Correspondence.

COLOR BLINDNESS.

To the Editor of the SCIENTIFIC AMERICAN:

May I call attention to a sentence from the article on Color Blindness in your issue of August 15, as bearing on some work done by me in the course of my color investigation? The sentence is as follows: "When you see that stream of red in the sky, what does he see at the same place? Something beautiful, no doubt, something he calls red as well as you. But is his red your red?"

You further say: "These are questions which cannot be answered now, and perhaps science may never be able to do so."

The difficulty which has hitherto blocked the way has been the want of a mechanical standard color scale correlatable to color sensations in such a way that the sensation can be recorded in terms of common understanding.

The difficulty is now entirely solved by means of a series of graded colored glass standards, which are made mechanical by being brought into color accord with such physical color constants as definite percentages of given thicknesses of potassium bichromate, potassium permanganate, copper sulphate, etc. Two feet of distilled water is suitable for the very light shades.

It follows that when one gives a name to the sensation excited and matched by a given standard, it is at once comparable with the name and value of the standard itself, which has been already correlated to a physical color constant, and can be recovered by its means.

The method of applying this system of defining a color sensation to the quantitative measurement of color blindness can be best illustrated by actual examples. The following five have been selected as typical from twenty-eight cases tested in my own laboratory:

EXAMPLES OF FIVE QUANTITATIVE MEASUREMENTS OF COLOR BLINDNESS.

	Units of Color Depth	Red.	Orange.	Yellow.	Green.	Blue.	Violet.	Neutral Tint.
To A vision.	1	White.	White.	White.	Dirty White.	Quite White.	Might be Blue or Red.	Dirty.
	5	Red or Blue, not a Yellow.	Might be Red, Green or Brown.	Think it Green or Yellow.	Very little depth at all.	Blue because like the sky.	Blue or Red.	Light Brown.
	10	Pink, don't know.	Brown or Green.	Green or Yellow.	Brown or Yellow.	Blue or Purple.	Blue or Lake.	Gray or Light Black.
	15	Think a Pink, a shade darker than pure White.	Yellow, Green or Brown.	Green or Yellow.	Brown.	Blue or Purple.	Blue or Purple.	Deep Red.
	20	Dirty, no color.	Red, Green or Yellow.	Green or Yellow.	Brown, might be Green	Blue or Purple.	Blue or Purple.	Black.
B vision.	1	Yellowish.	Yellowish tinge.	Yellow.	Cannot name.	No color.	No color.	...
	5	Yellowish.	Yellow.	Bright Yellow.	Yellowish or Bluish.	Blue.	Blue.	...
	10	Bluish.	Deep Yellow.	Deep Yellow.	Greenish	Blue.	Blue.	...
	15	Bluish.	Deep Yellow.	Deep Yellow.	Greenish, anything.	Blue.	Blue.	...
	20	Dim Blue.	Deep Yellow.	Deep Yellow.	Greenish.	Blue	Blue.	...
C.	1	Red.	Orange.	Light Yellow.	Green	Blue.	Violet.	...
	5	Reddish.	Yellow Green.	Light Yellow.	Reddish.	Blue.	Blue.	...
	10	Light Red.	Yellow Green.	Yellow.	Red.	Light Blue.	Deep Violet.	...
	15	Confused Gray.	Orange Green.	Yellow.	Confused Red.	Blue.	Deep Violet.	...
	20	Gray.	Orange Red.	Yellow.	Confused Green.	Blue.	Deep Violet.	...
D	1	Light Red	So-called Red.	Really Red.	Really Red.	Light Blue.	Bluish with tinge of Red.	...
	5	Red.	Reddish Orange.	Orange	Really Red.	Blue.	Blue.	...
	10	Reddish Blue.	Really Red.	Yellow tinge of Orange.	Red.	Blue.	Blue, unmistakably.	...
	15	Red.	Red, mere Orange.	Red or Yellow.	So-called Red, might be Green.	Blue.	Very Dark Blue.	...
	20	So-called Red deep color.	Yellowish.	Pure Orange.	Red	Dark Blue.	Blue.	...
E.	1	Pink.	Green.	Green or Orange.	Pink.	Pink.	Blue.	...
	5	Blue or Pink.	Green.	Yellow.	Red.	Blue.	Blue.	...
	10	Blue or Pink.	Dark Red.	Yellow.	Yellow and Dark perhaps Blue.	Blue.	Blue.	...
	15	Green.	Dark Yellow, or Green or, Red.	Yellow.	Orange or Green.	Blue.	Dark Blue.	...
	20	Deep Red with Blue in it.	Orange.	Yellow.	Dark Red.	Dark Blue.	Very Dark Blue.	...

The standards are selections from my color scales, and the intensities used by me are of 1, 5, 10, 15, and 20 unit values in the six spectrum colors—red, orange, yellow, green, blue, and violet. These color depths range from a very light to the darkest shade. The color names on the table are of medium depth (about 10 units). The exact language used by the examinee in describing the colors submitted has been written in full as being of suggestive value.

The apparatus consists of a frame with six windows, which can be filled with the color standards, either single, together, or in contrast at the will of the examiner. They should, however, never be submitted in their order of rotation.

The number of examples is insufficient for a scheme of classification, but admits a preliminary division into three classes, viz., normal, abnormal, and color blind.

The normal and color blind need no comment; they speak for themselves. The abnormal is here of two varieties; first, those having a faint perception, such as B for green, and D for red; second, those who cannot distinguish between two colors, but are normal for one of them, such as B for yellow and the whole five for blue and violet. I am now at work on a plan of determining which is the true sensation.

Referring to your sunset method of illustration, the sunset reds or the color of any other meteorological phenomenon can be measured, recorded, and reproduced.

It is evident that the value of this method depends on the true division of the color scales, and the correlation of their unit values to physical color constants, which enables their verification in any laboratory. In support of this, the international juries of the St. Louis Exposition in 1904 awarded a silver medal for the scales, and two bronze medals, one for pathological and the other for chemical research. They are also in use in over one thousand laboratories without their accuracy being questioned.

JOSEPH W. LOVIBOND.

The Color Laboratories, Salisbury, England.

FIRE-CONTROL MASTS.

To the Editor of the SCIENTIFIC AMERICAN:

In reading naval articles in the SCIENTIFIC AMERICAN and other papers, I notice a general satisfaction and pride over the fact that the United States has stolen a march on the other powers with respect to the new spiral tubular masts for fire control, which we are about to place on all of our ships both in commission and building.

No one denies that the day of the heavy military mast with fighting tops is past, and that in the future the masts of warships are to be only for the purpose of signaling, and perhaps for the fire-control station. Also this spiral tubular basket mast, which was so thoroughly tested under fire on the monitor "Florida" (now "Tallahassee") is conceded to be a success by naval officers. But before we rush blindly ahead, and place a lot of these lattice affairs on our ships, why not question the policy of other powers? England has been using a tripod mast on her new ships, beginning with the "Dreadnought," for two years. This type of mast, with one vertical and two slanting steel tubes, appeared, with differences as to height, on the old Peruvian battleship "Huascar." Now the British naval constructors have doomed the tripod mast, the last ship carrying it being the cruiser-battleship "Indomitable." The masts now in use will not be removed, but on all future vessels there will be only a couple of pole masts for the signals and wireless. I have not heard what type is to be placed on the German, Brazilian, and French "Dreadnoughts," but Italy is to have only the pole mast, and even the Japanese battleships "Aki" and "Satsuma" are equipped with two of this type.

Now the question arises, Where is the control station to be located? The vessels must have a central fire-control station; and although I have heard nothing about this important point, I think it likely that a bridge will be erected running breadthwise between the funnels or at any commanding point on the superstructure. This will, I think, serve as a station even better than a mast; for while it will command the whole horizon without interference, and be high enough above the water, owing to the greater freeboard of future ships, it will not be subjected to such heavy fire, or be in danger of being destroyed, as it would if located on a mast of any kind. What, then, is the use of the United States spending so much money over this new mast, when other nations are getting the same results with a safer and cheaper type? The time to check this is now; not after the masts are built. It is as foolish as the act which authorized the "Mississippi" and "Idaho," obsolete before launching, a clean waste of over $12,000,000, and now these two ships are to be the first to receive this latticework mast. Better leave bad enough alone, and let the military masts stand, than put up this expensive basket mast. We ought to place pole masts on all of our new ships, and on old ones too if any tearing down is to be done; and I would certainly like to know the reason for this spiral mast policy and the disadvantages, if there are any, of the British and Japanese type.

Masts, like all top hamper, are at their best undesirable, but until a method is discovered of placing the wireless and fire-control range finders under cover while still commanding the entire horizon, the pole mast and, as I think, probable midship bridge of the British "St. Vincent" are infinitely superior to the large, costly, spiral-tubular masts of the American "Delaware."

HAROLD M. KENNARD.

Brooklyn, N. Y., October 5, 1908.

[We do not agree with our correspondent in his statement that a bridge amidships would afford a better location for the fire-control platform than an open-work mast of the kind used in the "Florida" tests. In the long-range fighting of the future, the gunners will aim as near as possible at the center of the ship, where our correspondent proposes to place the bridge. The lattice mast would stand more hits before being wrecked than a bridge built upon the superstructure. One shell might wreck a pole mast; it would take several to bring down a lattice mast. —ED.]

CURIOUS FACTS ABOUT NUMBERS.

To the Editor of the SCIENTIFIC AMERICAN:

In an article which appeared in the SCIENTIFIC AMERICAN, March 28, 1908, page 222, under the heading "Curious Facts About Numbers," quite an importance was attached to the fact that any cube may be expressed as the difference between two squares.

In two particulars the teaching (by inference) seems to be misleading, first, in that the article would almost certainly lead to the conclusion that this is a property of numbers which is peculiar to cubes only. This is not so stated, but seems to be implied. The fact is that any number (or all numbers) can be expressed by the difference between two squares,

$$\text{as } 129 = 23^2 - 20^2$$
$$132 = 34^2 - 32^2$$

Second, it is misleading in that the conclusion is almost inevitable that the pair of squares indicated by the formula is the only pair whose difference is the cube desired. The truth is that most cubes, and in fact nearly all numbers, can be expressed in this way, by any one of several pairs of squares,

$$\text{as } 129^3 = 1073345^2 - 1073344^2$$
$$129^3 = 24983^2 - 24940^2$$
$$129^3 = 8385^2 - 8256^2$$

The explanation of the fact that any number is the difference between two squares, is so simple that it would seem to be almost useless to give the proof. Probably you are acquainted with the fact.

In the article referred to, at the conclusion of the argument, you state that $129^3 = 16770^2 - 16512^2$. This is an error probably caused by failure to follow all the steps indicated in the formula. It should read $129^3 = 8385^2 - 8256^2$.

FRANK NEWCOMB.

Beeville, Texas, September 21, 1908.

Remarkable changes have occurred in Morehouse's comet. The tail has become greatly condensed. On October 1 the comet was faint and without a tail. Yet on September 30 and October 2 it was distinctly visible. On the later date the tail was broad, fan-shaped on one side, with three shorter tails below it.