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NEW NEWSLETTER EDITOR

I regret that, for business reasons, I must resign as *Newsletter* Editor and Chairman of the Committee on Publications. I have enjoyed both responsibilities very much, indeed. The Board of Directors has accepted my resignation, and has also approved my recommendation that Dr. William Benson, a member of the Committee on Publications, be appointed to fill both posts. Dr. Benson has accepted and will, I am certain, do an excellent job.

William Benson completed his doctoral work in the summer of 1963. The work was done under the direction of Professor Harry Helson, at the University of Texas, and the title of his thesis was "A Quantitative Study of Color Contrast." He was granted an NIH post-doctoral fellowship for two years of study on problems of signal detection and laterization of tones under the direction of Professor James P. Egan at Indiana University.

In the fall of 1965, he was employed by the Bunker-Ramo Corporation to evaluate instrument landing displays at Randolph Air Force Base.

In the fall of 1967 he was employed by the National Academy of Sciences, where he still serves as Executive Secretary for the NAS-NRC Committee on Vision.

Please send all future *Newsletter* correspondence to Dr. Benson, whose address is shown inside the back cover of this *Newsletter.*

FSPT ANNUAL MEETING AND PAINT SHOW

Both the program and exhibit arrangements for the Federation's Annual Meeting and Paint Show to be held in Atlanta are well underway.

The program, with the theme "Change Is the Challenge," will open Wednesday, November 6, at the Atlanta Civic Center. Among the features announced by Program Chairman John Oates are:

- Mattiello Lecture by an outstanding coatings personality and authority.
- Keynote Address.
- Society papers (so far Kansas City, Louisville, Southern, Philadelphia, and New York have indicated they will present papers).
- Paint Research Institute Symposium on "Corrosion."
- Roon Award Papers.
- Research, educational, and manufacturing seminars.

For information write: Federation of Societies for Paint Technology, 121 South Broad St., Philadelphia, Pa. 19107.

FOURTH MEETING OF THE ROCHESTER COLOR GROUP

On December 18 the Graphic Arts Research Center of the Rochester Institute of Technology hosted another meeting of the Rochester Color Group. At these informal gatherings participants can leave their professional images at their places of work. They can leave their tight attire at home. They can be, instead, just as they want to be – comfortable and at ease.

Milt Pearson, GARC technologist, insists that this should be the aura under which he periodically invites people to the Rochester Color Group. "The meetings are strictly informal without any organizational structure, dues, or parliamentary formalities and usually include a sherry hour or a dutch-treat dinner," says Pearson. "The purpose of these gatherings is to bring together people who like to discuss their thoughts, concepts, and opinions on color in order to improve communication between people sharing this area of interest and to obtain a better understanding of the subject, itself. The hope is that such informal gatherings will encourage interchange of ideas between those interested in color whether it is art, industry or science."

Approximately 25 interested persons attended this meeting. If you have an interest in coming to this kind of meeting you are welcome and invited. Write to Milton Pearson at the Graphic Arts Research Center or phone (716) 464-2789.

RIT MODEL OF CIE COLOR SPACE DISPLAY AT BOSTON MUSEUM

From the end of March until early summer an RIT model of the MacAdam Limits in CIE Color Space will be part of an exhibit at the Boston Museum of Science. The model was constructed in 1967 by Milton Pearson, Technology Supervisor at the Graphic Arts Research Center, Rochester Institute of Technology, and has been used at RIT in a series of lectures on color and the 3-dimensional concept of color space as well as being available for RIT classroom instruction. According to Lorna Shanks, Graphic Coordinator at the Boston Museum, the model "will make a great difference to the quality of information we will be able to communicate to the visitors to the museum."

According to Pearson, while other models have been constructed, they are not common. This model was built in conjunction with a model of Hunter L,a,b color space and both were used to help demonstrate the need for expressing colors in a space having equal visual spacing when analyzing color reproductions. Such research is essential for reaching the goal of optimum color reproduction, one of GARC's programs for the benefit of the graphic arts industry.

The model will be on display at the Museum of Science, Science Park, Boston, MA 02114.

BRITISH COLOUR GROUP

Report of the 100th Meeting in January, 1974

Dr. F.J.J. Clarke on Digital filtering in an on-line spectrophotometry data system

Dr. Clarke began by discussing systems used in processing spectrophotometry data, the choice between off-line and on-line operation depending mainly on the rate at which photometric and wavelength information is provided. High resolution spectrophotometry can produce very large amounts of data, say 800 bits per second from the detector and 800 from the wavelength signals, and much of this may be wasted if too great an abridgment is made, e.g. in an analogue pen chart. This abridgment is usual in off-line operation with storage on paper or magnetic tape for future processing, unless costly refinements of the equipment are included, but the method may be adequate for colorimetry. On-line operation with the "peripherals" permanently coupled to the computer is more satisfactory for the accurate work done at NPL, and has led to a great economy in staff time.

The NPL system was described in detail. It includes a Micro 16P computer with a core of 16K words of 16 bit length and a backing store of a 64K word drum. It uses a specially provided high level language "Mathchat". The two Cary spectrophotometers (14 and 14R) may be used simultaneously and independently, and each has an ASR 33 teletype, a digital voltmeter and a wavelength encoder. The latter provides an absolute wavelength scale in order to limit errors caused by any temporary malfunctioning elsewhere in the system. A useful extra is a hardware multiplier-divider unit which greatly reduces the time taken in these operations. The scan can be stopped or altered in speed or back-tracked and restarted during the measurements. Immediate alterations of programme are also possible by having the interpretive compiler always present in the core.

The cycle of operation provides for accurate synchronization of alternate photometry of reference and sample, usually an average of 2½ measurements of each for each wavelength setting, which alters in steps of 1 A. The means of these measurements are taken and their ratio held in a buffer store. There follows a smoothing filter procedure to reduce noise in the initial processing of the data: this is an important feature of the NPL system. If the smoothed photometric value at a wavelength λ is required, then for example between $\lambda \pm 50$A the 101 values of reference to sample ratio at 1 A intervals are taken, multiplied by weighting factors determined by the particular equation chosen to fit the curve at this point, and the smoothed value at λ determined. The purpose of the choice of filter function is to approximate to the ideal filter (sinc x = $\sin \pi x/ \pi x$) which has a rectangular frequency response in its Fourier transform. The weighting functions and Fourier transforms of several filters (RC, running mean, etc.) were demonstrated to show their frequency responses compared with sinc x. In practice a quadratic least squares function is used to fit the photometric data. A quartic least squares function would be better, but requires more buffer storage capacity. Sinc x converges too slowly unless truncated, but the polynomials then give better performance for equal storage requirement.

For spectral curves with sharp profiles the number of points considered at a time on the spectral curve can be reduced from 101 down to a minimum of 3, where an arithmetic mean is used, but as much smoothing as possible achieved by a slow scan (say 0.5A/s) to allow 50 ratios of reference to sample at each A setting.

