THE RELATION BETWEEN SOUND

AND COLOR

AMERICAN FOUNDATION
FOR THE BLIND INC.

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"THE MYSTERY OF COLORED HEARING" is the title given by E. Fromaigeot to a summary of recent scientific work on this subject, contributed to *Comœdia* (Paris). Our knowledge of it in the past has been limited to occasional anecdotes of persons who associated color with musical tone, and to experiments in accompanying musical performances with varicolored lights or in displaying such lights and patterns by themselves, without tonal accompaniment. Now the artists and the scientists have decided to do a little team-work, and the first conference of a society for investigating the laws of this curious duality of sense-impressions has been held in Germany. Writes Mr. Fromaigeot:

"New investigations begun in Germany on the relation between sound and color tend to class this problem as a scientific and artistic question worth attention.

"Up to the present time, some of those who have studied it, following the Newtonian theory in a purely scientific way, have attempted to work out an absolute concordance of the two senses without bothering about artistic values; while others, trusting entirely to intuition, have done purely subjective work, without trying to base it on any scientific theory.

"The most recent case of the latter class is that of Scriabin, the Russian musical composer. The genius of this man realized what could be done with the two arts combined. But he saw in this dual art only a first attempt leading to a single and universal art that should satisfy all the senses at once. All the arts represented for him only a means for bringing on what he called 'extasy'; and their use was justified if it succeeded in approaching this final goal. Not for an instant did he dream of placing music and color on a plane of equality; the latter served him only to enhance the sonorous effect. It brought about for him an excitement of the senses such as would have been provoked equally well by a 'symphony of perfumes.' Each note was destined to receive its spot of color, each chord its wave of light.

"Here, according to Sabanejeff, is what he directed for the performance of 'Prometheus'—a great white hall with a great bare interior dome, having no architectural decoration. From this dome the shimmering colors rushed downward in torrents of light. The colors corresponded to the following tonalities—*do*, red; *sol*, orange; *re*, yellow; *la*, green; *mi* and *si*, pale blue; *fa* sharp, dark blue; *re* flat, violet; *la* flat, purple; *mi* and *si* flat, sparkling silver; *fa*, dark red.

"It is in this way that he visualized the accompaniment of his 'Mystery,' which he never finished, as well as two piano pieces in which the color-play took the place of orchestration.

"His indications stopt there, leaving all else vague, notably the construction of the color-projector. He himself never had occasion to direct the color performance of his 'Prometheus,' so as to ascertain whether the effect produced corresponded with his intentions. The first representation took place in New York in 1916, a year after his death. But according to the testimony of auditor-spectators the luminous cones projected into the air were not substantial enough to create an artistic impression.

"It is a Hungarian, A. Lazlo, who, in his book, 'Music in Colored Light' (Leipsic, 1925) undertakes to give a synthesis and a complete theory of the matter. Here are his chief points:

"Music in colors is a fusion of two arts into which each enters in a proportion fixt by the taste of the author. A union of this kind can not keep from being arbitrary, and realizable only by art; attempts to base work of this kind on science are errors.

"In fact, since the basic element of music, which is melody, can be harmonized and orchestrated in several different ways, without any of them being wrong, it would be absurd to add a new element—namely, color—according to any fixt rules."

Lazlo, we are told, then attempts to establish a treatise on harmony in which colors are used as tones in counterpoint, taking into account the fact that the eye is slower to appreciate color-changes than the ear those of sounds. He also elaborates methods of "color orchestration." But he acknowledges finally that all this is vague, and he confesses his inability to form any kind of a color scale. The writer goes on:

"This first attempt at a musico-pictorial theory acquires greater value from the fact that Lazlo has constructed a projective apparatus to realize his intentions, and has composed a series of color-music pieces. The book is rich in suggestion, but offers no solid bases from which we may escape the arbitrary. Scriabin, for instance, sees *do* major as red; Lazlo, as yellow; Petschig (another theorist), as brilliant gray; Dorken, as pale blue. The reunion of the two elements in the auditors depends often on unconscious association of ideas resulting from recollections of youth—an incident without meaning for art in general.

"So the new school of color-music recently opened at Hamburg seems likely to reach a result more satisfactory both for science and for art. Between the emission of a sound or a color and the fusion of the two in our own consciousness, a long road must be travelled.

