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Linear and Nonlinear Random Walks in 1d, 2d and 3d Space

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Short Communication

The regular octahedron [1] refers to the number of five Platonic figures. It can be composed of eight equal equilateral triangles or twelve identical segments. "The octahedron is dual to the cube" [2]. The regular octahedron can also be composed of many identical small cubes just as in Ancient Egypt were pyramids of stone blocks. The construction of an octahedron using small cubes can be obtained by considering a random walk in three-dimensional (3D) space. In [3] we considered a visual model of a 3D random linear and nonlinear walk in an octahedron. In [3,4] we reviewed and systematized the visual models of 1D, 2D and 3D random linear and nonlinear walks too.

In this paper we explore some new features, patterns and fractions of numbers in visual 3D models of random linear and nonlinear walks in an octahedron composed of small cubes.

Our studies of the deterministic models and visual constructions of linear (without any acceleration in Figure 1) and nonlinear (with the simplest uniformly acceleration in Figure 2) random walk and arithmetic figures given in this paper show various geometric properties and nonlinear effects of 1D, 2D and 3D spaces.

In 1D space with a linear random walk a linear arithmetic triangle (Pascal's triangle) is densely filled with numbers.

In 1D space with a nonlinear random walk a nonlinear arithmetic triangle [3.4] is loosely (contains gaps) filled with numbers.

In 2D space [3] with linear and nonlinear random walk linear and nonlinear arithmetic squares are densely filled with numbers (without gaps) in both cases.

In 3D space with a linear random walk

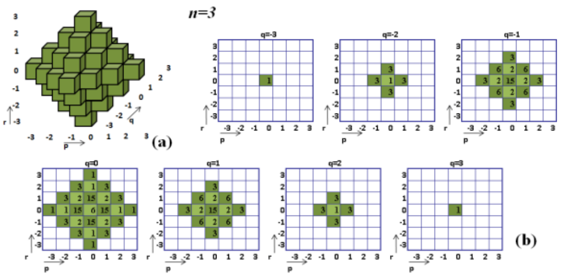

Figure 1: The third linear arithmetic octahedron (the third iteration 3). 1-fraction on the surface of octahedron and 2-fraction inside it.

the linear arithmetic octahedron is almost densely filled with numbers but the neighboring areas inside the octahedron remain are empty (contains gaps) until the next iteration (Figure 2).

cervical cancer. Diagnosis was made only after in 3D space with a nonlinear random walk the nonlinear arithmetic octahedron is not completely filled with numbers (contains gaps) as in the case of a nonlinear 1D random walk; some neighboring

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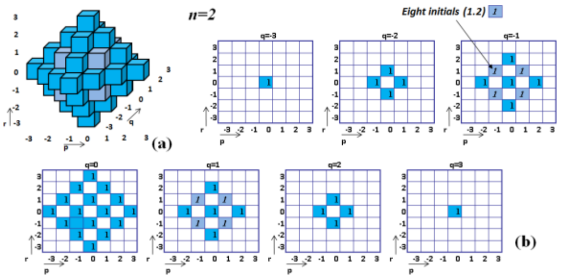

Figure 2: The second nonlinear arithmetic octahedron (the second iteration 2). 1.1-sub-fraction and 1.2- sub-fraction of 1-fracton.

regions inside the nonlinear octahedron remain empty (contains gaps) until the next iteration and some remain empty during several or many iterations. But gaps and "islands of numbers" or separate structures of numbers consistently appear and disappear after several or many iterations in a nonlinear 3D case.

Thus for nonlinear 1D and 3D cases we can speak of filling the numbers of the arithmetic triangle (1D) and the arithmetic octahedron (3D) in the form of "islands of numbers" or separate structures of numbers.

The results of research in this work are conveniently presented for the classification of different types of a random walk in the form of a table:

Linear random walk (one unit steps, perpendicular each other). Nonlinear random walk (first one unit steps, second two units steps, third three unit steps, etc., perpendicular each other).

Our studies can help describe various phenomena in optics [5], acoustics [5], biology [6], cosmology [7-9], etc.

Yesterday, Russian television reported new results on the study of neutron stars. It turned out that they do not necessarily turn into "Black Holes" despite their large mass, but continue to emit light. They can be called "White Holes" in accordance with the classification of Y. Matushko [9].

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