S.T.H.

A practical instrumental pass/fail system for colour control in textile dyeing by S.M. Jaeckel and C.D. Ward of Hatra

Michael Jaeckel emphasized the system, proven and used in industry, at least as much as particular pieces of hardware. On display was what his team thought most suitable now, after extensive tests of many instruments. He stressed maximum flexibility, versatility, and interchangeability.

He outlined the gamut of colour centres studied at Hatra, the spread of plots of visual acceptability against colour difference DE, the superior performance for pass/fail decisions of Adams-Nickerson (AN) type colour-difference formulae, especially of cube root versions such as Morton's (M), over other formulae, not only on the basis of regression analysis, but also on that of wrong decision frequencies. The "right" judge tended to be wrong about 1 in 5 times, the "wrong" judge up to 1 in 2 times, and especially by comparison with judges too lenient or severe instrumental decisions were significantly better when based on good formulae such as Morton Cube Root.

He then illustrated differences amongst hues, observer preferences, LAB space and DL DA DB difference space associated with AN and M formulae (industry preferred Latin letters). The Hatra system printed out XYZ and also DE DL DA DB DC O, (differences in total colour, lightness, redness/greeness chromaticness, and angle of DC relative to the standard to be matched) together with verbal descriptions. Tolerances for specific cases could be based on selecting simple combinations, e.g. DE and DL, from the print-out. Tolerances varied with shade, because even the best formulae were imperfect.

Slides were shown of the system and its components — a tristimulus colorimeter (the Harrison-Shirley Digital Colorimeter) HSDC interfaced with an electronic calculator suitably programmed by tape cassette (the Wang 600-6-T Programmer and Calculator) and linked to an output writer (the IBM 601) used on fabric of various types. Then Charles Ward took of it through its paces impeccably, and impressed by its simplicity and speed of operation (the whole process from presenting the first sample of hose to the final print-out took less than a minute). He also showed a cheaper simpler program giving an illuminated display only and not requiring an output writer, though this option was felt to be less useful. This exemplified the versatility of the set-up, indeed additional programs, not utilizing the colorimeter, to print out recipe-cards had been developed and were welcomed in dyehouses. Flexibility could extend to the availability of alternative programs for alternative print-outs and even, in special cases, to the substitution of other colorimeters.

Discussion included questions from Prof. Hunt on the acceptability to Hatra of Cube Root proposals to be considered by CIE; from Dr. Crawford on the accuracy of the system; and from Dr. Clarke on its performance with the Ceramic Colour Standards. Replies referred to visual/instrumental correlation of the same high order as M of one cube root proposal for CIE tested at Hatra; to precision within 0.2 DE at worst and often of 0 (repeatable) rather than accuracy being decisive in differential work and to 39 out of 45 DEs on an older version of the Harrison with the same filters being within the 95% confidence limits of the 45° line against DEs on a Colormaster, obtained elsewhere, calibrated against a Beckman spectrophotometer; and to DEs calculated between NPL data and measurements of a non-calibrated (NPL) tile set on various colorimeters exceeding the NPL 95% confidence limits for such sets for a number of tiles for all colorimeters, but rather less for the HSDC than for most others.

Report of the 101st Meeting in February, 1974

Dorothy Morley gave further information on the colour difference work which she reported at York. A brief background to the experiment was given, namely that 30 printed samples centering on 19 points in colour space were viewed by 20 observers, twice, who estimated the size of the colour difference in the I - VI scale where I was rated no difference, II just noticeable difference, III clearly noticeable, IV fairly large, V large and VI very large difference. The samples were viewed with about 4° angle of substance against a neutral grey surround. The spectral reflectances were measured and the tristimulus values calculated using the Atlas Artificial Daylight fluorescent lamps distribution.

Because, she said, we need estimates of colour differences larger than the small differences used previously acceptability work, the big problem is how to carry out the visual experiment. With the data in the form of 6 categories the problem is to change this category, or ordinal scale, into an interval or ratio scale. In a category scale, the widths of each category may well be different, so that the results are only amenable to very unsophisticated statistical treatment. In an interval scale, the separation between sequential scale values is constant, and on the ratio scale there is a zero. If the widths of each category were the same for each of the 19 groups of colour differences it would be legitimate to transform the category results into a interval scale by means of a cumulative unit normal distribution as the transform function. The mean boundary position of the 6 categories were derived from the 19 x 30 observations, and the category scale results were then cumulated by category (which is a legitimate statistical procedure) and via the cund distribution were transformed on to the interval scale, to give appropriate scale values. On the interval scale the boundary between categories I and II was taken as an arbitrary zero point. Testing the validity of this procedure by the X^2 test did not indicate that the method was very good, but comparison of the linear fit of the lines regressing the observed on the measured data did not support any lack of confidence in the results. However in the light of this experience she recommended that in future work of this type it might be better to explore the use of paired comparisions treating the data with non-metric multi dimensional scaling.

P.T.O.

In the second part of the meeting, Mr. Rigg presented a paper on "The Accuracy of colour difference equations in relation to perceived colour differences." A number of workers have reported that the performance of colour-difference equations in industrial shade passing situations is unsatisfactory. In most subjective trials observers are asked to comment on the acceptability of the colour variations from a standard and the results are then correlated with equations which are generally based on the perceptibility of colour differences. It is possible that the poor performance of the equations is due to differences between the nature of perceptibility and acceptability judgements. This possibility was examined by using data based on perceptibility judgements for testing various colour difference equations.

The method was illustrated using the MacAdam chromaticity colour matching ellipses. The calculated colour differences, AE, between the points on the circumference of the ellipse and the centre should be constant for any particular ellipse. Eighteen points were selected on the perimeter of each ellipse and AE values were calculated for a particular colour difference equation. The performance of the equation was measured by the standard deviation of log AE. A number of equations were tested using the subjective data of a number of workers e.g. Brown and MacAdam and also the Munsell system. The same area of the chromaticity diagram was used for each set of results and this represented the range obtainable with surface colours.

It was obvious that if the colour difference equation were derived from a particular set of data, then a good fit would be obtained for the perceptibility data. In general it was found the equations did not fit the perceptibility data much better than they fitted the industrial acceptability data. The Munsell system data was different from other data in that the colour differences were large. Other data was often obtained by colour matching techniques where the differences were either zero or very small.

One important factor was the conditions under which the judgements were made. An equation which fitted one set of conditions would not necessarily fit other conditions but given a defined set of conditions it should be possible to obtain a good equation. It appeared that different sets of equations would be necessary for different viewing conditions.

In conclusion Mr. Rigg said that the poor fits obtained using industrial acceptability data might well be due to differences in the viewing conditions used rather than any difference between perceptibility and acceptability judgements and further work was in progress on the subject.

M.B.H.

Report of the 102nd meeting in March, 1974

This was a joint meeting held in conjunction with the Society of Dyers and Colourists and was very well attended, there being a total of 53 members and visitors present. At the start of the meeting Prof. Wright told us of the death of Ralph Evans (Eastman Kodak U.S.A.). A few minutes silence was kept in his memory.