"The new school and its founder Dr. Anschütz are now attacking these intermediary problems. How can there be in our brains any connection between sound and color? What is the mental constitution of persons who have a specially clear perception of colors when they hear music? On what is based the difference of perception of different persons? These are vast and complex questions entering the domain of psycho-physiology and psychiatry, and involving a host of related problems.

"Dr. Anschütz has issued a large number of pamphlets and books on his researches. He has shown that a large number of persons connect each musical tone with a tint, more or less precisely. More rarely, they perceive a world of color when they hear music. He reports as a specially interesting case of 'color-hearing' that of an organist, Dorken, blind from the age of thirteen years.

"This man, despite his blindness, has retained a vivid memory of colors. Each note of the scale means for him a very definite tint. Each human voice produces a luminous vision—pleasant or otherwise; each odor has its 'photism'; every vivid sensation, such as muscular fatigue, toothache, even a hot bath, produces one. Sneezing brings it on. This sensitiveness would not seem to be a manifestation of disease.

"To gather further statistics, Dr. Anschütz has radio-broadcast an appeal throughout Germany and has had about 150 replies. Several professors of philosophy have aided him by making inquiries in their classes. The material thus gathered proves that 'synesthesia' or 'color-hearing' is not so rare as has been thought, and not necessarily abnormal. He divides color-audition into 'analytic synopsy'—where a color is seen for each separate tone—and 'synthetic synopsy' in which colors are seen only in moving patterns, in connection with a piece of music.

"Among these latter he distinguishes three types, those that while hearing much, perceive bright, shimmering colors on unstable surfaces or in moving serpentine lines; those who during music, and also when they hear violent sounds, see surfaces or masses slightly colored, moving slowly, detach themselves from a somber background. A third type perceives images, colorless or colored, but generally after audition, when at rest, often just before going to sleep. The same images appear after hearing the same piece, which differentiates these 'photisms' from other kinds.

"The first laws deduced from the statistics are rather vague; the color-scales corresponding to the musical scale of high or low notes follow in general the order of the solar spectrum, adding black and white. The order generally followed is, black, brown, blue, violet, red, green, yellow, white. The colors are oftener in the high than in the low register. While in the latter, one color corresponds to a musical interval of a ninth, in the upper register it corresponds only to a fifth. Dr. Hein expresses this mathematically by a formula based on the cubic parabola. If each note of the musical scale is represented by a color, the notes farthest apart from the tonal point of view correspond to complementary colors. For example, a white *mi* requires a black *si* flat; a yellow *la* flat corresponds to a violet *mi* flat.

"To enable any work to be done toward forming a speculative system it was necessary to centralize all efforts, to give every one a chance to express his opinion, to confront him with the others who differed, or to extend results by similar investigations. It was for this reason that Dr. Anschütz, after founding a society for the study of the problem, assembled the first 'Congress of Sounds and Colors,' on March 2-5 at Hamburg. Altho this first conference was not able to solve the problem, it at least succeeded in defining the field of action and in gathering new material. Besides Messrs. Lazlo and Anschütz, each representing his own point of view, Mr. Mahling, the secretary, gave a historical sketch, while philologists, artists, and professors contributed their own observations.

"The ideas of a crystallographer, Mr. Goldschmidt, who had succeeded in finding in his own domain a common law for sounds and colors, excited much interest."

Photograph by C. F. Bowen of the Geological Survey, Washington, D. C.

A SECTION OF THE FAMOUS THOUSAND SPRINGS IN THE CANYON OF SNAKE RIVER, IDAHO

OUR BIG SPRINGS

THE LARGEST SPRINGS in the United States, the quantity of water they discharge, and the geologic conditions that produced them, are discust in a water-supply paper by O. E. Meinzer, just issued by the U. S. Geological Survey. A spring of the first magnitude, according to the Survey, is one that has an average discharge of 65 million gallons a day—enough water to supply a city of half a million inhabitants. The report shows that there are about sixty-five springs in the United States which supply at least this amount of water, and that several springs or groups of springs produce each enough water to supply New York City. Our quotations below are from a summary of Mr. Meinzer's report, printed in *Water Works* (Chicago). We read:

