"DERMAL VISION" *

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At the Ural Zonal Conference of Psychologists held in Nizhnie Tagil in September, 1962, I. M. Gol'dberg presented the 22 year old Roza Alekseevna Kuleshova, who, blind-folded and by touch, distinguished the color of a surface, read press-printed texts, and determined the content of drawings and photographs. I. M. Gol'dberg explained her unusual abilities as being due to increased tactile or thermal sensitivity of the skin of the fingers, attributing this phenomenon to an illness from which the subject was suffering [1].

In October-November 1962, we conducted a psychophysiological investigation of the aforementioned abilities of R. Kuleshova, who was at this time in the Sverdlovsk Neurological Clinic. We determined the tactile-, vibration-, thermal-, and photosensitivity thresholds of the skin of the fingers and studied the influence of illumination, ambient temperature, and circulatory disturbances in the fingers on her ability to read and to distinguish colors and the content of drawings.

Tactile sensitivity was investigated with an esthesiometer and Frey hairs. In the first phalanges of the 3rd and 4th fingers of the right hand it proved to be higher than the normal sensitivity of the skin of the other fingers. Determination of the boundaries of the field of especially elevated tactile sensitivity with the aid of the hairs showed that these areas are oval in shape and are located in the skin of the first third of the first phalanges of the 3rd and 4th fingers of the right hand. When we investigated the vibration-sensitivity thresholds in the sonic-frequency range we did not detect any peculiarities in comparison with other individuals. The greatest thermal sensitivity† was found in the tips of the 3rd and 4th fingers of the right hand, with which the subject determined temperature differences in the 20-40° range with an accuracy of up to 0.5°.

After tight constriction the 3rd finger of the right hand could no longer be used to determine colors or the content of drawings, while the 4th finger of the same hand retained this capacity.

In connection with the fact that R. Kuleshova exhibited an elevated dermal tactile and thermal sensitivity, we were faced with the necessity of experimentally verifying the hypothesis advanced by I. M. Gol'dberg. In order to clarify the role of touch we conducted a number of experiments which showed that the phenomenon observed cannot be attributed to high dermal tactile and temperature sensitivity. Let us cite the data obtained in several experiments which disproved the "tactile" hypothesis of this phenomenon.

1. Reading of "blank" and inked typed texts on white paper (Expt. No. 5, October 10, 1962). The ribbon was removed from the typewriter and the keys were cleaned of ink residues and washed. Short lines of a simple text were typed on white paper, great pressure being exerted on the keys. The machine was then furnished with a black ribbon and a text of equal complexity was typed on the same paper.

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* Editor's note: The problem of "dermal vision" has attracted the attention of many researchers, in connection with the study of the so-called "Roza Kuleshova phenomenon." The diverse and contradictory data do not as yet permit us to draw any definite conclusions regarding the existence of "dermal vision" or its mechanisms. This article and the following one by P. G. Snyakin are published as an experimental study of this problem.

† The experiments were conducted with the aid of a specially designed thermode heated by running water, the temperature of which was monitored by the sensor of a medical electronic thermometer.

The subject began with the "blank" text. She made a prolonged attempt to read it, but could not make out a single word. She read the inked text without any difficulty under the same conditions.

2. Identification of a figure 10 mm in size (cross, triangle, circle, or rhombus) cut out of black paper and placed on a white or black background, through a celluloid film (Expt. No. 10, October 11, 1962). She easily identified all the figures on a white background. On a black background she found the figures but could not recognize their shapes.

3. Determination of the color of objects made of various materials with different surface textures (Expt. No. 6, October 10, 1962). She identified correctly the colors of cotton, wool, silk, and synthetic fabrics and of water, oil, and chalk colors applied to paper, wood, metal, and canvas. She determined the color of velvet, yarn, and hair.

4. Experiment No. 10, October 11, 1962. She read the word "today" (the beginning of a subhead) with effort but very rapidly from the newspaper "Pravda" through a celluloid film; the letters were 5 mm high.