The format for this meeting revolved around the short presentation of problems to a panel of experts for general discussion and off-the-cuff advice. The panel, chaired by Professor Wright, consisted of Mr. J.G. Holmes, Dr. R.W.G. Hunt, Mr. K. McLaren and Mr. A.C. Perry.

The first problem was presented by *Dr. W. Carr (CIBA-GEIGY (UK) Ltd.)* and concerned the effects of the rapid drying process on the colour strength of gravure inks. These inks have to dry (by solvent evaporation) in times as short as ½ second and it is thought that this may cause flocculation of the pigment i.e. the level of dispersion may be effected. This would reduce the optical density and colour strength of the ink film printed. Dr. Carr was requesting suggestions for techniques to investigate the degree of dispersion in the dry film compared with the wet ink.

Mr. Holmes suggested the use of photography or video tapes to lengthen the time scale available to analyse the paper the instant it is wetted, and so be able to compare it with itself rather than the liquid state. Dr. Hunt considered that a properly-designed densitometer able to plot optical density against time would be sufficient. Mr. Perry mentioned that at Paint Research Association techniques were being developed for similar problems with paint. These made use of their fibre-optic densitometer. Dr. Carr remained worried about the fact that as the ink dried the film thickness decreased to about one-third that of the wet film – gravure inks can be approx. 6% pigment, 65% solvents.

The second problem introduced by *Mr. C.M. Parry (Welsh School of Architecture)*; was "what instrument would the panel recommend for measuring the colour of building interiors?" Mr. Parry showed some slides indicating the overall effects on interiors of, for example, a strong orange carpet or a blue/green one.

Mr. Perry said that a suitable instrument might be one of the brightness spot photometers now available (at £2,000 - £3,000). These can give R, G, B or X, Y, Z values when "aimed" at a small area. They are used, for example, in colour television studios. Also computer-aided graphics are used in the U.S.A. to assess what colours will look like. Mr. McLaren believed that colour measurements will not solve this problem, because personal tastes are involved; these change. Mr. Holmes thought that the human eye is needed, not an impersonal "black box", but Mr. Chamberlain produced an appropriate Tintometer Ltd. instrument out of thin air and proceeded to give a straight commercial to Mr. Parry, if not the rest of the congregation.

Problem three was described by *Mrs. M. Conybeare (S.E.A.)*; she was appealing for help in any way possible with the very human problem of teaching deaf children to speak and to be responsive to visual stimulation. The aim is to develop a light/sound synchroniser by which the deaf may judge the accuracy of their pronunciation and learn the sound and symbol together.

Dr. Hunt suggested some form of frequency analyser which might have a blue light output for an excess of high frequencies in the vocal sound produced, perhaps yellow for medium frequencies and red for low frequencies. Mr. Holmes pointed out that the human eye analyses texture and direction, the ear in time. Mr. McLaren thought it would be possible to design a phonetic alphabet with different colours for each associated vowel sound. Mr. Pitt (from the floor) warned of the pitfalls to be avoided with brightly-coloured walls.

Dr. Crawford introduced problem four; how can a blind person identify the colours of materials with which he is working? Dr. Crawford described an abbreviated spectrophotometer which he has produced. It has five wavebands and the output is a note from a loud speaker – high notes for a red specimen, lower notes for blue, blue-green, yellow etc. A second device is a 3-filter colorimeter from which the ratios R/G, (R+G)/B and (R+G+B)/W are derived. A Wheatstone Bridge circuit has to be balanced by the user, and can be balanced by ear – a low note if off-balance in one direction, a high note the other way. This is not very satisfactory and Dr. Crawford wants suggestions for suitable outputs of the information.

Mr. Perry thought that a simple tactile device such as push buttons along a ruler scale might be the answer.

The fifth problem was posed by Dr. F.J.J. Clarke on behalf of *Dr. P. Trezona*. She was concerned with the relative merits of prism and diffraction gratings for use in large field colorimeters. For an instrument with adequate exit pupil width and narrow bandwidth, large dispersing elements giving high angular dispersion are needed. The advantage of gratings is their high angular dispersion and this is almost spectrally uniform. Their disadvantages are their high scattered light, abrupt changes in the spectral efficiency curves, the difficulties of cleaning or correcting damage and the amount of plane polarisation. Prisms have a drawback in their relatively low bandwidth in the blue and violet which reduces the light flux especially when narrow slits are used. These factors make the choice between prisms and gratings far from straightforward.

In the discussion, the panel of experts agreed with the summary presented by Dr. Trezona. Dr. Tarrant said that in spectrophotometry gratings were markedly superior to prisms. Dr. Clarke pointed out that the requirements for monochromators and polychromators were somewhat different. In the latter it was not desirable to have too high angular dispersion because it presented difficulties in designing objectives. Also the difficulties of cleaning make an old diffraction grating less satisfactory than an old prism but Mr. Holmes commented that he possessed some unsatisfactory, old, scratched prisms.

Mr. D. McConnell presented the sixth problem which dealt with the problem of obtaining results for 10° viewing conditions from filter colorimeters most of which use 2° observer data. Problems occurred with coloured and fluorescent white samples. The Glasser Cube Root system was used and when a modification was made to the yellow/blue balance the system worked well for white and coloured samples. With fluorescent white papers, there was a shift of colour values towards the red as fluorescence increased. The usual correction to achieve a true X value was to add a proportion of the blue filter reading to the red filter reading. It was found that if the blue reading was reduced to take account of only half the blue fluorescence the results agreed better with visual assessments. Mr. McConnell wondered if these corrections were justified and if the blue portion of the X response curve took account of the fluorescent light or was the response really further into the green. Alternatively, was there a failure of colour theory to give a true picture in this case.

Dr. Hunt was not sure whether the problem was a difference between colorimetry and visual assessments or in the whiteness formula. Mr. McConnell pointed out that the L, a, b system worked well for non-fluorescent white samples but was he justified in "fudging" it for the fluorescent white samples. Mr. Perry recommended that the spectral reflectances should be measured and the chromaticities calculated. Mr. McConnell replied that this had been done and the 10° calculations showed some slight improvement over the 2°. Professor Hunt emphasized that the geometry of illumination in the spectrophotometer should be the same as for the viewing conditions. The question of a "fudge factor" did not dismay Mr. Holmes as he considered this was a device for correcting known errors of measurement. However, such a factor would only apply to the instrument for which it was produced. Professor Wright said that replacement of the blue filter peaking at 440 nm in a Harrison colorimeter by a violet one peaking at 420 nm produced a bigger shift in the chromaticity co-ordinates than the shift from 2° to 10° and that this had helped in one case. Mr. McLaren asked about the control on the visual assessments and Mr. McConnell said that the results were reasonably consistent.