"Of the 65 first-magnitude springs 38 issue from volcanic rocks, 24 from limestone, and 3 from sandstone. Of the 38 springs in volcanic rocks, 16 are in Oregon, 15 in Idaho, and 7 in California; of the 24 limestone springs 11 are in Florida, 7 in Missouri, 4 in Texas, and 1 each in Alabama and Arkansas; the 3 sandstone springs are all in Montana. The volcanic rocks are chiefly basalt that was greatly jointed and broken at the time it solidified, but large springs also issue from obsidian and rhyolite, and from fragmental volcanic material. Limestone is so readily worn away by percolating ground water that it may be full of crevices, caverns, and natural tunnels. In many limestone regions surface streams are virtually absent, and nearly the entire drainage system consists of natural tunnels that carry the water underground. Where these tunnels come to the surface they produce large springs. The sandstone springs and a few of the other large springs issue from great fissures produced by faulting.

"As a rule the large springs yield water that is very clear, but a few of the limestone springs become muddy after heavy rains. In deep spring pools the clear water generally has a beautiful delicate blue hue, and hence the name 'Blue Spring' is applied to several of the large springs. The water in some of the spring pools is so transparent that objects at the bottom are distinctly visible, and fish can be seen swimming about as if in mid-air. In the Silver Spring, in Marion County, Florida, glass-bottom boats are used, and the view through the sun-lit waters of the deep spring basin, with its underwater vegetation and fish of many varieties, is described as truly fascinating.

"The huge springs that issue from the black lava walls of the canyon of Snake River below Shoshone Falls, in Idaho, are very spectacular. In a forty-mile stretch of the canyon, below the falls there are eleven springs of the first magnitude, the largest of which furnish about enough water to supply New York City, and altogether the springs that discharge into this canyon yield enough water to supply all the cities in the United States of more than 100,000 inhabitants with 120 gallons a day for each inhabitant. Unfortunately, however, not even one large city can avail itself of this abundance of spring water, which is as pure as any bottled water sold for general use. Many of the springs issue 100 to 200 feet above the river, and their clear waters, dashing over the black rocks of the canyon walls, produce cataracts of striking beauty. The Thousand Springs, which discharge 864 cubic feet a second, are now in part harnessed to produce power, but formerly they made a waterfall 2,000 feet long and 195 feet high. Snowbank Spring, which is a part of the Thousand Springs, dashes over the rough talus slope, forming a cataract of pure white against a background of intense black. The Niagara Springs, which issue from the canyon wall 125 feet above the river-level, also form a spectacular cataract.

"Silver Spring, in Florida, has a maximum record flow of 822 cubic feet a second, and is believed to be the largest limestone spring in the United States. Blue Spring, in the same county, apparently ranks next among the limestone springs of the country.

"The largest spring in Missouri is probably Big Spring, in Carter County, but Greer Spring and Mermec Spring are close competitors. The largest spring in Arkansas is Mammoth Spring, in Futon County; the largest in Alabama is the Big Spring at Tuscumbia; the largest in Pennsylvania is believed to be Boiling Spring, in Cumberland County; and the largest in Indiana is believed to be Wilson Spring, near White Cloud. All these springs issue from limestone, but Boiling and Wilson Springs are not springs of the first magnitude.

"The largest springs in Texas are the Comal Springs, near New Braunfels. Other springs of the first magnitude in Texas are Goodenough Springs, twelve miles southeast of Comstock; San Marcos Springs, at San Marcos; and San Felipe Springs, two miles northeast of Del Rio. The historic San Antonio Springs are nearly if not quite of this magnitude. These springs issue from limestone in a great fault zone that extends through a large part of the State.

"The largest springs in California are those at the head of the Fall River. Other springs of the first magnitude are Rising River Springs, Great Springs, Burney Creek Springs, and Crystal Lake Springs. All these springs issue from volcanic rock in the northeastern part of the State.

"Oregon has numerous huge springs that issue from volcanic rock. One of the largest and best-known is Opal Spring, which is situated in the canyon of Crooked River. The combined flow of the springs along Crooked River, as well as that of the springs along Metolius River, would be sufficient to supply New York City.

"The largest spring in Montana is Giant Spring, near Great Falls. The other two first-magnitude springs in the State are the Warm Springs and the Big Springs, near Lewistown."