

## Workshop *Challenging Objects* - Exposé

Recent history of science has paid increasing attention to the role of objects in the formation of scientific knowledge. Objects are no longer considered merely as inactive objects of theoretical reflection or scientific inquiry. Rather it is acknowledged that objects independent of any systematic theoretical investigation are complex entities whose manifold characteristics depend on the diverse context in which these objects are embedded. It is accepted that prior to any explicit theoretical reflections objects incorporate knowledge. This can either be the knowledge related to the practical contexts in which such objects are applied or else knowledge embodied in the objects themselves such as the design of artifacts.

It is understood that objects as embodiments of knowledge tend to play an important role in the transmission of knowledge, both diachronically and synchronically. Objects are preserved over time and can travel in space. When in this kind of transmission the context of an object changes, the knowledge associated with it is often transformed. Likewise the objects themselves as epistemic entities are altered when the knowledge connected to them evolves. It has been analyzed how objects can become endowed with social status or high economic value, conditioning, at least to some extent, the way in which they are treated in a theoretical context.

Drawing on the wealth of insights that has originated from recent object-centered approaches in the history of science, the workshop aims to explore and elaborate a epistemological concept regarding the role that a particular type of object played in a particular period for the development of a particular body of knowledge - the *challenging objects of early modern mechanics*.

Challenging objects are objects which challenge hitherto epistemologically relevant scientific theories, descriptions, explanations, features, principles and foundations of scientific knowledge and its histories. In this sense they can be considered as pre-theoretical, but epistemologically very relevant objects. Though being things in a certain way without mind, they nevertheless are encapsulated manifestations of orders of different forms of knowing (as, e.g., practical, aesthetical, functional, observational knowledge in the broad sense of the expression ›knowing/knowledge‹).

According to the epistemological concept of challenging objects, the development of the theoretical knowledge of mechanics in the early modern period can to a large extent be accounted for by the increasing attention scholars and engineer-scientists of the period paid to new objects of study which

they investigated by means of the extant conceptual frameworks. These objects and phenomena had their origin predominantly in the rapidly developing technology of the day. Some of them, such as the flywheel, were technological innovations; others, such as the projectile trajectory, due to related technological developments in this case the introduction of gunpowder artillery provoked a novel practical interest. The practical experience gathered in the application of these objects in a technological context became one of the points of departure for related theoretical considerations. Thus, before the onset of the experimental method, these objects were a source of empirical knowledge which accounts for one aspect of their fundamental role in the conceptual reorganization of mechanical knowledge in the 16th and 17th centuries.

These objects also served as shared knowledge resources. In combination with the theoretical frameworks employed in their investigation, these objects largely determined the possible theoretical questions and answers. The striking similarity between Galileo's and Beekman's considerations concerning pendulum motion may serve to illustrate this point. The focus on "challenging objects" thus allows for an understanding of congruent theoretical developments so characteristic for the period which can hardly be accounted for by oral and textual transmission alone. Another stimulus for the development of the theoretical knowledge of mechanics is the fact that the theoretical accounts given for these challenging objects often sought to mirror and account for the complex relations of these objects in their technological context to other mechanical objects and phenomena of interest. In many cases this led to the integration of previously disparate mechanical knowledge. This evidently represents an important mechanism for the unification of mechanical knowledge. Galileo's identification of the projectile trajectory with the catenary and his attempt to explain the former dynamical phenomenon in terms of the latter purely statical one is an excellent example.

The concepts of the extant theoretical frameworks of mechanics were probed by their application in the investigation of these novel challenging objects. The new results thus produced, as well as the internal inconsistencies often disclosed in this process, account for the inherent potential of the challenging objects to trigger and advance conceptual developments. This last point is illustrated impressively by Beekman's formulation of a principle of inertia in relation to the rotary motion of flywheels.

This approach to the challenging objects of early modern mechanics has provided the basis for two recent case studies, one concerning the role of the pendulum, the other the role of fly-wheels for the development of early modern mechanical thinking. The aim of the workshop is twofold: On the one

hand it aims to refine and extend the epistemological concept developed so far; on the other hand it aims to probe this approach by contrasting it with alternative explanatory schemes and by comparing it with the insights that have been gained in other object-center studies in the history of science.

In its epistemological components the workshop will include questions like: What are the epistemic and practical virtues of challenging objects grounded in? Which types of knowledge are involved/ encapsulated/embodied in challenging objects? How to analyze the encounters of the involved forms of knowledge and descriptions (e.g., the encounters between practical and theoretical knowledge, between action and theory)? How to frame and to conduct the study of the epistemologically relevant features of challenging objects (given that these features are not those of theoretical encapsulation or sentential and propositional structure)? How to describe and conceive of challenging objects as manifestations of the interplay of different and distributed forms of knowledge? How to spell out the social and intersubjective background which already is relevant ·behind· what counts as a challenging object?

Besides the interplay of different forms of knowledge within the epistemic profile and scientific role of challenging objects it is important to analyze the functions of the challenging objects in the processes of transfer as well as of change of scientific and other forms of knowledge.

The workshop will be based entirely on the exchange of arguments structured by a set of leading questions. Participants are, however, strongly encouraged to prepare short statements in the hope of thus increasing the level of the discussion. Whether and in which form the results of the workshop will be published is left to a joint decision of the participants.