

Book Reviews

BERNADETTE BENSAUDE-VINCENT, *Éloge du Mixte. Matériaux nouveaux et philosophie ancienne*, Hachette, Paris 1998, 358 pp. (ISBN 2-01-235413-0)

At first glance it seems to be a paradoxical title for a paradoxical book. What do the ingredients of our modern or post-modern world (novel alloys, fibre reinforced and sheet composites, ceramics) have in common with patterns of thought, concepts and answers that for the majority of those who participate in their development and fabrication have been long ago proven to be obsolete, inadequate, and false? Are not the current theories about the atomic constitution of matter, chemical bond and spatial arrangement of atoms sufficient to explain the elaborated know how and – more – predict the hitherto unknown?

Bernadette Bensaude-Vincent's aim is to show that this view is incomplete and that the reductionism inherent to it is inadequate for the understanding of both theory and praxis of creating and handling the 'novel materials'. Before, in a methodical sense, entering the world of atoms and quanta, scientists have to master intellectually and practically the jungle of things, their material properties and the phenomena associated with the material composition of things; and that mastering is done with linguistic machetes, the blades of which have been sharpened by the Aristotelian thought.

The book consists of an introduction and four parts, each of which is subdivided into several chapters. Its composition follows a classical methodical pattern ranging from the introduction of the philosophical instruments to the exemplification of the concepts in the discussion of various models of society, technical innovation, and civilization.

The first part deals with terms, concepts and their justification. Starting point is the introduction of the terms *matter* and *material* by recurring to their etymological origin, namely the ancient Greek and the Latin words for wood, *hyle* and *materia*. Both terms refer not only to a certain kind of 'matter' or 'stuff', but have also connotations that are rooted in artisan practices. It was the ancient Ionian natural philosophy that isolated both notions in a 'pure' form by distinguishing between *matter*, the philosophical term for the substrate of the sensible and resisting world, and the various *materials*, the characteristic properties of which are the cause of this particular material world that surrounds us. However, wood is also in a second sense unique. It can be regarded under a multitude of aspects: Organic tissue with the capability of self-reproduction; malleable substrate that patiently endures the shaping forces of the carver; natural philosophers' favorite archetype of matter ...

With its natural and cultural aspects, wood thus acts as the conceptual prototype for any material. In contrast to matter as the perennial substrate of being, the material bears in itself both a natural and a cultural history, it plays a role in a civic and in a scientific narration.

In the course of the first part, Bernadette Bensaude-Vincent introduces and discusses the cultural history of her other two central terms, *composite* and *mixt*. The term *composite* has been used in a variety of contexts ranging from literature to biology before becoming a *terminus technicus* of modern materials science. Nevertheless, composite materials – in the modern sense – have had various uses in Mesopotamia of the 3rd millennium BC, and in ancient Egypt – for mummification. The *mixt*, on the other hand, has been always in the focus of philosophical thought beginning with

Aristotle's reflections. In his work Bernadette Bensaude-Vincent finds the terminological distinctions for the various '*modi*' of the mixt that still enable the classification of the results of modern material producing practices and sciences. In this context, the concept of the 'true mixt' is of paramount importance, namely the mixt that does not occur only to the senses as such, but that displays new material properties that are different from the properties of its components. The next chapter is devoted to the importance of fire, both as analytical and synthetic tool, as a means to distinguish between elemental and mixt. The first part closes with discussing the relevance of the distinction between natural and artificial, and stressing the fact that chemical knowledge is, in a Heideggerian sense, also a product of human action.

The second part deals with the social, economical, political and scientific history of the transition from prescientific practices of 'stuff producing' to the mighty chemical industries that has shaped the Western cultural history in the last two centuries. This process began when manufacturers of the outgoing 18th century started to produce 'substitutes' of chemicals needed in daily life and artisan practices of that time. Soda, ammonium chloride and sulfuric acid are the main examples. In the middle of the last century, the emergence of organic chemistry opened the vast field of true synthetic chemistry, *i.e.* of the production not only of substitutes of natural occurring dyes or drugs, but of hitherto unknown substances, with similar, but augmented, or altered properties. The invention of the mass production of steel and the amelioration of its properties freed mankind from the caprices of wood and the limits of iron. Suddenly, scientific know how was not the limiting factor for the deployment of technology any more, it was the market, or politics, or both that decided where and how a new material, a new substance can or has to be used. Aluminum's short career as a precious metal – more expensive than gold – is such an example, but also the

story of rubber or of aspirin. At the end of the last century a huge net between industrial capital, imperial ambitions, military strategic thinking, academic and industrial research, and civil applications was woven, a net that redefined and reshaped the definition of what a material is and what it is worth of.

The last two parts are devoted to the main topic of the book, the 'novel materials' and especially the composites. When they first appeared in the 1930s, nobody could imagine that this sort of materials would occupy more than a small niche in the vast fauna of the technically applied materials. The secret of their success was the fact that the composites are not merely representatives of a class of substances, like for example the paraffins, but realizations of a concept. Their design is guided primarily by their desired application and not by chemical constraints. Modern composites are 'true mixts' in the Aristotelian sense, displaying properties that are more than the mere addition of the properties of their components. Accordingly, the decision for launching a new composite takes various technical, economical, and also political factors – in the sense of assessing the acceptance of the product – into consideration, a process that has been called by one manufacturer *hyperchoice*. Composites are 'hyperchosen' materials, perhaps the only ones that fall into this category. After demonstrating this process in a multitude of case studies, Bernadette Bensaude-Vincent ends her book with a glimpse on potential future developments of 'smart' or 'intelligent' composites with complex properties like 'memory', self-monitoring, and self repair. Thus, the circle that began in Greek antiquity – with wood as the archetype of matter, living tissue, and natural working material – closes, certainly at a higher level, by guiding research in the direction of creating the archetype of technically perfect working materials, and the current efforts in creating 'biomimetic' materials.

What is the role of philosophy in this drama – or is it a comedy? Bernadette

Bensaude-Vincent's plea at the end of her book is for a "Philosophy of the Ordinary", a philosophy that doesn't reside in a fairy tower, disconnected from everyday life. However, this does not mean that philosophy should follow every fashion and reflect every innovation under the prism of modernity. It is rather so, that philosophy as a science has its own standards and its own methods of thinking. The challenge for philosophy – in Bernadette Bensaude-Vincent's view – facing the explosive proliferation of new materials and new technologies is to establish a new relationship between technology and nature, helping the former to grasp and order the latter. The project may be called in Bernadette Bensaude-Vincent's own words '*cosmotronics*', i.e. helping technique create a cosmos, a harmonically arranged world.

In her effort to open the realm of the profoundly technical, the engineering world of novel materials and composites, the hybrid between chemistry and mechanics to philosophical reflection, Bernadette Bensaude-Vincent took both a risk and a challenge. She managed to convert the challenge into an interesting and refreshing thesis and to defend it with a convincing argumentation providing pieces of strong evidence: She showed that our modern material-technical world cannot be understood solely in atomistic and quantum mechanical terms; that phenomenological concepts are still inevitable in our thinking. Such concepts have been issued by men like Aristotle who carefully observed their living world; they make out our common sense view. The risk she took was to be distracted by the sheer fascination of the technically possible, by the number and the reports of successes that were provided by the actors of the drama she observed. Sometimes, especially in the fourth part, she dwelled a little too long in front of the shop windows of the big industries and was persuaded – despite her overall critical attitude – to enter the shop, or take a ride. A shorter description of all the wonders she encountered during her journey would help the

reader to follow her and to understand her point easier – especially if he belongs himself to the manufacturers of the described marvels.

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