Dance - Lesson 2 - Coordinate Symmetry - SD

Introduction
Dance a beautiful art form often involving human bodies moving through space and time with focus and precision. In this lesson you will explore one of the concepts often seen in dance, symmetry. You’ve also seen this concept, literally, every time you look in the mirror! You will create a pair of dancers in Choreo Graph, and they will dance together in a symmetrical way. As they move, you will examine the x,y coordinates and see how they are related.

Pictured is a snapshot of a moment in a Choreo Graph “symmetry dance”. Do you notice a relationship between any of the coordinates?
Dance is a beautiful art form full of motion that can be analyzed in mathematical terms. Dancers glide across space, spin in place, and fly through the air. Symmetry is often utilized in dance. Two dancers appearing as mirror images of each other requires a great deal of practice and precision.

To do

Part 1

1) Open Choreo Graph and snap pictures of you and your partner, make sure in both pics you’re standing in a symmetrical way to each other.
2) Trace your whole body as a single digital puppet. Then do the same with the pic of your partner.
3) Size yourselves on screen so you’re are about the same size.
4) Place the pivot points on the same spots.
5) Now go to “Animate.” Tap the wrench icon on the bottom left and turn on “grid” and “coordinates.”
6) Slide your little pieces around and notice how the coordinates change.
7) Line your “Choreo Graph dancer-selves” up on opposite sides of the y-axis so that the corresponding coordinates are (x,y) and (-x, y). (For example, see the sample pic on page 1.)
8) Now that you have your starting point, you’re ready to create the dance!
9) Tap the second keyframe in the graph below, slide your dancers to new positions so that they remain symmetrical. Now tap the third keyframe, move your dancers, and repeat for all the keyframes.
10) Be careful as you set the position for each keyframe.
In this chart, write the names of the dancers. Each keyframe in Choreo Graph is represented by k1 through k13. Record the coordinates for each keyframe. Also make note of any angle settings.

<table>
<thead>
<tr>
<th>Dancers</th>
<th>k1</th>
<th>k2</th>
<th>k3</th>
<th>k4</th>
<th>k5</th>
<th>k6</th>
<th>k7</th>
<th>k8</th>
<th>k9</th>
<th>k10</th>
<th>k11</th>
<th>k12</th>
<th>k13</th>
</tr>
</thead>
</table>

Questions

1) Across which axis are the dancers symmetrical? Circle one: X axis -or- Y axis

2) From keyframe to keyframe, what pattern do you notice in terms of the angle measurements between the two dancers?

**Tap the “translation” tool and look at the lines of your dancers. Choose two of the longer lines.**

3) Find the equations of each line. Use the form y = mx + b

4) What pattern do you notice about the slopes of each line?

5) What pattern do you notice about the y-intercepts for the lines?

6) What pattern do you notice about the y-intercepts for the lines?
7) Are the lines symmetrical about the y-axis? How do you know?

Part 2

Now that you created a simple dance with 1 part for each dancer, you’re ready to get a little more complex. This is your chance to get creative while continuing to play with the idea of symmetry.

Your task: Design a dance so that at least half of it is expresses symmetry.

1) Create a new project, and create two new dancers. This time, feel free to make more parts for each dancer. For example, legs and arms can be separate. (Note: The more parts you make, the more complex it will be to keep track of everything!)
2) Rather than record the coordinates and angles for every keyframe, indicate in a different chart the moments that are symmetrical.

Note symmetry at each keyframe with the letter “S” or leave it blank if the dancers are not symmetrical.

<table>
<thead>
<tr>
<th>Dancers</th>
<th>k1</th>
<th>k2</th>
<th>k3</th>
<th>k4</th>
<th>k5</th>
<th>k6</th>
<th>k7</th>
<th>k8</th>
<th>k9</th>
<th>k10</th>
<th>k11</th>
<th>k12</th>
<th>k13</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Questions

1) How much of your dance would you estimate to be symmetrical?

2) Symmetry is a fascinating concept that we also see in nature. Having played with and examined symmetry, what are some things that you find interesting about symmetry? Why do you think symmetry exists in nature?
3) As you look at the translation lines of your dancers, what do you notice about the lines that are symmetrical as compared to those that aren’t?