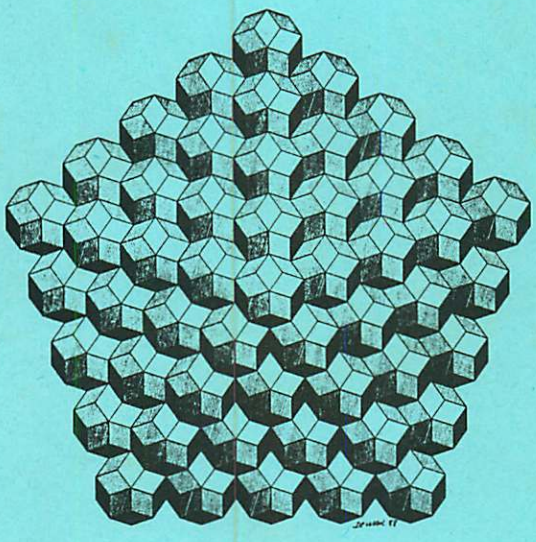
Symmetry of STRUCTURE

an interdisciplinary Symposium

Abstracts

I.



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ASYMMETRIC EDUCATION: PROSPECTS AND DANGERS

URI FIDELMAN

DEPARTMENT OF GENERAL STUDIES

TECHNION, ISRAEL INSTITUTE OF TECHNOLOGY, HAIFA, ISRAEL

Humam beings have an external symmetrical appearance, however, their internal structure is asymmetric. For example, the heart is in the left side of the body. Moreover, the two cerebral hemispheres of the human brain are somewhat functionally asymmetric.

Several dichotomies were suggested to characterize this functional asymetry. One of these is the analytic processing of data by the left hemisphere one datum after another temporally versus synthetic data processing by the right hemisphere which creates a new whole out of several data. This dichotomy was suggested by Levi-Agresti and Sperry (1968). Ben-Dov and Carmon (1976) suggested that all the other hemispheric dichotomies can be obtained from this single dichotomy. The discovery of these two cerebral data processing mechanisms became possible by their asymetric locations in the brain, but the degree of lateralization is different in individual persons.

The existence of the two hemispheric mechanisms is already applied in the treatment of dislexia. Most of the cases of dislexia are due to a non-efficient left hemisphere which does not enable the children to process the letters one after another while reading. This difficulty can be avoided by teaching these children to read in the global method, namely, to read each word as a single picture. On the other hand children with a non-efficient right hemisphere fail to read in the global method, but they can learn to read one letter after another.

It was suggested in Fidelman (1984) that a dualic method of teaching related to the hemispheric mechanisms can be applied also in the teaching of arithmetic. It was found there that the concept of ordinal number, namely, number as a property of a single element, is related to the left hemisphere; on the other hand the concept of cardinal number, namely, number as a property of a whole set, is related to the right hemisphere. Therefore children with a more efficient left hemisphere can learn arithmetic more easily through ordinal concepts, while children with a more efficient right hemisphere can learn arithmetic more easily through cardinal concepts. The technique of computation may be the same in both methods.

It was suggested in Fidelman (1987) that learning calculus in the standard approach of potential infinity is related to the left hemispheric mechanism, while learning calculus in the non-standard (Robinson's) approach of actual infinity is related to the right hemispheric mechanism.

The hemispheric duality in human cognition extends over the whole of cognition and even of culture, see Bogen (1965). It was found in Fidelman (1989) that the dualic conception of physical phenomena as discrete particles and as continuous force-fields or waves may also be related to the hemispheric mechanisms, and this relation may possibly be applied in education.

It is possible to classsify children before entering school according to the efficiency ot their hemispheric mechanisms and to teach them both reading and arithmetic according to the method which suits their brain's functioning. A similar classification can be performed at highschools and universities in order to present physics and physical chemistry to students with a dominant left hemisphere through corpuscular presentation at the first stage of their studies, and to present these subjects to students with a dominant right hemisphere through continuous presentation

at the first stage of their studies. Similarly, students can be classified in order to teach calculus more efficiently, the computation method in both the standard and the non-standard methods of teaching are the same, only the concepts and the proofs differ.

Each student should learn both systems of concepts, the left and right hemispheric related, of each subject. One system which suits his aptitude should serve each student in his own creative thought and be applied as "a native scientific language". The other system of concepts should serve as "a foreign scientific language" in order communicate with persons whose aptitude is different.

The advantage of this dualistic education is that it will increase the learning level of the whole population. It will prevent "slow learning" due to a method of teaching which does not suit the brain of the student. This is most important in the future society, in which automatization will replace the manual work and the importance of education will increase for both individuals and society.

The danger in this asymmetric educational method is that it may create two parallel cultures which do not communicate. However, the present situation is already the same. A controversy exists between ordinal and cardinal approaches to the foundations of mathematics. As a famous mathematitian, Lebesgue, stated about this conflict, no discussion between the two parties had been possible because they had no common logic so they could do no better than to insult each other.

A similar situation occurred in physics regarding the duality of phenomena. Einstein is the most outstanding representative of the wholistic, spatial and continuous approach to the perception of physical world. This approach may be characterized as right hemispheric. Einstein could not accept the consequences of the discrete quantum mechanics, though he himself discovered the photons.

We may conclude that mathematics and physics developed as two extreme hemispheric-related approaches. Asymmetric education may, indeeed, increase this extremity, but doing so it may accelerate the great discoveries of the future. Persons with equally efficient hemispheric mechanisms can operate as mediators between the extreme approaches and synthesize a united culture from the two extreme sub-cultures.

If each individual person will learn not only the "scientific native language" but also the "scientific foreign language" and will learn to communicate with members of the other hemispheric-related sub-culture and respect it (instead of insulting each other), than the asymmetric education may lead to a symmetric and harmonious united civilization.

REFERENCES

Bogen, J.E. (1969). The other side of the brain, II, Bulletin of the Los Angeles Neurological society, 34, No. 3, 135-162.

Fidelman, U. (1984). The hemispheres of the brain and the learning of Peano's and Frege's arithmetics, Focus on Learning Problems in Mathematics, 6, No. 4, 77-83.

Fidelman, U. (1987). The hemispheres of the brain and the learning of standard and non-standard analysis, International Journal of Mathematical Education in Science and Technology, 18, 445-452.

Fidelman, U. (1989). The biology of physical knowledge, Kybernetes (in press).

Levi Agresti J. and Sperry, R.W. (1968). Differencial perceptual asymerty in major and minor hemispheres, Proceedings of the National Academy of Science, 61, 1151.