

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....\$3.50 a year.
Great Britain and Europe..... 4.50 a year.

Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XVI. NEW YORK, NOVEMBER 28, 1890. No. 408.

CONTENTS:

THE INTERMARRIAGE OF THE DEAF, AND THEIR EDUCATION <i>E. M. Gallaudet</i> 295	Mount St. Elias. <i>Wm. H. Dall</i> 303 Annular Phase of Venus <i>Lewis R. Gibbes</i> 303
WORK AT THE NEW YORK STATE AGRICULTURAL EXPERIMENT STATION..... 299	A Problem in Physics <i>H. A. Hazen</i> 304 Children as Teachers <i>E. A. Kirkpatrick</i> 305
NOTES AND NEWS..... 300	BOOK-REVIEWS.
LETTERS TO THE EDITOR. Righthanded-ness and Effort <i>J. Mark Baldwin</i> 302	Civilization: An Historical Review of its Elements..... 306 AMONG THE PUBLISHERS..... 306

LETTERS TO THE EDITOR.

* * Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Right-handedness and Effort.

PROFESSOR JAMES replies in *Science* for Nov. 14 to my letter in the issue of Oct. 31, taking exception to my interpretation of my baby's use of her right hand only for strong efforts. Without summarizing the points at issue, I may indicate where it seems to me his explanation lacks force.

In the first place, I agree with him in all that he says about a "natural prepotency in the (brain) paths to discharge into the right arm." This is undoubtedly the explanation of right-handedness, as my observations would indicate as far as they go. I also agree with him in casting out the view that brings in conscious distinct memories and choices. They are a later development. There is nothing in my letter to indicate such a view. On the contrary, I accept the "semi-reflex" theory of the possibility of the use of either hand. But quite apart from these facts of the nervous basis, the question arises: What is the least difference in consciousness required to explain the preferential use of the right hand when effort is involved?

Now, Professor James kindly says that my observations "show how strong stimuli may produce more definitely localized reactions than weaker ones. The baby grasped at bright colors with the right hand almost exclusively." So far clear enough. But whenever the same stimulus, say a piece of common newspaper, was used in two experiments, at ten and at fourteen inches distance respectively, the same "more definitely localized re-action" took place in the second case; but in this latter case the stimulus which produced this "more definitely localized re-action" was fainter, being farther away, and the other conditions being the same in the two experiments. The child always used the right hand for long distances, even when the objective amount of stimulus remained the same. The least inference, I think, is that the intensity of the stimulus is not, at any rate, the exclusive cause of the more definite re-action. Greater intensity might account for the use of the right hand in some cases, but we certainly cannot hold at the same time that lesser intensity accounts for it in others.

The new element must represent the influence of former experience. I see no way to avoid this alternative. This is what I meant by "memories," merely some kind of a conscious modification which alters future re-actions. A purely physical modification would not suffice, for it would have its full force also in cases which involved no effort. Now, we may hold that such "memories" are exclusively of afferent nerve processes, or that they involve also a conscious modification due to efferent nerve processes. If the former, we may attribute them to the greater "promptitude, security, and ease" of right-hand movements, as Professor James suggests, or to former movements of the eyes, involved in the visual estimation of distance (which I am astonished he does not suggest). The first alternative, which Professor James asks my ground for rejecting, is inadequate for the following reasons. If such memories of afferent processes be of movements with effort, they are already right-handed, and the question is only thrown farther back; but, if they be of effortless movements, then their motor influence would be perfectly indifferent, as I said in my former letter. My experiments show this. If there had been differences in "promptitude," etc., the child certainly would have shown preference for the right hand in effortless movements during the latter six months of the first year. But, on the contrary, it was only when making violent effort that there was any preference at all. Even after she developed such preference in cases of effort, the use of her hands when no effort was required continued to be quite indifferent. Does not this indicate that the traces left by former afferent processes of the same sense are not sufficient?

Moreover, in the absence of all feeling of the efferent current, what could sensations of "promptitude," etc., be but the consciousness of better adaptation and co-ordination of movements? But at this stage of life all the child's movements are so ataxic, that there seems to be no practical difference between the two hands in regard to the lack of the tactile delicacy in which pathological cases show motor ataxy to consist.

If we seek for the needed "memory" among the sensations of eye-movements in the case where the stimulus is weaker (more distant), it is possible that we may find an afferent element which brings up the intensity of the hand-memories to the necessary pitch. There may be a connection between the centres for feelings of eye-movement and feelings of hand movement, so that their united "dynamogenic" influence is the same as the high intensity of the color stimulus. But, while freely admitting such a possibility, it only pushes the question farther back again; for how do we know that these eye-memories do not involve consciousness of the efferent process which innervates the eye-centre? And, besides this, there is another element in the hypothesis that afferent elements from other senses may furnish the "kinæsthetic co-efficient" for a given voluntary movement; namely, that such activities of the other senses invoked took place along with movements of the attention, which might, and probably do, contribute an efferent element to consciousness. This possibility I have never seen anywhere recognized.

But in this case my experiments show conclusively that eye-movement memories did not re-enforce the intensity of the arm-movement memories; for, when the distance was more than fourteen