Path

To Karin Rosenthal

Dean Rosenthal

2014



Drawing by Dean Rosenthal ©2014

There are exactly 24 permutations of 1-2-3-4. In *Path*, these permutations are applied to a four note melody, G-Ab-Bb-Db, in a regular manner that corresponds to the drawing on the previous page (in mathematical terms this drawing is considered a *graph*). The drawing displays the symmetries that can be found when connecting all of the permutations by transposing pairs of numbers/notes. In the drawing, each permutation is labeled and a path that runs through all permutations, landing on each once and only once and returning to the first, can be seen by following the arrows. In mathematics, this type of cycle is called a Hamiltonian Cycle. Because the path that takes us around the drawing shows which way to go, the drawing is called a *directed graph* or *digraph*.

The music can be performed on oboe, but it also could sound good on the clarinet and clarinetists are welcome to try it.

The piece should be played with as little vibrato as possible. Because there are only four basic rhythms, each phrase should be played smoothly and carefully.

This short piece is an example of music that on the surface is simple, clearly didactic, and minimalist, but it also explains some very intriguing mathematics. I could have made a complicated piece out of such a drawing, but I like that you can very clearly hear the path the permutations take around the drawing.

The music and drawing were composed during a residency at the Eclipse Mill in North Adams, MA in the summer of 2014.

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Performance History:

- The wulf, Los Angeles: performance by Joe Thel
- Spectrum, NYC: performance by Phil Raskin
- The Coral Gables Museum of Fine Art, Coral Gables, FL: performance by Katerina Kusevic