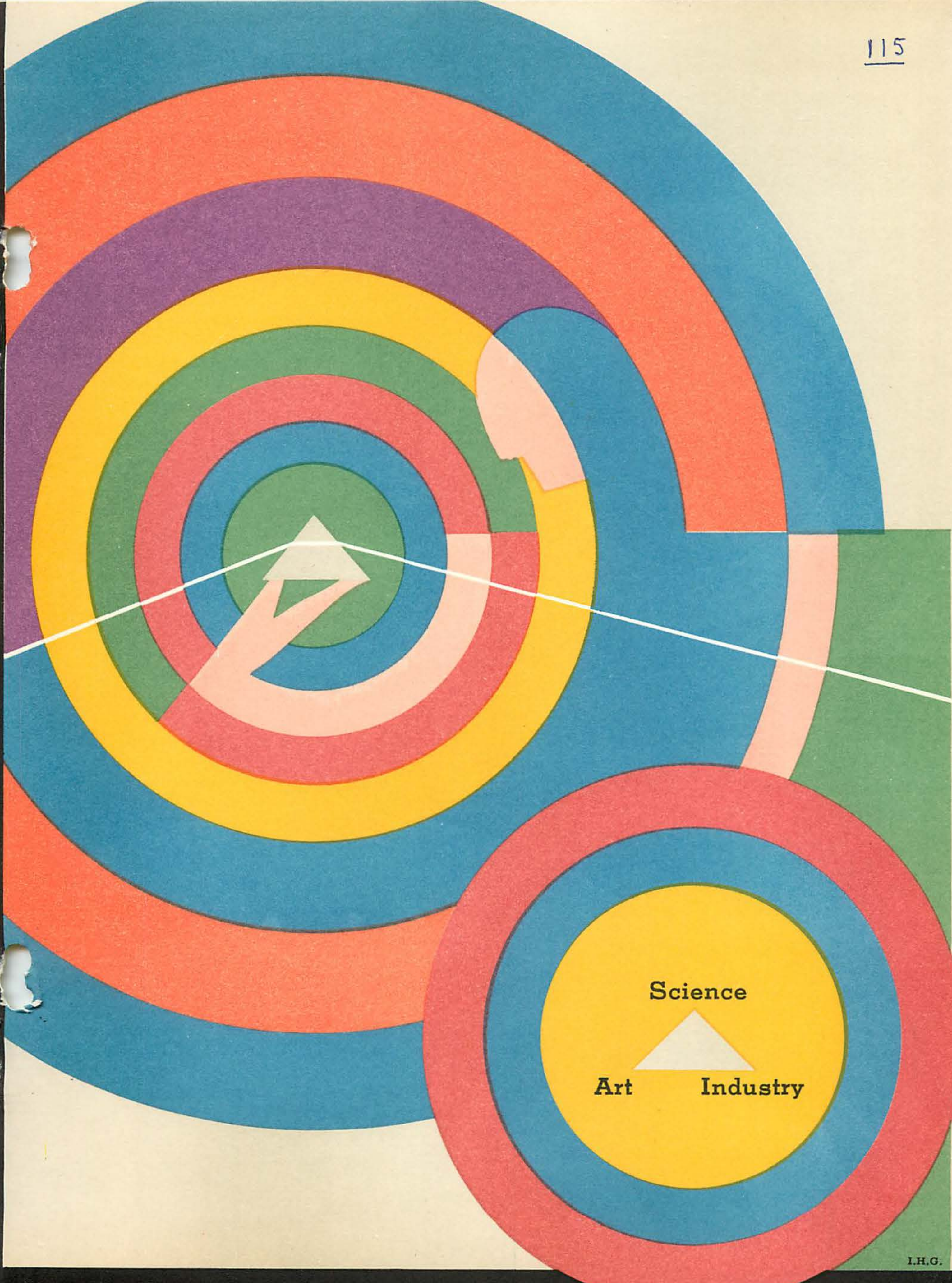
Science
Art
Industry
I.H.G.

INTER-SOCIETY COLOR COUNCIL NEWS LETTER NO. 115

J U B I L E E   I S S U E

INDEX

Progress in Color, 1936-1954

JUBILEE ISSUE COVER

The cover for this JUBILEE ISSUE was designed and painted in the spring of 1954 by I. H. Godlove to illustrate the coordination of color represented by membership in the Inter-Society Color Council in the fields of science, art, and industry, in what was Dr. Godlove's idea of color harmony and balance in design. The modernistic lady holds the prism through which a beam of light is directed and split into its respective colors. The printer matched his inks to samples of wool dyed according to Munsell specifications and furnished him by Dr. Godlove, who made all arrangements with the printer himself but did not live to see the final copy. M. N. G.

Single copies of this special JUBILEE ISSUE of the News Letter are available at one dollar per copy prepaid to the ISCC secretary. For six or more copies, prices will be quoted.

INTERSOCIETY COLOR COUNCIL

NEWS LETTER NO. 115

NOVEMBER 1954

News Letter Committee:

I. H. Godlove
Deane B. Judd
Dorothy Nickerson

For matters of business (subscription, missing copies, etc.) address the Secretary

I. H. Godlove, Editor
127 Spring Garden Street
Easton, Pennsylvania

Ralph M. Evans, Secretary
Color Control Division, Bldg. 65
Eastman Kodak Co., Rochester 4, N. Y.

Subscription price to non-members $4.00 annually

-- J U B I L E E   I S S U E --

FOREWORD This JUBILEE ISSUE of the NEWS LETTER marks the 100th issue under editorship of the late Dr. I. H. Godlove. He planned it as an issue of "rejoicing and accomplishment," and had laid his plans so well that after his death there was little to be done by others except to follow through and complete them. This has been done in large part by his wife, Margaret Noss Godlove, to whom we express our sincere thanks.

At the annual meeting last spring Dr. Godlove asked for a News Letter budget for 1954 that would include funds for a special cover that he was planning, for he wanted it to be in color. He showed us a sketch of what he planned, and in the next few months he completed the final painting, and made arrangements with a local printer for its reproduction.

It was his plan that this JUBILEE ISSUE should consist of brief reviews of the progress made in color during the time covered by the 100 issues under his editorship, such reviews to cover the many fields represented in the Inter-Society Color Council. To prepare these reviews he wrote, many months ago, to a list of about 30 persons. He was concerned because even then there were others he wanted to ask, but he thought that he could not extend the list further. When acceptances began to come in he found that practically everyone asked would accept. Then he became concerned over the size and cost of this special issue, but the Board of Directors told him to go ahead and include them all - to make this number what its name implied - a real JUBILEE ISSUE. It was only the Saturday before his death that Dr. Godlove wrote the item FROM RETROSPECT TO PROSPECT that concludes this issue.

For those who may not be well acquainted with the history of the INTER-SOCIETY COLOR COUNCIL it may interest them to know that the first News Letter was dated October 16, 1933. It consisted of 7 pages of notes supplied to the secretary,

M. Rea Paul, by delegates Gathercoal of the School of Pharmacy, University of Illinois; Arny of the College of Pharmacy, Columbia University; MacDonald of TAPPI; Judd of NBS; Farnum of the R. I. School of Design; and Gage of Corning. Through No. 10, issued September 30, 1935, the News Letter came out whenever the secretary had sufficient material, an average of just less than five pages per issue. For the next five issues, through 1936, R. G. MacDonald, secretary of the Council, edited the News Letter. Its length grew to an average of 14 pages for the five issues - varying from a low of 4 to a high of 27 pages.

In late 1936, Dr. I. H. Godlove became editor:- News Letter No. 16 of January 1937, his first number! On page 16 his appointment was announced as editor in chief, with Charles Bittinger, editor for art; Deane B. Judd, editor for science. Carl E. Foss was added as editor for industry with No. 21, September 1938. With No. 21, the present masthead was adopted, and the News Letter has since then - for sixteen years - been put on stencils, run off, and mailed by Mimeoform Service of Washington, whose Miss Laura McNaught has been our chief, and very satisfactory, contact during all these years. The editors remained as listed for many more numbers, through No. 53, May 1944, with Faber Birren serving in recent years as a member of the News Letter Committee. The number of pages aimed at was 14, and this has been held pretty well in most issues.

My own copies of the News Letters are in bound volumes. As I look them over in preparing this Foreword I am much impressed with the interest they still hold, the information of current use that they contain! What started out as a newsletter - just a gleam in Rea Paul's mind's eye - has become a regular, important, and not too expensive medium for keeping the Council membership together and aware of what goes on in color today. A very large part of the credit for this surely goes to our late editor, Dr. I. H. Godlove, who served us so faithfully for these last one hundred numbers. There are a few of us who have helped in the past or present, but it is Dr. Godlove to whom the lion's share of the credit belongs. He - with the help of Margaret Godlove, his wife - prepared most of the material, and had copies typed out to send to associate editors Nickerson and Judd and, after taking into account their comments, on to Mimeoform Service for publication.

With this JUBILEE ISSUE, which celebrates the 100th issue under his editorship, I had expected that it would be my privilege as President to express to Dr. Godlove our formal thanks, and our congratulations on a job well done. We are proud of this, our JUBILEE ISSUE, and of him, our Editor. I had wanted to tell him, as he started into his second hundred numbers, in what affection and good will we held him. While he does not live to see these words published, he had them in manuscript before his death. Personally, I can say that working with him was a wonderful lesson in the possibilities of human relationships. There were occasions when we differed, even sharply, on certain News Letter matters, but it was a real joy to know that here was a person so completely selfless in his interest in the good of the Council and its News Letter, and so completely understanding of the other person's motives, that there never had to be any hesitancy about saying directly to him exactly what one thought. It is a characteristic for which his friends held him in high esteem.

And as for financial wizardy! Dr. Godlove always was modest in his request for funds. There were a few early years when the amounts requested were as low as $25.00, for by volunteer help stencils were cut and even run off. However, budgets gradually increased with rising costs and a much increased circulation list, although even today the News Letter budget is considerably under $1,000.00 per year.

With this issue the News Letter celebrates in a special dress - a cover in color, made in accord with the editor's own design.

While he is not here to receive our congratulations on his first one hundred issues, we rejoice - as he would have wanted us to - that this JUBILEE ISSUE can serve as such an appropriate memorial to him.

Dorothy Nickerson
President 1954-55

ILLUMINATION
—
Norman Macbeth

For people interested in color, whether they be physicists, lighting engineers, designers, artists, etc., the period 1936-1954 shows some of the greatest progress which has been made in illumination, affecting color, in the history of artificial illumination. Until this period we had been content to use light sources such as candles, kerosene lamps, gas illumination, incandescent lamps and, for special applications, arc lamps and mercury lamps. Prior to 1936 nearly every one thought of artificial illumination as an incandescent light low in color temperature but esthetically pleasing from the point of view of decorations, facial color, and other objects of general consideration color-wise. The incandescent lamp is practically a "black-body radiator" that abounds in energy at the red end of the spectrum, which is generally complimentary and which generally causes little difficulty in color planning. In the special fields of color matching, of course, difficulties were encountered with "metamers," when good matches under natural daylight failed to match under incandescent lighting.

Over the years, however, there has been an increasing demand for light sources having higher color temperatures than those of incandescent lamps, or that could be used to produce special effects with relatively high efficiency; and one important solution to this problem was found in 1939 with the advent of fluorescent lighting. The attention of the public was dramatically focused upon fluorescent lighting through its rather general use at the New York World's Fair in 1939. Since then fluorescent lighting has gradually grown to a point where most of the offices and factories are lighted by this means. The advantages are manifold but basically they are high efficiency, low brightness, new colors and a minimum amount of heat to affect general air-conditioning programs. Of great interest to the colorist, however, is the fact that here, for the first time, was an efficient light source producing a white, green, or blue light which could be used dramatically, or for technical advantage. Lighting engineers, who previously had not paid too much attention to the color effect of lighting on surround, proceeded to employ fluorescent lighting as a general lighting tool, with some rather disastrous results which are still concerning lighting engineers and colorists to this present day. Since the public was accustomed to natural daylight or incandescent illumination, both of these having spectral energy distributions approximating that of a black body for equivalent temperatures, no particular attention was given to the fact that fluorescent lighting sources, although assigned color temperatures for certain colors, did <u>not</u> have spectral distributions similar to a black body's; and as a result these changed the appearance of certain colors. The general public became conscious of this problem when restaurants were illuminated with white or daylight fluorescent tubes, and the appearance of food did not appear natural nor appetizing; nor did this illumination, because of its deficiency in red, make more glamourous a woman's general appearance. Now lighting engineers stopped to consider the ways and means to correct this situation so they could continue to utilize this efficient and modern illuminant. Almost simultaneously research projects were conducted to select colors which would not be adversely affected by fluorescent illumination, and to develop new and better phosphors, including those radiating far-red energy, so that all colors would be properly represented when objects were illuminated by fluorescent light. The introduction of warm white and the deluxe colors have had an important effect upon eliminating some of the unfortunate results color-wise produced in early fluorescent illumination. Committees of the Illuminating Engineering Society and other organizations are working hand in hand for a perfect solution to this problem, with the obvious advantage that this combined effort would definitely improve the working knowledge of all colorists and assist in correlating lighting problems with all color problems.

With the advent of fluorescent light and the increased use of color, the problem of visual color matching became more serious, and standards were needed for the illuminant in industrial color matching; and a committee was set up by the Inter-Society Color Council where a study of this situation was undertaken in connection with textiles. After several years, a recommendation was forthcoming concerning a standard illuminant for textile color matching: filtered incandescent light at a color temperature of approximately 7500° Kelvin. Industry after industry has adopted this standard, which has been extremely helpful from the point of view of industrial color control.