The final problem was posed by *Dr. S.T. Henderson* and *Miss M.B. Halstead.* In their work on the application of the von Kries correction for adaptation to CIE colour rendering indices, it had been found that colours on the purple side of the locus of reference illuminants on the chromaticity diagram had higher indices than those on the green side. Two possible causes for this effect were the location of the Judd P, D, T primaries on the X, Y diagram and the non-uniformity of the 1960 CIE UCS diagram which is used in the calculations. The former explanation had been eliminated by changing the location of the D primary which was the doubtful one but this had little effect on the results. An alternative chromaticity diagram was required and some preliminary calculations had been made using MacAdam's geodesic diagram. This had the severe disadvantage that the conversion equations were very complicated and a method of converting from the geodesic diagram into the u, v or x, y system had not so far been produced. A more disturbing fact was that the lines of correlated colour temperature on the u, v diagram, which are, by definition, orthogonals to the full radiator locus on a uniform chromaticity diagram, were not normal to the locus on the geodesic diagram. Chromaticities located at +20 mpcd on the correlated colour temperature line at 3900 K on the u, v diagram gave correlated colour temperatures of 4400 K and 3500 K on the geodesic diagram. The problems were how to select points equidistant from the reference locus and which chromaticity diagram should be used.

Professor Hunt hoped that a formula as complicated as the geodesic one would never be standardised. The uncertainties were so great that such complication was unnecessary and the CIE was considering modifying the UVW system by expanding the W scale by 50%. Mr. McLaren suggested that a cube root colour difference formula, like the proposal before the CIE, might be used but he was not sure how it could be applied to light sources. Mr. Holmes said that to adopt a particular chromaticity diagram was one thing but to say that particular lines on it represented correlated colour temperature lines assumed a knowledge of the shape of the diagram at any point. He felt it was not unreasonable to postulate that they might not be orthogonals to the full radiator locus. Mr. Pitt felt that complicated equations presented no difficulties to computers and that the reverse conversions could be achieved by tables. "If the conversion was right it would be accepted but was it right? remember it was based on one observer." Dr. Henderson replied that the geodesic diagram was based on fourteen observers but Professor Hunt said that there was a big spread in the new data and he did not believe that the system would be accepted if tables had to be used. He suggested a cube root type of formula would be preferable to others such as ANLAB and Munsell. Dr. Henderson commented that a draw-back of the geodesic system was that it did not contain a luminosity factor. Dr. Clarke concluded the discussion by saying that one should not worry about the complexity of a calculation but he did not regard the CIE colour rendering index as having any great validity.

The meeting, which was a new type of meeting for the Colour Group, was very successful and this was obvious from the large number of people who stayed behind afterwards to continue the discussions.

COLOR INFORMATION CENTER (PARIS)

A meeting was held in January at the Centre d'Information de la Couleur (CIC) to review the AIC Congress held last year at York (Great Britain). Two audio-visual presentations were given on "York et le Yorshire (sic)" by Maurice Déribéré, and "a York, de Toutes les Couleurs" by Pierre Courteville.

M. Rubio-Vergara, director of the center of high studies for Beaux Arts in Madrid, presented a description of the international exposition on color which he is preparing for 1975 in Madrid. One section will be concerned with the esthetics of color photography.

Working committees of the CIC have been concerned with color animation, audio-visuals, and the whitening process. At the January meeting, there was discussion of a possible committee for studying psychological aspects of light and color to solve problems common to the CIE, CIC, and AFE (Madrid). Such a committee was activated to study and produce a report on the subject. Anyone interested may contribute, or inquire by writing M. Déribéré, President of C.I.C., 1 bis, Avenue Séverine, 92400 Courbevoie.

(A communication from the French Color Information Center translated by R. W. Burnham.)

SENSORY CORRESPONDENCES ASSOCIATED WITH THE PERCEPTION OF COLORS

Maurice Déribéré, President of the *Centre Information de la Couleur*, Paris, and Vice President of *Press Scientifique*, recently presented in Paris a review of his own, and other, research done over many years on "correspondances sensorielle".

Using the chameleon as an example, he described the influence of radiation on living beings. In the chameleon the whole body adapts to solar radiation, its manner of positioning itself, inflating itself, its orientation, and its skin color variations, by the play of its specialized chromatocytes. He also gave an account of the work of Benoit on the stimulating action of red on the endocrine glands of the duck.

Sensory interactions exist in man that are often very poorly understood. These interactions are, however, rendered quite reasonable if one reflects on the fact that all sensations, resulting from particular stimuli, are transmitted and interpreted at the level of the cerebral cortex. Such interactions may be deduced from literary fantasies or poetic reconstructions like those found in Rimbaud's celebrated sonnet or the verses of Verlaine, ideas expressed by Father Castel, or musical transcriptions by Scriabine. Musicalistic painters like Blanc-Gatti and Valensi have painted sonorous impressions that even physicists may visualize.

It does not, therefore, seem surprising that some stimuli have resonances on a second sense that correspond (to a first sense). From questions and concomitant observation, it has been possible to establish relationships between sound and color, then between colors and odors or tastes. In a real sense color spectra of olfactory and gustatory sensations have been established.

These relationships are more often affective, and obtained on a basis of intuitive relations, reasoned and psychological rather than "true" physiological syntheses. Thus, an acid taste will more likely be associated with citron (lemon) and, because of this, to yellow or yellow-green. By the same token, a menthol taste implies green, and one will tolerate only poorly a rose-colored menthol which would appear faded and not fresh – even if it has the same "real" taste as a green one which does appear fresh and agreeable.

From these principles one can envisage applications, in the conditioning of certain products, up to a realization of complete environmental control. An example was given of an overheated mechanical work shop where enervating hand work is required of female employees. The unpleasantness can be relieved by attention to illuminating conditions, by the color of the walls (perhaps two tones of blue), sweet music (distributed 10 mn/H) and "quotidian pulverization on green plants in the application of lavendar perfume".

Apparently such attempts have been made in several countries to make things seem more natural, in particular, in France by Madame Duplessis for the blind. Blind persons placed in varying environments may, for 7 out of 10 of them, tell when they are in an illuminated room or not, and may also tell whether the walls are red or blue.

The sense of touch has been sampled and shows singular possibilities in most cases. Examples are given of the judgment of the weight of objects which differ depending on the color of the object. It is also known that a shock may produce a reaction of real color sensations.

(A communication from the French Color Information Center, translated and edited by R. W. Burnham.)

COLOR: THE MIND EXPANDER

Extracted from "Packaging: The Contemporary Media", by Robert G. Neubauer, 208 pp. with 33 color illustrations, 1974, Van Nostrand Reinhold Co., New York. $20.00.

