

Albert Einstein. *The common language of science*. September 28th, 1941.

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The first step towards language was to link acoustically or otherwise commutable signs to sense-impressions. Most likely all sociable animals have arrived at this primitive kind of communication--at least to a certain degree. A higher development is reached when further signs are introduced and understood which establish relations between those other signs designating sense impression. At this stage it is already possible to report somewhat complex series of impressions; we can say that language has come to existence. If language is to lead at all to understanding, there must be rules concerning the relations between the signs on the one hand and on the other hand there must be a stable correspondence between signs and impressions. In their childhood individuals connected by the same language grasp these rules and relations mainly by intuition. When man becomes conscious of the rules concerning the relations between signs the so-called grammar of language is established.

In an early stage the words may correspond directly to impressions. At a later stage this direct connection is lost insofar as some words convey relations to perceptions only if used in connection with other words (for instance such words as: "is", "or", "thing"). Then word-groups rather than single words refer to perceptions. When language becomes thus partially independent from the background of impressions a greater inner coherence is gained.

Only at this further development where frequent use is made of so-called abstract concepts, language becomes an instrument of reasoning in the true sense of the word. But it is also this development which turns language into a dangerous source of error and deception. Everything depends on the degree to which words and word-combinations correspond to the world of impression.

What is it that brings about such an intimate connection between language and thinking? Is there no thinking without the use of language, namely in concepts and concept-combinations for which words need not necessarily come to mind? Has not every one of us struggled for words although the connection between "things" was already clear?

We might be inclined to attribute to the act of thinking complete independence from language if the individual formed or were able to form his concepts without the verbal guidance of his environment. Yet most likely the mental shape of an individual growing up under such conditions, would be very poor. Thus we may conclude that the mental development of the individual and his way of forming concepts depend to a high degree upon language. This makes us realize to what extent the same language means the same mentality. In this sense thinking and language are linked together.

What distinguishes the language of science from language as we ordinarily understand the word? How is it, that scientific language is international? What science strives for is an utmost acuteness and clarity of concepts as regards their mutual relation and their correspondence to sensory data. As an illustration let us take the language of Euclidean

geometry and algebra. They manipulate with a small number of independently introduced concepts, respectively symbols, such as the integral number, the straight line, the point, as well as with signs which designate the fundamental operations, that is the connections between those fundamental concepts. This is the basis for the construction, respectively definition of all other statements and concepts. The connection between concepts and statements on the one hand and the sensory data on the other hand is established through acts of counting and measuring whose performance is sufficiently well determined.

The super-national character of scientific concepts and scientific language is due to the fact that they have been set up by the best brains of all countries and all times. In solitude and yet in cooperative effort as regards the final effect they created the spiritual tools for the technical revolutions which have transformed the life of mankind in the last centuries. Their system of concepts has served as a guide in the bewildering chaos of perceptions so that we learned to grasp general truths from particular observations.

What hopes and fears does the scientific method imply for mankind? I do not think that this is the right way to put the question. Whatever this tool in the hand of man will produce depends entirely on the nature of the goals alive in this mankind. Once these goals exist, *the scientific method furnishes means to realize them. Yet it cannot furnish the very goals. The scientific method itself would not have led anywhere, it would not even have been born, without a passionate striving for clear understanding.*

Perfection of means and confusion of goals seem--in my opinion--to characterize our age. If we desire sincerely and passionately the safety, the welfare and the free development of the talents of all men, we shall not be in want of the means to approach such a state. Even if only a smaller part of mankind strives for such goals, their superiority will prove itself in the long run.