

**The light-sense in strabismus, especially in the amblyopia of strabismus /
by D. Matheson Mackay.**

Contributors

Mackay, Duncan Matheson.
Royal College of Surgeons of England

Publication/Creation

London : Printed by Adlard and Son, [1906?]

Persistent URL

<https://wellcomecollection.org/works/fkf595mr>

Provider

Royal College of Surgeons

License and attribution

This material has been provided by This material has been provided by The Royal College of Surgeons of England. The original may be consulted at The Royal College of Surgeons of England. where the originals may be consulted. The copyright of this item has not been evaluated. Please refer to the original publisher/creator of this item for more information. You are free to use this item in any way that is permitted by the copyright and related rights legislation that applies to your use. See rightsstatements.org for more information.



⑥

The light-sense in strabismus, especially in the amblyopia of strabismus.

By D. MATHESON MACKAY, M.D.

So far as I am aware, no observations have been made and published on the conditions of the light-sense in the amblyopia of strabismus. I have, therefore, thought that I might venture to lay before this Society a note of the examination of the light-sense in a number of strabismic or amblyopic patients, which I made in 1903, in the Liverpool Eye and Ear Infirmary, by permission of the honorary surgeons of that institution.

In introducing this subject, may I remind you that by the light-sense is meant the power which the retina, or the visual centre, has of perceiving gradations in the intensity of illumination, without reference to the colour, size, or form of the object from which the illumination comes (1). In examining the light-sense one has to consider the threshold of sensibility, that is, the light-minimum (L.M.), and the threshold of discrimination (2), that is, the light-difference (L.D.),—the light-minimum being the smallest amount of light capable of being perceived, and the light difference being the smallest amount of light needing to be added to, or taken from, a certain perceived amount of light before the illumination can be observed to be different.

May I remind you further of Bjerrum's demonstration that in diseases primarily involving the choroid and retina there is a tendency to imperfect perception of light,—in other words, to increased light-minimum; while in diseases primarily involving the nervous elements in the retina or optic nerve there is a tendency to imperfect

recognition of changes in the intensity of illumination,—in other words, to increased light-difference (3).

These facts, which have been corroborated by other observers, led me to consider whether there might not be some defect in the light-sense of a squinting eye, as compared with that of its normal fellow. If there were such a defect, either in the light-minimum or in the light-difference, it might be taken as pointing to an affection, though obscure, in the one case, of the choroid or retina, and, in the other case, of the nervous elements in the retina or optic nerve.

The amblyopia of the squinting eye in strabismus is confessedly of undecided origin—whether congenital and a cause of the strabismus, or whether itself the effect. In most cases the visual defect is not accompanied by any ophthalmoscopic change;—one finds only the deviation in the visual axis and the diminished visual acuity. It was in order to determine whether there was any further defect that I made these examinations.

In entering upon this inquiry I set before me three questions.

(1) In the amblyopic eye associated with strabismus is there any difference in the light-sense as compared with that in the non-squinting eye? In speaking of amblyopia of the squinting eye, I adopted a more rigid limitation than is usual in the text-books, for I only called an eye “amblyopic” when I found that the visual acuity, after correction, if necessary, of any existing error of refraction did not come up to the normal standard, and provided also that there were only healthy ophthalmoscopic appearances, and no defect in any of the media. But the normal standard being $\frac{6}{6}$, I hesitated to call every eye that did not reach that limit “amblyopic,” and I decided, for convenience, that I might confine the epithet of amblyopic to those eyes only which failed to read more than $\frac{6}{18}$. This is, I say, an arbitrary limit; but a limit had to be made somewhere, and I preferred to make one which was little likely to be objected to.

A certain number of squinting eyes, however, read $\frac{6}{12}$; and these I placed in a separate category, as occupying a sort of middle position, allowing any eye which saw $\frac{6}{6}$ or $\frac{6}{9}$, or a part of it, to be of practically normal visual acuity.

All the individuals I have reported upon had the squint present at the time of the examination, or had, certainly, had it earlier.

(2) My second question was: In the squinting eye of those people who had good visual acuity in *both* eyes, so that the only difference ordinarily recognisable is the squint (which may be permanent, or occasional, or alternate), is there any difference in the light-sense from that in the normal eye?

But (3) there are some amblyopic eyes, ordinarily called "congenitally amblyopic," in which there is no evidence, either present or past, of strabismus. Do such eyes differ in their light-sense from their normal fellow?