Color Comes First

The psychologist speaks of immediacy *with reference to the human experience of color. "Color rather than shape is more closely related to emotion." Where average persons may be visually exposed for a short period to a simple collection of different shapes (squares, circles, triangles) in different simple colors (red, yellow, blue) there will be far better recall of color than form. Undoubtedly in a package color comes first. Its impression is immediate – and no thought or deliberation are required in the process.*

Having aroused instant response, what feelings, moods, motivations do the colors of the spectrum evoke? Reactions have infinite variety, making color perhaps the most fascinating and vital of all factors in package design. In basic stimulation there may be action in red and calmness in blue – always. Yet as styles, vogues, and fancies change, the red can swing toward flamingo, crimson, vermillion, and still be red, while the blue can be cerulean, ultramarine, sapphire and still be blue.

When the designer picks color, he deals directly with human emotion. He can be capricious or dignified, exciting or boring, as his skill expresses itself. Three notes on a piano can lead to the theme of a ditty or a symphony. So, too, can three colors (or two colors, or one color) lead to a package that can inspire or discourage, sell abundantly or lie dormant. Much depends on good design, on understanding and feeling for color, and on ingenuity, talent and keenness of perception.

Faber Birren

When describing any given package, the color is usually the first adjective used: It's a brown box; a red tube; a green bottle; a gold can. Radio and print ads pick up these descriptions in order to call attention to the package.

Yellow

In a recent article on the use of color in packaging, there was a statement to the effect that yellow is not a strong attention-getter, "probably because of taste preference." If we look at the definitions of the words "attention" and "taste," we can easily refute this observation.

The dictionary defines "attention" as: 1a. The act or state of attending through applying the mind to an object of sense or thought; 1b. A condition of readiness for such attention involving a selective narrowing or focusing of consciousness and receptivity. 2. Observation, consideration with a view to action. As for the definition of "taste": Individual preferences, inclination, critical judgment, discernment or appreciation; manner or aesthetic quality indicative of such discernment or appreciation.

Now isn't attention gotten through surprise, shock, contrast, juxtaposition, and many other factors having to do with the graphic placement of units? Therefore, attention-getting has much less to do with taste than basic emotional responses and recognition.

All the foregoing is meant to emphasize that yellow is indeed a strong attention-getter, whether by itself or in combination with other colors. It is cheerful, vibrant, alive, and almost sure to get strong response. It is easy to find at point of sale and often brightens up a dark corner at point of use.

Orange

One wonders, why was orange such a popular packaging color in the late eighteen-hundreds? Cough drops, gunpowder, snuff, stove polish — all had orange packages. Possibly this color was designed to stand out on a dark shelf. In those days many products had the name of a color as part of their trade name. There were Red Scarlet, Red Line, Blue Ribbon, Blue Line, Orange Rifle Powder, and many more. As for this last product, the container was actually black and even the label was black, so the name is a puzzle. Today we have many products that include a color as part of their name too: Green Giant, White Rose, Blue Bonnet, Red Bow Lentils, Screaming Yellow Zonkers, for example.

Though orange is a very popular color now, it would not be true to call it today's color; no color is. Science has allowed us to print them all brighter, cleaner, and truer, so that they can be used to greatest advantage on packages.

THE PUMPKIN FRATERNITY. Everybody loves a pumpkin — people with or without children. It's a symbol of harvest and also of the Halloween spirit. Pumpkins are a pleasure because of their form and color; also, it's a challenge to take a ride out on the weekend to find exactly the size and shape pumpkin that you want. Relatively few pumpkins are eaten. Most are decorative, grimacing or smiling in the window or just lending a friendly touch of orange to a front step. Orange is a sociable color.

Red

The all-purpose color, red is official, important, commanding. An eye-stopper and car stopper, it appears on most nations' flags. A red cherry sparks up a drink, too.

In the fifties one food-producing client used to say, "Give us any color as long as it's red." This advancing, good-natured, vital color is favored by both the mass market and its sophisticated segment.

One of the three monographs on color published by International Printing Ink in 1935 observes:* "Remember that while genius may work in violent color combinations, those of lesser talent must play safe. Satisfactory results may be achieved if we use colors of low values and weak chroma for our larger areas and contrast the small areas with colors of high value and strong chroma. While this safe rule may not often produce real distinction in the use of color, it will avoid many atrocities."

"Violent color combinations" are no longer unusual in these days. These arresting combinations practically lift the products from the shelf and toward the consumer.

Red is pretty close to the heart!

**Color in Use*, International Printing Ink Monograph No. 3, p. 17.

Purple

The following charming passage is to be found in *Spectacle de la Nature*, published in 1769:**

The purple fish, Purpura. Notwithstanding their rugged and bristly aspect, they are those from which the ancients borrowed their purple color, which was in all likelihood a white liquor that this little fish keeps in a sort of bag, or folded tunicle which it carries on its back and which it shifts immediately, as soon as you offer to take it from the rock on which it crawls and is lost if not catched with a great deal of care. It dyes wool of a very deep red mixed with purple and never changes either by the air or in the washing, but the quantity of this liquor in each of these fishes is so very small that an exceeding great number of them will be only sufficient to dye one piece of stuff, which was the reason of the purples being set at so high a value among the ancients.

The color purple has always been associated with royalty, but now it has become a less exclusive color, and has shown up in such product lines as liquor, dog food, and toiletries. Yet it is still the most expensive color to produce in terms of the materials needed to attain color brilliance and permanence. It also possesses poor resistance to both sunlight and chemicals, so that in a sense it is still a very special regal color.

**C. Davis et al., Vol. 3, London: R. Franklin, p. 152.

Blue

Distance is achieved through using cool colors on the mountains — the warm hues, red, orange and yellow seem closer to the viewer than cool hues.

Robert Henri, circa 1919

Although blueberries and concord grapes are blue, this color has never been considered appetizing. Blue stands for refinement and conservatism, sensitivity and cleanliness; that is apparently why it has been the favorite *background* color for foods and food products for many years. A decorative border of blue is a peerless complement for the depiction of food in the warmest of colors, and generally blue makes a noble backdrop for the outthrusting red, causing it to advance even more through contrast. Because of the association of purity with this color, it is also used in countless packages for soaps, detergents, and cleaners. And, let us not forget, the blue ribbon, which is still the prize in many a competitive event.

Green

Green ads and green packages abound, perhaps because green is the color of hope.

Green, the suburban color that is so closely linked to nature, is also a symbol of victory and safety. It soothes and exhilarates. According to Faber Birren: "Green is a color of wide appeal; cool, fresh and comforting in its beauty. It is a sign of balance and normality. It has the universal appeal of nature."***

The Green Giant, Del Monte green, shamrocks, and emeralds – all these are green. The "go" light speaks of peace and promise. Because it is a secondary color, green is usually better liked by adults than children. Like blue, it creates a good, balanced background for warm, bright hues.

***From *Your Color and Yourself* by Faber Birren, Sandusky, Ohio: Prang Publishing Co., 1952, p. 51.

The previously discussed colors – yellow, orange, red, purple, blue, and green – are the remembered, familiar colors with which we are most concerned in packaging. The experts Luscher, Birren, Ketcham, among others, have written in depth about these colors' psychological effects.