The fluorescent light brought "approximate daylight" at low cost and high efficiency; and lighting engineers have been trying to produce other sources of white light, also of high efficiency, some of which are required to be near point-sources rather than diffuse sources like the fluorescent lamps. Since 1945, three new light sources have been developed with this in mind: the Mercury Cadmium Lamp, the Zirconium Lamp, and the Xenon lamp. The first is an improvement over ordinary Mercury lights in that it contains many more lines in the visible spectrum; but they are not continuous, and this light source to date has not appeared to be practical. The Zirconium Light is an extreme example of a point source which has found considerable application in optical instruments where a whiter light was required. To date the Xenon Lamps appear to be the best bet to produce a white light of high efficiency having an approximate point-type source of illumination. These lamps are very expensive, since they are made in quartz in small quantities, but continued experimentation and use will undoubtedly reduce their cost to a point of industrial feasibility. This light source has a large number of bands that appear almost continuous. Its efficiency in high wattages is 36 lumens per watt; and if assigned a color temperature, this would be near 6000° K.

In a brief period of 18 years we have seen evolved more new practical light sources, advantageous color-wise, than have been developed in all previous lighting history. Most important, these lights have stimulated mutual understanding between lighting engineers and colorists. Based on principles of brightness and efficiency alone the lighting engineer cannot solve many lighting problems, but must take into consideration color and surround. On the other hand, colorists must understand the new principles of illuminating engineering to better use illumination in their work. More knowledge and understnading by all concerned on the physics, psychophysics, and psychological aspects of the relation between light sources and color rendition is indicated to make the best use of existing new light sources and others to be developed in the future.

COLOR MEASUREMENT — Deane B. Judd

The story of progress in color measurement since 1937 is largely one of exploitation of the 1931 C.I.E. standard observer by means of which spectrophtometric data can be reduced to color specifications in terms of tristimulus values, X,Y,Z, and in this way correlated with what the observer of normal color vision sees. There has been progress in spectrophotometers themselves, in methods for computing tristimulus values, and in calibrating color scales, collections of color standards, and color systems. And a whole new technique whereby tristimulus values and various expressions for color difference may be read directly has been developed - photoelectric colorimetry. These developments have made possible the extension of color measurements to many new applications.

The Hardy automatic, recording photoelectric spectrophotometer has become widely distributed in industrial laboratories, and two new photoelectric spectrophotometers (Beckman and Cary) have already served significantly in commercial color measurements. The spectrophotometer has achieved widespread recognition as the basic color-measuring instrument (OSA, ASTM, ASA) when its data are reduced by means of the C.I.E. standard observer.

Great attention has been paid to reduction in the time and effort required to compute tristimulus values from spectrophotometric data. The selected-ordinate method has been greatly extended (MacAdam, Bowditch and Null); a semigraphical method (Robinson) has been devised; and electronic computers (Knudsen, MacAdam) have been adapted to this job. In addition, no less than five calculators (Swank and Mellon, Sears, Van den Akker, Middleton) have been developed for this special job culminating in the very fruitful Davidson-Imm attachment for the Hardy spectrophotometer.

Spectral measurements reduced by means of the C.I.E. standard observer have been applied to fluorescent lamps (Jerome), to printing ink (Foss, Granville), and to glasses (Forrest, Kreidl and Pett). The spectrophotometer has similarly been used to calibrate two very useful systematically arranged collections of color standards: Munsell (Glenn and Killian; Kelly, Gibson and Nickerson; Granville, Nickerson and Foss; Nickerson and Wilson), and Ostwald (Foss, Granville and Jacobson). The Munsell color standards have been used visually in turn to provide a record of the colors of two other collections of color standards: Ridgway (Hamly), and Plochere (Middleton). Other color scales, such as the Fats Analysis Committee scale (Urbain and Roschen, Thomson), have been similarly standardized, as have also the widely used standards of the Standard Color Card of America (Reimann, Judd and Keegan) issued by the Textile Color Card Association. A general method of color grading based on spectrophotometry plus the C.I.E. standard observer has been developed (Osborn and Kenyon).

The fundamental calibrations of working color standards have greatly extended the use of visual colorimetry. The Lovibond tintometer has been adapted to the measurement of tristimulus values on the C.I.E. system (Schofield), and a chromaticity difference colorimeter utilizing color standards defined by spectrophotometry has been developed (Judd). This colorimeter has been applied to the color grading of mica (Judd). Color scales for rosin (Brice) and for maple sirup (Brice, Turner, Southerland and Bostwick) have been established. A six-primary additive colorimeter (Donaldson) capable of highly accurate and precise determination of tristimulus values directly without the mediation of such color standards has been developed in England.

Probably nowhere have spectrophotometrically calibrated color standards been exploited so successfully as in photoelectric tristimulus colorimeters developed since 1937. Indeed, if three photocells could be developed to have spectral sensitivities with wavelength dependence exactly equal to the functions, $\overline{x},\overline{y},\overline{z}$, defining the standard observer, the measurement of tristimulus values, X,Y,Z, of any unknown sample of radiant flux would be possible without spectrophotometrically calibrated color standards, and this development is closely approached by the template method (Winch) whereby the unknown flux is dispersed into a spectrum before incidence on the photocell with template before it. However, the simpler method of adjusting the spectral sensitivity of the photocell by interposing an optical filter of glass has found by far a wider application in this country. In this case the adjustment of the filter-photocell sensitivities to the C.I.E. standard observer is only approximate, and the photoelectric colorimeter serves reliably only if a color standard spectrally similar to the unknown is available. Four photoelectric colorimeters for opaque specimens have been developed to the point of considerable industrial acceptance: multipurpose reflectometer (Hunter), color-difference meter (Hunter), PPG-IDL color eye (Bentley), color master differential colorimeter (Glasser). These developments all followed much pioneer work and critical studies by Gibson, Perry, Barnes, Hunter, Van den Akker, Scofield, and others. A photoelectric colorimeter (Barnes) was also developed early for self-luminous sources and remains preeminent today. Photoelectric colorimeters have been applied to the fading rate of paints (Eickhoff and Hunter), to tomato purees (Younkin), to petroleum products (Diller, De Gray and Wilson; Lykken), to color printing (Hardy and Wurzburg), to sorting of fruits and vegetables (Powers, Gunn and Jacob), and in an automatic form to color grading of cotton (Nickerson, Hunter, and Powell).

COLOR AND GLOSS INSTRUMENTATION — Richard S. Hunter

The sense of sight is so intimate that most of us seldom stop to appreciate or analyze it. However, there is a group which has developed, during the past eighteen years, an increasingly healthy respect for the dexterity and sensitivity of the human eye. It is those who attempt to design and use instruments that assign numbers for various attributes of the visual appearance of objects and materials. The human eye is agile and makes rapid analyses of scenes which pass before it. Instruments, at best, measure but one or two attributes of a few objects in these scenes under but one or two of many possible sets of illuminating and observing situations.

The inherent deficiencies of instrument measurements of appearance attributes are better appreciated today than they were in 1936. The claims for various instruments offered to measure color are actually less ambitious today than they were eighteen years ago. The performance of available instruments has, on the other hand, improved considerably, as those which failed to live up to their claims disappeared and better ones took their places.

Accurate color measurements depend today, as they did in 1936, on accurate spectrophotometry and integration according to the C.I.E. standard observer. Professor Hardy described the preliminary model of his spectrophotometer in 1929[1] and the model which enjoys such widespread acceptance in 1935[2]. Since 1936, there have appeared an automatic integrator for the Hardy instrument [3] and a number of other noteworthy advancements in spectrophotometry.

Dr. Gibson[4], in 1936, set forth in some detail the requirements for a successful photoelectric tristimulus colorimeter. The first photoelectric tristimulus colorimeter to find widespread acceptance (the writer's Multipurpose Reflectometer[5]) appeared in 1937. A number of instruments using the same basic principle have appeared in the intervening years. However, photoelectric tristimulus colorimeters have suffered from the start by the inability of their designers to duplicate in source-filter-photocell combinations the spectral distribution functions of the C.I.E. standard observer. As a consequence, these instruments must be used primarily to intercompare specimens of similar colors and spectral characteristics. Where they are used to measure color, the "hitching-post" technique must be used. That is, there must be available for each color measured an independently calibrated, permanent standard with which to set the machine. In spite of this limitation, the speed, simplicity, and relative cost of these tristimulus instruments have led to their widespread acceptance.

Much present day gloss instrumentation dates from the paper, Methods of Determining Gloss presented by the writer[6] at the 1936 ASTM meeting. This paper showed that different gloss instruments were required for the evaluation of different types of surfaces. Since then, a number of different measurement methods and instruments have been designed. Each is applicable to a specific class of surface.

From the foregoing, it can hardly be said that there has been revolutionary growth of instrumentation in the appearance-attribute field during the past eighteen years. Instruments to measure color, gloss, and reflectance are much more widely distributed than they were eighteen years ago. Measurements with them are widely used in the development of new products and in maintaining the quality of existing products.

Instruments have gone from the laboratory to the plant. Photoelectric cells are now widely used with the remarkable electronic recorders and controllers for continuous measurements of gloss, reflectance, and color as materials such as plastic, paper and cloth are being made or processed. Further, these measurements now are made automatically to adjust the processing machines so as to hold the optical properties at their desired levels. Thus, optical instruments have become part of the jealously guarded production know-how of many manufacturers.

Instruments for color, gloss and reflectance have gone into new industries as well as into new places in established industries. In 1936, the chief fields of application were paint, paper, signaling, lighting, vegetable oils and perhaps one or two others. Since 1936, their use has spread into new fields such as ceramics, plastics, food, graphic arts, home economics, television, etc.

References

(1) Hardy, A. C., JOSA and RSI 18, 96 (1929)
(2) Hardy, A. C., JOSA 25, 305 (1935)
(3) Davidson, H. R. and L. W. Imm, JOSA 39, 633 (1949)
(4) Gibson, K. S., Instruments 9, 309 and 335 (1936)
(5) Hunter, R. S., J. Research NBS 25, 581 (1940) RP 1345 and NBS Circular C429 (1942)
(6) Hunter, R. S., Proc. ASTM (II) 36, 783 (1936) and J. Research NBS 18, 19 (1937)

PSYCHOLOGY
—
Sidney M. Newhall

People want to know not only how colors are perceived but also how colors are discriminated and remembered and how they influence our feelings and actions. These conscious and behavioral responses to color stimulation are the concern of the psychology of color just as inevitably as responses to stimulation in general are the concern of psychology in general. Brief mention of but a few important developments must suffice here to represent the many significant advances of the last 20 years.

One of these developments is a more accurate conception of our capacity for color response. Measurements are being made of such matters as the angular size of color stimulus necessary to evoke normal color perception, the level of luminance required to ensure cone function, the range of wavelengths capable of evoking hue, capacity for chromatic adaptation, and individual differences of various sorts. Tests of defective color vision as well as of normal color sensitivity have now entered a quantitative stage.

The many variables found to require control in color capacity investigations emphasize anew the complexity of the factors underlying color appearance. The qualitative fact has long been known that numerous external and internal factors contribute to how color looks; but only recently has progress been made in quantifying the contributions of such factors as the quality of the illumination, the luminance of the stimulus, the contrast of the surroundings, the mode of appearance, and the level of adaptation. Important studies of the effects of such factors have been made with achromatic as well as chromatic test samples. The closer the observable and controllable evaluations of the factors concerned, the further our progress toward the goal of the prediction and control of color appearance.

This same goal is being furthered by an allied development which consists in current study of the fundamental response processes of human color vision. Experimentation with various adaptation illuminations and observational techniques is progressively improving our estimates of the fundamental response functions. The better these estimates become, the better basis they can provide for effective prediction and control. Fortunately, for this purpose, the actual mechanism of color vision does not need to be known. It will suffice if a stimulation can be developed which accounts for the principal phenomena of adaptation and color matching.

A major field of inquiry in which pioneer progress is being made is that of the influence of color response upon very different psychological processes such as memory, emotion, and action. Harmonious employment of color as in dress and interior and exterior decoration can promote favorable affective response, while efficient use of color as in coding and equipment design is conducive to more effective behavior at work. Quantification in this complicated field has been marked by the recent development of the first reliable test of memory for color.

The psychology of color necessarily involves living organisms and color stimuli, as well as color responses and secondary effects of color responses; therefore, progress and possibilities of progress must be credited in considerable part to numerous non-psychologists. This is particularly true regarding techniques and instrumentation in the physiological, optometrical and physical fields. Moreover, some of the problems of the psychology of color are of such general interest that it is not surprising to find outsiders working on and contributing directly to the solutions of the problems. In this connection the Inter-Society Color Council itself, in its function as a clearing house of color problems and information, is contributing increasingly to the broadening scope and influence of the psychology of color.

MUNSELL SYSTEM
—
Blanche R. Bellamy

During the 18 year period covered by the 100 issues of the News Letter under the very able administration of our esteemed late editor-in-chief, Dr. I. H. Godlove, there has been considerable progress in the development of the Munsell system and its application to the fields of science, art and industry.

Reports by a number of persons since 1936 have put on record many advances for which the Munsell Color Company had neither the background, facilities, nor funds. In the scientific field these have included the "ISCC-NBS Method of Designating Color" by Judd and Kelly (NBS Research Paper 1239, September 1939) and the revised edition, to be published as NBS Circular 553 early next year, a series of 5 papers published in the December 1940 issue of the Journal of the Optical Society of America, and 4 papers published in the July 1943 issue of the same journal. Outstanding among the JOSA papers were: 1, The History of the Munsell System and its Scientific Application from 1900-1940 by D. Nickerson; 2, the papers by Glenn and Killian in the December 1940 JOSA, and one by Kelly, Gibson and Nickerson and another by Granville, Nickerson and Foss in the July 1943 JOSA reporting C.I.E. values from spectrophotometric analysis of Munsell papers; 3, the Preliminary and Final Reports of the OSA Subcommittee on the spacing of the Munsell colors by Newhall in December 1940 and by Newhall, Nickerson and Judd in the July 1943, JOSA.

There have been many other reports either directly or indirectly concerning the Munsell system, materials and their use since that time. In the March 1953 issue of JOSA, Nickerson, Tomaszewski, and Boyd published C.I.E. data for repaints of Munsell papers not previously published. Recently, two papers have been completed at the National Bureau of Standards by G. Wyszecki. One reports extensions of the Munsell renotation to very dark colors soon to be published in JOSA, the other, a regular rhombohedral-lattice sampling of Munsell renotation space (JOSA, September 1954). In a report of Technical Committee No. 7 to the C.I.E. conference in 1951, Judd listed 60 references to "the growing use in America of the psychophysical quantities, Munsell hue and Munsell chroma." Munsell value has long been used and accepted by many in psychophysical work.

