WORDS AND SCIENTIFIC CONCEPTS.

F. Emery, March 1995.

Cassirer, after a close study of the development of science in chemistry, pointed out that scientists were defining nouns in a radically different way to which we were accustomed in ordinary use of language. The same word could have quite different meanings depending on whether it was used scientifically or in popular speech. Little wonder that scientists regarded popularisation of science with deep reservations, if not outright hostility. It was not just a problem of translation into a more restricted language or of simplification. In both of those cases the scientist could reasonably expect that his major message, or finding, would get across. What angered scientists about popularisation is that in rendering their findings into a prose form, no matter how fine the prose, their message was too often basically distorted. They were misrepresented and misunderstood. That problem remains with us to this day.

I suppose most of us have an inkling of some difference from our school-days. Then we were told that our commonsense idea of something having an invariant weight should not be seen as equivalent to the physicists' concept of mass. For physics weight is mass times the acceleration due to gravitational forces. For most of our practical purposes the difference due to variation in gravitational forces makes no difference. We are prepared to dismiss the differences between scientific and everyday words as simply a matter of an exactness that takes more factors into consideration. We feel that scientists can afford the time and effort to achieve that extra exactness because that is what they are paid for. We expect, and typically find, that scientists are just as lax as ourselves when they are involved in their daily lives and outside their speciality.

This is not the difference that Cassirer had in mind. He was pointing to a qualitative difference, not just a difference in degree. The linguistic differences cannot be accounted for by simply allowing for a bit more exactness. In displacing alchemy and driving out terms like 'phlogiston' science was also replacing words by 'constructs'.

What is the difference that creates this gap in understanding?

Our language was built up on a pre-scientific concept of the world. It was simply assumed that what our language needed to convey was the interaction of things that could be classified by the similarity of their properties. The world was presumed to be a made up of things that had sets of properties peculiar to them and these things interacted to produce yet more peculiar phenomena. Aristotle was the genius who spelt out the logic inherent in that kind of language by assuming that change was illusory and that things either were or were not. Things were to be classified by those seemingly immanent properties (not accidental ones) that they had in common. That language, and that logic, served us quite well, and continues to do so, except when we need to control their changes with the sort of precision required to design a fractionation column for an oil refinery. For that sort of precision we rely on the language developed by the science of chemistry.

This is quite annoying to classicists and poets: The meanings of words were established in antiquity and now scientists are trying to redefine them! They are being redefined only as required to control desired changes eg the production of petrol of a given octane level.

The difference is well spelt out with the word 'metal'. That word has been long in useage because metals have been long in useage.

The traditional definition was as propertied things:" Any member of the class of substances represented by gold, silver, copper lead and tin. Originally this class was regarded as including only these bodies together with certain alloys (as brass and bronze) and hence as definable by their common properties, viz high specific gravity {weightiness} and density, fusibility, malleability, opacity, and a peculiar lustre (known specifically as 'metallic'). In process of time other substances were discovered to have some but not all of these properties;

the class was thus gradually extended, the properties viewed as essential to its definition becoming fewer." (O.E.D.).

Now, compare this with a modern scientific definition of the same matter: "Nearly all of the 81 known metals have either one or two electrons in the outermost shell, valency electrons. When the number of these is three or more, as in aluminium and germanium respectively, the element becomes less metallic in nature. These valency electrons hold the key to metallic properties...They are the active agents in a metal's chemical reactions...But the boundary between metals and nonmetals is fuzzy, and some elements can behave as either. Often temperature, pressure and impurities can make the difference. Almost any substance can become a metal if its atoms are crammed closely enough together."
(Harris,1994)