However, in order to produce these colors effectively, a standardized system of color control is used. The four colors involved are yellow, magenta, cyan, and black (or dark blue). These are the colors of the graphic arts and all of the psychological hues in their different subtleties, values, tints, and shades can be obtained from them. It is true that a solid corporate orange, deep green, or deep red cannot be achieved with just these four colors; you would have to use an additional separate color, and in so doing add considerable expense to your budget. With the standard "process" colors you can only hope to get near matches.

Yellow

This color is practically invisible when used as type against a white background. But when yellow is surrounded, outlined, or supported by colors of deeper value, it comes into its own. It's a rare packaging illustration that doesn't require yellow to create appetite appeal and believability. Properly balanced in relation to the other three colors. yellow pulls the other colors together and makes for naturalness in an illustration.

It's rare that a cents-off or feature panel on a package doesn't employ yellow as its eye-catching focus or background. The lightest of the bright colors, it is normally the commonly used "first run" color in full-color process printing. Its light reflectivity is higher than any other color and acts as strong basic support for magenta, cyan, and black. As a field for black or type of other dark colors, it makes for high legibility.

Frequently a client will admit to color blindness: "can't distinguish various reds" or "everything goes brown." Naturally it is important to know about these deficiencies in the beginning of package planning in order to ensure normal color recognition rather than being limited by the client's faulty subjective conditon. The sophisticated mechanisms for color measurement and production analysis that are available to us should not let us forget that color is seen by human eyes, and that the final judgment is ours.

Magenta

Full strength, magenta is a provocative, party pink, but only recently has it been used in its bright pink form. When you add yellow in varying amounts, the color turns red. If it is improperly balanced, magenta will contribute too much "ketchup" in a food illustration, and also make for too ruddy a complexion or hair that is too auburn.

Dress designers, interior decorators, people in cosmetics – all have myriad names for subtle, different shades of red. But when it comes to directing the consumer, the list is relatively short, since dealing in numerous similar shades would only serve to confuse.

Here is a selection of some different shades of red, the color with the long frequency:

Crimson, wine, cerise, cardinal, fuchsia, carmine, magenta, scarlet, Chinese red, beet red, burgundy, rust, maroon, cranberry, barn red, light red, alizarin crimson, dark red, pink, mulberry, hot pink, iris, ruby, flame red, mauve, lake, blood red, scarlet red, rose, brick red, indian red, geranium, auburn, rose madder, cadmium red, fire engine red, heliotrope, garnet, strawberry, Christmas red, raspberry, vermilion, ruddy, tomato, cherry, and carnation.

Properly balanced, magenta supplies the broadest range of eye-provoking colors, igniting both graphics and illustrations.

Cyan

Cyan plays the villain in many four-color process illustrations. Too much blue and the complexion of a face takes on a ghostly appearance. Too little blue and the green valleys in an illustration lose their cool and tranquil aspect. When blue is out of balance, the results can look like a badly tuned color TV picture. Generally, cyan out of balance gives an illustration a muddy look.

Black (Dark Blue, Dark Brown)

The final details and texture of fabrics, metal, leaves, or food are brought into sharp focus with the last color to be printed. All the previous time and preparation that has already gone into the work can just be wasted unless the final touch color is applied carefully and correctly. Any of the last-down colors – such as dark blue, brown, maroon, or deep green – can warm up or cool off a block of essential directional copy and thereby help to continue the mood or atmosphere of a total package as the copy is being read.

Color Coding

The earliest form of color coding can be seen in ice and milk cards. The housewife would place the card in her front window, and make sure that the right amount or the product she wanted was on top; if the milkman or iceman couldn't make out the number or the word from his wagon, he was sure to see the color that stood for them.

Today there is color coding for product identification at all stages of production. In the plant it helps to expedite the production; in shipment, the movement; and in the store and home the selection. Colors identify many things: a flavor, category, size, or even quality level. The six colors – yellow, green, red, orange, blue, and brown – are used for basic coding. But to create mood on less functional products, subtle variations of these colors are used. The latter colors, which were unattainable years ago and thus considered exotic, now, with contemporary graphics, can evoke very personal associations in the consumer's mind.

Certain colors used to be associated with specific types of products, but you can no longer rely today on pink being the color of cosmetics or blue the color of poison. The boundaries are gone, and, more and more, unexpected colors and color combinations are showing up on unexpected products. Once a cosmetic counter was predictably soft, femine, pastel, A man entering upon such an area felt out of place. Things have changed. Today the exact same shades and tints of all colors can be found in all product groups. The colors are, most of them, bright and in full intensity. Infant departments – dainty pink and blue? Look again. Men's departments – brown and gray? Look again. Style and fashion have made us anticipate the colors that go with certain products but they have also opened up new possibilities that, if supported by graphics and good total design, will be accepted.

Corporate Color

If you measure the areas of product exposure in any department of a supermarket, you will see at once the influence of the corporate color of the leaders on private labels and other products.

Although it is unlikely that Campbell's red will ever change to Del Monte's green, or Lavoris's red to Listerine's amber, many switches in graphics, including that of color, could come about and render the color chart on this page obsolete. This is possible, but not very likely.

The swatches approximate, as best as four-color process colors can, these well-known hues.

A group of people in front of a crowded display window will search out as many different things as there are people doing the viewing. A variety of consumer interests and attitudes is brought to bear on all the items displayed. Some viewers will feel a pressing need to buy a given item; some will be more casual. Still others are so blasé that they require their eyes to be caught by an exact, exciting wavelength in order to react. What a bore it would be if we all sought the same thing!

Colors, symbols, words, all combine to reach out to be desired and purchased.

When a designer attempts to establish a distinctive color, he sometimes forgets to think about the exposure and conditions of light under which the package will first be seen and then later used. The store brighter-than-sunlight conditions are generally different from the kitchen, bathroom, bedroom, and game room lighting, and the initial color image should remain the same in spite of lighting differences. Another important consideration is whether the new color (which may very well turn into a corporate color if it succeeds) can be run in combination with other standard process colors or whether an additional separate printing is needed. In the latter case, the extra costs involved, will be an important factor that must be evaluated.

In order to detect blind embossing, you need low angle lighting, for the modeling disappears in brilliant lighting. Unlike annual reports, executive letterheads, and expensive perfumes, packages are rarely studied at very close range and under low, stark lighting, so that subleties such as blind embossing could easily be lost.

FLOOR COVERINGS – COLOR TOP FACTOR IN CONSUMER CHOICES

Color is Number 1 on the consumer's choosing and buying checklist for carpeting, a survey of dealers across the country has determined.

Merchants insist that color beats out price and brand-name, the two important runners up in consumer preference.

Furthermore, the latest Los Angeles Times marketing research report on wall-to-wall carpeting stresses that color is by far the most important factor affecting consumers' selections.

While many dealers rated brand-name second to color in importance, several said they believed brand-name has diminished in importance as a factor influencing selection.