In 1942 the American Standards Association included the Munsell system in their American War Standard Z44-1942 "Specification and Description of Color," and many industrial journals have published articles on color control and standardization which include use or descriptions of the Munsell system of color notation. A handbook on disk colorimetry by Dorothy Nickerson, Color Measurement of Agricultural Products, published by the U. S. Dept. of Agriculture in 1946, described the Munsell notation and its advantages in the specification and control of agricultural products by the disk spinning method. Judd's book Color in Business, Science and Industry published by John Wiley & Sons in 1952 includes not only a description of the system but a discussion of its advantages in color specification and standardization. The Science of Color, by the Committee on Colorimetry of the Optical Society of America, published by Crowell in 1953, contains a description and many references to the Munsell system, including several plates in full color that accord with the Munsell three-dimensional concept.

A number of books in art, interior decorating and photography which either refer to, or are based on the Munsell system have been published since 1936. Outstanding among these are: The Language of Drawing and Painting, by Arthur Pope, Harvard Press; The Art of Color and Design, by Maitland Graves, Macgraw-Hill; Contemporary Color Guide, by Elizabeth Burris-Meyer, Wm. Hepburn, Inc.; An Introduction to Color, by Ralph M. Evans, John Wiley & Sons; and the recent Color, How to See and Use It, by Fred Bond, Camera Craft Publishing Company.

In September 1942, through the generosity of the Munsell family, and after consultation with many in the color field, the Munsell Color Foundation was established to hold and vote the stock of the Munsell Color Company. The Foundation is dedicated to the scientific and practical advancement of color knowledge in the fields of

"Science, Art, and Industry." Its board of trustees consists of seven members, including three special trustees, one appointed by the Director of the National Bureau of Standards, one by the Board of Directors of the Inter-Society Color Council, and the incumbent manager of the Munsell Color Company. There is one Trustee to represent the donors. The original members of the Board consisted of: Deane B. Judd, Dorothy Nickerson, B. R. Bellamy, Loyd A. Jones, Arthur S. Allen, I. H. Godlove, and A. E. O. Munsell (representing his mother, as donor). The vacancy left by Mr. Allen's death in 1943 was filled by appointment of Dr. Royal B. Farnum; the vacancy left by Dr. Jones' resignation in 1948 was filled by appointment of his associate Dr. David L. MacAdam. Dr. Godlove's death has created a vacancy that will be hard to fill because of his long and intimate knowledge of the Munsell Company and the purposes of the Foundation.

Between 1936 and 1954 a number of new items have been developed to assist in the study and application of the Munsell system of color notation. <u>Student Sets</u> were first introduced in 1937; <u>Standard Papers</u> representing various values and chromas for the 20 hues falling between those published in the 1929 edition of the Book of Color were published in 1942 along with special papers of 9 value, and 1 and 3 chromas for selected hues; the <u>Farnsworth-Munsell 100-Hue Test</u> for examination of color discrimination, developed by Comdr. Dean Farnsworth of the MSC, USNR, was produced by the Munsell Color Company and first distributed in 1943.

Most items developed since that time have been for application of the system in special fields of endeavor, and consist of charts for a particular purpose that display papers selected from the complete Book of Color series. Among these are the <u>Soil Color Charts</u>, <u>Munsell Value Scales for Judging Reflectance</u> (for illuminating Engineers, Architects and Interior Decorators), <u>Rock Color Charts</u>, and <u>Plant Tissue Color Charts</u>.

The <u>Macbeth-Munsell Disk Colorimeter</u> was introduced in 1953 for grading the color of agricultural products and for measurement of other products and materials in terms of C.I.E. Tristimulus Values and Munsell notation.

In 1942 Davidson and Hemmendinger were engaged by the Munsell Color Company to prepare paint formulas and produce samples for 1,000 colors based on renotation positions in color space. Samples were produced on matte and glossy surfaces, the matte surfaces within AA tolerance. Both matte and glossy surfaces were measured spectrophotometrically with the plan in mind that from these measurements further formulations and samplings would be worked out for renotation standards (within AA tolerances) for glossy surfaces. The sampling and measurements on matte surface were completed in 1953 and certain phases of this work were reported during the March 1954 OSA meeting.

The information provided in Wyszecki's paper "A Regular Rhombohedral-Lattice Sampling of Munsell Renotation Space," combined with the ability and willingness of Davidson and Hemmendinger to produce formulated physical samples for points specified in C.I.E. space leaves us, in 1954, with a very hopeful outlook for gaining - within the realizable future - representations of uniform color spacing which will serve as a guide in producing standards that will be an even closer approximation to the concept which A. H. Munsell had when he published in 1907 the first Atlas papers to represent equally spaced scales of Hue, Value and Chroma.

The Munsell Color Company, and I believe I can speak for the Munsell Foundation, are well pleased with the scientific progress that has been made in the past 18 years --

the period covered by the past 100 issues of the ISCC News Letter. If in the next 18 years developments are equally impressive the Munsell system will have traveled a long way toward the goals set for it.

OSTWALD-TYPE
COLOR SYSTEM DEVELOPMENTS
—
Walter Granville

A principal characteristic of color charts patterned after the Ostwald system is the equilateral triangular shape of the array of colors showing the variations of each hue. In this array, which is the same for all hues, white, black and full color are shown at the apices. Scales of tints, shades, and neutral grays are shown as continuums joining these unique end-point colors. These characteristics produce an easily understood color arrangement which simplifies travel in the color world.

During the past 20 years, charts of this type have arisen from relative obscurity to some degree of prominence. The first work in English was the translation of Ostwald's Color Science by Taylor in 1932. This important book was followed by studies and writings of Birren, Bond, Foss, Granville, Harringer, Jacobson, Nickerson, Zeishold, and others. These provided the basis for the production of the Container Corporation of America Color Harmony Manual in 1942, and a symposium on the Ostwald system chairmaned by Judd before the Optical Society of America meeting in 1944. The Manual, now in its third edition , has, over other representations, the added and equally important features of color chips that are glossy on one side and mat on the other; both having a high degree of permanence previously unknown to systems of surface color standards. This period also marks the use of spectrophotometry, and C.I.E. data to standardize a complete collection of Ostwald system colors, those contained in the Manual. Dr. Godlove collaborated in this work.

Among other color charts of the Ostwald type are Birren's The American Colorist, Gaugler's Color Helm, and Jacobson's Basic Color, all with printed colors. In Europe, Baumann's Farbenkarte Atlas II, Muller's Swiss Color Atlas, and a series of books and charts by Muster-Schmidt based on the original Ostwald colors, all with coated color swatches, were among those produced.

The most prolific author during this period was Birren, among whose books The Story of Color, Color Dimensions, and Selling with Color are well known. Other books during this period include Jacobson's Basic Color, the Taylor, Knoche, Granville - "Descriptive Color Names Dictionary," and in Europe, the writing of Bouma, Buchwald, Richter, and Ristenpart. Ostwald's daughter, Grete, has maintained interest in these color developments through the Wilhelm Ostwald Archive in Grossbothen.

COLOR NAMES
—
Kenneth L. Kelly

Work was begun on ISCC Problem 2, Color Names, in 1936 when a full time research associate was placed at the National Bureau of Standards by the United States Pharmacopoeia and the National Formulary. Based on two well thought out reports in 1932 and 1933 by the chairman of the ISCC Measurement and Specification Committee, Dr. I. H. Godlove, the ISCC-NBS system of color names began to take shape and was published in 1939 as NBS Research Paper 1239, Method of Designating Colors. Over 30,000 copies of this pamphlet have been distributed.

A great deal of work went into, first, the choice of these names and, secondly, into the selection of the color-name boundaries so that the result would satisfy the demands set up by Dr. Gathercoal who stated that "A means of designating colors in the

United States Pharmacopoeia, in the National Formulary, and in general pharmaceutical literature is desired; such designation to be sufficiently standardized as to be acceptable and usable by science, sufficiently broad to be appreciated and used by science, art, and industry, and sufficiently commonplace to be understood, at least in a general way, by the whole public." The type of color names and the method of setting the boundaries are now history and many of you readers assisted in these selections.

As with all publications, especially in science, revision was indicated and an ISCC committee was activated in 1947 to study RP1239 and recommend changes. After several meetings and much whole hearted cooperation and study, a new set of color-name charts embodying suggested changes, especially from the textile field, was finished and the body of the paper was completed. However, since Munsell notations had been published for the colored samples descriptive of the color names in 14 recognized systems of color nomenclature, it was decided to include in the new publication a dictionary of color names in which, through the medium of the Munsell notation, the equivalent ISCC-NBS designation for each of these color names would be given. A second type of table is included in which synonymous and near synonymous color names are grouped.

This opus has been nearly three years in the making and has been possible only through the willing cooperation of our members and even of several non-members. This spirit of cooperation is the backbone and strength of the ISCC. Finally the copy was ready, all 1200 pages, it was approved for publication by the Bureau and sent to the Government Printing Office. After several conferences to decide format, work was begun and is now well along. It will be published early next year as NBS Circular 553, about 150-170 pages, buckram bound, entitled "The ISCC-NBS Method of Designating Colors and a Dictionary of Color Names." We at the Bureau have had many a chuckle at such color names in the Dictionary as Isabelle Color, Heart's Desire, Cuisse de Nymphe (the color of a nymph's thigh) and many others; so we heartily recommend the Dictionary as a bedside book for light reading.

As in the other reports in this Jubilee Issue of the ISCC News Letter, the hand of our former editor was ever present in ISCC Problem 2, Color Names. For it was he who thought out and wrote the two early reports upon which all of the work on color names is based. Throughout the developmental, committee and writing stages, his cooperation as an observer, contributor and critic was never ending.

THE FUNCTIONAL USE OF COLOR

—

Faber Birren

The past ten years have witnessed a tremendous growth of color acceptance in industrial plants, offices, schools and hospitals. What has been new to the field of color has been a shift in viewpoint from one largely esthetic to one of functionalism and purpose. Where once color -- if used at all -- was chosen on a basis of personal whim and fancy, it now finds guidance in good scientific technique, in studies of brightness, in ophthalmic measurements of the human eye, in an analysis of physiological and psychological reactions.

During this time the writer has been fortunate in undertaking a number of major projects and in collecting data on results. In the field of safety, for example, the introduction of a carefully devised and standardized coding of hazards has helped to lower accident frequencies. In a program for the New York City Board of Transportation, accident frequency rate dropped 42.3 per cent and had an estimated value of $500,000.00 a year in reduced compensation payments and medical expenses.

The same code, adopted by the U. S. Navy has, by admission, been partially responsible for a substantial curtailment of accidents -- as much as $1,400,000.00 in the period of a year over thousands of enlisted and civilian personnel. The code is now standard also with the Coast Guard.

The value of color in accident prevention is easily reckoned, because detailed records are available of dollar costs. Otherwise, however, the merits of good color are not always so simply determined. However, in a study conducted in a government office by Public Buildings Administration and the U. S. Public Health Service, improved lighting and a functionally devised color scheme resulted in a production rise among workers using accounting machinery of 5.5 per cent. In gross savings on payroll this was equivalent to $139.25 per worker, per year.

There being good reason to accept this figure ($139.25) as an indication of the value of good lighting and color over bad, the economic significance of functional color looms large indeed.

With time, the technical and clinical aspects of color control gain increasing importance -- and fascination. There is no doubt that brightness and stimulation of color prod the autonomic nervous system of the body, while softness and dimness invite relaxation. It is wholly possible to mark visual strain and fatigue in measurements of rate of eye blinking, convergence reserve, a general dimming of sensitivity on the retina, increased muscular tension, change pulse and respiration rate. Data thus assembled gives a person confidence that a job well done is "beautiful" for a lot of reasons other than feeling and emotion.

Where, ten years ago, the typical factory had brick walls, whitewash, dark green dadoes, battleship gray machinery, today color is abundantly employed. It is the personal experience of the writer that justification of color is no longer necessary -- acceptance is virtually universal, and the industrial plant not bedecked in hue has become the exception.

Environment control, brightness engineering, color conditioning, are all becoming current phrases. Research is backing up theoretical convictions with facts.

COLOR BLINDNESS AND COLOR APTITUDE TESTS

Forrest L. Dimmick

Since it is the function of a news letter to tell its readers of current events, it is interesting to note how well the Inter-Society Color Council News Letter, working in conjunction with other publications of the Council, kept members informed of developments in the field of Color Blindness Tests and the Color Aptitude Test.

The first mention of color blindness tests will be found in issue No. 32 of November 1940 where the announcement of the American Optical Company's Pseudo-Isochromatic Plates appeared. In the following issue (33) attention was called to a reproduction of Stilling's test and to the Rabkin Test which had just become available. Later there appeared a notice of Freeman's "illuminant stable" test (88).

Development of interest in Color Blindness within the Council is indicated by a succession of brief notes and special articles on the subject. Two papers on "Color Blindness" and "Color Blindness Tests" by Dr. Elsie Murray are summarized briefly (43). A proposed test derived from the Color Aptitude Test material is described (44) and specifications for the series of colors are given (50). A bibliography on color blindness by D. B. Judd is announced (53) and made available to Council members. Classifications of color deficiency types are presented and discussed by Judd and by Farnsworth (57). Renewed interest in anomaloscopes is documented by reference to reports by Sloan, by Newhall and by Farnsworth and Willis (107, 108).

When reports of important developments appeared in other publications of the Council, the News Letter did not duplicate them. Thus the Minutes of the annual meetings carried notice of the appointment of a committee on Color Blindness, as well as its annual reports recording important actions it had taken. One such event was the approval by the Council of a selection of 18 pseudo-isochromatic plates from the American Optical Company's book. The action was based on data obtained by Hardy, Rand, and Rittler. Similarly, announcement of the new Hardy-Rand-Rittler pseudo-isochromatic plates was made at the 23rd meeting of the Council and carried in full in the minutes of that meeting.

