

higher, vibratory or translatory motion? and he will see the absurdity of the language.

If one will bear these principles in mind, they will be helpful in unravelling phenomena which otherwise may appear to be very puzzling. For instance, one may frequently come across the statement that one cannot get out of a machine what is not in it or put into it. Is it so? Coal is put into a furnace, and heat comes out. Mechanical motion is put into a dynamo, and electricity comes out. A current of electricity is turned into an arc lamp, and light comes out. The character of the product thus depends upon the form of the machine and its relation to some antecedent factor. The physical knowledge we have enables us in most cases to trace and understand the metamorphosis. In some cases the molecular changes are not so completely known in detail, yet the quantitative relations between what goes in and what comes out of the machine are so definite that one is warranted in asserting that no other factors are present but the one considered. In one sense, the product of any machine is like its antecedent, if both be but kinds of motion, or forms of energy as some prefer to say; but if one assumes that these various forms of energy differ in any way from forms of motion, or that they have distinct individualities, then one can get out of a machine what he does not put into it. What seem to be more unlike than the mechanical movements of a steam-engine and the electricity of the dynamo? One is simplicity itself; the nature of the other, its product, has been the despair of philosophers for generations. The subject is of fundamental importance, chiefly because some philosophers have evolved their schemes without duly considering the obvious relations.

However much a given phenomenon may differ in character from its known antecedents, no good reason can be assigned for thinking that, when properly analyzed, it would be found resolvable into other factors than matter, ether and motion. Furthermore, there is no evidence that any one of the physical forms of motion is or was necessarily prior to any other. As there is no hierarchy among them, no one of them can be called primal. A linear arrangement does not properly represent their mutual relations. They are more like a close ring of interrelations.

The visible universe may be considered as a vast machine, within which motions are being exchanged by contact and by radiation. It is not the absolute amount of energy a body may have which determines whether it shall give or receive, but it is the degree it has of a given kind of energy. Thus, it is the temperature of a body that determines for it whether it shall gain or lose heat in the presence of other bodies. The whole tendency is towards equalization of conditions, and for this reason some philosophers think they foresee the end of this act in the drama of the solar system. The possibility of the variety of phenomena that gives interest to existence depends upon the fact that at present matter is in an unstable condition, and, when uniformity of condition is reached, there will be an end to changing phenomena. Astronomers