Rules Schemas

Games as Emergent Systems

Rules Schemas

- Games as Emergent Systems
- Games as Systems of Uncertainty
- Games as Information Theory Systems
- Games as Systems of Information
- Games as Game Theory Systems
- Games as Cybernetic Systems
- Games as Systems of Conflict

Types of Systems
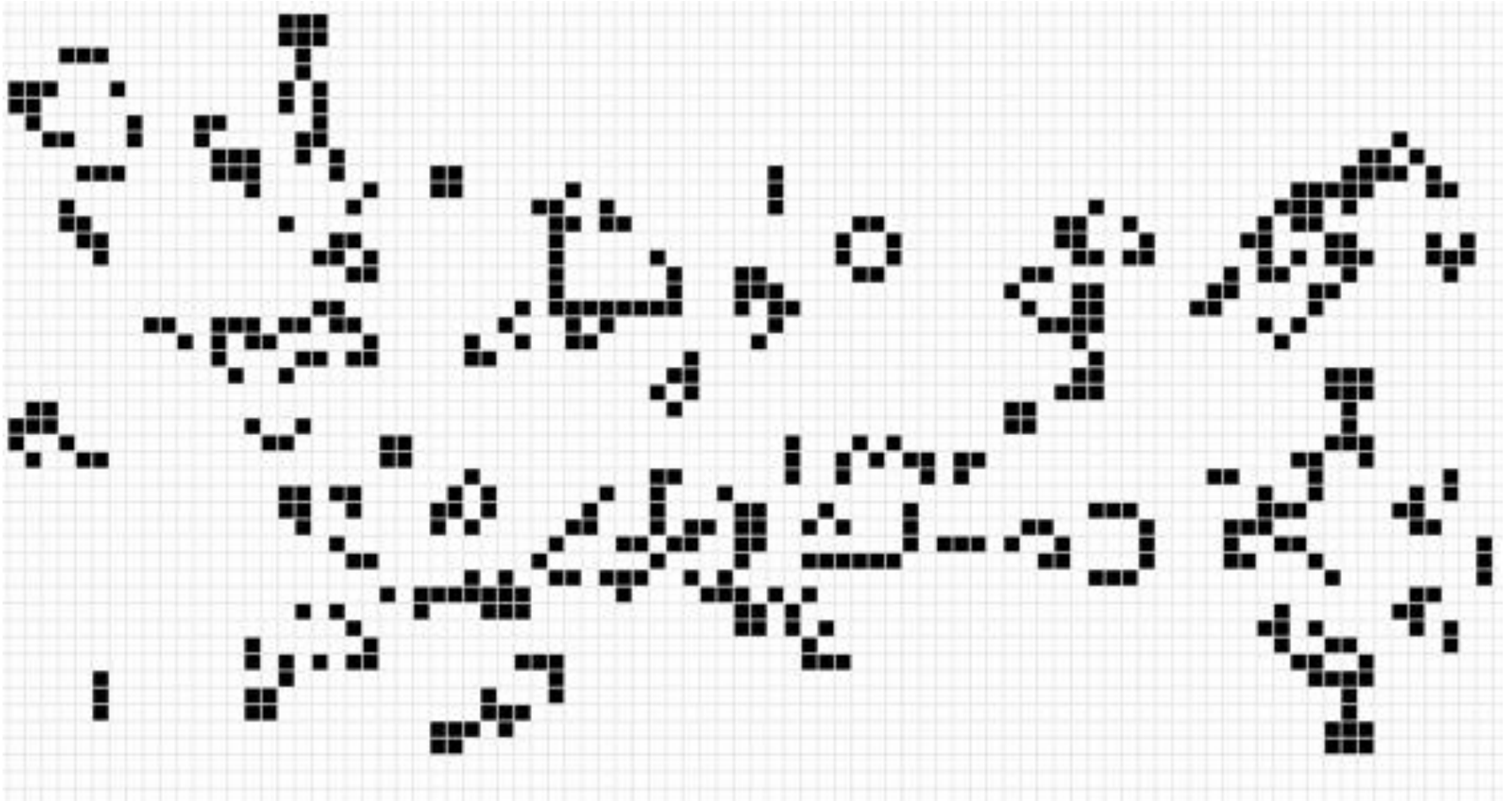
- Fixed
- Periodic
- Complex
- Chaotic

Complexity

- More than the sum of its parts.
- Necessary (but not sufficient) for a game.
- Demonstrates *emergent behavior*.