Those merchants who said that price is more important than brand-name argued that consumers cannot spend beyond their means no matter how much they like a particular fabric.

From *Home Furnishings Daily*, Monday, February 25, 1974.

BOOK ANNOUNCEMENT

The Hickethier Color Atlas. Edited and with an introduction by DR. SIEGFRIED ROSCH, Professor (emeritus), University of Giessen, and scientific collaborator, Leitz, Inc. 1,000 color samples on 40 plates in plastic ringbinder, 10½ x 12½, $350 (April).

The first edition of this classic color atlas, published over 20 years ago, generated intense interest and was quickly sold out. It is now being reprinted in very limited quantity. Its color values are so accurately measured that they can be converted into International CIE coordinates or the standards of the DIN color chart. The book's arrangement of colors on removable plates with cutouts is particularly advantageous for practical work.

Van Nostrand – Reinhold Publisher.

(Has anybody ever heard of this atlas? Comments invited. Ed.)

PRINTED MEDIA MAY BE HAZARDOUS TO CHILDREN

Two scientists at the College of Medicine and Dentistry of New Jersey, in Newark, believe that the printed media may contribute to lead poisoning in children. A particular hazard is "the fabrication of spitballs," say Dr. M. M. Joselow and Dr. J. D. Bogden (1). Their ideas are based on spot analyses for lead in printed media (2) collected in the New York City area. The analytical method was a modification of Delves cup-atomic absorption spectrophotometry; it can "easily" detect 10^{-9} gram of lead.

Ingestion of lead-based paint as a result of pica – a craving for nonnutritive material – has drawn most of the attention in childhood lead poisoning. Joselow and Bogden point out, however, that printed media are readily available to children and that they do contain lead. All the newspapers tested contained the element, with the black and white sections running generally between 5 and 35 p.p.m. These relatively low levels, the Newark scientists say, could be due to contamination from lead type or perhaps from lead-containing driers in inks. Much higher levels of lead were detected in almost all colored pages tested among newspapers, Sunday supplements, comics, and large-circulation national magazines. One children's magazine showed concentrations exceeding 4000 p.p.m. The source in colored pages evidently is lead-based pigments.

Certain exceptions turned up, however. One Sunday comic section "obviously" did not use lead-based pigments for colors. This was the case also with professional journals of relatively low circulation.

The significance of the lead in printed media to public health is difficult to assess, Joselow and Bogden say. They could find no reports of lead poisoning attributed to that source. On the other hand, few physicians, nurses, or even mothers suspect such sources and thus are unlikely to specify them, the investigators point out.

The two scientists are particularly concerned about spitballs. A moderately effective spitball, they say, could be made from 25 square centimeters of almost all the papers tested. Such a missile would weigh about 140 mg. (anhydrous). And if made from colored paper, especially green, red, or yellow, it could easily contain more than 100 micrograms of lead which could be leached out with saliva or ingested in shredded paper. If only part of the lead entered the system in that way, the manufacture of just a few spitballs could mean a lead intake of more than 300 micrograms, which has been proposed as the maximum daily intake from all sources for children. This would be on top of an assumed daily unavoidable intake of 100 to 200 micrograms from sources like food, water, and air.

(1) *American Journal of Public Health*, 64, 238 (1974).

(2) Including C&EN for Sept. 11, 1972, whose lead content was 50 p.p.m. in pages with blue color, 100 p.p.m. for green and yellow, and 150 p.p.m. for red.

by K. M. Reese

From C&EN, March 25, 1974.

PRODUCTS AND SERVICES

Color Aptitude Test Kits available through Education Council

A Color Aptitude Test Kit, to assist employing printers in selecting qualified personnel, is again being made available to the industry by the Education Council of the Graphics Arts Industry, Inc., an affiliate of the Graphic Arts Technical Foundation, Pittsburgh, Pa. The kits may now be ordered through that Council.

The Kit is composed of two tests: the basic color blindness test, and a color matching test consisting of plastic chips which must be matched with an easel of chips, resulting in an evaluation of color strengths and weaknesses.

The ability to match colors is said by some (but not by others) to be inherent in an individual and can be improved only a slight degree with training and experience. In addition, many individuals can detect shades, tones, and tints more easily in one color than they can in another. Color matching is further complicated by the fact that no two individuals have any assurance that they are receiving the same mental impression when they view the same color situation.

The color aptitude test used by the Education Council in its studies of persons employed in the printing industry was developed by the Color Aptitude Test Problems Subcommittee of the Inter-Society Color Council. It was first released in 1944 and has since been revised several times. The Education Council recommends that (1) all applicants for a printing plant job which may involve color matching skill, (2) all personnel presently involved in color matching, and (3) all customers who regularly make color-matching decisions be encouraged to take the color aptitude test to determine the extent to which they actually possess color matching aptitude and abilities.

Color Aptitude Test Kits can be purchased by GATC members for \$260; and by non-members for \$360. The Kits may also be rented (members–\$35 and non-members –\$70). For further information, contact The Education Council, Graphic Arts Technical Center, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

GATF 1973 Research Report

The 1973 GATF Annual Research Department Report is now available.

The 1973 Report contains 21 detailed reports covering 24 separate projects pursued by Department staff during the past year.

Among other things, color is dealt with in reports on 'A Systems Analysis of Color Reproduction,' and 'The Munsell-Foss Color Chart'.

Those interested in obtaining a copy of the 1974 Report should contact the Research Department, Graphic Arts Technical Foundation, 4615 Forbes Avenue, Pittsburgh, Pa. 15213.

GATF Publishes Course Outlines

Course Outlines for curriculum development in nine areas of graphic arts education have been prepared by the Graphic Arts Technical Foundation, Pittsburgh, Pa.

The outlines are designed for teachers, in-plant instructors, training directors, or anyone concerned with graphic arts education programs. Prepared under the direction of Dr. George M. Halpern, Voorhis Technical School, New York, N. Y., from extensive trade analyses of major areas of work, the outlines cover: Line Photography, Halftone Photography, Color Separation Photography, Tone and Color Correcting, Offset Lithographic Stripping, Platemaking for Offset Lithography, and Web Offset Pressmanship.

The outlines, ranging from 20 pages to 61 pages, are available at $4.00 (complete set of nine outlines for $30.00) for GATF members, $8.00 each for non-members.

For further information on the Course Outlines contact: Order Department Graphic Arts Technical Foundation, 4615 Forbes, Pittsburgh, Pa. 15213.

