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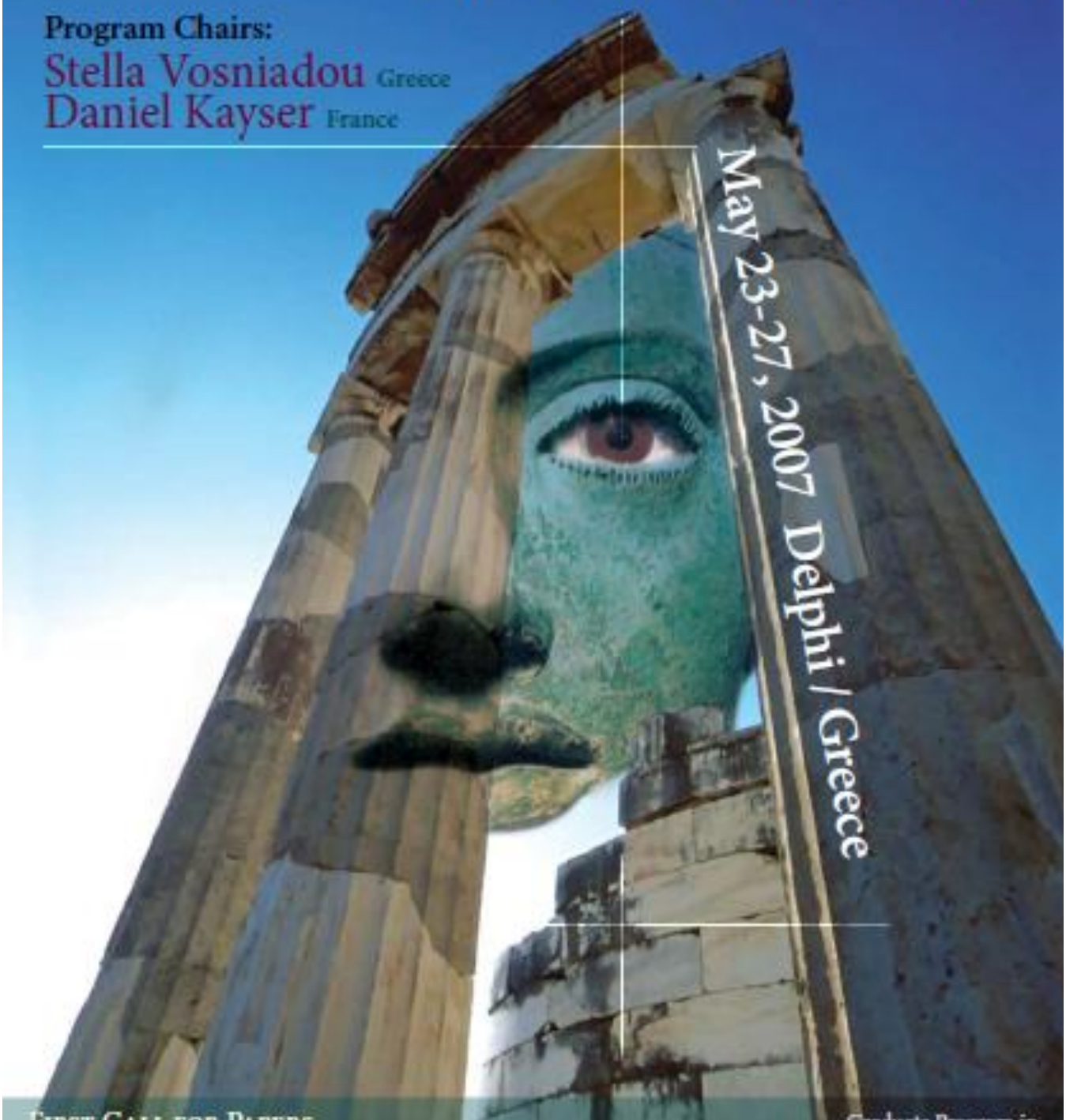

First Call for Papers

We invite submissions to the second European Cognitive Science Conference, under the auspices of the Cognitive Science Society.

Important Dates

Submissions due:	November 15, 2006
Acceptance Notifications:	February 15, 2007
Camera-ready copies due:	March 9, 2007

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Posters

Aspects of students' rational number reasoning: A conceptual change perspective

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Introduction

Rational numbers are difficult for students to understand and this fact has been demonstrated in numerous studies (Smith, Solomon, & Carey, 2005). An aspect of rational number reasoning that has not been extensively investigated so far is students' understanding about the dense structure of the rational number set. In this study we investigated the development of students' understanding of density from a conceptual change perspective. A key assumption of the particular theoretical framework that we adopted (Vosniadou, in press) is that children form initial explanatory frameworks about numbers, which are tied around their understanding of natural numbers. When new information about rational numbers comes in contrast with what is already known, the conceptual change framework predicts the formation of a specific type of misconceptions, called *synthetic models*, which reflect the assimilation of new information in prior, incompatible knowledge.

The set of natural numbers consists of discrete elements which share a similar form, in the sense that any natural number is represented as the combination of a finite number of digits. On the contrary, the set of rational numbers is dense and any rational number can be represented either as a fraction or as a decimal.

We assumed that the particular characteristics of the natural numbers set mentioned above are key elements of students' initial number concept and are bound to constrain students' understanding of the dense structure of rational numbers. Prior research has provided evidence that the idea of discreteness is indeed a barrier to the understanding of density (e.g. Merenluoto & Lehtinen, 2002). It is also documented that students have many difficulties moving flexibly and effectively among the various forms of rational numbers (e.g. Khoury & Zazkis, 1994). We claim that students draw on symbolic notation to treat decimals and fractions as different, unrelated sorts of numbers and this interferes with their understanding of density. We hypothesized that students form synthetic models of the structure of rational numbers intervals, reflecting the constraints associated with their initial explanatory frameworks about numbers, as well as the assimilation of new knowledge about rational numbers. This hypothesis was tested in an empirical study.

Method

The participants of the study were 164 9th and 137 11th graders, who were administered open-ended and forced-choice questionnaires, consisting of six questions. In both cases, students were asked about the number of numbers between two pseudo-successive rational numbers (like 0.005, 0.006 or 1/3, 2/3)

Results and Discussion

According to our results, students' accounts of the rational numbers intervals reflected the expected constraints. More specifically, our participants generated the following types of synthetic models: a) intervals that preserve the discrete structure of natural numbers, while the initial numbers were considered successive, b) intervals preserving the discrete structure of natural numbers, while the initial numbers were not considered successive, c) intervals containing "infinitely many" equivalent numbers d) intervals containing infinitely many numbers, when the initial numbers were decimals (or fractions) and intervals with a finite number of numbers, when the initial numbers were fractions (or decimals), and e) intervals containing infinitely many numbers of the same symbolic representation. We draw on our results to argue that the development of rational number reasoning cannot be accomplished by mere enrichment of students' initial explanatory frameworks of number.

References

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