Emergent Behaviors

Unforeseen but clearly recognizable patterns that arise from complex systems whose rules can be understood.

Conway's *Life*

Gearheads, 1996

Emergent Behaviors in *Gearheads*

- **Ziggy:** fast, flips onto back when it bumps into someone, flips back on next bump
- **Kanga:** fast, punches toys in front of it forward
- **Walking Time Bomb:** medium fast, explodes when it runs out of energy
- **Disasteroid:** slow, destroys enemies in its path
- **Crush Kringle:** slow, stomps when it runs out of energy to reverse all nearby toy directions
- **Handy:** medium fast, moves forward wining up any toys it encounters

Creating Complexity / Emergence

Complexity arises from combinatorial explosion. In other words, the number of different relationships that elements of a system can have to other elements in the system.

Complexity is NOT

- Randomness
- More things
- More rules

Complexity and Cognition

Is Tic Tac Toe a complex game?

Is Tic Tac Toe a complex game for an adult human?

Is chess a complex game for an adult human?

Is chess a complex game for Deep Blue?

Emergent Behaviors

Unforeseen but clearly recognizable patterns that arise from complex systems whose rules can be understood.

Emergent Behaviors

Unforeseen but clearly recognizable patterns that arise from complex systems whose rules can be **understood**.

Defined in terms of the cognitive capacity of the player.

Emergence

Emergent behaviors are often unintended and not discovered until gameplay.

Designing complex systems with emergent behaviors requires iterative design!

Games as Systems of Uncertainty

Uncertainty

- **Macro Uncertainty:** the outcome of the game is not known before the game starts

    Necessary for meaningful play?

- **Micro Uncertainty:** the outcome of individual events in the game is not known

Certainty of Events

- **Certain**: outcome is known in advance
- **Risk**: outcome not known in advance, but probability is known
- **Uncertain**: outcome and probability unknown

Most games employ a mixture of these.

Risk

Diplomacy

Feeling of Uncertainty

Most games create a feeling of uncertainty (often through complexity) even if there are actually no uncertain events.

For example, in *Diplomacy*, players are uncertain whether or not others will do what they say they will do.

Fallacies of Probability

- **Overvaluing the long-shot**: players overvalue low probability high gain bets

- **Thinking of successive chances as additive**: people don't know basic statistics

- **Monte Carlo syndrome**: probability of an event does not change based on prior events

- **Overemphasis on good outcomes**: b/w unlikely bad and unlikely good, players expect good

- **Lightning never strikes the same place twice**: unlikely bad events won't repeat, but good will

- **Luck**: superstition about people or things

Games as Uncertainty

It is important to understand both the mathematical probability of how your game works as well as the way people will experience that uncertainty.

Games as
Information Theory Systems

Information (Theory)

The field of information theory is the mathematical and computational study of how messages are transmitted.

Focuses on the structure (number of bits) of a message, not its content or meaning.

Studies the presence of entropy, or uncertainty in a message.

Information (Theory)

Information is a measure of all the possible things that a message could be. Information dispels entropy.

A known message has no information.

A 1 bit message (e.g. coin flip) has low information because it has two possible values.

An 8 bit message has higher information because it has 256 possible values.

Information Theory in Games

Information Theory often studies how to reduce uncertainty. Many games can be seen as high-information messages for which players try to reduce uncertainty.

Mastermind

Clue

Noise

Information Theory usually studies how to reduce the influence of noise on the transmission of a message.

However, many games are based around introducing noise into communication.

This is possible thanks to the *lusory attitude*, which allows players to accept inefficient rules for the sake of the game.

Charades

Redundancy

Redundancy in communication is put in place to ensure that not every component of a message is necessary.

Redundancy in games can be used to help players maintain steady progress deciphering messages in the game.