Another event of major importance was the Symposium on Color Blindness arranged for the Optical Society of America by the Color Council. Naturally, since the documentation of this symposium was complete for members of the Council, no further comment was carried in the News Letter. Attempts to coach or color-train applicants to pass color-chart tests were called to the attention of News Letter readers by Elsie Murray (58) and by our Subcommittee on Color-Blindness Studies (73). Omission of items on color blindness that might interest the Council were, indeed, few. Farnsworth's pseudo-isochromatic chart for tritanopia was not mentioned, probably because it was fully discussed by one of the Optical Society's invited speakers. Pickford's work has not been presented, but it is difficult to know what could have been said that is new or of interest to the Council.

Perhaps because the Color Aptitude Test was, for a time, one of the Council's major activities, a full chronology of its development can be found in the News Letter, beginning with the announcement of the problem and the appointment of the committee in May 1940 (29). Progress with the preliminary test was reported at six-month intervals, showing some of the steps in production of materials, in test design, and in statistical treatment of data.

In November 1944 (56) after two previews which gave the plan of the test and specifications for the color series, announcement was made that the 1944 Edition was available for distribution. For the following nine years, there was no news to report. The Color Aptitude Test was in use by nearly 50 purchasers; plans were discussed within the committee pointing toward the final development; means for financing the venture were sought. Finally, in January 1953 (104) it could be told that a relatively new member of the Council, the Federation of Paint and Varnish Production Clubs, had agreed to furnish the means for putting a new and more finished edition of the test on the market.

The program of the 1952 meeting carried a report that a prototype of the new edition would be displayed at the Council's Color Exhibition. Finally the minutes of the 1954 meeting tell of the distribution of over 100 sets and of the further standardization of the set undertaken by the committee and sponsored by the Federation of Paint and Varnish Production Clubs. A statistical study of about 1000 test results is now under way.

DYES
—
E. I. Stearns

Dyes are used to color many articles of commerce. Each person in the United States requires about one pound of dye a year in his consumption of textiles, paper, leather, plastics and other materials. But the most important of these is textiles.

The volume of dye business closely follows the volume of textile business year after year. Accordingly, in large part the progress in dyes is inspired by the needs of the textile industry.

For many years, textile fabrics were made with natural fibers, primarily cotton and wool. In general, these were dyed in one of three ways. In direct dyeing, the fiber was placed in a water bath containing dye in solution; and the dye would exhaust from the bath to the fiber. Dyes in this class were known as acid, basic or direct dyes. In a second type of dyeing, the dye was converted chemically into a soluble form which exhausted from the dye bath to the fiber and then once in the fiber it was regenerated to its original form. Dyes in this class were known as vat or sulfur dyes. The third method of dyeing consisted of exhausting half of the dye molecule from a bath into the fiber followed by a second treatment in which the second half of the dye molecule is exhausted into the fiber. Once inside the fiber, the two halves combined to form the complete dye molecule. Dyes in this class were known as chrome, developed, or azoic dyes.

Many improvements in dyes for the natural fibers have been made in the last twenty years. The new dyes have greater brilliance of shade and have better durability to light and washing. In addition, a fourth method of coloring has been developed, namely, coloring with resin-bonded pigments. In this process, selected pigments of outstanding lightfastness are bound to the individual textile fibers by the adhesive action of a resin. The increased productivity of our textile mills which has been attained by modern processes such as continuous dyeing and pressure dyeing has required the invention of new dyes.

While the natural fibers still predominate in the textile field, in recent years the dyeing problems have been immensely complicated by the production of man-made fibers which have radically different dyeing properties. Some of these man-made fibers are produced from raw materials that in a natural form were originally of a fibrous nature and these may be called regenerated fibers. An example is viscose rayon. Other man-made fibers have no counterpart in nature and these may be called synthetic fibers. Some examples are nylon, orlon, acrilan, dynel, dacron, and saran.

To illustrate the relative importance of the different kinds of textile fibers the 1952 World Production may be cited.

1952 World Production of Textile Fibers

Fiber	Millions of Pounds
Cotton	15,810
Wool	2,500
Regenerated	3,100
Synthetic	800

The synthetic fibers have received most research attention from textile chemists and colorists because they have presented new dyeing problems. Some dyes have been found which are direct dyeing on the synthetic fibers.

New dyeing techniques have been developed for the synthetic fibers. Some dyeing assistants have been found which link selected dyes to the fiber. Another new coloring technique is to pigment the dope from which the fiber is to be made. Then when the fiber is formed by extruding the dope through a small orifice, the fiber is already colored. This has the advantage of using lightfast pigments and locking them inside the fiber structure so they have good wash fastness.

The shopper in a department store may find that the fabrics appear to be similar to those available twenty years ago but because of progress in the field of dyes the textile fabrics are much more serviceable. The colors are applied to new fabrics of improved quality and are now more durable.

DYEING OF SYNTHETICS — Frank J. O'Neil

During the period of 1936-1954 the world has seen commercial production for the first time of synthetic fibers such as Nylon, Orlon, Dacron, Dynel, Acrilan and X-51. All the synthetics presented problems relative to dyeing.

In the earlier phases of the development and production of the various synthetics, their popularity, stimulated by a great advertising program, suffered because of the lack of a good line of colors and relatively poor fastness of those colors that were produced. The more hydrophobic the fiber the more marked and serious this condition became. Cost of dyeing the fibers was excessive because of the amount of dye used or the type of dye required.

The first break came when it was discovered that carriers or swelling agents aided in penetration of the fiber. The first to be discovered was o-phenylphenol followed by others such as m-cresol, benzoic acid, and salicylic acid.

The second improvement came with the discovery that the hydrophobic fibers could be dyed more successfully at high temperatures and pressures with or without carriers depending on the shade and fastness required.

Within the past year, in the dyeing of piece goods, the greatest progress has been made. Dyeing procedures were improved, new dyes were developed and better carriers were discovered. In many cases the dye could be applied at the boil and a full line of shades was obtained.

Dacron ("Terylene" in England), the first polyester fiber developed, although difficult to dye originally, may now be dyed with dispersed acetate and azoic dyes at the boil without assistants and will produce a satisfactory range of shades.

Carriers, although excellent for diffusing and assisting in dyeing, are expensive, difficult to remove, leaving carrier stains and some affect the lightfastness of the fiber. Research is being conducted along the lines of improvement of such carriers for Dacron dyeing.

Orlon was the first of the acrylonitrile fibers to appear. The fiber as originally developed, was found very difficult to dye. However, as each new type appeared, improved dyeing properties were obtained. For dyeing Orlon three methods were developed: 1) Dyeing with an assistant, such as o-phenylphenol, which increased the affinity of acid dyes used at the boil; 2) the copper-ion method employing cuprous salts in the dyebath to increase the absorption of dyestuff; 3) high temperature (250°F) dyeing under pressure which improved the exhaustion and fastness of colors. Acid and basic dyes could be applied which normally had little affinity at the boil.

At present, the new type Orlon staple can be dyed a full range of shades using new basic and acetate dyes at the boil. The light-fastness and wash-fastness properties of shades so dyed are good. Selected vat dyes may be applied at the boil in all but extremely heavy shades.

Along with dyeing methods, new dyes, etc., dyeing processes and equipment were either revised or in some cases developed for use in the dyeing of Dacron and Orlon as well as other synthetics. Among these are the Pad Steam Process, The Uxbridge Submarine System, the Molten Metal Process, The Thermosol Process and the Barotar Process.

In the Pad Steam Process, the dye is padded on the cloth and then passed through a chamber of superheated steam at 250°F. The high temperature increases penetration of the dye into the fiber. The equipment is simple in construction and employs high pressure steam generally available in most plants.

In the Uxbridge Submarine System the entire dyeing apparatus is kept under steam pressure to maintain temperatures around 250°F. The fabric is dyed in an aqueous medium.

In the Molten Metal Process, the dye may be padded onto the fabric first or the dye bath may be floated on top of the molten metal. The fabric is then passed through the liquid metal maintained at a prescribed temperature. The molten metal forces the dye into the fibers. The heat transfer from metal to fabric increases speed of dyeing.

In the Thermosol Process, the dyestuff is padded onto the fabric and then passed through a hot air chamber for a very short time at temperatures up to 400°F. The dyestuff is diffused into the fiber at a very high rate. The use of this process in the dyeing of Dacron produces shades with maximum fastness properties.

In the Barotar Process, the cloth is wound on a roll and placed in an Autoclave after which it is dyed at a temperature around 250°F. There are several production units in operation at present.

COLOR PHOTOGRAPHY — Ralph M. Evans

The past eighteen years have been active ones in the field of color photography. During this period there has developed a new era in photographic reproduction of color. The introduction and widespread acceptance of three-color "subtractive synthesis" materials has almost completely replaced additive methods of color photography. Monopac films, containing three sensitive layers in which dyes are formed by secondary color development, have made practical methods of color photography possible and tremendously increased its popularity. The ever increasing use of these materials has been instrumental in affecting the decline of two-color photographic processes.

The first commercially successful monopac color film was introduced by the Eastman Kodak Company in 1935 under the name Kodachrome Film. In this reversal process, couplers, capable of producing dyes upon reaction with the oxidation products of certain developing agents, are located in the developing solutions. The following year Agfacolor Reversal Film appeared in Germany. Couplers were dispersed in the emulsion layers during manufacture of this film. These compounds were immobilized by attachment of heavy molesular chains.

The relative simplicity of processing a contained-coupler type film has led to the development of numerous materials of this sort. In 1940, Kodacolor Aero Reversal

Film (now known as Kodak Ektachrome Aero Film, High Contrast) was supplied to the armed forces. This film contained couplers dispersed in oily particles to prevent diffusion, and could be processed in the field. Further developments on this material led to the introduction of Kodak Ektachrome Film and Ektachrome Processing Kits in 1946. The problem of coupler diffusion throughout an emulsion was dealt with by Ansco in the manner perfected by the organic chemists of Agfa when Ansco Color Reversal Film and processing kits were made available in 1944. Recently, DuPont has described a motion picture print material in which silver halides are suspended in a synthetic polymer rather than gelatin. Color couplers may be made an integral part of the polymer itself, in that way eliminating the problem of coupler mobility.

Monopac color films with white opaque bases, for the production of prints from transparencies, were brought forth in this country by the Eastman Kodak Company in 1941 and Ansco in 1944. Other printing methods of the carbro, dye destruction and dye toning sort have been used to some extent in making color prints. Dye imbibition and transfer methods such as the Technicolor Process and the Kodak Dye Transfer Process have been very popular with amateur and professional photographers as well as in the motion picture field. However, the advent of color negative-positive processes has served to make the color print a common commodity. Color negative-positive systems have been extremely useful to professionals and have served to bring color photography within the reach of all amateurs.

Agfacolor negative material for the production of motion pictures appeared in Germany in 1939. In late 1941 the Eastman Kodak Company announced an amateur color negative film called Kodacolor Film and in 1947 Ansco Plenacolor Film was introduced. Kodak Ektacolor Film, a negative color film designed for use with Kodak Pan Matrix Film for producing Dye Transfer Prints, became available in 1948. Kodak Ektacolor Print Film appeared shortly thereafter together with Eastman Color Negative and Eastman Color Print Film intended for use in the motion picture industry. Amateur or cinematography negative materials have also been marketed by Agfa in Germany, Ansco in the United States, Ferrania in Italy, Gevaert in Belgium and Tellko in Switzerland.

While photography remains essentially an empirical science, there has been an ever increasing search for intrinsic theoretical bases and an increased knowledge of color reproduction principles. Perhaps the most important practical results of such studies, thus far, has been the increased use of integral photographic masking in commercially available materials in order to correct for deficiencies of dye systems and improve reproduction. Corrective silver masks have been used in Kodacolor negatives and also in Plenacolor negatives. In 1948 and 1949 the Eastman Kodak Company adopted the use of an integral color mask produced by colored couplers, a method which is now used in all their negative materials.

Obviously, all the theories and hypotheses of the past eighteen years cannot be commented on here. Much work has been devoted to the establishment of aims and attempts to define, more quantitatively, the problems of color photography. It is evident, however, from the development of the art that such research has made possible the rapid growth of color photography since 1936.

COLOR TELEVISION PROGRESS

—

Peter C. Goldmark

In the period between 1936 and 1940, the electronic fraternity's chief attention in the field of communication was concentrated on monochrome television. The birth of television in a commercial sense took place around 1939, and very little thought, if any, was given to television in color.

During 1940 in the Laboratories of the Columbia Broadcasting System a group was formed for the purpose of looking into the possibility of creating a color television system which would be practical and good enough for commercial use.

In August 1940, for the first time in history color television was broadcast over CBS' regular black and white transmitter in the Chrysler Building, and demonstrated to the Federal Communications Commission. The system used was simple. It employed what is now called the Field Sequential System, whereby the scene to be transmitted was analyzed in rapid sequence with three suitable primaries and transmitted as a succession of black and white pictures alternating, at 120 times per second, from red to blue to green. A rotating disk was employed in front of the camera tube in the studio. At the receiver red, blue and green filters rotated in front of a cathode ray tube in synchronism with the color disk at the camera. The resultant pictures were highly satisfactory in quality, and the Federal Communications Commission, after hearings, urged the industry to continue experimentation with color television.

Regular test transmissions were carried out; however, the war called a halt to color work, and not until the end of 1945 was it resumed. At that time CBS, still alone in the field, proposed a commercial wide band color television service in the ultra-high frequencies, but the industry favored proceeding with black and white television and after prolonged hearings the proposal was turned down by the FCC.

Around that time RCA demonstrated a simultaneous color television system, employing three camera tubes, and three picture tubes at the receiver in the form of a triple projector.

Soon thereafter black and white television was launched on a large scale and color television went back to the laboratories. In 1947 CBS refined its color system and designed a compact camera and receivers for use in medical teaching. These were demonstrated at the AMA Convention in June of 1949, when, for the first time in history, thousands of doctors were able to see, in natural colors, operations and other clinical processes, transmitted from the operating room to the auditorium.