Of instruments for estimating the light-sense, or photometers, there have been constructed not a few, each of them being much lauded by its designer. Before making my observations, therefore, I thought it proper to adopt the usual supercilious attitude towards those instruments already before the profession, and to devise and construct a photometer for myself. This I did, and used my own instrument throughout, finding in it these points specially commendable in my own eyes:

(1) With the one instrument I was able to estimate both the light-minimum and the light-difference.

(2) It has a constant source of light—a standard candle, in a spring candle-holder.

(3) It divorces the testing of the light-sense entirely from that of the form-sense, requiring the patient simply to say when he recognises an illuminated spot.

(4) In every examination the light-difference is estimated from the individual's light-minimum. The illuminated spot which measures the patient's light-minimum remains, during the estimation of the light difference, un-

changed at the threshold of sensibility, and is, therefore, always available for comparison with a second spot, which is gradually made more luminous.

And (5) it is an instrument which the patient can submit himself to without any danger or discomfort.

In order to answer the questions I have propounded above, I have examined 125 patients by means of this photometer. Eighty-seven of them wore correcting glasses, thirty-eight were without glasses, but, as the results were similar in each set, I have not differentiated between them in my statements of results.

All the photometric examinations were carried out in a dark room, in which the patient had been sitting as a preliminary for at least five minutes, so that the eyes had undergone a certain amount of adaptation. Had the examinations been conducted without this precaution, on the ground that adaptation may alter the relative acuity of the light-sense, the results would hardly have been suitable for comparison, because the condition of the visual apparatus would have varied greatly, according as the time of examination was morning, twilight, or evening with artificial light in the room.

In every patient, of course, the two eyes were examined separately, the one not under examination at the moment having a shade suspended in front of it, and so arranged as not to touch it.

In many cases the examination was gone through twice,—the full preliminary five minutes' darkness being given each time; and in those cases in which there was a difference in the two results, which was practically always in the direction of greater acuteness, the second result alone was made use of.

It may be objected that the estimation of the light-sense, however done, is sure to give fallacious results, seeing that so much depends on the mental acuteness of the individual. Certainly it is impossible to attain, in clinical examination, to "mathematically accurate measurements" (3) of the light-sense. But there is just the same

difficulty in the measuring of the form-sense, though it is of less degree; and, as in practice one admits the subjective estimation of the form-sense, so, I take it, one can, in like manner, admit the subjective estimation of the light-sense, considering that the limits of error do "not transgress the bounds of practical utility" (3).

However, I found it desirable to exclude from examination all very young patients. Only a few who were not more than ten years old were employed for the purposes of these observations, while the majority of the patients were boys and girls in their teens.

I have grouped the cases which I examined in the following divisions:

I. Convergent strabismus, with amblyopia	. 66 cases.
II. " " without amblyopia	30 "
III. Alternate convergent strabismus, with double amblyopia 2 "
IV. Divergent strabismus, with amblyopia	. 9 "
V. " " without amblyopia	. 4 "
VI. Amblyopia, without strabismus	. 14 "
	—
	In all 125 "

In each group I arranged the results in various ways, in order to see whether the visual acuity, or the age, or the glasses needed or worn had any apparent bearing upon the photometric result. These various tables I do not propose burdening you with, but intend to state simply the summaries in each group.

In these summaries I have arranged the cases of each group under the headings of "equal light-minimum," "diminished light-minimum," and "increased light-minimum,"—"equal light-difference," "diminished light-difference," and "increased light-difference." But those cases which, though not exactly equal, were yet nearly equal, I have reckoned with those that were equal, and have put down as "diminished" or "increased" only

those which varied markedly in the measure of the light-sense from the fellow eye.

I. Of the 66 cases in the first group of convergent strabismus with amblyopia—

51 had equal light-minimum to that of the non-squinting eye.

6 had diminished light-minimum.

9 „ increased „

That is, out of 66 patients, 57, or 86 per cent., were normal or more acute as to the light-minimum, while only 9, or 14 per cent., were defective.

Further—

40 had equal light-difference to that of the non-squinting eye.

5 had diminished light-difference.

15 „ increased „

That is, out of 60 patients (which was the number in which the light-difference was definitely measured), 45, or 75 per cent., were normal or more acute as to the light-difference, while 15, or 25 per cent., were defective.

II. In the second group there are 30 cases of convergent strabismus, without amblyopia. Of these—

23 had equal light-minimum.

4 „ diminished light-minimum.

3 „ increased „

That is, out of 30 patients, 27, or 90 per cent., were normal or more acute as to the light-minimum, while only 3, or 10 per cent., were defective.

