

'All that exists are atoms and the void.' - *What is an atom?*
What is the void?

Atomism developed as an attempt to solve the problems created by Parmenides and Melissus. In developing a monist theory of being, these philosophers declared that everything was being; there was no becoming or not-being. All being was unified in the “one”, which was immutable. There was no void (since not-being was unthinkable) and all change, variety and motion were illusory. Empedocles and Anaxagoras formulated promising systems which tried, in their various ways, to incorporate the sensory evidence for change, plurality and motion with the central Parmenidian thesis of unity. The solutions suggested by Leucippus and Democritus, the first of the Atomists were more radical.

What is an atom? Broadly, an atom is the most basic building block of a system, the fundamental brick in a metaphysical “Lego” © construction. Although forms of atomism have appeared in logic and psychology, I will confine myself here to physics. Think of Parmenides the “one”. The “one” could be considered as an atom, since it is the sole unit of being. It is a rather odd example, since it would be a cosmos where being is just a single atom, obviously very large and space-filling. Nevertheless, it is a useful starting point for atomism in general, since the solution of the atomists would be very much akin to multiplying the “one”, possibly an infinite number of times, and arguing that these entities constituted the new building blocks of being. Before coming to Democritus, we may consider Empedocles cosmology, where being consisted of four elements which were themselves immutable, but which could combine in various ways in order to provide an explanation for plurality and motion. It is not an atomic theory as such, but can be interpreted in atomic terms.

The most significant ancient atomist cosmology was that developed by Democritus. In order to preserve the underlying unity of being of Parmenides and reconcile it with variety, Democritus reasoned that there must exist basic corpuscles of matter, which were themselves invariant, but could combine and recombine into observable stuffs which had qualitative differences and variable lifetimes. The existence of these atoms could be deduced by pure reason; there was no possibility in ancient times of empirically demonstrating their existence.

Atoms can have size, shape, and perhaps weight. They can move about, collide with other atoms and either rebound from such collisions, or form clusters. Atoms, as the basic lego bricks of the cosmos, must be indivisible. We today think of atoms as having distinct, separate parts: protons, electrons, and neutrons. That would (literally) be nonsense to an Ancient Greek. The Greek *atoma* means 'uncuttable thing'. Also, atoms must be imperishable; they neither come into being nor go out of being. Apart from size and shape (the primary qualities) atoms have no other qualities, such as colour, taste or smell. These are secondary qualities and can be created through a process of various combinations of the atoms; atoms in themselves cannot possess these qualities, as they are homogeneous. Democritus provides no explanation as to the process by which atoms combine to form

clusters and why some collisions might result in recoil, whilst others result in groupings of atoms. There is some hint that atoms may be 'hooked'. And so be capable of joining.

The existence of atoms implies the existence of Void. In Epicurus's words: "The totality is [made up of] bodies and void." "Body" means that which is both extended and offers resistance to touch ('tangible'). "Void" is that which is extended but does NOT offer resistance to touch ('intangible'). Sometimes Epicurus calls atoms 'Full' and void 'Empty.' To the ancient Greeks, void is not-being, it is nothing. It does not mean the same as "space" means to 21st century science.

What is the atomists argument for the existence of the void?

1. That bodies exist is universally witnessed by sensation itself. That is, we can see and touch bodies.
2. If void did not exist, then the bodies would have no place to move. But we see bodies moving. Thus void exists.
3. Nothing else exists, because "Beyond these two things (body and void) nothing can be conceived, either by a comprehensive grasp or analogously to things so grasped, ... as complete natures rather than what are termed properties or accidents of these things." (Epicurus).

That is, anything else that you might think exists (e.g., colours, temperature, smells) is dependent upon the existence of atoms (and the fundamental characteristics of atoms). In other words, everything is either extended or not extended. If something is extended, then it is a body; if it is not extended, then it is void -- by the definitions of 'body' and 'void'. There is no third option.

Here we have the essence of the the ancient Greek atomist cosmos. A probably infinitely large number of atoms move about in the void, colliding rebounding and fusing. Although there are laws about what happens when atoms meet other atoms – as there are laws in any system where building blocks are assembled – the actual myriads of possible combinatorial arrangements of atoms is a matter of chance. This is a highly mechanistic explanation of being, combined with a large measure of chance. It is not surprising that it did not appeal to Plato, and to the medieval schoolmen. It would be many hundreds of years before atomism underwent a serious re-emergence in the late 18th – early 19th century through experimentation in chemistry.

The case for the existence of the void had to be reopened after the development of wave theory in the 19th C. The proponents of the wave theory thought of space as a medium with not only geometrical properties but with physical ones as well. At first the physical properties of the medium, the ether, were described in the language of mechanics; later they were described in that of the electromagnetic field theory of Maxwell. Yet, to a certain extent the old dichotomy between occupied and non-occupied space persisted. For, according to the ether theory, the atoms moved without difficulty in the ether, whereas the ether pervaded all physical bodies.

In contemporary science the distinction between void and matter is less sharp. owing to the fact that the distinction between material phenomena, which were supposed to be discontinuous, and light, which is supposed to be continuous, appears to be only a relative one. Modern science still speaks of space and even of "empty" space, but this

void is not absolute: space has come to be regarded as the seat of the electromagnetic field, and it certainly is not the void in the sense in which the term was used by Democritus.