inst. 230, 263-8 (Aug. 1940) as a result of a search for a non-toxic soluble compound which under X-ray excitation would fluoresce in the lethal range, preferably at 2600 A. or less, and so furnish a practical method of increasing the effect of X-radiation on tumor tissue. Under the assumption that fluorescence varies in intensity but not in quality with the source of excitation, they also used cathode rays and ultra-violet light as exciting agents. The results, which are reported under the title "Excitation and Detection of Ultraviolet Fluorescence", were negative; but incidentally a vast amount of useful information was obtained. 1600 substances, mostly organic, were examined. It was found that the fluorescent light emitted by these compounds in the lethal range was so weak as to furnish no practical tool. Some other conclusions were: (1) aromatic compounds fluoresce more strongly both as solids and in solution than do the aliphatic compounds; (2) many inorganic salts fluoresce in the solid form but do not in solution; (3) in each group (of similar chemical structure), the lower wavelength limit of fluorescence is set by the unsubstituted member; added radicals (as hydroxyl) lengthen this limit; (4) certain radicals as SO_3H, OH, COOH, intensify fluorescence, while others, as NO, NO_2, tend to quench it; (5) in general the short-wavelength limit of the fluorescent light corresponds to the long-wave limit of the absorption band; (6) fluorescence excited by X-rays is weak compared to that by cathode rays or ultraviolet; this may be due to greater absorption; (7) the fluorescent light emitted by some compounds in the lethal range when excited by X-rays is so weak that the method is not a practical one.