The FCC, now aware of the use of color television in such a demanding field as medicine, ordered a hearing to determine whether color television could not be adopted for public service. At the outset of the hearings RCA also proposed a color system to the FCC. This was RCA's dot sequential system, where colors were alternating after each picture element, as contrasted with CBS' color alternation after each picture field.

RCA employed three tubes at their camera and three picture tubes at the receiver. Towards the end of the hearings, they also demonstrated a single color tube. After considering these systems carefully, together with that of a third contender, Color Television Incorporated of California, whose system employed color alternation after each line, the FCC ruled that the CBS method be the commercial color television system for the USA.

Just before the standards became effective RCA sued the FCC and after appeal the case went to the United States Supreme Court. In the summer of 1951 the Supreme Court ruled in favor of the FCC, and thus color television standards using the CBS system went into effect. Unfortunately, as a result of these delays the public already was in possession of a great many black and white television sets, numbering over ten million. The CBS system, while extremely simple and of high quality, could not be received on a black and white set as black and white unless the set was adapted to do so, or was initially designed to take care of both standards.

CBS started broadcasting regular commercial color television programs immediately after the Supreme Court ruling, and several receiver manufacturers became engaged in the design of color sets, but the Korean war, which was under way at the time, called a halt to further color television activities. The manufacture of color television receivers was prohibited by the government in order to preserve strategic materials. During this time black and white sets, however, could be produced and by the time the Korean war was over, and the manufacture of color sets permitted, the number of monochrome sets in the public's hands had almost doubled. It now became evident that a color television system introduced at this time must be able to be received on black and white sets with no modifications, if broadcasters were to retain their audience during color broadcasts.

The industry now got together and under the NTSC (National Television System Committee) set out to develop what was called a compatible color television system which, when broadcast in color, could be received on all black and white receivers in as good a quality as black and white broadcasts without changes on the receiver.

The best television engineers in the country joined this Committee and by the end of 1952 the NTSC was able to propose to the Federal Communications Commission a set of color television standards which, after thorough demonstration (participated in by the entire industry) was accepted by the FCC.

Soon thereafter standards were set and the now well-known NTSC Color Television System became the new USA standards.

Manufacturers began to design color tubes and color receivers. During 1953 both RCA and CBS brought out color tubes which, although small (15"), gave convincing proof of the high picture quality possible with the NTSC system. Also during 1953 CBS developed and employed regularly in its color broadcasts a single tube color camera for the NTSC system, employing the Chromacoder, which translated the single-tube picture into an NTSC signal just prior to transmission. Early in 1954 several receiver manufacturers put color receivers on the market, employing 15" color tubes. The prices were in the neighborhood of $1,000 and the public showed little interest in these color sets. While regular color broadcasts were on the air every week from CBS and NBC it was evident that color receivers would have to show pictures approximately as large as those on black and white receivers.

In the summer of 1954 CBS demonstrated the first large-screen color tube in production (approximately the same size as the 21" rectangular black and white tube). As a matter of fact this tube at present is the only large-picture color tube manufactured in quantities for receiver manufacturers, although RCA has announced a 21" color tube which they said would be produced later this year.

Several receiver manufacturers such as Motorola, CBS, and RCA have demonstrated large-screen color receivers to the public. CBS and Motorola receivers are already in production and available, and are priced under $1,000.

While color television for home entertainment has radically deviated in its technical details from the original approach of the field sequential system, the latter is still expanding in closed-circuit use in the fields of medicine, military applications, and other closed-circuit industrial use. Here the simplicity, reliability and high-quality of the pictures are receiving paramount consideration and the question of compatability is unimportant.

During 1953-1954 four Universities have taught surgery through the use of this color television system, and the American Cancer Society held a thirty-week closed circuit post-graduate course, the largest of its kind in history, transmitted from New York hospitals to five other cities in the country. Color television projectors producing a 6' wide image were developed by CBS to show in these cities, to doctor audiences of up to five hundred, the cancer clinics which gave the practising physicians in these towns a stimulating and thorough education in the most up-to-date cancer detection and treatment techniques.

CERAMICS — I. A. Balinkin

Less than two decades may appear to be an extremely short interval of time to expect many advances in ceramic color technology -- a field which goes back to the primitive days of human existence. And yet, it can be said, that real progress has been made in developing new colorants, better processes, more precise measuring methods and instruments, novel products and finally more glamorous surroundings.

A more complete understanding of the basic elements of color science has constantly urged ceramists to take advantage of instrumentation for color measurement, specification and evaluation of color tolerances. With this knowledge, control of color uniformity becomes less mysterious. When the factors influencing color variability are known, they can be kept within the required range. With the improved control there is an ever present demand to make the color tolerance even more stringent.

Ceramic Colorants

Ceramic colorants are rather complex systems composed of suspensions of minute particles in some liquids. They are used as stains, glazes, enamels or glasses when applied to whiteware, metal or glass and fired to a fairly high temperature at which either complete or partial fusion takes place.

Ceramists had to say "good-by forever" to a family of uranium colorants. In this instance the "power of color" is being transformed by the processes of fission into vulgar physical power. Also a gradually increasing scarcity of selenium -- it is also finding a better company in physics -- will impoverish already weak representatives in the orange and red hues.

While no substitute is yet available for the orange and red colors formerly produced by uranium compounds, the new tin-vanadium yellows and greens are better than those formerly produced by uranium.

Because it is becoming increasingly difficult to obtain good red hues from CD S-Cd Se solid solutions, it has been suggested that we put to work our gold reserves to enjoy the beautiful red shades of the ruby whose "heart" is gold.

Chrome-alumina pink stains and zirconium-vanadium yellows have added new tints and uses. Manganese-alumina stains are gradually replacing the "Jap Ochre" of iron-silica.

An important new ceramic colorant came as a result of research in the solid state physics by Dr. C. A. Seabright who made vanadium-zirconium blues and greens. This is considered the most important recent development of great scientific and commercial importance. Recent, and possibly future restrictions, on cobalt (blue) will make this even more significant.

Ceramic colorants are called upon today to give colors of high tinctorial strength, to give colors of precision, colors that "match from batch to batch."

With air conditioning rapidly gaining acceptance of builders and owners, colors of high reflectance on the outside of a house is a matter of good economy. Ceramic granules on asphalt shingles are made available in pastel colors.

Enamels

A new method of producing titanium dioxide of great opacifying power was developed by H. C. Commons, Jr. and C. J. Kinzie. It was found possible to supply this enamel in thickness of only .008" which imparts toughness and good impact-resistance. This new enamel replaces the antimony and zirconium types previously used.

Silk and metal screening processes are receiving a wide acceptance as a method of decorating all kinds of ceramic ware. On glass bottles paper wrappers are replaced by equally colorful but now permanently applied labels. Glass colors in a wide range of colors are fired at temperatures of 1050°F to 1150°F. They satisfy the strict requirements of alkali resistance necessary for washing and the acid resistance found in certain food products.

A new development of a thermoplastic medium permits the paste to be applied at a temperature of 160°F to 200°F. The metal screen is heated electrically and the colorants solidify upon touching the ware. Solidification instead of drying speeds up the process of printing and permits two or three color applications almost as fast as a single color.

Enameling on aluminum instead of steel eliminates the problem of rusting. Units of large sizes are being used as a decorative element in architecture.

Traditional slate for blackboards is now being replaced by chalkboard colors in black, white, yellow or green. Applied as enamels to steel or glass they are better functionally and psychologically.

Enamel colors in many appliances are adding "exciting new colors to glorify your kitchens" -- green or yellow. Another color is said to change its color like a chameleon to gray, green or blue in cool or warm tones depending upon the surrounding colors. This trend is a revival of twenty or thirty years ago when attempts to sell colored stoves nearly bankrupted a number of stove manufacturers. But the color climate is different today. And, strange as it may seem, the color of some widely advertised products on color TV may be picked for no other reason than an attractive reproduction on the picture tube screen!

Glass

A new variety of glass filters based upon interference of light has become commercially available. They are made by depositing various materials of carefully controlled thickness on the surface of clear and colorless glass. These filters can be made to show a remarkable spectral selectivity which could not be produced by ordinary glass filters.

Glass bottles in clear colors of several hues are being considered for food containers. Proper selection of color can make the food look more attractive and appetizing. Thus a sharp competitive edge can be brought about at the point of sale.

Photosensitive glass has been developed to give photographs of timeless permanency. A clear and colorless glass plate is exposed through a transparency to an ultraviolet radiation in the range of 300 to 350 millimicrons. The latent image thus produced is then developed by heating to 625 °C. Because the image is formed within the glass thickness, it has three-dimensional aspects. The same technique can be used to form a grid of white lines for efficient diffusion of light from the lamps.

An important series of articles was published by Dr. W. A. Weyl during 1943-6 on the effect of different ions on color in glass. These papers were later published in a book form.

In our atomic age glasses of high light transmission have been developed for shielding the observers against gamma and X-rays. These windows are heavily leaded and do not become brown after many hours of exposure.

Many important ceramic strides were made to give us a television picture tube which does not suffer from color blindness - but that is a story in itself.

White Wares

Probably the most significant color development in dinnerware is the use of bold chromatics in solid patterns covering large areas. This trend originated on the West Coast where the rise in the dinnerware industry is partly responsible for an extensive use of colorful designs in their products. The traditional European ideas of white with dainty design are waning under the impact of the Western influence which now pretty well covers the whole country.

An interesting trend is noted in the pottery, not of the more obvious hand-craft variety, but of the high craftmanship type. While the hard glossy surfaces in the surround previously called for complementary rough texture characteristics in the ceramic "pièce de résistance", today diffuse and soft lights and backgrounds require a pottery of hard glossy porcelains with glaze effects characteristic of the variegated, polychrome flambes and Sung transmutation monochromes.

For years lead compounds were essential requirements of many glaze formulations because of their low fusion temperature and high brilliance. However, the toxicity of lead as a slow-acting poison has always been considered a hazard. Today glazes containing lead are practically eliminated from production.

In the ceramic wall-tile industry the traditional white of bathroom and kitchen walls is now replaced by chromatic colors of many hues. Not so long ago about half of all wall tile was made in white color. Today it is about ten percent. At first, color found its way by the use of trim and soon bathrooms in vivid colors became the fashion of the day; orchid walls with green trim or green walls with orchid trim. Manufacturers were called upon to produce hundreds of colors. But as the passion for highly saturated colors gradually died out, colors of weaker saturation for larger areas are accented with darker trim. Today careful record is kept of changing public preference and the limited number of colors is selected so as to give, in combination, a pleasing effect. At the moment pink of the "First Lady" variety is beginning to move forward in wall tile.

Modern architecture stripped the buildings of many superficial adornments. Colorful glazed wall tile can provide the new interest and variety. Accordingly, newly developed frostproof tile is made available in many colors for exterior use even for severe winter conditions.

In preparation of this review the author had the pleasure of consulting with Messrs. R. W. Foraker, J. W. Iliff, A. M. Illing, A. and Louisa King, T. Lenchner, H. Macke, E. P. McNamara, T. G. Pett and W. A. Weyl to whom grateful thanks are here expressed.

GLASS
—
N. J. Kreidl

Glass people have enjoyed color, have been puzzled by color, and have sold color on a basis equal to that of people in other fields. We have, from sheer enthusiasm, prepared, tested, and inspected literally thousands of kinds of colored glasses that have never been commandeered by any customer, sales director, or manufacturing vice-president. My colleague at Penn State, Dr. W. Weyl, used to exclaim that we had just invented another brownish glass of ordinary properties at one hundred times the usual cost.

For many hundreds of years, the red glasses, - rubies - have fascinated glass people beyond all technical or economic reason. As a result there has been more recently added to the medieval copper and gold rubies the useful and beautiful cadmium sulfoselenide glass, and in our days the sofar useless and expensive red glasses formed by the over-oxidized form of unavailable uranium, and a magenta glass formed by irradiation of certain glasses with gamma rays.

It was not so very long ago that I first became aware of the Inter-Society Color Council, its interesting and entertaining News Letter, and its scholarly and facetious editor Dr. Godlove. At this time, despite the many years of manufacturing of various colored glasses, there was much that the glass technologist did not know about color. We shared with many industries the complete lack of an intelligent word and number language to state matching, acceptance, and tolerance requirements. We could neither send nor receive information regarding the matching of two-colored sunglass lenses, nor could we record intelligently the trained inspectors' passing or rejecting of soft-drink bottles or fancy table ware.

It was as an "apprentice" delegate of the American Ceramic Society that I first made the acquaintance of the other members of the Color Council. The great interest that Society members immediately took in the Delegation as well as the outstanding response to the First Symposium on Color which the Council sponsored with the Society are proof of the then prevailing conviction of our lack of color language, knowledge, and measuring technique. Except in the use of glass as a light-filter material, where limiting spectrophotometric curves were of necessity used as tolerances, visual inspection against sometimes non-permanent standards by inspectors of possibly variable matching ability were general practice just fifteen years ago.

There can be no doubt that the association of glass technologists with the Council catalyzed the natural growth of color science and language among glass people. The C.I.E. system and the definitions of the Colorimetry Committee of the Optical Society of America became common knowledge of glass colorists about five years ago.

In many cases the Hardy recording spectrophotometer was used as the instrument defining master data on existing physical standards. Timidly, a little more than five years ago, publications had started to appear that indicated understanding of the applicability of the psychophysical concepts promulgated by the Council to non-filter color problems in the glass industry. Apart from the subjectivity of trained inspectors and customers, their inherent skill was fully confirmed by repeated correlations of existing tolerance dimensions with spherical spaces of equal perception in which perhaps four, five, or six "judd" units defined the acceptance radius. New instrumentation is gradually being adopted; from this point on full spectrophotometric control appears less necessary.

The writer being engaged in the spectacle lens operation of Bausch & Lomb may be excused for using the colored sun-glasses as examples. Contrary to expectation this product is subject to extreme control, partly because the intensified color viewed in edgewise observation influences the customer in making his purchase, and partly because in the manufacture of prescription-ground lenses the replacement factor of one lens must be considered.