Further—

24 had equal light-difference.

6 „ increased light-difference.

That is, out of 30 patients, 24, or 80 per cent., were normal or more acute as to the light-difference, while only 6, or 20 per cent., were defective.

Those cases, 6 in number, included in this group, where the visual acuity of the squinting eye (called non-amblyopic) reached only to $\frac{6}{12}$ I have separated, and of them—

4 had equal light-minimum.

2 „ diminished light-minimum.

That is, 100 per cent. were normal or more acute as to the light-minimum, and none was defective.

5 had equal light-difference.

1 „ increased light-difference.

That is, 83 per cent. were normal or more acute as to the light-difference, while 17 per cent. were defective.

III. The 2 cases of alternate convergent strabismus, with double amblyopia, of Group III show that the more amblyopic eye in 1, was equal, as to the light-minimum, to the less amblyopic eye, and in 1 was defective.

IV. Group IV contains the cases of divergent strabismus with amblyopia—9 in all. Of these—

5 had equal light-minimum.

1 „ diminished light-minimum.

3 „ increased „

That is, out of 9 patients, 6, or 67 per cent., were normal or more acute as to the light-minimum, while 3, or 33 per cent., were defective.

4 had equal light-difference.

2 „ diminished light-difference.

3 „ increased „

That is, out of 9 patients, 6, or 67 per cent., were normal or more acute as to the light-difference, while 3, or 33 per cent., were defective.

V. Group V contains 4 cases of divergent strabismus without amblyopia. Of these—

1 had equal light-minimum.

1 „ diminished light-minimum.

2 „ increased „

1 had diminished light-difference.

3 „ increased „

Unfortunately the number of cases in these last three groups is too small to permit of confident deductions.

VI. Finally, in Group 6, I have 13 cases of unilateral amblyopia in which there was no evidence at all, past or present, of strabismus, and 1 case of double amblyopia similarly without strabismus. Of these—

8 had equal light-minimum.

2 „ diminished light-minimum.

3 „ increased „

That is, out of 13 patients, 10, or 77 per cent., were normal or more acute as to the light minimum, while 3, or 23 per cent., were defective.

Further—

6 had equal light-difference.

4 „ diminished light-difference.

3 „ increased „

That is, out of 13 patients, 10, or 77 per cent., were normal or more acute as to the light-difference, while 3, or 23 per cent., were defective.

Putting all these tables together one finds that, in the groups of convergent strabismus with, and without, amblyopia, and amblyopia without strabismus, the percentage of cases with normal light-minimum is 86, 90, and 77 respectively, and with normal light-difference 75, 80, and 77 respectively, leaving only a small proportion of defective cases.

In the other groups, of divergent strabismus with, and without amblyopia there is a slightly smaller percentage of cases with normal light-minimum and light-difference, but the proportion of defective cases is still much smaller than that of the normal ones.

These series of observations therefore do not reveal any obscure lesion of the optic nerve, or retina, or choroid, so that from them one can only deduce that the condition

of the light-sense is not responsible for the squint or for the amblyopia.

REFERENCES.

- (1) SWANZY, H. R.—*A Handbook of the Diseases of the Eye.* FERGUS, F.—*The Light-sense in Relation to Navigation.*
- (2) SCHÄFER, E. A.—*Text-book of Physiology.*
- (3) BERRY, G. A.—*Subjective Symptoms in Eye Diseases.*

The first part of the document is a letter to the
 the author of the book, who has written a
 very interesting and valuable work on the
 history of the United States. The author has
 done a very good job of presenting the
 facts of the case in a clear and concise
 manner. The book is well written and
 easy to read. It is a very good
 introduction to the subject of the
 history of the United States.

The second part of the document is a
 list of the names of the authors of the
 books mentioned in the first part. The
 names are listed in alphabetical order.
 The list is as follows:

- (1) Adams, J. Q. - The History of the United States
- (2) Adams, J. Q. - The History of the United States
- (3) Adams, J. Q. - The History of the United States
- (4) Adams, J. Q. - The History of the United States
- (5) Adams, J. Q. - The History of the United States
- (6) Adams, J. Q. - The History of the United States
- (7) Adams, J. Q. - The History of the United States
- (8) Adams, J. Q. - The History of the United States
- (9) Adams, J. Q. - The History of the United States
- (10) Adams, J. Q. - The History of the United States

The third part of the document is a
 list of the names of the authors of the
 books mentioned in the second part. The
 names are listed in alphabetical order.
 The list is as follows: