PSYCHOLOGY

Color-Blindness Test

Representatives of 13 Technical Groups Evolve New Measure Consisting of Matching Metal Chips

By EMILY C. DAVIS

A NEW and foolproof test for color-blindness, which consists of matching color chips, is one of America's latest scientific achievements, valuable to national defense and generally useful, besides.

"Are you color-blind?" is an important question these days. Important to know about prospective soldiers. Important for drivers of all kinds of motor vehicles, for railroad engineers, for many others who may be expected to read color signals with ease and speed.

No less than 5 per cent. and possibly as many as 10 per cent. of the men in the world are color-blind. So the estimates run. No census has ever counted all the men who confuse red and green, or have other difficulties in seeing or distinguishing rainbow hues.

Taking the lowest estimates, 50,000 men in a million have some form of this hereditary visual condition. Women transmit the trait, but are rarely affected.

America's new color-blindness test shows in less than two minutes whether an individual has any serious defect of color vision. So Miss Dorothy Nickerson, secretary of the Inter-Society Color Council, explained in an interview.

Special Committee Formed

A committee appointed by the Inter-Society Color Council, under the co-chairmanship of Dr. Forrest L. Dimmick, head of the Psychology Department at Hobart College, and Carl E. Foss, color consultant, of New York City, has devised the new test, and has already produced some sets for experimental use. The test is not yet standardized or marketed.

Taking the test, an individual is shown a row of about a dozen attractively colored chips of enameled metal. They are lined up on a neutral background. One at a time, from a matching set, chips are handed to the person taking the test. He must place each one below the chip that it seems to match.

Matching these small squares of color, a color-blind individual makes mistakes, and the mistakes are quite unlike those of the person with normal color vision, who might peer closely and choose cautiously before placing a chip below the very best match. The color-blind individual may decide to place a medium gray chip below a purple chip, because the tones look the same to him.

"Every school child," said Miss Nickerson, "could be easily tested for color-blindness, if the test becomes the accepted standard."

Nothing to Hide

Scientists who have studied this condition feel that color-blindness is not a thing to hide, or to be depressed about. A color-blind person cannot expect to do certain kinds of work. But every one has personal handicaps and limitations. The worry and waste that color-blindness generally causes are due to not finding out about it, and adjusting to it.

What sort of waste and worry?

"Well," Miss Nickerson answered, "young men have been known to enter surgical training without knowing until then that they were color-blind. In surgery, color vision is sometimes very important. Color of blood, for instance, changes as ether is administered, and the blood by its changing color may give a warning signal, calling for quick action by the surgeon. A young doctor with a defect in color vision would not be nearly so handicapped in general medicine.

"And there was waste in the case of a young man who decided to be an auditor. At school, he realized that he could not tell red entries from black, and began to worry for fear he had chosen a career that he could not follow. The school, perhaps unfamiliar with color-blindness, reassured him. Red ink was not so widely used, any more. He would get along all right.

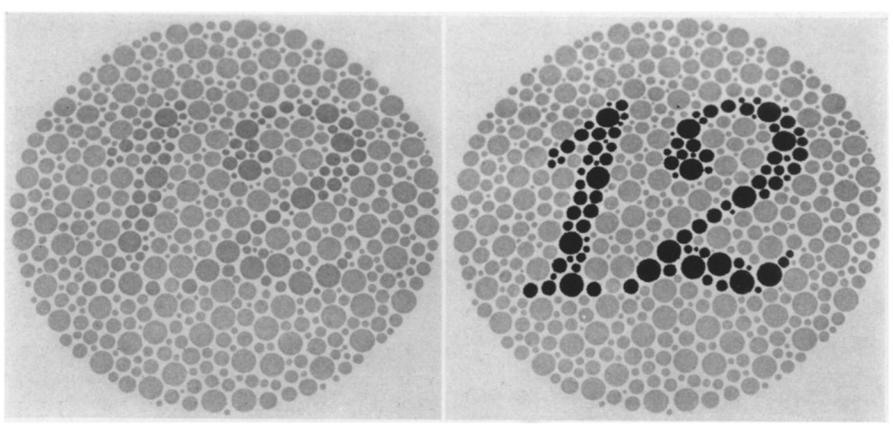
"But entering business, this color-blind young auditor did have difficulties, encountering red ink problems. He might have been happier and more successful in another commercial line, which had no color signals."

The U. S. Army and Navy are taking strict account of color vision in testing recruits, and the new test is likely to be very helpful to them.

Barred From Navy

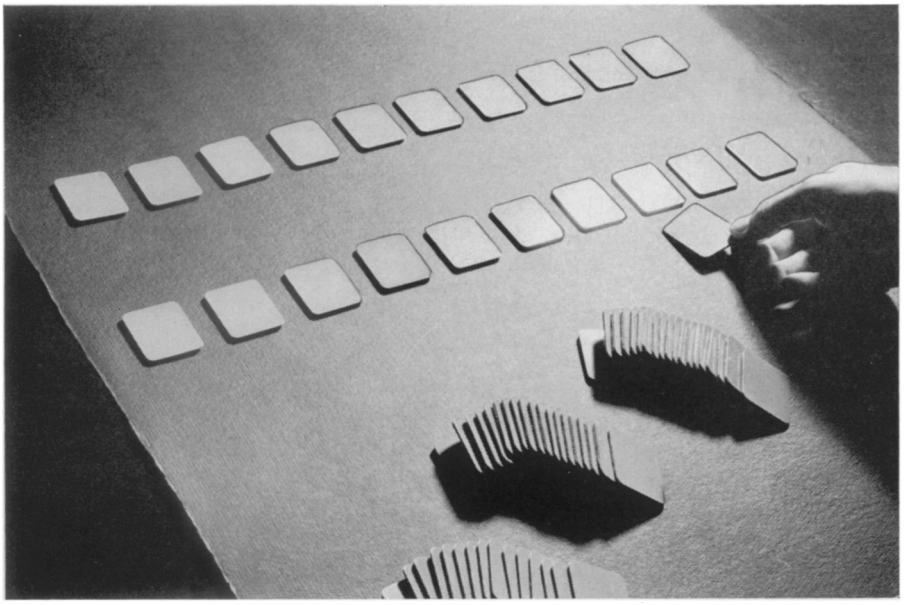
The U. S. Navy takes no recruit who cannot distinguish primary colors. Aboard ship, explains the recruiting service, a man must take his turn standing watch, and inability to distinguish red lights from green—one common form of color-blindness—is too great a handicap for a sailor or officer.

The Army, while equally insistent on knowing whether a prospective recruit or selective service man has any form of color-blindness, does not bar a



MOSAIC TEST

You have heard that color-blind air observers detect certain kinds of camouflage. A normal observer using a color filter might do the same trick. The "color-blind" camera shows what happens: A red 12 on bluish-gray ground of the same lightness is hidden when photographed with a common type of film. Through a green filter the red 12 looks dark. A red filter, on the other hand, would show it light. This is a card from one of the older type of mosaic tests.



NEW COLOR-BLINDNESS TEST

Matching color chips, a person with defective vision makes mistakes that a normal person would never make. A minute and a few chips test color-blindness. With 40 chips and more time, the test measures color aptitude.

man for this cause alone. At one time, color-blindness did bar Army recruits. Now, the Army steers such men away from signal work or other duties that require normal color sight, but only for Army commissions or for the flying cadets is color-blindness a disqualifying condition.

That color-blind flying observers might render special service spotting camouflaged objects hidden from normal sight is a war story going the rounds. They might, agreed Miss Nickerson, when asked about it. But—a properly selected color filter of glass would enable an observer with normal vision to do about the same thing. And—the person with normal vision would not be handicapped in other color-sighting situations, as the color-blind might.

Other Tests Tried

The Army, Navy, and other organizations that consider color vision important enough to warrant giving tests, have investigated and relied on a variety of devices. Matching worsteds is one test. A number of tests, such as the Ishihara and Stillings, resemble mosaic patterns of dots. In these, round or pebble-like dots form a pattern of subtly arranged colors, so planned that in each there is a numeral, letter or simple design hidden more or less, or in plain view, according to the color vision of the beholder. These mosaic tests have gained considerable fame in recent years, as a scientific attempt to detect kinds and degrees of defect in color vision.

But of all the tests available, none is rated quite satisfactory for quickly and surely identifying color-blind conditions.

Worsteds Fade

"Worsted samples get soiled from handling or fade," explained Miss Nickerson. "A person with normal color vision may even be too good for this test. He may see that a faded sample is different from a fresher one, and make the mistake of rating the two different, when they should be the same."

And the well-known mosaic tests are not foolproof. It is no secret that these tests can be learned by ill-advised people so bent on concealing color-blindness, or faking it, that they will practise up with coaching, to pass or fail.

"It is very poor judgment to attempt such faking," declared Miss Nickerson, "because if color-blindness is important in a line of work, each person presumed to have normal vision will be relied on to recognize color, as in responding to signals. Sooner or later, a concealed color handicap is bound to be revealed, and it is sheer luck if no damage has been done."

From Russia, Germany, and Japan, mainly, have come these dot design tests for color-blindness. Since they have been a mainstay for testing this condition, there has been apprehension lest foreign supplies of these tests would be cut off. American publishers rising to the occasion have begun turning out similar tests as best they can.

Color experts cautiously point out that it is very difficult to duplicate technically the colors used in such tests. Two charts may look alike on casual inspection, and yet one will differ from the other in a far more important fundamental way. Explained in terms of color science, certain inks absorb and reflect light of given wavelength differently. In one light two blues match. In another light they do not—as every woman shopper who ever tried to match a sample well knows.

American color experts, who have hoped for a better sort of test, believe that the new American invention solves the problem. And, curiously enough, it is a by-product of a much harder achievement in color research.

Need for Aptitude Test

For it was a plea for a color aptitude test that led to the evolution of the color-chip test. A manufacturer of textiles went to consult an eye specialist. He asked whether the physician knew any way of picking out an employee who would be good at detecting color differences in fabrics. The eye specialist said that was a problem for the Inter-Society Color Council, and no easy problem, either. The problem was put up to the Council, and Dr. Deane B. Judd, chairman of the Council, named a committee to tackle it. The committee consists at present of more than a dozen members who represent all types of interest in such a test; physicists, psychologists, and physiologists; representatives of college laboratories, and of military and industrial groups.

Within a year, a method for solving the problem has been found, which is something of a speed record for a task of this sort. And along with it, has come the color-blindness test, which has a far more popular usefulness.

The Inter-Society Color Council, as its name suggests, is made up of specialists in color research who represent 13 national scientific and technical groups, in addition to many members who join as individuals. It is—or was until recently—a unique scientific body, bringing together experts who know color from every angle. To study a color problem, the Council may put together a psychologist, physicist, paint technologist, and lighting engineer. The Council is no longer (*Turn to page 398*)

CHEMISTRY

New Glare-Eliminating Screen 99.99 Per Cent Efficient

Made of Invisible, Submicroscopic Molecules That Line Up Light Waves to Vibrate in Same Direction

A NEW type of glare-eliminating screen for automobiles and other purposes, claimed to be 99.99% efficient, was recently patented by Edwin H. Land, scientist-president of the Polaroid Corporation. It is the first to use invisible, submicroscopic molecules instead of crystals to line up light waves so that they all vibrate in the same direction, and can be partly or wholly cut off by another sheet of the same material set at an angle to the first. It is also the first to be made of wholly synthetic materials, all obtainable in the United States, so that no imaginable accident of war and blockade can cut us off from the supply.

Previous polarizers, used in sun glasses, lamps, etc., have employed minute crystals (usually of quinine) embedded in a plastic sheet. The new one, known as Type H, uses one of the new synthetic, rubber-like plastics known as polyvinyl alcohol. This is stretched out from three to eight times its original length, which gets its molecules all parallel with each other; then it is exposed to an iodine solution, which renders the molecules able to filter the light into all-one-way (polarized) waves.

Use of polarizing sheets as headlight glare eliminators has been contemplated for a considerable time. If the headlights are screened at an angle of 45 degrees so that they will send out only polarized light waves, and if the driver uses a similar screen on his windshield, the blinding glare of oncoming headlights is eliminated. The new kind of Polaroid promises to bring headlights and eye-screens of this kind closer to realization.

The new Type H Polaroid is said to transmit a third more light than earlier types of polarizing sheets, and yet when two sheets are turned at right angles to each other practically no light at all gets through. In tests with the sheets turned completely at right angles, a hundred-watt lamp behind them became completely invisible.

Almost perfect freedom from color, together with high efficiency and polarizing power, are expected to make the new sheeting especially suitable for scientific and military optical instruments, camera filters for color photography, projection of three-dimensional pictures without color distortion, glareless illumination for stores, desks and art galleries, and for other purposes.

The materials used in the wholly synthetic polarizing sheeting are coke, lime, air, water and iodine.

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unique, because, in the midst of blitzkriegs, British scientists under the sponsorship of the National Physical Society, have succeeded this very year in forming a similar color group in England. That such an organization should be considered worth starting in wartime, and should schedule its meetings ahead, is significant. It indicates the importance which scientists attached to color research problems.

For testing color aptitude, the committee of American scientists has evolved several series of 40 color chips. The first two of these series are graded in such delicately progressive steps from a middle gray to a yellowish red and from gray to a purplish red, that it takes superior color vision to place a duplicate chip below the one chip in the series that it does perfectly match.

Producing these chips called for high technical skill, since the gradations are very uniform, as tested by spectrophotometric measurement. The chips in a series are all of the same brightness, differing only in degree of color.

For workers who test fabrics, or deal in color differences of cotton fiber—which is Miss Nickerson's line of color research in the U. S. Department of Agriculture—it is important to have ability to detect fine color differences.

No one who has tried thus far has achieved 100 percent. success in matching all chips. Among the most skillful have been scientists from the National Bureau of Standards, who have been among the individuals who have taken the test experimentally.

By giving the test to many people, the committee is now standardizing it, that is, finding out accurately what rating an individual should make to be considered excellent, good, poor, at discriminating color differences. When thus scaled, the test will be ready for use.

The color-blindness test, which the Council calls a by-product, consists of certain chips from a series, producing a simplified problem for a tested person to solve. With these chips, color-blindness can be detected in a minute. But finding out how much aptitude an individual has for color discrimination may be a chip-matching problem of an hour, or even longer.

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RADIO

'Radio Wave Sprinkler' Aids Forest Fire Fighters

A "RADIO wave sprinkler" will be used to aid fire-fighting crews in National Forests this summer. It is an automatic relay station that picks up radio waves from one point, and transmits them to another, using an automatic relay of portable size which is operated by batteries. Thus it permits the short-range, light-weight radios developed for parachute fire-fighters last spring to communicate with headquarters, even at relatively long distances. (*U. S. Forest Service.*)

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