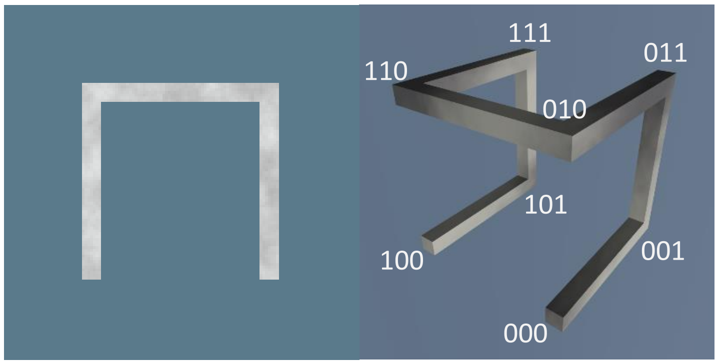
∞	00000000	0	00000000
1	00000001	1	00000001
2	00000011	2	00000010
1	00000010	3	00000011
3	00000110	4	00000100
1	00000111	5	00000101
2	00000101	6	00000110
1	00000100	7	00000111
4	00001100	8	00001000
1	00001101	9	00001001
2	00001111	10	00001010
1	00001110	11	00001011
3	00001010	12	00001100
1	00001011	13	00001101
2	00001001	14	00001110
1	00001000	15	00001111
5	00011000	16	00010000
1	00011001	17	00010001
2	00011011	18	00010010
1	00011010	19	00010011
3	00011110	20	00010100
1	00011111	21	00010101
2	00011101	22	00010110
1	00011100	23	00010111
4	00010100	24	00011000
1	00010101	25	00011001
2	00010111	26	00011010
1	00010110	27	00011011
3	00010010	28	00011100
1	00010011	29	00011101
2	00010001	30	00011110
1	00010000	31	00011111
6	00110000	32	00100000
1	00110001	33	00100001
2	00110011	34	00100010
1	00110010	35	00100011
3	00110110	36	00100100
1	00110111	37	00100101
2	00110101	38	00100110
1	00110100	39	00100111
4	00111100	40	00101000
1	00111101	41	00101001
2	00111111	42	00101010
1	00111110	43	00101011
3	00111010	44	00101100
1	00111011	45	00101101
2	00111001	46	00101110
1	00111000	47	00101111
5	00101000	48	00110000
1	00101001	49	00110001
2	00101011	50	00110010
1	00101010	51	00110011
3	00101110	52	00110100
1	00101111	53	00110101
2	00101101	54	00110110
1	00101100	55	00110111
4	00100100	56	00111000
1	00100101	57	00111001
2	00100111	58	00111010
1	00100110	59	00111011
3	00100010	60	00111100
1	00100011	61	00111101
2	00100001	62	00111110
1	00100000	63	00111111

The Untitled Binary Sequence

I was considering the Hilbert curve and its extension to higher dimensions. There seems to be some discrepancy about how to orient the individual boxes in more than two dimensions. The problem arises from the following issue: By making 90° (orthogonal) rotations, a square can only be oriented 4 different ways on a plane, but a cube can be oriented 24 ways in 3-space, and a tesseract can be oriented 196 ways in 4-space.

Although there are likely very simple rules that can be established that are consistent across all levels, I left that problem alone and instead focused on the properties of the basic element of a space filling Hilbert curve. In two dimensions it is like a horse-shoe, and in three dimensions it is a folded and extended version of that horse-shoe.



This shape is the path used to pass through every vertex in an n-cube. If one tries to trace the edges of a six-sided die with a marker, for example, they will find the same shape as in the image on the right, although the start and end points may be different if it is not a closed loop.

Because I am dealing with the simplest element, I can assign every dimension to a bool/bit: Left or Right, Up or Down, Forward or Back, Out or In. I can then address any location –vertex, as it is— a binary value. In my 3-cube above, the bottom right corner the line starts at can be 000. It travels back to 001, then up to 011, then forward to 010, left to 110, back to 111, down to 101, and finally forward to 100.

I found this results in a new counting sequence for binary. It follows the rule that only one place value (or dimension) can be changed at a time. The process is systematic. I thought about calling this the orthogonal binary sequence, but that already has a meaning in electronics. The applications of this sequence are unknown to me today.

These numbers can be converted to the original binary with this algorithm:

0s are read as 0s and 1s are read as 1s. After reading a 1, the opposite becomes true, until after another 1 is read.

SETTING	READ	OUTPUT	NEW SETTING
0=0, 1=1	0	0	0=0, 1=1
0=0, 1=1	1	1	0=1, 1=0
0=1, 1=0	0	1	0=1, 1=0
0=1, 1=0	1	0	0=0, 1=1

The original binary can be converted to this new form the same way, but with the added rule that every time the values of the 1s and 0s are swapped, the digit that triggers that swap is changed. I.e. The reversal occurs every time the digit read is different from the last.

I've looked at some of the patterns emerging from the sequence. The map in the corner, read from right to left and top to bottom, indicates the replacing digits (0s and 1s) with black and white pixels. The values on the far-left column of this page indicate the place value that is toggled (log2). Keeping track of these values is a highly effective way to keep track of the counting sequence itself. It resembles the fractional inch marks on a ruler, but rather than being fractal it grows outward to infinity. This also exists in the normal binary.