

FLORAL COLOURS AND THE PHYSIOLOGY OF VISION

Part XII. Some Concluding Remarks

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A LOGICALLY sustainable foundation for physiological optics is provided by the two following propositions:

- A. The pure colours of the spectrum are the primary physiological sensations and these are as numerous as the number of distinguishable colours in the spectrum.
- B. The progression of colour visually perceived in the spectrum is consequential on the progressive increase in the energy of the light-quantum incident on and absorbed by the visual receptor.

These propositions may be considered as axiomatic. For, they only state in explicit language what we are entitled to assume to be true, *viz.*, that the physical characteristics of light and our sensory perceptions of it are very simply related to each other. Indeed, Newton in the first part of his classic treatise on optics stated the first of our two propositions in perfectly clear language, while in a later part of the same treatise, he explained the colour-sequence observed in the spectrum as a consequence of the varying "size" of the corpuscles which he assumed light to consist of.

An extremely important characteristic of monochromatic light is the variation of its luminous efficiency as also of the threshold of colour discrimination over the range of the visible spectrum. In an earlier publication by the author (Reference 1), the explanation of these features has been discussed in detail on the basis of the foregoing two propositions and it was shown that they are highly successful in accounting for the facts of observation. It is, therefore, unnecessary to traverse the same ground here. The present studies on the colour sensations excited by polychromatic radiations traverse a much wider field and it is therefore not surprising that many new results have emerged. But these do not conflict with or contradict the results of the earlier studies but on the other hand support and reinforce them. That

the facts of polychromatic colour-perception can only be explained on the basis of the recognition of the pure colours of the spectrum as the primary physiological sensations is indeed evident from the results set forth in the eleventh part of the present memoir. It is especially clear from the extraordinarily important role which, as we have seen, is played by the relatively narrow region of wave-lengths between $566\text{ m}\mu$ and $589\text{ m}\mu$, in other words, by the yellow sector of the spectrum.

In this connection, we may usefully recall the observations on the functioning of the human retina described in the earlier publications of the author. These made use of a special technique in which an observer views extended source of white light through a suitably chosen colour-filter held in front of his eye and after a little while suddenly removes the filter. A colour-filter dyed with methyl-violet which absorbs the yellow rays of the spectrum gives by far the most striking effects. When such a filter is held in front of the eye and then quickly removed, a brilliantly-coloured image of the foveal region of the observer's own retina flashes into his field of view. Comparative studies thus made with various colour filters (Reference 2) show that the yellow sector of the visible spectrum plays a highly important role in the physiology of vision, a result which, as we have seen, also emerges from the studies described in the present memoir.

It should be fairly obvious to a reader of this memoir that the observations on floral colours and their spectral composition described and summarised in it are basically in conflict with the ideas and beliefs regarding colour and colour-mixtures current at the present time. In a recent publication (Reference 3), the present author has examined the so-called trichromatic hypothesis originally put forward by Thomas Young and shown that neither in its primitive form nor in the more sophisticated presentations of it given by Helmholtz and later writers does that hypothesis possess any logically sustainable foundation. That the trichromatic theory of vision has many adherents at the present time is due to the current belief that it is capable of giving a satisfactory description of the facts regarding polychromatic colour-perception. When that belief has been shown to be unfounded, a total rejection of the Young-Helmholtz theory becomes inevitable.

SUMMARY

The results of the present studies on the visual perceptions of polychromatic radiation support the fundamental thesis that the primary physiological sensations are those excited by monochromatic light. The so-called trichromatic hypothesis and the theories of colour vision based on it are not

logically sustainable. They are further contradicted by the facts of observation described in the present memoir.

REFERENCES

1. Raman, Sir C. V. .. "The Perception of Light and Colour and the Physiology of Vision," Memoir No. 125 of the Raman Research Institute, *Proc. Ind. Acad. Sci.*, 1960, 52, 255.
2. _____ .. "The Role of the Retina in Vision," Memoir No. 133 of the Raman Research Institute, *Ibid.*, 1962, 56, 77.
3. _____ .. "The Trichromatic Hypothesis," *Curr. Sci.*, 1963, 32 (6), 245-47.