Puzzled?

Is a “fun” talk in Beamer possible?

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Here’s a useless outline

- Some cute puzzles
- Some tricky puzzles
- Four equivalent boring puzzles
- Some annoying puzzles
- An infinite unsolvable puzzle
Puzzle boxes

200 years old (Japan)
Art puzzles

- Inspired by puzzle boxes but with a much wider variety of design elements
- Annual competitions:
  http://www.puzzleworld.org/designcompetition/
Six-piece burrs

- 200 years old

Philippe DuBois's Level 6.4 Burr
Disentanglement

- Spatial reasoning puzzles
- These pictures are boring
Chinese rings

- 2000 years old (China)
- Design enforces these rules:
  - Can only manipulate rings up to the first ring on the handle, or the one after it
  - Cannot manipulate a ring if the previous ring is off the handle
Equivalent puzzles

- Equivalent to staircase puzzle and Spinout; similar to Tower of Hanoi

  ▶ Spinout demo: http://www.puzzles.com/products/SpinOut/PlayOnline.htm

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Recursion and Gray codes

- Puzzle is recursive (to solve the $n$-ring puzzle, first solve the $n - 1$-ring puzzle)
- Gray codes: sequences of binary numbers where successive numbers differ by one bit
  - Usually generated recursively: coincidentally this means Gray codes correspond to solutions of Chinese rings puzzle
- Relationship between Chinese rings and binary numbers discovered by Édouard Lucas (inventor of Tower of Hanoi)
Jigsaw puzzles

- Traditional jigsaws are $O(n^2)$ search problems (each edge has a unique match)
  - Boring unless you’re the government (DARPA Shredder Challenge)
- Tetravex is hard (many matches $\rightarrow$ nonlocal) — NP-complete
  - “Eternity II” puzzle (16x16 Tetravex puzzle, rotations allowed) remains unsolved (despite $2M prize July 2007—end of 2010)
- “Tetravex tiles” were originally called Wang tiles in formal logic
- Tiling problem: given an finite set of Wang tiles and infinite supply of each can you tile an infinite plane?
  - Undecidable: equivalent to halting problem for a Turing machine
Aperiodic tiling

- This implies there must exist “aperiodic tile sets” that can tile the plane, but can’t form periodic patterns (otherwise you could search for periodic tilings).

- Below: aperiodic Wang tiles, Penrose tiles

- 2011 Nobel in chemistry awarded for discovery of quasicrystals
Links

- http://www.johnrausch.com/PuzzlingWorld/
- http://www.tavernpuzzle.com/
- http://www.puzzleworld.org/PuzzleWorld/