The tempo of mass production methods gradually crowds out the ancient arts of the glass maker. In modern manufacturing it becomes necessary to adopt the methods of specifications and tolerances based on physical measurement rather than the preference of the master glass maker.

Most recently our glass control pattern might, for instance, be indicated as follows: (1) the evaluation of the mean color specification and the manufacturing spread by a Hardy Spectrophotometer (2) the comparison of customer acceptance and the manufacturing spread in terms of a Hunter Color Difference Meter, that is of a physical instrument closely related to psychophysical metrics, (3) the control of finished glass product by one, two or three wavelength abridged spectrophotometry (4) the evaluation of customer complaints and inspection facts (inexplicable off stocks etc.) on a similar basis.

In all probability glass and ceramic people will soon have another Color Symposium using some cooperative arrangement with the Color Council and find a two-fold surprise in the great advance and the great gap of the unknown when viewing usage and prospect that second time. In all certainty, among glass technologists and other ceramists the great enjoyment of work with color and other colorists will persist and contribute to the progress of their art.

ARCHITECTURE — Waldron Faulkner

In the field of architecture many of the recent advances have been caused by the application of scientific principles.

One of the contributions science has made is the setting up of color standards. The logical classification of colors, their accurate measurement and specification have brought about a better understanding of color itself and have given a new appreciation of its importance to modern architecture.

Science has also demonstrated the relation of colors to the reflection of light and heat. Today architects are giving an immense amount of thought to the heating and cooling of buildings. Every means of reducing heat loss must be given consideration. Now that the importance of the reflectance of light colors is understood, this has many applications in building design and construction. Recent tests indicate that the use of white stone chips (instead of black) reduces the heat transfer of composition roofs by as much as ten per cent.

The reflectance of light colors for interiors of all kinds is being properly appreciated for the first time. Walls, floors and ceilings are now considered as reflecting surfaces whose contributions to proper lighting conditions are as important as that of the source of light itself. Offices, factories and schoolrooms are designed today with this principle in mind.

Science has made possible the invention of color systems which give a new conception of color and color harmony at a time when modern architecture is ready to take a new interest in this field.

At the Chicago World's Fair in 1933 modern architecture lifted its ugly head in a big way for the first time in this country. Although the spirit was willing, the flesh was weak and the result was not encouraging at first. It was agreed that something must be done to give this conglomeration of weird structures some added interest. A noted artist was imported and was given a free hand. He decided to give the buildings a coat of many colors; bright, vivid and gay. A collection of dull buildings was transformed at the last minute to a riot of color, which saved the day for modern architecture!

But this was a long time ago and modern architecture has come a long way since that time. It no longer has to hide behind a coat of gaudy paint but can stand alone, unadorned and unashamed. A new principle of honesty has been adopted which says that a building material should be exposed in all its natural beauty and should not masquerade to look like something else.

Some architects today go so far as to think that a coat of paint is no longer necessary or even sincere, except possibly as a protection from the elements. This means that the color in a finished building depends more than ever before on the choice of building materials.

However, the selection of these products for a modern building is one of the most taxing processes in the architect's office. This must be done by means of catalogues, color cards and samples, whose reproduction in color is generally unreliable. The need of standardizing the colors of building materials, their proper classification and authentic reproduction is only now beginning to be appreciated and holds a challenge for the immediate future. It is an area in which the Inter-Society Color Council has already made a valuable contribution.

PRINTING INK
—
C. R. Conquergood

The Printing Industry has often been referred to as the "Art Preservative," but great strides forward in volume of printing during the lifetime of the ISCC by chemical and mechanical improvements has altered the situation so that art alone is no longer the sole patron of the industry.

Religion and education may have been the motive power that gave birth to its widespread influence, but commerce and industry in our modern world could not live without printing.

The application of Printing Ink to paper and other products, now exceeds all other forms of human communication, despite the genius of moving pictures, radio and television.

As an industry the Printing Ink industry may be considered as the "mighty mite" of printing. It is at the same time one of the smallest yet most important ingredients of the printed sheet.

Individual members of the Printing Ink industry have played an important part in the activities of the ISCC since its inception, and have profited immensely from the general exchange of information made available by the activities of the ISCC.

Until more recent years Ink makers and users may have underestimated the influence of light and lighting on their product, since the chemical activities have been so important and so absorbing.

Printing Ink colorants (mostly pigment dry colors) have variants over a wider range than many other mediums because they involve wide ranges all the way between extreme opacity to extreme transparency. For instance in the paint industry, hiding power or opacity is of great importance, but much of the modern color printing requires ranges of transparency in Inks to produce multicolor affects from three or four single Printing Inks.

Color measuring instruments to replace the human factor, in the printing of color production is only in its infancy as yet.

The factors of tradition, history or photo reproductions, and the variations of individual tastes determine the choice of colors used. Paper surfaces, mechanical printing equipment and consumer requirements determine the physical construction of sundry inks. The chemical and physical qualities of oils, resins, pigments and other necessary components, dictate the selection of proper materials to produce quality printing.

The visual qualities of printing depend not only on the finish of the Ink such as glossy or matte, but of the underlying paper surfaces exposed to the eye through, and surrounding the central printed area.

Printing Ink is primarily a surface coating, so placed as to arrest attention, arouse interest, designate information or impress the fancy of the buyer.

Printing Ink is not a choice between art or science, but the melding of art and science to the end that men may live a fuller life.

In the making of Printing Ink most manufacturers maintain a chemical laboratory for control and development work. A few of the large companies extend their activities to research. The industry maintains the National Printing Ink Research Bureau at Lehigh University, Bethlehem, Pa.

Color pigments include both black and white as well as a long list of chromatic materials, both organic and inorganic.

The Printing Ink Maker is concerned primarily in the field of color by chemistry and art, and to a lesser degree by physical science and psychology, although the latter appear to be of increasing importance.

COLOR IN GRAVURE — Oscar Smiel

Gravure from its inception, about 1878, has always been a color process if we were to make a rather literal observation. By that we mean that after Karl Klietsch, a Bohemian, invented the process in Europe, a brown or sepia ink was used to print monotone pictures. In this country, the Van Dyck Gravure Company of New York City introduced gravure in 1904, printing circulars, calendars and art pictures, mostly in sepia or green inks with some attempt at two and three colors in later years.

Seventeen years later in 1921 the first newspaper to have full color in its Sunday magazine roto section, made with yellow, red, blue and brown inks, was the Chicago Tribune. Up until then, brown, green and blue inks respectively were used to print the monotone gravure Sunday section. Some printers, especially in catalogue and magazine printing, simulated four-color printing by combining green and orange inks from two separate printing units. The results were often pleasing, sometimes horrible. However, for facsimile reproduction of artwork, such as paintings, watercolors, carbros or ektachromes, and in order to compete with letterpress and offset for the advertising dollar, gravure had to go eventually to the three pigment primaries of yellow, red and blue, plus a black or key color, as the term is used in printing.

The Second World War with its paper, chemical and machinery shortages retarded the gravure industry's progress with color both in the publication field as well as in the packaging industry. But about 20 years ago, technological advances were made which were the beginning of gravure's phenomenal growth as a printing medium. From 1934 to 1937, the advent of high-speed press equipment, with electric eye control of register, fast drying inks, the Weiss Speed Dry enclosed ink fountain, the News-Dultgen Halftone Gravure Process of engraving gravure cylinders, and the establishing of Intaglio Service Corporation, the first gravure engraver to service the national advertiser, started the ball rolling. These features made available to the local and national advertiser an old media in modern dress, ready to serve his needs insofar as reproducing his color ads economically, quickly and accurately was concerned. Gravure had come of age and now could produce millions of copies in full color on cheaper newsprint or on more expensive magazine papers at high speeds of 1,200 - 1,400 feet a minute on web presses pouring forth 20,000 to 40,000 supplements an hour. The aforementioned technological upheaval made it possible for the New York Times, New York News, Chicago Tribune, Philadelphia Inqirer, American Weekly, This Week Magazine and Parade Magazine to get their 85-100 millions of circulation on the stands Sunday morning in time for the public's after-breakfast reading habits. It also accelerated the growth of gravure magazines such as Collier's, Woman's Day, Family Circle and many others. Woman's Day alone went from 16 pages of color in 1944 to 80 color pages in 1952.

In publication printing some 80 gravure magazines and 138 newspaper supplements now use color gravure. Syndicated groups such as Metro, Three Markets, This Week, Parade, and American Weekly, by creating package deals for the national advertiser and reducing his costs while increasing circulation, have added impetus to an already fast growing industry. From little or no color, and little or no advertising in gravure before the thirties, to one of the leading color printing media in the fifties, upon which the advertising agencies are lavishing almost 300 million dollars a year is the saga of gravure in publication printing. In packaging the same is true though no such figures to indicate gravure's gigantic and fantastic strides are available. Color in packaging was once done only by letterpress or offset, but today more and more printers of food wraps, labels, boxboard cartons, foils, plastics, metals and other surfaces too numerous to mention are switching to the intaglio way of printing. Gravure's ability to print any color and special inks at high speeds on practically any surface has created new markets - markets where color predominates. A startling indication of this is the appearance of the over-loaded shelves of our super-markets, as well as the fact that one well known press manufacturer of gravure presses for packaging has been building and installing one multicolor press of from two to seven cylinder units every two or three weeks ever since 1945. Couple that with the spectacular increase in color gravure advertising magazines and newspapers the past twenty years, and it is little wonder that the terms gravure and color are fast becoming synonomous.

COLOR TECHNOLOGY IN THE GRAPHIC ARTS

—

Daniel Smith

The Graphic Arts have advanced in virtually all phases of its color technology in recent years. New colorants have been developed, as have been new techniques for production of color copy, new techniques for color correction in reproduction processes, as well as control of color in production.

The theoretical aspects of color reproduction have been more clearly defined and reduced to commercial practice. Coincidental to these theoretical developments have been advances in the practical problems of color perception as related to energy distribution of illuminants and individual color aptitudes.

Some of the outstanding advances may be listed and described briefly as follows:

Copy preparation

Color photographic processes of uniform high quality have become readily available.

Color Separation and Correction

Color mixture theory was developed which indicated requirements for faithful color reproduction.

Equations of color mixture theory were reduced for rapid solution by electronic calculations.

Color correction achieved by automatic scanning and high speed electronic solution of the pertinent equations.

Photographic masking theory and methods were developed, and are in wide commercial use.

Reproduction and Color Control

New pigments of desirable spectrophotometric characteristics have been developed, the phthalocyanines and benzidines being of particular interest.

Flushing colors made available pigments of higher tinting strength and improved spectrophotometric characteristics.

Daylight fluorescent pigments of high purity and luminance were introduced.

Densitometry found widespread routine application for quality control in production.

Illumination

Low cost illumination of adequate levels and quality for visual color judgment was made readily available.

Visual Evaluation of Color

Reference to color systems as a means of communication increased with the availability of several excellent color order systems with good specimens.

The general release of the ISCC Color Aptitude Tests has made industry more conscious of personal differences in color aptitude and provided a means for selecting qualified personnel.

PLASTICS — G. W. Ingle

It is no coincidence that the ISCC News Letter and the use of color in plastics have grown simultaneously since 1936. From the early days of older cellulosic thermoplastics, color was an important factor, but its real value was not realized until the commercial expansion of polystyrene in the late thirties. Since then, the advent of the methacrylates, polyvinyl chloride and polyethylene has shown the continued dominating role of color. This fifty-fold growth from knick-knacks to a billion pounds per year of articles of more lasting value has been due to the relentless penetration of plastics into all fields of applications, where color, - its appearance, permanence control and costs - is of primary concern.

These few years have seen the growth of major plastics technologies paralleling that of color itself. Methods of plastic production are closely related to methods of coloring. To increase output, uniformity of color and of performance in subsequent use, and to lower costs, varieties of extrusion have been developed to a high degree. New colorants have been designed to withstand processing and application conditions for plastics materials.

The contemporary growth of spectrophotometry is mirrored in plastics technology. The direct application of C.I.E. colorimetry is evident in the methods of research, development and production control now in use by plastic manufacturers. The technical journals not only show this assimilation but also prove that creative work in colorimetry is actively pursued by plastics technologists. It is symbolic that the samples in the Color Harmony Manual, possibly the most widely used commercial system of color specification, are made of plastic sheeting.

The trend to coloring of plastics by the fabricator, rather than by the primary materials manufacturer, is broadening the utility of color in plastics. To further this technic, uncolored plastic materials have been designed specifically for coloring by the fabricator, using injection-molding or extrusion technics. While this change obtains economy and flexibility, especially for the smaller manufacturer, it has led to a greater realization of the problems of color. As a result, technical interest in color and its measurement is increasing, as is the demand for capable personnel trained in this field. This expansion of interest augurs well for the future of the ISCC and its News Letter.

THE COLOR OF OIL — Procter Thomson

Just about the time the first of the hundred issues being commemorated came out, Hollywood put out a movie called "The Redhead."

To promote this they decided to have a contest to decide who had the reddest hair among the available candidates in the Los Angeles area. After announcing the contest, the promoters asked their scientific friends how they could decide who had the reddest hair. The answer was, of course, the spectrophotometer. At that time, the only spectrophotometer in commercial use, west of the Mississippi was in the laboratory of The Procter & Gamble Long Beach factory. The boys lugged the visual comparison job up to Hollywood and thus decided the momentous question - "who has the reddest hair."

What has happened to oil color is the result of the spectrophotometer becoming a common instrument, instead of a rarity of the physics laboratory.

It has been customary to trade in the glyceride oils, cottonseed, soybean, peanut, coconut, and the lighter tallows and greases, on the basis of the Lovibond color as determined by the Wesson method. In this method the hue of the oil in a 5" column is matched by piling up red and yellow Lovibond glasses in specified ratio. This is a reasonable procedure except when the oil contains chlorophyll. When the oil contains chlorophyll the results are almost meaningless. This fact has become evident through spectrophotometry.

