

Extract from

Ontology Meets Business - Applying Ontology to the Development of Business Information Systems

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5.5.3 Levels of Reality

One challenging problem that 4-dimensionalism can help to explain, is the apparent coincidence of different objects. A simple example is presented in **Fig. 11** below.

The problem arises when, because of the way that parts are arranged, the whole has emergent properties that are not present in the simple aggregate of the parts. So in this case:

- When the nut and bolt are screwed together, they act as a fastener,
- When the steel they consist of is formed into the shape required, they have the properties of a nut and bolt respectively,
- When iron and carbon are mixed and arranged appropriately, they make steel,

- **Fig. 10.** A broom, with various heads and handles.

- Carbon and iron molecules are arrangements of carbon and iron atoms respectively,
- A carbon or iron atom is an arrangement of particular numbers of protons, neutrons and electrons.

Now at a point in time, each of these is coincident. However, when you look over time, you can see that the spatio-temporal extents for each level are different, as illustrated in **Fig. 12** below.

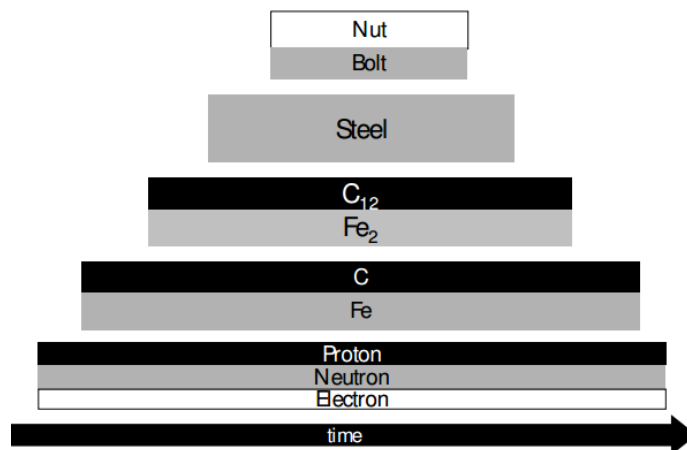


Fig. 12. The levels as potentially distinct objects

A problem case that is often used in the literature, is of the two pieces of clay that are brought together to form a vase, which at some later time is broken into a number of pieces, see **Fig. 13** below.

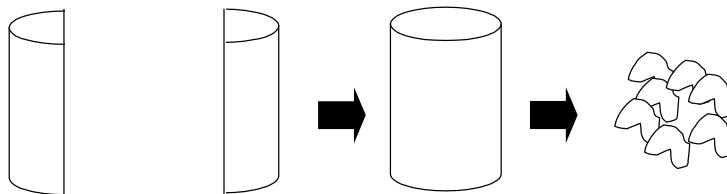


Fig. 13. The example of the coincident piece of clay and vase

Neither the clay nor the pot exists as one piece before the two parts are brought together or after the vase is smashed. So there is one object that is both the vase and the piece of clay it is made from. The consequence of this for an extensionalist is that the same individual can belong to classes at different levels of reality. This in turn means that a level of reality is in the end about the relationship between the classes, rather than between

particular individuals, where the rule is that it must be possible for individuals to have a different spatio-temporal extent at the different levels, rather than that they must be different.

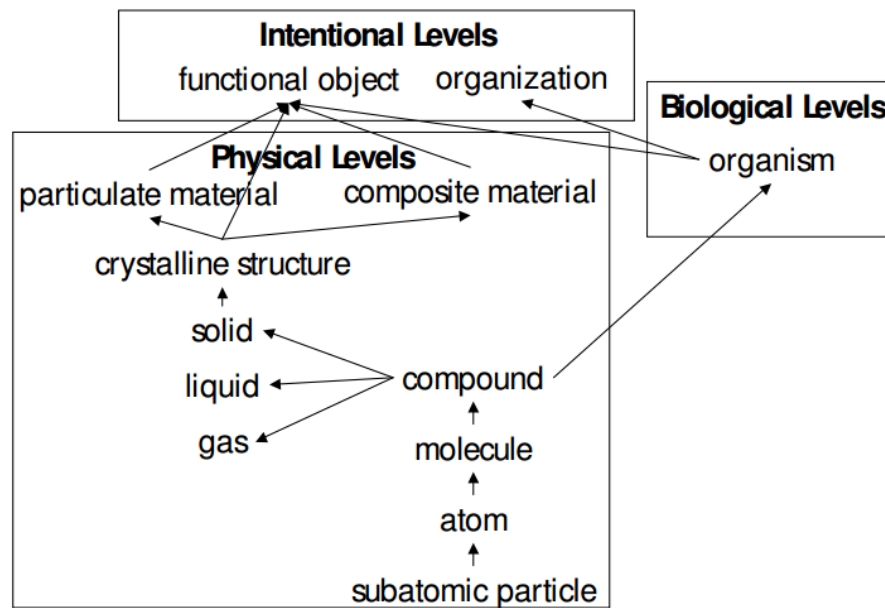


Fig. 14. Levels of reality implicit in ISO 15926-2

Fig. 14 above shows the levels of reality that are implicit in the data model of ISO 15926-2 [5]. It should be noted that, because any whole that has emergent properties because of the arrangement of its parts is a new level, many of these levels may be strata or sub-strata rather than distinct levels, and are certainly not complete. However, the levels in the physical strata are thought to be distinct.