## Ki Yung's misunderstanding

When I was at Korean Physics Olympiad camp, Ki Yung came up with the following paradox regarding the relativistic length contraction. See the figure below on the left. Balls are initially at rest, but they start to move along the dotted lines inside an octagonal-shaped room. They change their direction by bouncing at the four corners. If the distance from one corner to the adjacent one is L, the whole trajectory will be 4L. If the initial distance between the balls is d, there are 4L/d balls initially. However, as they start to move with speed v, the distance between the balls contracts relativistically, and it becomes  $d/\gamma$ . Thus, it seems that there are total of  $4L\gamma/d$  balls. So, it seems that the number of balls increase. Where are the extra balls coming from?



Ki Yung asked this question to a couple of teaching assistants but couldn't get a satisfactory answer. I also thought about this problem for quite a long time. Later, somebody told me that the distances between the balls don't contract, but I was not satisfied. However, much later, I asked this problem to a couple of physics professors and I got a satisfactory answer. He drew the above diagram on the right and that settled my misunderstanding. As the balls accelerate together, the distances between them don't change.