SPACE-FILLING CURVES

Dimension Changing Mappings:

- Continuous, one-to-one mapping from an interval to a n-dimension region
  $\Rightarrow$ Index to an interval $\rightarrow$ Point in a n-d region
  $\Rightarrow$ Index generated using interleaving
- Example:
  Point (x, y) in a unit square $\rightarrow$ Index i to a unit interval

$$
\begin{aligned}
x &\equiv 0.x_1 x_2 x_3 \ldots;\ \ 0 \leq x_i \leq M-1\ (base\ M) \\
y &\equiv 0.y_1 y_2 y_3 \ldots;\ \ 0 \leq y_i \leq M-1\ (base\ M) \\
i &\equiv 0.(x_1 y_1)(x_2 y_2)(x_3 y_3) \ldots\ (base\ M+1)
\end{aligned}
$$

Properties:

- Digital Causality
- Self-similarity

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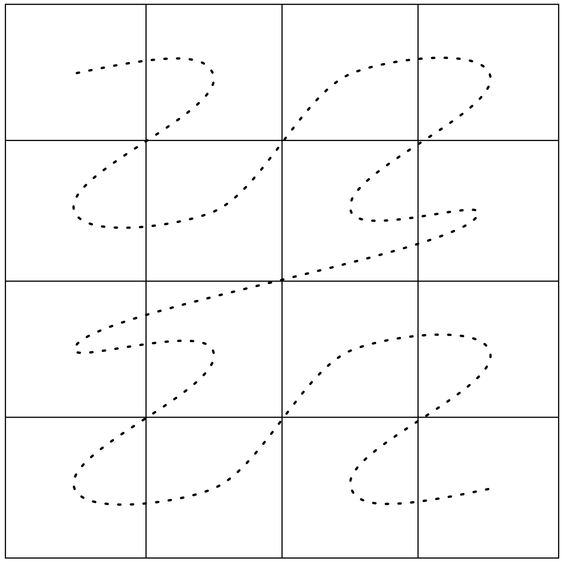
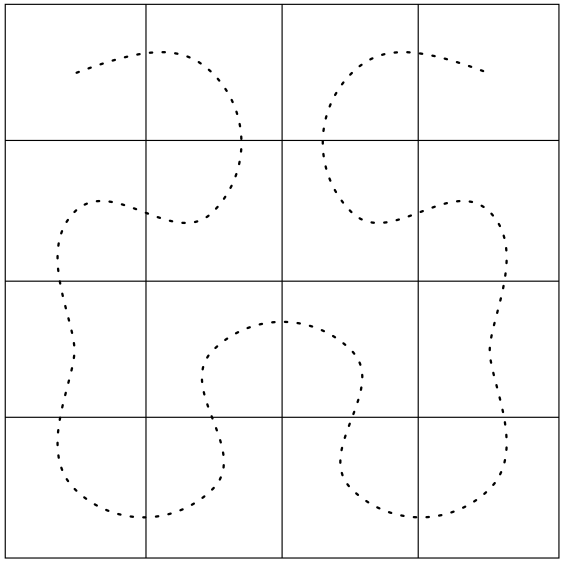
Space-Filling Curves - Examples