Our problem now is to decide upon the specific absorbancies to use to represent the color of the oil, and how to weight these absorbancies for the purpose of deciding upon equitable discounts for dark oil. The big problem in any single number color system is to decide upon the aspect of color that the single number system should correlate with - hue, density, saturation, or some combination of these. In general, the brightness values as given by large Y in the trichromatic system correlate with the visual appearance and attractiveness of the oil. Any system of representing color in oils will weight this value the heaviest.

COLORS FOR LEATHER — Helen D. Taylor

The Tanners' Council of America is located at 411 Fifth Avenue, New York City and was organized in 1918. It includes 300 tanners, who produce 95% of our total leather volume. All types of leather are tanned, finished and colored, and 85 percent of this production is used for footwear, manufacturing 500 million pairs of shoes yearly.

The membership of the Council is limited to the United States of America, and also includes shoe manufacturers and shoe retailers.

The Color Bureau of the Council issues four sets of seasonal colors annually, for men's, women's and children's shoe leathers.

These standards are guide posts for volume colors, and are the result of a comprehensive coverage of fashion trends, of regional preferences, of volume sales and high style planning in all of the related fashion fields.

A preliminary seasonal color forecast is sent to all tanners so that they can cooperate in the development of the colors. The final selections for the standard swatch books are made by the Tanners' Color Committee meeting with the representatives of the shoe retailers and the shoe manufacturers. The Leather Standard Swatch Books are available at cost, to anyone who wishes to purchase them.

The colors are shown in all of the important tannages and finishes and are named, described and pinpointed for their best category.

The Leather Show, in New York, twice yearly, displays the seasonal colors in all leathers.

The tanning and dyeing of leather is a slow and intricate process. Each skin has been a living thing and there are many unpredictable chemical differences that the skilled color man must overcome to produce his colors.

Small color differences are important, not only to the tanner, but also to the manufacturer who wants identical colors from several sources. The retailer also wishes to retain the color standard on reorders.

The swatch books are valuable in coordinating color throughout the fashion industry. Leather garments and accessories also are guided by these colors.

The Tanners' Council was admitted to membership in the Inter-Society Color Council in 1953.

COLOR IN MILITARY SPECIFICATIONS

Frank J. Rizzo, Alvin O. Ramsley

In presenting a view of the status of color requirements in military specifications, it is only fitting that this report start with an acknowledgment of the contributions which the Inter-Society Color Council and its member societies have made to this aspect of specification. We wish to single out, among others, the Textile Card Association and the American Association of Textile Chemists and Colorists, member bodies of the Inter-Society Color Council. This latter group especially is rendering invaluable assistance in the preparation of color formulations and specifications which are tried and true. The future impact of the Inter-Society Color Council and its member bodies on the character of color specifications can be emphasized only by stating that the reports on Inter-Society Color Council Problems 7, Survey of Color Specifications; 12, Illumination and Viewing Conditions; 16, Standard Methods of Mounting Textile Samples; 18, Colorimetry of Fluorescing Materials; and 19, Colorimetry of Near-White Surfaces, are being eagerly awaited for relation to problems of the US Army Quartermaster Research and Development Center, and, we are sure, by other military research establishments as well.

From early days, experience has shown that the textile industry works better to a fabric standard than to one on a different surface. This comes, we are sure, as no surprise to the membership of the Inter-Society Color Council since surface and color are essentially inseparable as has been well demonstrated by Judd and others. The practice of issuing fabric standards is still in existence and, we dare say, will continue to exist for many more years as the most practical procedure to bring shade and fabric requirements before the supplying industry.

For other product specifications, similar physical standards continue to be utilized and probably will be utilized for some time to come. None-the-less, the situation has not been static. Munsell color designations are to be found in one specification after another. Color card cable numbers define requirements of color for many small items. Color cards of Federal issue showing results of scientific color studies are utilized (reference TT-C-595 for Ready-Mixed Paints). Specifications based on filter colorimeters have appeared in certain military specifications in recent years and CIE designations of color, particularly for camouflage colors, have been utilized.

What may be construed as slowness of action on the part of military establishments and particularly the Quartermaster Corps, in utilizing scientific methods of color specification, is in reality the result of recognition of two situations, one, the existence of a number of problems which require solution before definitive requirements can be implemented in specification, (witness the several Inter-Society Color Council problems cited above) and, two, the status of industry, such as the textile industry, to which military and Federal establishments go for their various material needs. These outward signs are not indicative of the technical effort going into the color problems for the armed services and notably for the Quartermaster Corps, for which your authors speak more authoritatively.

Color standardization based on spectrophotometry, the application of colorimetric principles, the scientific spacing of tolerance ranges, the study of colorants in relation to color and fastness properties, constitute major areas of Quartermaster Corps research in the field of color for textiles alone, and similar researches are underway not only in the Quartermaster Corps but in other military establishments as well in all facets of color technology.

Recognition of surface problems in relation to color has for instance prompted such specification changes in the field of textiles as the requirement of sponging to remove surface finish before the evaluation of light fastness and similar action prior to evaluation for shade.

One of the major contributions of the Inter-Society Color Council which the Quartermaster Corps adopted shortly after its publication was the 7500° Kelvin -2800° Kelvin conditions of illumination for the evaluation of shade. This action alone has been productive of much better understandings between Government and industry.

The future can only expect greater use of scientific procedures for color evaluation in military specifications, and the rate at which such progress will be made can be expected to be dependent upon the rate of solution of problems now existing. It will also depend upon the rate at which the industries supplying the military establishments adopt scientific procedures and acquire the technical tools and personnel for the proper utilization of scientific methods of color evaluation as may be required by Government specifications.

COLOR IN NAVAL AFFAIRS — Comdr. Dean Farnsworth

"The Chief of Naval Operations has designated HABITABILITY as a military characteristic of ship design" (BuShips Notice, 4 February 1954). This Naval program started in the submarine service in 1948 with the appointment of four members of the Inter-Society Color Council, Mrs. Elizabeth Burris-Meyer, Mrs. Helen D. Taylor, Carl Foss and Faber Birren, to the ComSubLant Advisory Group. This group, at the request of the Commander of the Submarines of theAtlantic Fleet and of the Medical Research Laboratory, New London, created and set standards in color and lighting. The thorough overhauling which they did in the interior of the designated experimental submarine, the USS CUTLASS, created the prototype for color improvements on ship interiors extending through six years and into nuclear submarines. Colors and materials which they selected at the time have been made standard by the Bureau of Ships, and are the basis of the extensive improvement program in color, lighting and interior appointments which has now been extended to the entire Navy.

The first color conference held after World War II was an "Open House" at the U. S. Naval Submarine Base, New London, Connecticut, in April, 1947, for members of the Inter-Society Color Council and their friends. The purpose was to exhibit post-war developments in color and acquaint the ISCC with submarine problems, many of which they had worked on during the War. Four noteworthy speeches were on the program - Dr. Walter Miles demonstrated his now famous "Method of Entopic Plotting of the Macular Area," Dr. Selig Hecht made his first public presentation of the loss of luminosity of three types of color deficiency, Dr. Glenn Fry laid the basis for his present interpretation of the mechanism of color vision, and Captain Charles Bittinger unveiled his oil painting of the Bikini atom-bomb explosion. Captain Charles Shilling, Comdr. Dean Farnsworth, and Dr. Forrest Dimmick were hosts.

Mrs. Marion Willis, representing the Aeronautic Medical Equipment Laboratory, Philadelphic Navy Yard, and Comdr. Dean Farnsworth, U. S. Naval Medical Research

Laboratory, New London, have coordinated extensive plane-to-ship sea trials of the most detectable colors for air-sea rescue equipment. Because of the yellow-blue blindness of the central fovea, yellow was found to be an inferior hue for attracting attention of survivors at sea. A scarlet, close to Munsell 7.5 Red, has been recommended instead. Most recent tests have indicated that a permanent fluorescent red-orange is available which has more than twice the detectability of any other pigment.

This discovery grew out of independent investigations by Dr. Deane B. Judd, Captain Charles Bittinger and Commander Dean Farnsworth early in the War designed to identify the "10 most distinguishable colors" to be placed in the tails of remotely-controlled projectiles. This resulted in the rediscovery of Koenig's tritanomalous behavior of color in the central fovea.

For the benefit of the Navy and other military services, Deane B. Judd has made two important proposals. He has made a selection of colored indicator lights for radar, radio and other electrical panels which can be distinguished by color-blinds in addition to normals. He has also suggested that color codings of gas cylinders, those containers of highly-explosive gasses, be selected with a view to non-confusion by color defectives. These proposals are of importance in making available, with safety, a larger proportion of the manpower of the country.

COLOR IN ART
—
John Scott Williams

Color has been an essential part of art practice for a long time. To report on progress with Color in Art since 1936 would seem to be outside the province of an art review, as fine development in color and in permanency of pigments occurred centuries ago and among many peoples of our smiling, if somewhat troubled, earth.

There is however a very definite progress in one direction since 1936 and especially since 1946 and that is in the volume of artists' colors sold. The purchase of art materials and supplies that accompany the present day urge to paint runs into millions of dollars in retail sales. A great class of amateur artists has come into existence. Their absorption of art materials is now big business for the suppliers. While it is impossible to state the sales volume in accurate figures, Mr. C. L. Ellison who is Advertising Manager of the American Artist Magazine, has stated that $60,000,000 a year in retail sales of art materials should be a safe and conservative estimate. He agrees with others who are in touch with the field that about one out of six are professional artists, the other five in the amateur class. They are known as the Saturday and Sunday painters.

Equally uncertain are the factors contributing to the urge to paint. Many years ago no polite education was complete without lessons on the piano, now it looks as if no education is complete without a pot of paint or a tube of color. Has the phonograph and the radio interfered with the use of the hands on the ivory keyboard? Has modern or contemporary art produced this rash of painters? It must look easy to an amateur who observes that the worse the drawing is the more popular the product is to young enthusiasts.

Musical notes are designated by letters but visual art now does it by numbers. It's a new method, this painting by numbers. The drawing is furnished, the spaces are numbered with counterpart numbers on the colors to be used. A complete paint kit can be furnished and for less than $5.00 a new artist comes into existence. If the novice becomes ambitious, king size kits in 18 x 24 inches are now on the market, just like ordinary and king size cigarettes. This may all seem like a joke but when one market authority stated that over $50,000,000 of these "Do It By Numbers" paint kits have been sold in the past two years, it is no longer funny.

This new number kit method is not confined to oil paints. Jewelry, art tiles, textile paints, home decorating kits and a number of other craft outlets are part of this new progress of do it by numbers. In justification of this avalanche of art the manufacturers and dealers believe it will help unfold new talent as well as amuse. Professionals believe there are plenty of talents but not enough buyers, if everyone paints who want to buy.

Leaving the avocation and frivolous progress in color, my personal progress has been a serious technical one in porcelain enamel using 10 colors in a series of 24 applications and using a firing constant as close to 1530°F as possible and reducing the firing program to as few as 10 total fires. This does not include the base coat firings, usually three, which we reduce to two. This enamel problem consists of 15 sets of key maps to be used as part of the embellishment features of the 15 Battle Monuments in progress in various theaters of action of World War II. They show the progress of the War against Germany and Japan by means of a series of dated graduated area fronts on Mercator type maps which are in a series of 6 to the set, size 24 x 32 inches; each map being individually framed in bronze and stone mouldings; placements exposed or protected depending on the individual architecture of the moment.

The problem calls for a precision firing program with proper calculation for the fading rates of sensitive thinly metalic oxides so that the end results of hue, value and chroma will be as desired. As it is our first attempt at quality map interpretation in permanent form it has called for much patience, some failures, some near successes and some arrivals. Not only have melting points caused us concern but boiling points of some oxides have caused us more. Carbon gas formation so called in the steel base has required consideration as well as nice differences between titanium, antimony and zirconium with the real headaches in cadmium and selenium.

By way of diversion we mangled and set up 4 different types of the periodic table. To relieve the tension of a desired performance at one time we let the artist's imagination run wild trying to understand the elemental aspect of color and wondered if the elements have a sex problem too. Many of the metals seem to be gray fellows; cubic in type. One might think of them as square heads, evidently masculine in character and often seem to need the influence of the non-metals to give them the proper color, which of course may be considered as the feminine influence, the same as we dull males need the softer feminine influence in our lives to give us the proper color and incidentally permanency.

When the addition of another oxygen atom may change a color completely as our laboratory expert informs us, no wonder the raw heat of a furnace plays havoc with our attempts at color control. No more the rosy tints of an early dawn or the pearly hues of a gracious atmosphere may concern us until we are completely satisfied that we have a fair understanding of the brutal heat of what shows in the hungry throat of a big continuous furnace, until we are satisfied that we solve low boiling points, fading rates of oxides, mixed with a little chemistry, a little physics and a burning desire to mould some military maps to a satisfactory conclusion as a visual document of fair permanence recording the historical progress of a vast war and for the inspection of visitors to the cemeteries where loved ones have passed before their time in the struggle for human dignity and freedom.

Those who have seen our results think we have made progress in color and have achieved our objective. They wonder how it was done. The answer to that is easy, we made many mistakes but kept at it.

THE CURRENT COLOR EXPLOSION — Egmont Arens

One of the chores put upon the Industrial Designer by his clients, is to come up with some kind of a prophecy regarding the next most probable state of the public's taste. Our clients want to know, not only what the public is buying today, but what it will probably be buying tomorrow, next winter, next year and so on into the future. This applies to design, and particularly to color.

The industrial designer's attitude towards public taste is well expressed by Franz Wagner of Raymond Loewy Associates, in a recent article in the Formica News:

"Design organizations, unlike pollsters, know a great deal about people's habits and tastes without actually ever going to the people. Instead the information is gathered about the customer as if he were being observed on the other side of a one-way mirror. The minute a person is asked to describe his taste he talks about what it has been, in so far as he can use language to communicate the idea.

"What the designer needs to know is not what a consumer thinks his taste is, but how it had affected what he does. If his taste makes him buy something or want something, then the information is important. Otherwise, we may gather some fascinating facts: he says red is his favorite color; he likes orange sportscars. Why, then, we ask ourselves, does he buy a green rug for his living room and a gray four-door sedan?

