Teaching Geometry via Musical Rhythm

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Abstract

A proposal for designing an interactive software system for teaching geometry using musical rhythm is described.
Target audience: High School and Elementary School Teachers
Timeframe: One year
Relevant field of mathematics: Geometry

1 Summary

Traditionally, geometry has been taught in the schools as a purely mathematical subject. For example, families of polygons such as triangles, squares, rectangles, pentagons, etc., are defined in terms of the number of edges, the angles between edges, the relative lengths of edges, etc., and the subject is left at that. More recently visualization has played an increasing role in teaching geometry [1]. Teaching tools have also been explored that use motions such as linkage reconfigurations to classify the different polygons [2]. However, *sonification* of polygons and other mathematical objects has not yet been explored as a teaching tool.

Musical rhythm has traditionally been taught using Western music notation by studying a variety of rhythmic patterns, and listing their properties, such as syncopation, and then left at that. More recently rhythmic patterns have been represented as polygons on a circle [4] with the goal of using geometry to help in the teaching of musical rhythm [3].

In this project it is proposed to teach both areas (geometry and musical rhythms) simultaneously, by representing musical rhythmic patterns as polygons on a circle, thereby also obtaining a sonification of polygons and their properties. It is anticipated that teaching both subjects together in this way will have the synergistic effect of enhancing the pleasure, motivation, and learning ability of the students in both geometry and musical rhythm.

For a concrete illustrative example consider the ubiquitous clave Son pattern played in salsa music. This pattern may be represented in box notation as [x . . x . . x . . . x . x . . .] where 'x' denotes striking the instrument, and '.' denotes a silence. Hence there are five strikes in a total measure of sixteen equal units of time. This rhythm may be represented as a pentagon on a circle

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of sixteen equally spaced points where the successive distances between the vertices of the pentagon are 3,3,4,2,4. Examining this polygon one notices immediately that it is symmetric about a line through the second strike. This helps to introduce this property of polygons and their corresponding rhythms.

The goal of this project is to first explore and outline which concepts in geometry are most suitable for teaching using rhythm in this manner, and then to design an interactive software system that incorporates the resulting ideas.

References

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