Morton Order



Peano-Hilbert Order

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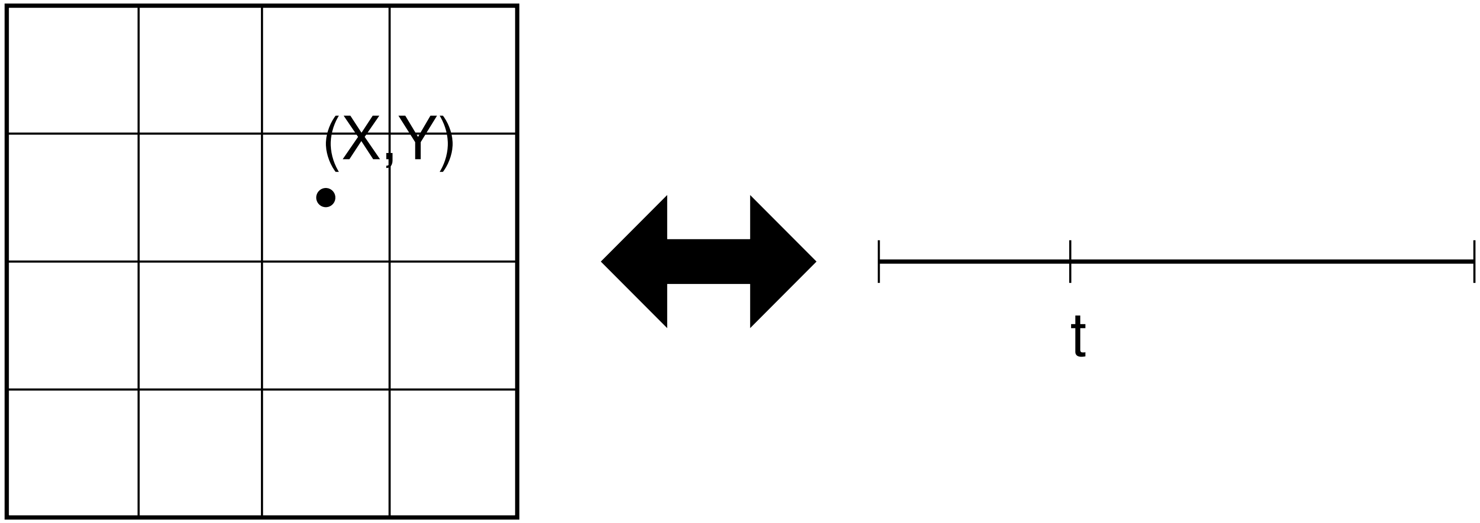
Space-Filling Curves - Digital Causality



$$t = 0.(x1y1)\ (x2y2)\ (x3y3)\ (x4y4)\ \ldots\ldots$$

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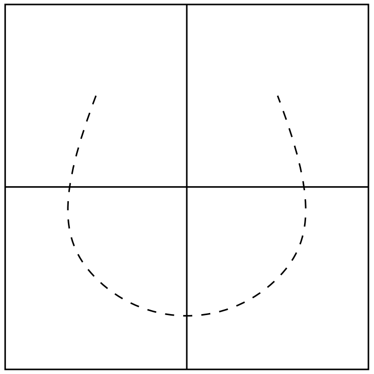
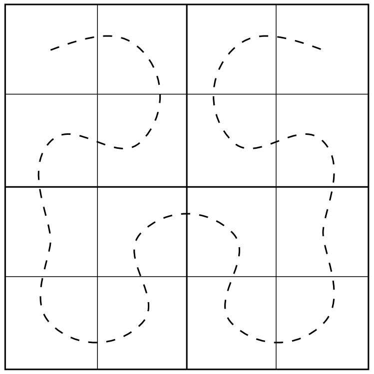
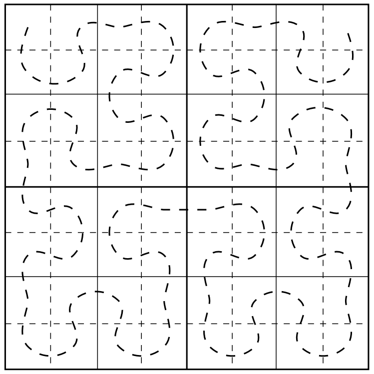
Space-Filling Curves - Self-Similarity



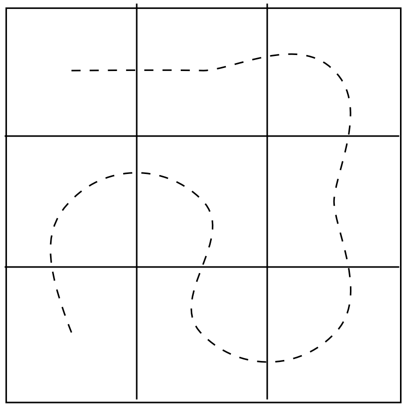
Degree 1



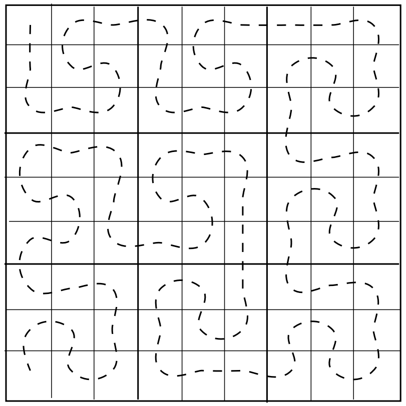
Degree 2



Degree 3



Degree 1



Degree 2

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