"And the reason is simple: abstract, truthful statements about preferences tell only part of the story of what affects a person who is suddenly, thoughtlessly perhaps, turned into a buyer. At this point he becomes a selector; if it isn't there he never gives it another thought. Designers are responsible, quite often, for what is there. They must be able to assess taste on a time basis and in focus with all other objects, the sight and shape and condition of which influence the sight, shape and condition of all other objects.

"Out of the reaches of design philosophy to the ring of cash registers an industrial design organization accumulates an amazing diversity of data about what is called The American Way of Life. And what is more important to producers who retain industrial designers The American Why of Buying."

In my talk before the Inter-Society Color Council in March 1950, I predicted that the then evident somewhat conservative color selections by the public would change along with any definite change in the national prosperity. If we went into economic decline, color preferences would become even more conservative. But if we achieved real prosperity over a period of time, we might witness a color explosion of atomic proportions.

As you know, the boom has been of long duration, and in spite of dire prophecies, shows few signs of recession. As prophesied, the color preferences of the American people have blossomed into a color riot. If you will look over the cars in any parking lot, you will see raspberry reds, shocking pinks and fire engine vermillions: color has invaded almost every department of consumer goods. Even refrigerators which held out for white over more than a decade have yielded to the demand, and you now see gay colors applied to them, both inside and out. The temper of the times is also discovered in the title of a play. "The Solid Gold Cadillac" is an appealing title, because people seem to be in a sort of golden craze, as regards their purchasing. Gold has supplanted chrome as trim for refrigerators and other home appliances, and is very popular on such personal consumer items as lipsticks, fountain pens; and gold ink, which disappeared from packaging during the war, is coming in again, because it potently spells quality to the purchaser.

If all this proves that prosperity provokes bad taste, it will be found equally true that hard times are quite the reverse; and, by some mass psychology that we do not quite understand as yet, will goad people into more tasteful color selections. At any rate, if there is a recession, color preferences will go conservative; the gaudy colored automobiles will gradually disappear from the roadways, and the sombre blacks, dark blues and dark greens will reemerge. All types of consumer goods will then follow the trend. Bathrooms and kitchens will go back to white; clothes will be more demure; and America will sober down until the next wave of prosperity provokes a new color explosion.

COLOR COORDINATION IN THE HOMEFURNISHINGS FIELD

—

Elizabeth Burris-Meyer

Up until 1946 color in home furnishings was an individual matter and the manufacturer brought out what he wished and the consumer bought what she could find or had it made if she could afford it, through her decorator. At this time was begun the first concerted effort on the part of the press of a shelter magazine, retail stores, and manufacturers to bring the American woman colors she wanted for her home which she could assemble herself. In the fashion field the problem of color coordination had been handled with great success for many years. Fashion authorities introduced new colors and overnight the American woman's wardrobe took on a new hue, or certain other colors were kept in the fashion picture until they had run their cycle of customer acceptance. Such a coordinated color plan was long overdue for the home furnishing field.

A few years prior to 1946 packaged displays of color coordinated room settings including furniture, floor coverings, upholstery, papers, accessories and papers and paint had been shown in certain retail stores which were excellent as far as they went. But their scope was limited and the customer's preferences unsolicited in advance. Also prior to this date, sales figures on colors in home furnishing merchandise meant nothing because if a customer wanted to buy a new rug she was happy to go home with a gray or green rug since most frequently the store would not have a blue rug in stock.

In order to find out the colors the readers wanted to buy most, House & Garden magazine, in 1946, went right to the consumer to find out their color preferences. In leading stores from coast to coast people were asked what colors they had in their homes in all phases of homefurnishings and what colors they would like to have, provided, they were available. Conferences between editors, leading designers, decorators and stylists gave the magazine a group of trend setting colors with which to supplement the colors determined by the consumer survey.

In 1946-47 the first package of correlated colors chosen as those most wanted by the American woman were sent out first to a selected list of manufacturers of upholstery, draperies, floor coverings, china and wallpapers. These colors were to be matched by the manufacturers. The colors were also sent to certain key retail stores so that they might plan for displays in model rooms with the merchandise mentioned above in the colors most wanted by the customers themselves. The magazine then began the color program, now in its ninth year, telling its readers how to live with color and how to use color, which has consistently widened its scope during the past eight years until 409 manufacturers are now producing 5000 homefurnishing materials in House & Garden Colors. As many as 236 stores show them and readers of House & Garden are told in the September and March issues how they may use these colors to achieve the effects they would like in their homes.

Some of the colors selected change annually in certain directions reflecting the results of the magazine's color research and editorial thinking. As the country's architecture and way of living changed in the past eight years, so have the colors changed. Certain hues have proved themselves pretty fundamental, however, continuing in the color package consistently, changing only slightly in value or chroma.

The life cycle of some of the colors shown in the past eight years shows a consumer acceptance of general interest. Their influence will naturally increase as the cooperation between manufacturers and retailers increases. For example, Forest Green presented first in 1946 as a forecast of a color which was most wanted for home decoration but was not available up to this time, was received with phenomenal support; it became a top seller and remained in the color package until 1953. Avocado Green, 1947-48 was forecast as a wanted color but not currently available either. It immediately became a volume seller particularly in fabrics. When the national preferences showed a swing from greens predominantly yellow to those with bluish tones (1951) House & Garden anticipated the change and introduced a variation of green (Leaf and Emerald Green) which were more blue than Avocado. Geranium and Flame (1947-48-49-50) were apparently answers to a quite general longing on the part of consumers because Flame was a new vivid color. Since then the overall color picture has become lighter and brighter while Flame itself has remained the same. In 1947-48 Buckskin, Sandalwood and Pebble, all variations of beige were brought out and shown in room settings as new colors. These have all become leading colors as has Carnation introduced in the same year. Of all the new colors introduced in 1947 and 48 the pinks have had the greatest general acceptance and have increased in number more than any other color family. In 1954 the color package is generally lighter and clearer as a whole than it has been in previous years. This is due in large part to America taking enthusiastically to indoor-outdoor living with large expanses of clear glass walls, to its outdoor furniture which is as right in the house as on the lawn or terrace, to man-made materials which are easy to keep spotless even in light colors, to its casual way of living and doing its own painting, to shingling its own roof, and to papering its own walls in colors that it likes which are more readily available than they have ever been before.

COLOR IN HOME FURNISHINGS — Scott Wilson

The excitement of watching color changes in public taste these past two decades can be compared, perhaps somewhat fancifully, with the diurnal passage of the sun from East to West on a perfect autumn day. In the more than twenty years that I have been vitally concerned with color and the public, especially in the field of home furnishings, I think I must have seen every color phase and mood, from the expectant gray of early dawn to the final flamboyant defiance of an October sunset.

It would be assuring to say that logical reasons can be found and presented to explain the fluctuation in acceptance of colors, the popularity of one as against another. If there were time and wisdom for a proper study of the subject, I have no doubt some scholar could relate reactions to certain colors to historical events, social development, and economic conditions. It is my conviction that such relations exist, but lacking both the time and the wisdom to substantiate my hypothesis, I must resort to guesswork or instinct or my own limited personal experiences, always remembering the rule in formal debating which points to the dangers of "judging from too few instances."

Nevertheless, when I started my designing career, at the same time fearfully and intrepidly, during the gloom of the Depression Thirties, economics demanded that fabrics and wallpapers be printed with the fewest possible screens or rollers. And practicability was an essential. Therefore there developed a style, based on necessity, of using a few white figures against large areas of dark background, the contrast of white against dark producing a dramatic effect with a minimum of cost, and the dark background proving eminently practical. Black, dark brown, steel blue, egg plant, were the vogue. This vogue appears in retrospect as the perfect example of the effect of economics on color.

As prosperity crept slowly back, however, the practical colors were no longer essential. In the late thirties, at a home-decorating show in New York, a fearless decorator named Syrie Maryham startled the world by exhibiting a room done entirely in "shades of White," and bang! the pendulum lurched drunkenly back and the Great Pastel Period was upon us. The economic picture had changed, and color with it.

Until the beginning of World War II the languid pastels stayed with us. Oyster white, dusty rose, dusty blue, dusty everything dominated the American home. But with the coming of the war, dye supplies from abroad were in scarce supply; and with our own advent into the hostilities there were even government rules about the use of inks and dyes, and the color coverage on fabrics was limited to 35%. Remember "Lucky Strike Green Goes to War?" Most merchandise during this period was colored by the manufacturers with whatever coloring matter came to hand. And since the public was happy to buy anything, no matter how dreadful it might be, little care was taken with color, and the results were a horror to behold. There was history at work on color.

Simultaneously, the laboring classes - and let this be said with proper reverence - rose to a prosperity and a buying power never before dreamed of; and not having had time in their rapid rise for the development of sensitive color tastes, they demanded and of course got merchandise that in color was raw and almost primitive. Whether the post-war trend to sharp, blatant colors was due entirely to this social revolution which came almost imperceptibly upon us, or whether there was also a strong reaction to the khaki world in which we had lived so long, it is hard to say.

But we can be grateful that it didn't last for long. The social revolution continued, but in a somewhat happier light. Building materials were once more available, and the home-building boom was on. And there was the money for building. A home, a new and lovely home, became the national passion. Women remembered - and men, too - all the pretty pictures they had seen in the "home" magazines, and more than anything they wanted these pretty things.

Homage should be paid here to the truly wonderful influence which these "home" publications have had. However ultra-chic and sometimes almost trivial some of their illustrations may have been, they have always had a stimulating effect.

Once more the changing social and economic picture comes into sharp focus. The lack of household servants (social and economic), the advancement, now admitted, of women to man's side at the bar (social; and make my martini very dry) means that the housewife has no idea of being relegated to the kitchen while her master has his evening snifter in the living-room. The kitchen, therefore, has been restored to the respected place it used to hold in the American farm-house - really a living-room with cooking equipment. This has brought about drastic changes in the idea of color for kitchens. The drab cream walls of the past era are gone, and with them the antiseptic white of the refrigerator and the stove. In designing kitchen tablecloths and towels the standard harsh reds, blues, greens and yellows are no longer the rule. To replace them are pink, turquoise, pumpkin, brown and even purple. The sky seems to be the limit, both in color combinations and design material. The kitchen is a place to live in, to spend a great part of one's working day, so why not have it gay and cheerful?

Anything too much seen or tasted becomes, of course, monotonous, and this quite naturally applies to color just as to anything else. Fashions in color have been for a long time confined to women, but now the male is finding release from the drab rules of the Victorian era, from the practical requirements of dust and soot-laden air, so the male of the species is once more preening his plumage as nature intended, and has joined the game of accepting and rejecting color. Since change is always a stimulant, mankind will continue to take pleasure from it, and so colors, it seems sure, will achieve and lose popularity just as always before, and then in the course of a cycle come back into popular acceptance.

If I were to predict, and I think I dare, the next color change, I would say that it will be in the direction of clean, bright color, judiciously combined. There is, after all, just as much if not more subtlety in the combination of clear colors as there is in the putting together of the more muted tones. Part of my hunch is based on what I see women wearing on the streets. Instead of the grays, browns and blacks of former years, one sees brilliant colors in such stable garments as street coats. This is not the sort of garment that a woman buys casually with the idea of using it for only a season. If, therefore, she buys a new coat in a clear canary yellow, cherry red, turquoise, or purple, it means that she has accepted those colors as things that she is content to live with for some time to come. Having accepted them for her clothes she is then prepared to accept them for her home furnishings.

FROM RETROSPECT TO PROSPECT

—

I. H. Godlove

It's not the brains or genius
   Nor money that we pay;
It's the close cooperation
   That's bound to win the day.
It's not the individual
   Nor Council as a whole,
But the everlastin' teamwork
   Of every bloomin' soul.

It seems to us that there is only one good but sufficient reason to stop and look backward. That is to see in what direction we have been going, and how far. For thus we may see whether we are headed right, and orient ourselves in the desired direction. If we look backward merely to recall and relive the past, we are mentally dead or dying.

This Jubilee issue is one in which our stars stop, look and glisten. We first realized the scintillating probabilities when we drew up the list of shining stars whose names now appear on their respective effulgent articles. We can say this in all modesty; for once at last during the past 100 issues they, not we, must labor for the prognostic pabulum fed to you, hopefully, for your delectation. We doubt whether any of these stars has said explicitly: "Follow my light; in that direction lies Progress." For in that delectable field of fabulous fervent felicity which we call Color, you are not children in the grades; you are experts who will readily see the signs pointing out the way of right. For you are yourselves members of a galaxy differing from the stars of this issue only in having been not so near the center of activity in the period 1936 - 1954.

The mention of time recalls a minor but significant incident in past ISCC history. Riding from a meeting on a Fifth Avenue bus, an ISCC past Chairman threw his arm spontaneously over our shoulders and exclaimed: "I.H., isn't this Color group a wonderful bunch to know and work with?" We fervently answered "Amen." At no time in our personal history was this heart-warming feeling more evident than when, during our own incumbency of the chairmanship, in trying to do too much, bad health overtook us. And at no place in our 23-year association with Council affairs have we realized this soul-satisfying feeling more than in our associations in the work on editing of your News Letter. Virtually from the start of our 18-years of editing we have been closely associated with our present President, Dorothy Nickerson, and our past Chairman, Deane B. Judd. If the News Letter has contributed anything toward welding the Council into a powerful instrument for progress in the color field, it is largely because of the stimulating but steadying influence of these two practical scientists.

Others too have helped. Faber Birren and Taylor Duncan have been frequent contributors, and Margaret Hayden Rorke a constant one. Past Chairman Balinkin has contributed many delightful items, stemming chiefly from his ever-present effervescent sense of humor. Elsie Murray and Walter C. Granville have contributed often over the years. In the early days Charles Bittinger served as Editor for Art, while Deane Judd was Editor for Science. Since Ralph M. Evans took over as Secretary, the aid rendered by him and his assistant George B. Gardner, has been constant, efficient and timely.