Bridges 09 Interactive Workshop: The Geometry of Longsword and Rapper Sword Locks

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Abstract

This interactive 75-minute workshop is suitable for teachers, students, geometry enthusiasts, dancers, and parents and children participating in the conference. Working with two traditional English sword dancing teams from Vancouver (Tiddley Cove Morris & Sword Dancers and Steel Phoenix Rapper), we will explore the geometric constraints of longsword and rapper sword "locks" (friction-locked symmetric configurations of wooden and metal "swords"). The workshop will offer demonstrations of these traditional dances and locks, led by the two dance teams; then workshop participants will be encouraged to try building the locks by dancing them (with help from the professional dancers) and by building them with coffee stir sticks. The geometry of locks will be explored in terms of some knot theoretic principles (crossings, sticks), and in terms of star polygons, minimum/ maximum angles, number of sticks, and "physical algorithms" for their production.

Structure of the workshop

Members of the Vancouver longsword and rapper sword teams, Tiddley Cove Morris & Sword and Steel Phoenix Rapper, will collaborate with Susan Gerofsky (herself a member of both teams) in leading an interactive workshop on aspects of mathematics and traditional dance for teachers, students, geometry enthusiasts, dancers, parents and children attending the conference. Demonstrations by the professional dancers will be followed by opportunities for participants to learn parts of the dances, creating longsword and rapper locks with swords through choreographed movements and building miniature versions of the locks with wooden coffee stir sticks, while exploring aspects of geometry and multiple representations and algorithms embodied by these forms.

What are longsword and rapper sword locks?

Longsword and rapper sword dancing are two styles of traditional sword dances recorded and practiced in the north of England [1, 2]. Longsword is performed by a team of dancers, traditionally based in one particular Yorkshire village. The dance uses blunt rigid wooden or metal "swords", held hilt and point by the dancers so that the members of the team are connected to one another by their swords through much of the dance. Longsword dances consist of movment figures danced by the team, punctuated with "locks" – regular geometric shapes, often star polygons – formed through dance moves. Locks weave all the dancers' swords together into an aesthetically pleasing geometric figure, which is held together by friction. Once the lock has been displayed, to the cheers and appreciation of the audience, dancers grasp their own sword and break the lock to continue the dance (often carrying out a mock "beheading" of the team captain or musician in the process!)

Traditional rapper sword dance has been recorded mostly in Northumbria, in the area around Newcastle-upon-Tyne, England. Like longsword, it is performed with blunt metal "swords" held hilt and point by the dancers, but rapper swords are flexible and springy rather than rigid, which affords a different range of shapes and configurations. Rapper sword dance moves are somewhat different from longsword stepping and figures, but like longsword, rapper is also structured as dance figures interspersed with "locks" created through collective movements of the dancers. The flexibility of rapper swords offers more options in the presentation of topologically isomorphic locks.

Exploring the geometry of longsword and wrapper sword locks

These regular figures are formed quickly in the course of a vigourous set dance, and then raised up, usually by one dancer, for watchers to admire. The nature of the production and display of the locks raises the following two interesting issues from a geometric point of view:

1) The locks must be capable of being produced smoothly and quickly through the choreographed movements of the team of dancers – that is, there must be a "physical algorithm" developed through the dance to produce these stellated and other shapes. When the same shapes are created by one person working alone with long wooden coffee stir sticks, it takes much greater time and effort to arrive at the figure. In this participatory workshop we will:
   • explore the nature of the physical algorithm that produces locks with a team of dancers,
   • work on developing small-scale physical algorithms that work with the stir sticks, and
   • compare these stick-based algorithms with other pencil-and-paper algorithms to produce similar figures.

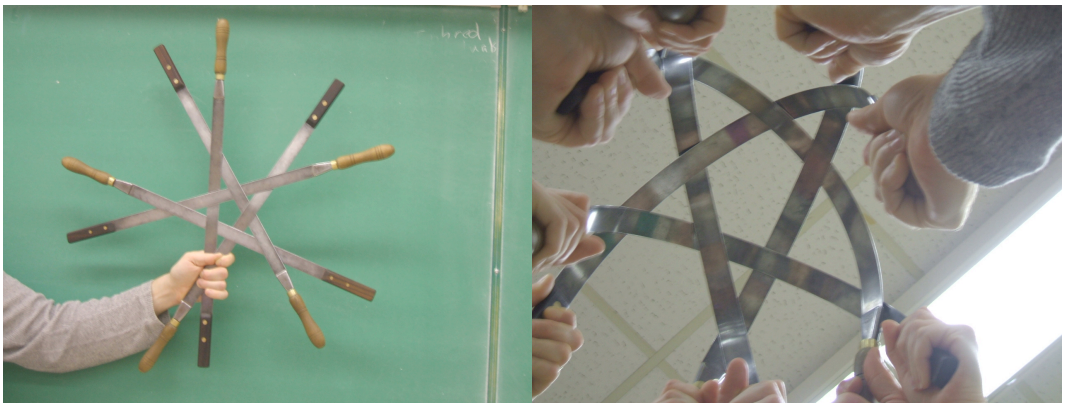
   Throughout these explorations, we will be working on developing the idea of multiple algorithms and multiple representations of mathematical objects, and talking about the kinds of insight gained by noticing equivalencies and differences between these.
2) The locks are held together by friction and tension of materials, in a form that involves weaving of sticks/ swords. This fact, and the physical construction of the two kinds of sword impose geometric constraints on the locks. These constraints can be explored through addressing questions like:
   • what is the minimum/ maximum number of swords that can be used in a lock?
   • what is the minimum/maximum/optimum number of crossings needed for a lock to hold?
   • what constraints are there on the size of the angles in the locks?
   • given these constraints, can we design new locks (other than the traditional ones) that would hold and be constructable using a physical algorithm in the course of the dance?

There is the possibility as well of making lock shapes from string or cord, and exploring isomorphisms of knots and sticks, an area that has been developed in knot theory.

References

[1] Allsop, I. (1996). *Longsword Dances from Traditional and Manuscript Sources*. (A. G. Barrand, Ed.) Brattleboro, VT: Northern Harmony.

[2] Cawte, E.C. (1981). A History of the Rapper Dance. *Folk Music Journal*. 4(2), 79-116.



Photos of rapper sword locks with Steel Phoenix Rapper team at a practice (S. Gerofsky)