Combinatorial Geometry for TV Audiences

Jin Akiyama

Research Institute of Educational Development, Tokai University

Tokyo, 151-8677 JAPAN

E-mail: fwjb5117@mb.infoweb.ne.jp

March 3, 2004

For the last fifteen years, I have had TV programs whose aim is to impart the wonder of mathematics to general audiences. The program presents novel ways of recognizing, analyzing and solving mathematics problems that may be encountered in daily life. Audiences are guided through the processes of discovery, experimentation and generalization. Many manipulative models are used to enhance the visual presentation. In this lecture, I will discuss several topics from combinatorial geometry which comprise the mathematical foundation for some of problems recently presented in that TV show, namely:

1. Wrapping and Packing

    (a) Minimum area problem for a sheet used to wrap a box
    (b) The efficiency of tetrapaks (double packable solids)

2. Foldings

    (a) The shape of wrapping paper (folding polygons to convex polyhedra)
    (b) The maximum volume of polyhedra folded from a polygon of unit area (Malkevitch problem)
    (c) Shapes that can be made into envelopes (flat 2-foldings of convex polygons)

3. Dissections

    (a) Insights from Dudeney's Canterbury Puzzle
    (b) Solids that can be dissected and turned inside out to produce themselves or other solids (reversible solids)

The lecture will include a demonstration of manipulative models.