5. Identification of the subject of a negative on celluloid film 0.1 mm thick in reflected light, on a white or black background (Expt. No. 7, October 10, 1962). On a white background the subject of the negative was determined through the celluloid base in 35 sec. On a black background she could not determine the subject within 1 min; she complained that her fingers were sweating.

6. Determination of the possibility of reading a printed text without touching the letters (Expt. No. 25, October 15, 1962). With sufficient illumination she correctly read a printed text by running her 3rd and 4th fingers along the bottom of the line (at times not touching it).

7. Experiment No. 27, October 16, 1962. In darkness she rapidly learned to identify the color of a light beam passed through a system of infrared filters. In this case she made movements with her fingers as though to feel the beam.

The "thermal" hypothesis, which holds that R. Kuleshova determines the color of objects from differences in their surface temperatures, was disproved by the following experiments.

1. Experiment No. 43, November 4, 1962. Paper strips of different colors (blue, lilac, green) were glued to a metal plate. One edge of the plate was heated. The subject, blindfolded, touched the paper strips and noted the change in their temperature, but did not detect any change in the color of the paper as it was heated.

She correctly named the colors of the paper strips regardless of their temperature.

2. Experiment No. 37, October 31, 1962. The skin of the 3rd and 4th fingers of the right hand was illuminated with the focused beam of a projector. The sensor of an electronic thermometer placed where the hand was located was heated to 31.6°; the illumination was 500 lx. A glass plate (infrared filter) 5 mm thick was placed in the beam path. After the beam passed through this plate the sensor temperature dropped from 31.6 to 8°, while the illumination decreased from 500 to 460 lx. A light filter of violet cellophane was then placed in the beam path instead of the glass plate. In this case the temperature rose to 29.5° and the illumination dropped to 50 lx.

Despite the fact that the violet beam was "warmer" than the white beam, the subject identified the latter as "warmer" (lighter) and the violet beam as "cooler" (darker); this corresponds to a greater extent to light perception than to heat perception.

3. Experiment No. 45, November 21, 1962. Luminophores were applied to paper strips 3 × 10 cm in size, which were glued to black paper. After the luminophores were activated the lights in the room were extinguished and the strips, luminescent with "cold" light, were covered with ordinary transparent glass 3 mm thick.

The subject ran the 3rd and 4th fingers of her right hand over the glass and easily determined the location of the light and dark areas. The result was the same when the glass was preliminarily heated.

As the basis of the "optical" hypothesis, which most completely explains the dermovisual perceptions of R. Kuleshova, we assumed an extreme photosensitivity of the skin of the fingers of her right hand, developed by prolonged purposeful practice. The sensitivity of human skin to rays in the visible portion of the spectrum was described by N. B. Poznanskaya [3] in 1963. Experiments on the formation in man of conditioned-reflex reactions to intense photostimulation of the palm of the hand were successfully conducted in A. N. Leont'ev's laboratory [2] in 1937-1940.

The phenomenon exhibited by R. Kuleshova presented the previously unknown ability of man to perceive derm-

ally not only intense direct light impulses, but also weak reflected ones. As a result, she is able to determine the color and configuration of reflective surfaces at short distances. We permitted ourselves to call the phenomenon observed "dermal vision," since it is in many ways reminiscent of the visual act. Let us give a few passages from the entries in our records.

1. Experiment No. 28, October 17, 1962. An image 2 × 3 cm in size was thrown on frosted glass with a slide projector. The subject (blindfolded) "looked" at the picture on the opposite side of the frosted glass with the 3rd finger of her right hand and identified its contents.

2. Experiment No. 26, October 16, 1962. 7 pm. dusk. The subject was in a room, 6 m from a window. An image of the window (7 × 10 cm) was projected onto the skin of the palmar surface of the ungual phalanges of the fingers of the right hand with a condensing lens system (with a focal length of 1.5 cm). The illumination at the point of projection could not be measured with a LM-3 luxmeter, since it was not of sufficient sensitivity. Nevertheless, any time the projection of the window was aimed at the 3rd finger the subject reported that she sensed a "spot of light."