Munsell Color has New Catalog

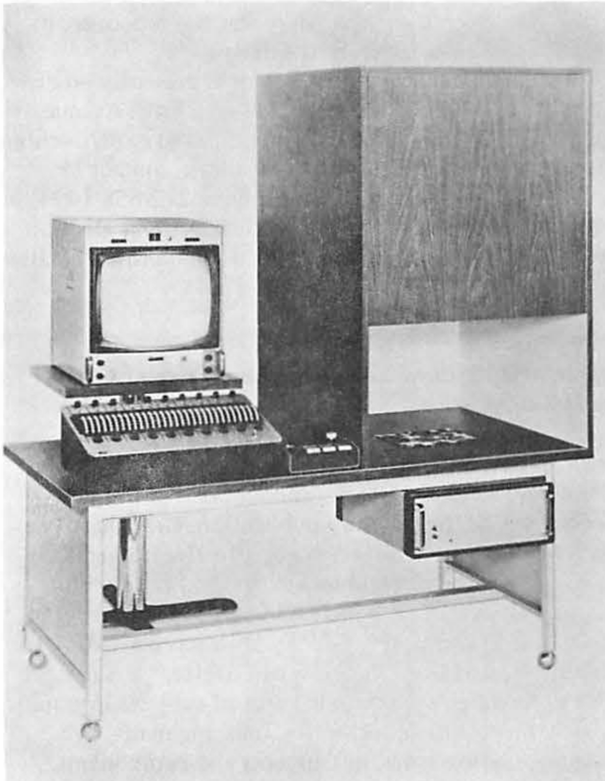
Munsell Color Products has published a new catalog that incorporates not only its product line but also includes informative notations on many aspects of color standards and concepts.

For example, the new catalog gives an historical perspective on the development and current status of color standards. Additionally, a full explanation of the Munsell system of color notation is given in the text, along with easy-to-read illustrations.

A working knowledge of this system is important in many fields. The development and specification of color designs and communication of color information between sales, engineering and production departments are facilitated by reference to the Munsell system. Many governments have made the system a "standard", along with various agricultural agencies.

Munsell Color Products, part of the MACBETH COLOR & PHOTOMETRY DIVISION of Kollmorgen Corp., is offering the 4-color, 16-page catalog and price list through its sales representatives or through: Dr. J. Davidson, Munsell Color, 2441 N. Calvert St., Baltimore, Md. 21218.

DIANO Graficolor System "Renders" Color Artwork Electronically



Working from a single piece of monochromatic master artwork consisting of black, grays, and white, an almost limitless number of color variations can be created, displayed and preserved photographically using the new DIANO Graficolor 904 Color Simulator.

The Graficolor 904 is creating a great deal of interest and excitement with leading photographers, advertising agencies, and design studios as they discover how easy it is to experiment with and achieve exotic color effects in the preparation of package and textile designs, advertising layouts, and other creative artwork.

In addition to "rendering" design artwork in any combination of colors, Graficolor may be used to add special color effects to black and white photographs or virtually any graphic image, line or full tone. Graficolor is expected to find a wide variety of applications in all areas of the graphic arts.

Graficolor is already producing significant time and cost savings in the textile industry while demonstrating design flexibility heretofore impossible. Textile producers are now able to view instant variations of their basic patterns, reject those without sufficient visual appeal and photographically record acceptable combinations.

Additional production cost savings and control of color fidelity in finished goods is provided by the "formulizing" capability of the Graficolor. Since all colors programmed into a "simulation" are numerically identified, they may be keyed to any set of dyes or pigments to achieve rapid translation of designs to any reproduction process.

Essentially a closed circuit TV system with a series of ten programmable channels, the Graficolor completely eliminates the need for time consuming, expensive artist's renderings previously required to see how a design would look in various color combinations.

To use the Graficolor system, a design is first rendered by mechanically separating the image into as many as ten different flat gray values ranging from black to whites. This monochromatic master artwork is then viewed and projected by the Graficolor TV system. The operator or designer, using a keyboard, then enters a color choice to replace each gray value. When an acceptable combination is achieved, the numeric designation of each color is recorded and a specially equipped 35mm camera is used to film the image in color. The operator may then repeat the procedure to "create" another variation of the design.

A working model of the Graficolor is presently on display at the DIANO offices located at 685 Fifth Avenue, New York, New York. For information as to experimenting with your designs on the Graficolor, please contact Mr. Charles Saleski at this address (telephone 212-838-1494) or Mr. Wesley Coppock at DIANO Optical Systems Division Headquarters, 75 Forbes Blvd., P.O. 346, Mansfield, Massachusetts 02048 (telephone 617-339-3701).

Graphic Arts Research Center Increases Price of Graphic Arts Patent Abstracts

The Graphic Arts Research Center, Rochester Institute of Technology, Rochester, N.Y., announces that the subscription rate to the monthly publication, Graphic Arts Patent Abstracts, will be increased, effective immediately.

Reasons for the increase include general production costs, as well as the sharp increase in cost of source information used in composing GAPA. Abstracts for GAPA are carefully selected from the 'official Gazette," U.S. Patent Office to include a well-rounded area of subjects in graphic arts including printing, substrates, inks, pigments, dyes, packaging, photography, instruments and components.

GAPA is an efficient approach for being aware of future competitive products and systems. Companies developing new ideas do not pass out proprietary information, yet the technology is disclosed in this kind of patent literature.

The new subscription rate to Graphic Arts Patent Abstracts is $84 per year. Additional subscriptions sent to the same address and having a common invoicing are available at $56 per subscription per year. For a sample copy, send $2.00 for postage and handling fees. Write to Graphic Arts Patent Abstracts, Graphic Arts Research Center, Rochester Institute of Technology, One Memorial Drive, Rochester, N.Y. 14623.

Color Seminar for Pressmen

The Graphic Arts Research Center at RIT will conduct a three-day Color Seminar for Pressmen on June 26-28.

This color program is designed especially for pressmen who want to obtain the best possible printed results from a given set of color plates under shop conditions. In contrast to other GARC seminars, the Color Seminar for Pressmen emphasizes color control in the pressroom rather than the production of color separations and plates.

For more information, contact William Siegfried, Training Director, GARC, Rochester Institute of Technology, One Lomb Memorial Drive, Rochester, New York, 14623. Phone: (716) 464-2758.

Munsell Names Davidson General Manager of Color Products

Dr. James G. Davidson has been named General Manager of Munsell Color Products, producers of visual color standards.

In his new position he will be in charge of all business operations of Munsell Color Products, part of the MACBETH COLOR AND PHOTOMETRY DIVISION of Kollmorgen Corp. Additionally, Davidson will be responsible for new product developments and expansion of the consulting services, responding to an increasing need for industrial color standards.

Davidson, former manager of the Color Systems Technical Center in Charlotte, N.C., received his Ph.D. from Rensselaer Polytechnical Institute. He is a member of the Inter-Society Color Council, American Chemical Society, Association of Textile Chemists and Colorists, Society of Plastic Engineers and the New York Society of Paint Technology.

He can be reached at Munsell Color Products, 2441 North Calvert St., Baltimore, Md., 21218.

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NOTE:

The Council promotes color education by its association with the Cooper-Hewitt Museum. It recommends that intended gifts of historical significance, past or present, related to the artistic or scientific usage of color be brought to the attention of Christian Rohlfing, Cooper-Hewitt Museum, 9 East 90th Street, New York, New York 10028.