

Title: Mathematics and the Empirical Sciences: Charles Sanders Peirce on the Status and Application of Mathematics

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Abstract: Abner Shimony mentions that his undergraduate years at Yale in the forties provided an introduction to three profound philosophers that influenced his thought – Alfred North Whitehead, Charles Sanders Peirce and Kurt Gödel. For all three, mathematics played a central role in the unfolding of their lives and thought. This paper will focus on the earliest of this trio, and focus on Peirce's complex and rich views on the nature and practice of mathematics, attending first to the necessary and foundational nature Peirce ascribes to mathematics and to the place of hypothesis, diagrams,

and observation in its development. For Peirce the foundational nature of mathematics arises from the absence of a need to ground it in any further discipline, even a discipline such as logic. The contextualization of a number of these issues in the work of the British mathematicians George Boole and J.J. Sylvester will be explored as well as the powerful yet complex influence of his mathematician father, Benjamin Peirce. Then the role of mathematics in the empirical sciences will be considered, and the meeting point traced in Peirce between the abstract, general and necessary, qualities that figure in mathematics, and the particular and empirical that constitute the description of nature. As various commentators have noted, in the epistemological concerns that dominate Peirce's thinking, intriguing and interesting tensions appear between, on the one hand, his understanding of mathematics and, on the other, his view of an evolving nature which is governed by chance and our knowledge of which is always fallible and thus

open to revision. The meeting place, the theme of Wigner's famous essay reflecting on the effectiveness of mathematics in the natural sciences, is at the heart of the enterprise of mathematical physics. And arguably Peirce's writings here serve to bring out a number of deep and persistent issues that attend exploring this topic.

**MATHEMATICS AND THE EMPIRICAL SCIENCES:
CHARLES SANDERS PEIRCE ON THE STATUS AND
APPLICATION OF MATHEMATICS**

**I) BRIEF INTRODUCTION TO THE LIFE AND
WORK OF PEIRCE AND THE PROBLEMS OF
PEIRCE SCHOLARSHIP**

**II) THE PLACE OF PEIRCE IN ABNER
SHIMONY'S WRITINGS**

**III) PEIRCE ON THE NATURE OF
MATHEMATICS AND ITS DISCIPLINARY
IDENTITY**

**IV) BENJAMIN PEIRCE ON THE
RELATIONSHIP BETWEEN MATHEMATICS
AND NATURE**

**V) CHARLES PEIRCE ON THE APPLICATION
OF MATHEMATICS**

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Peirce, Charles.jpg (JPEG image, 667x782 pixels)

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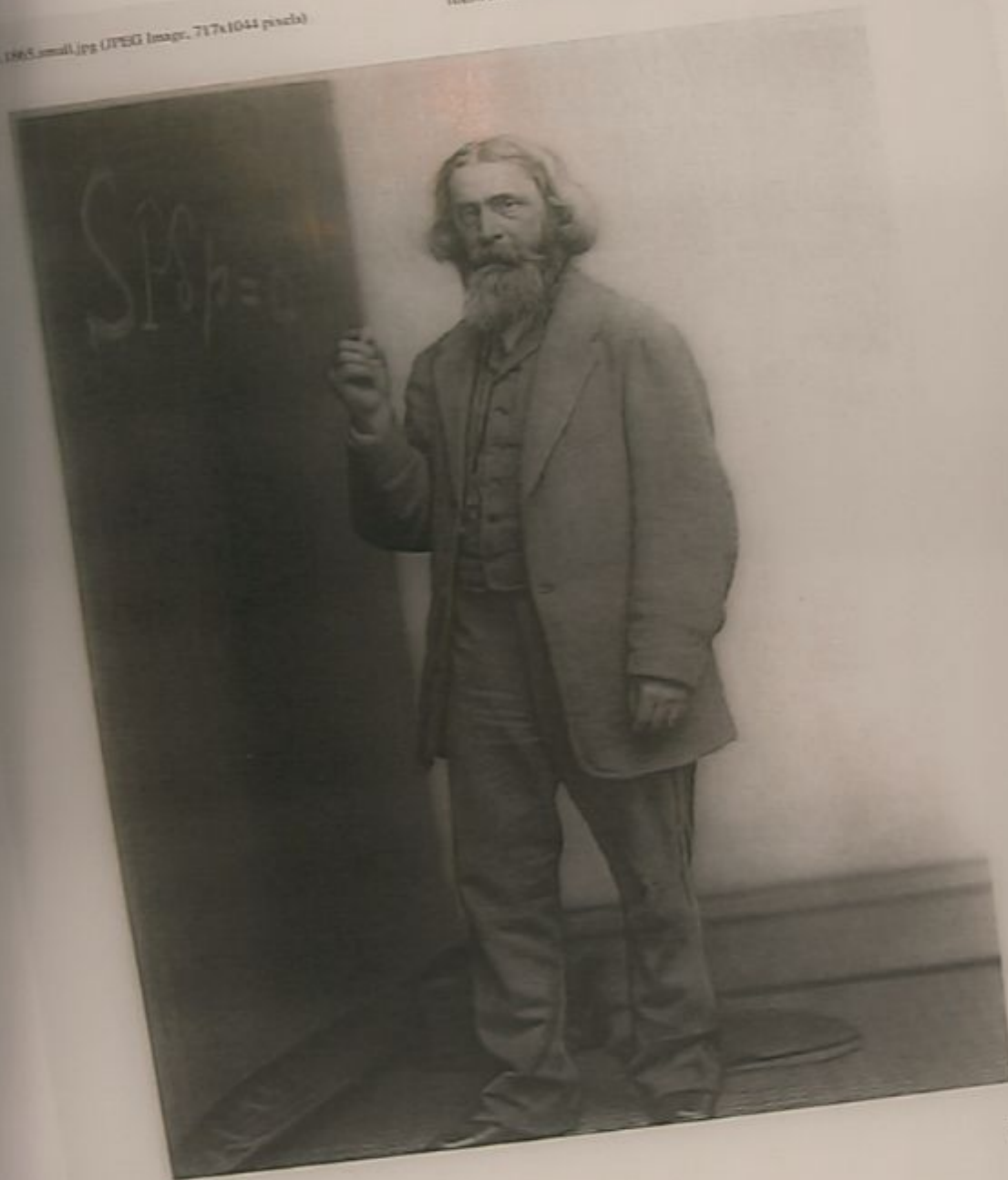
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All A are B
If A then B

Mathematics

Abstract
Formal
Necessary
Symbolic

Empirical Reality

Concrete
Particular
Contingent
Physical

Relationship Mathematics & Nature

① Mathematics as map [Representation]

$$F = ma \rightsquigarrow \frac{m}{\infty} \rightarrow$$

② Practices of the Mathematician
Scientist

Relationship Mathematics & Nature

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Thematics of Nature

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→ Concrete
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Mathematician

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Drawing

All A are B

If A then B