3. Experiment No. 34, October 20, 1962. With the 3rd finger of her right hand the subject read a newspaper text printed in characters approximately 2 mm high. At an illumination of 20 lx her reading speed was 175 characters per min, while at an illumination of 1 lx it was 99 characters per min. It was found that she could not read in complete darkness.

4. Experiment No. 31a, October 21, 1962. The investigation was conducted in a dark room. Colored paper surfaces (red, yellow, dark blue) were illuminated with red light. Under these conditions the subject called the red and yellow surfaces white and perceived the blue as black. She could not read inscriptions made on paper with red india ink. Visually (with this red light filter) the colors of the surfaces which she felt appeared the same to us as to her.

The similarity of "dermal vision" to ordinary vision is increased by the existence of dark and light adaptation.

5. Experiment No. 25, October 15, 1962. We investigated R. Kuleshova's ability to read a text from a printed book on passing from darkness into bright light and vice versa. She could not read in complete darkness. After 10 min of dark adaptation she read with difficulty at an illumination of 1 lx. On rapidly shifting to an illumination of 1000 lx she also read with great difficulty during the first few moments. On shifting from an illumination of 200-300 lx to an illumination of approximately 1 lx her sensitivity increased after 20-40 sec.

We evaluated the "acuteness of dermal vision" (the number of photosensitive dermal elements in an area 1 mm^2) from the subject's reading of texts made up of small characters and from her ability to resolve two points separated by various distances.

6. Experiment No. 9, October 11, 1962. Illumination—150 lx. daylight. The subject read the name of the newspaper "Pravda" with the 3rd and 4th fingers of her right hand after 4 sec (the letters 23 mm high). Heads (with letters 6 mm high) were read at a rate of 150 characters per min. Text printed in the 9-point type (with letter heights of from 1.58 to 2.58 mm) used for the body of the newspaper was read at a speed of 170 characters per min. She read similar texts visually at a rate of 800 characters per min. The subject thus read approximately one-fifth as rapidly with her fingers as with her eyes. She read texts from "Pravda" printed in even smaller type (with a letter height of 1.3 mm) with her fingers.

Because of the absence of optical refractive systems (the crystalline lens and vitreous body) perception of the details of an object or figure from a distance is difficult in "dermal vision." The receptive field is formed by those areas of the skin closest to the object of investigation but not covering it. The "visual field" in "dermovisual" perception is thus very narrow. In order to take in a large drawing it must be studied line by line, in a manner similar to the scanning of a television frame.

R. Kuleshova's "dermal color vision" is well developed.

Experiment No. 29, October 18, 1962. Under artificial illumination (200 lx) the subject correctly determined visually the content of all the Rabkin polychromatic tables. In other experiments she also correctly determined the content of all the polychromatic tables.

SUMMARY

In October 1962, the authors undertook an investigation of an extraordinary phenomenon in a 22 year old Roza Kuleshova who, when blindfolded, was capable of discerning the color of painted surfaces, could read printed matter and recognize the subject of drawings and photographs by means of digital perception. Results of numerous investigations counterevidenced an assumption that the phenomenon could be accounted for by heightened tactile and thermal sensitivity, and it was confirmed that the skin of R. Kuleshova's fingers was sensitive to light stimuli. A second (extraoptic) vision was thus revealed in man and termed as "skin vision."

LITERATURE CITED

1. L. M. Gol'dberg, Vopr. psikhol. (1963), No. 1, p. 35.
2. A. N. Leont'ev, Problems of the Development of the Psyche [in Russian], Moscow (1959).
3. N. B. Poznanskaya, Byull. éksper. biol. (1936), Vol. 2, No. 5, p. 368.

All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.
