

Evelyne Barbin

IREM & LMJL University of Nantes, France

evelyne.barbin@wanadoo.fr

Using Ancient Instruments in Geometry Teaching with Bachelard's Phenomenotechnique

Abstract

In his *Nouvel esprit scientifique* (The New Scientific Spirit) (1934) Gaston Bachelard wrote that scientific instruments are “materialised theories”. He added: “Scientific phenomenology is, therefore a phenomenotechnique essentially. It reinforces what is reflected behind that which appears. It educates itself by what it constructs”.

Firstly we explore the notion of phenomenotechnique to explain how a geometrical instrument can be conceived as a “connaissance-en-action” (knowledge-in-action) in the construction of geometry. In particular, we will examine a hierarchy of instruments (Gerbert d’Aurillac, Jean Errard, Oronce Fine) that can be used in an elementary geometrical teaching. Here figures are embedded in a space from the start, contrary to Euclidean and usual teaching where geometry is a study of figures without space.

Secondly we analyze how the hierarchy of problems in the *Dioptra* of Hero of Alexandria can lead to a geometrization of a “concrete reality” and to a construction of a general notion of similitude. With Hero, to solve a problem requires to follow a kind of “programme”: to draw a schema, where concrete lines are represented; then to imagine new lines, which are necessary lines for solving the problem; then to transform the schema in a geometrical figure, on which reasoning operates. In the *Dioptra*, a general notion of similitude appears, which means, a notion not limited to the similitude of two figures. This notion is not present in Euclid or in usual teaching, but it is pertinent for an elementary geometrical teaching based on problems and solved using instruments.

In conclusion, we propose a reformulation of Bachelard’s phenomenotechnique appropriate to the construction of geometry by instruments, because Bachelard did not particularize this case, and we will criticize the reading of Luc Trouche of Rabardel’s “old work”.

References

- Bachelard, Gaston. *Le Nouvel esprit scientifique*, Paris: Alcan, 1934.
- Bachelard, Gaston. *The New Scientific Spirit*, trad. Arthur Goldhammer, Boston: Beacon Press, 1984.
- Bachelard, Gaston. *Philosophie du non*, Paris: PUF, 1940
- Barbin, Évelyne. L’outil technique comme théorème en acte, *Sciences et avenir*, 140, 2004, p. 26-27.
- Barbin, Évelyne, L’instrument mathématique comme invention et comme connaissance-en-action, *Menon*, 2, 2016, 9-30.
- Barbin, Évelyne. La Dioptra d’Héron d’Alexandrie : investigations pratiques et théoriques, in É. Barbin, D. Bénard & G. Moussard (éd.). *Les mathématiques et le réel : expériences, instruments, investigations*. Rennes: PUR, to appear.
- Rabardel, Pierre. *Les hommes et les technologies : approche cognitive des instruments contemporains*. Paris: Armand Colin, 1995.
- Simondon, Gilbert. *Du mode d’existence des objets techniques*. Paris: Aubier-Montaigne, 1969.
- Trouche, Luc, « Des artefacts aux instruments, une approche pour guider et intégrer les usages des outils de calcul dans l’enseignement des mathématiques », *Actes de l’université d’été de Saint-Flour*, 2005, p. 265-276.
-
-
-