Crossword Puzzles

Easy Crossword Puzzle #9 by Dave Fisher (puzzles.about.com)

Across

1. Combines

5. Numero uno

9. Classic late night TV

12. Field yield

13. Bow

14. Ornamental pond fish

15. Instrument

16. Uncommon

17. Actor Brynner

18. Water source

20. Pressing

22. It's brewed

23. Honey maker

24. __ band

28. Unruly crowds

32. Afire

58. Notion

59. Regular, abbrev.

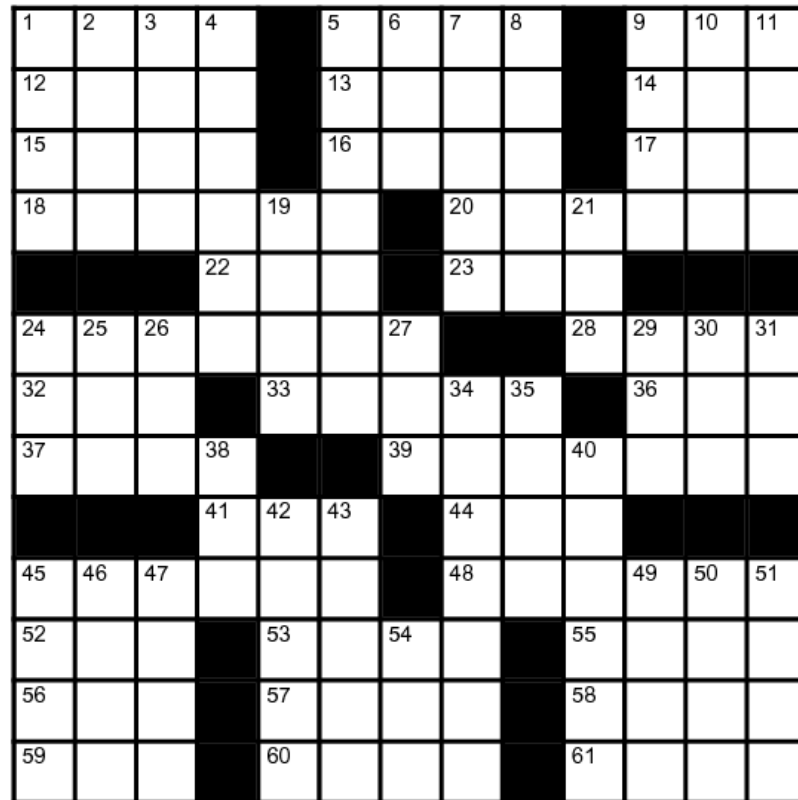**60.** Let

10. Verb preceder

11. Merry-go-round music

42. Command

43. Make a rug

45. Drinks slowly

Games as Systems of Information

Information

In this context, **information** means knowledge.

Games can be of two kinds:

- **Perfect Information**: all players share complete knowledge of the game at all times.

- **Imperfect Information**: information is a resource in the game, and is distributed asymmetrically among players or the game

Chess (Perfect Information)

Poker (Imperfect Information)

Information Games

Perfect Information Games

- Highly analytical
- Highly competitive
- Often as much about the opponent as the game

Imperfect Information

- Can be randomized and/or balanced
- Discovery can be an enjoyable element
- Invites trickery

Stratego

Information ≠ Uncertainty

	Perfect Information	**Imperfect Information**
Uncertain	*Risk*	*Poker*
Certain	*Chess*	*Stratego*

B.S. aka *Cheat*

4 Kinds of Information in a Game

1. Information known to all players
    (e.g. cards on the table in poker)
2. Information known to subsets of players
    (e.g. each player's hand in poker)
3. Information known only to the game
    (e.g. yet undrawn cards in poker)
4. Unknown information
    (e.g. dice roll)

Using Imperfect Information

- Create a rhythm of exploration and discovery (e.g. Metroidvania games)

- Give players a feeling of progress (e.g. learning new spells in an RPG)

- Allow players to learn/discover the game system (e.g. simulations and tutorials)

Games as Game Theory Systems

5 Pirates Riddle