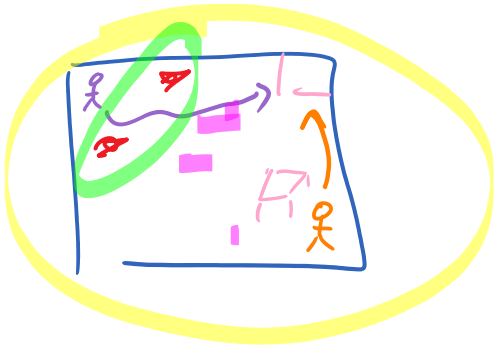
Game/Content Evalulation



Desirable qualities of a game or level

- appeals to senses
- memory / randomness
- drawishness?
- balance
- simple vs. rules?
- interesting – strategic depth
  - how many levels of skill are there to progress through

What makes Chess, Go, ... interesting?

complexity – state space / game tree size
- branching factor
- complexity class

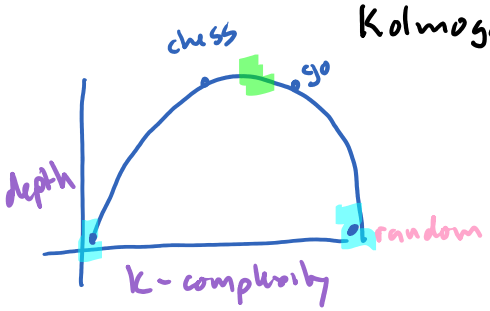
10^{47} chess 10^{170} Go

set of operations: +1, +3, −2, ~~×5~~, ×2, ..., %6

start @ 1 choose operation (then out of play for rest of game)

at end P2 wins if result is a square (or even)

then apply pseudorandom # generator



Kolmogorov compelxity (compressability)

complexity of sequence is length of shortest algorithm to produce it

10^9 repeats

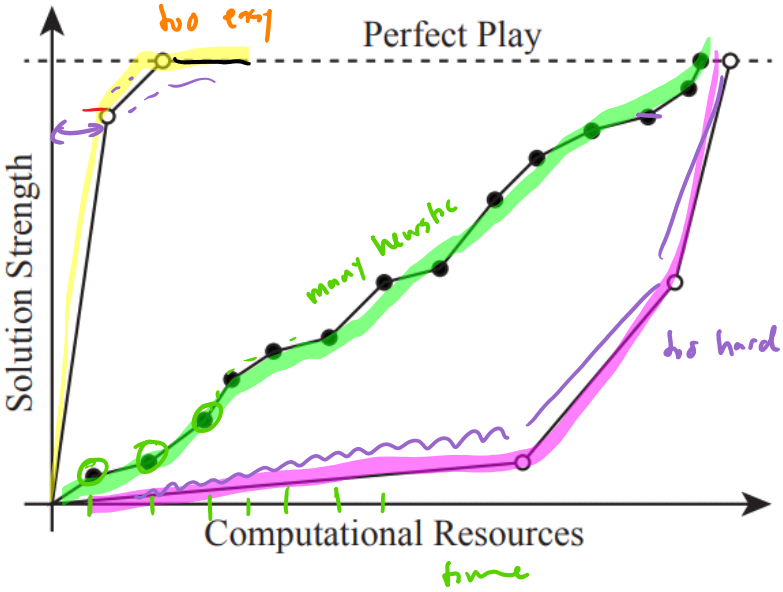
abcd abcd abcd .... abcd low complexity

a x q r i 9 4 3 % b Z J k ... high complexity

heuristics compress search

depth ≈ # of heuristics to learn

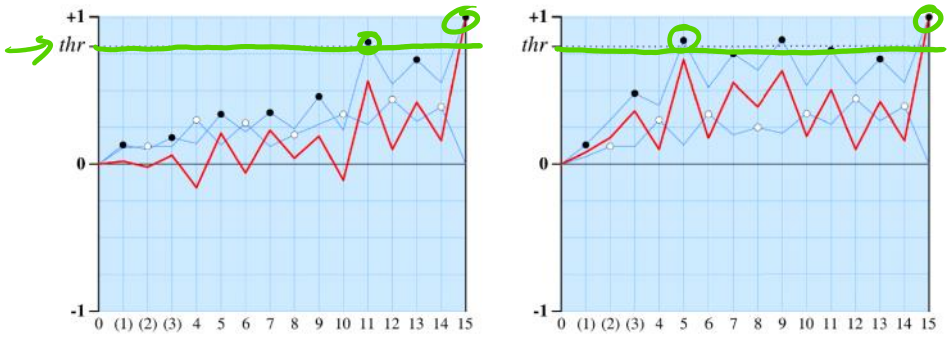
Strategy Ladder



From: Lantz, F., Isaksen, A., Jaffe, A., Nealen, A., & Togelius, J. (2017). Depth in strategic games. Proc. 31st AAAI Conference on Artificial Intelligence, AAAI 2017. 967-974

Ludii :

Metrics : decisiveness

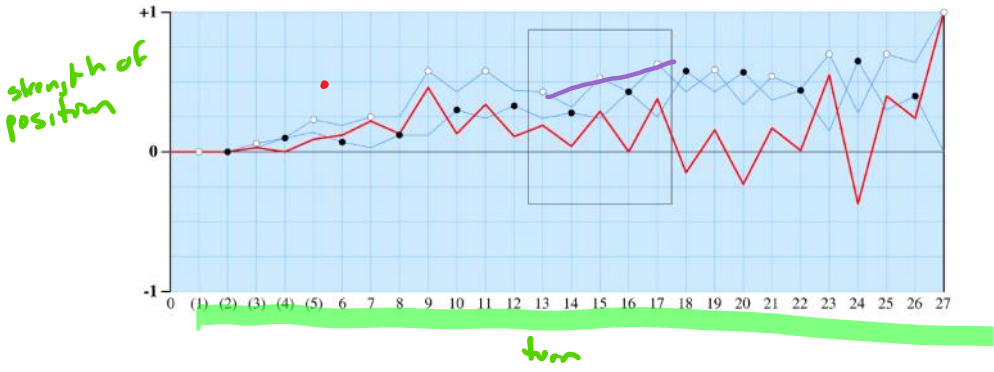


Diagrams from

Browne, Cameron Bolitho (2008) *Automatic generation and evaluation of recombination games.* PhD thesis, Queensland University of Technology.

From <https://eprints.qut.edu.au/17025/>

Momentum



Qualitative measures from heuristics for novice-level AIs

↓

developed with evolution strategy

Correlate with subjective evaluation of games

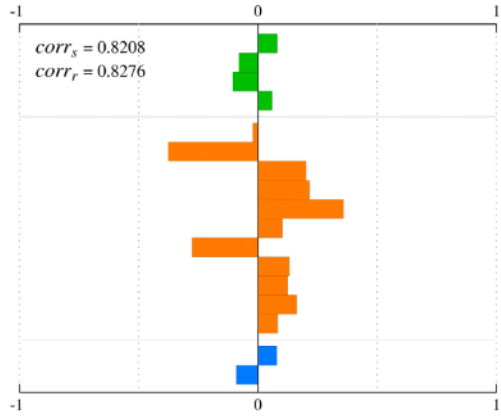
human

intrinsic

quality

viability

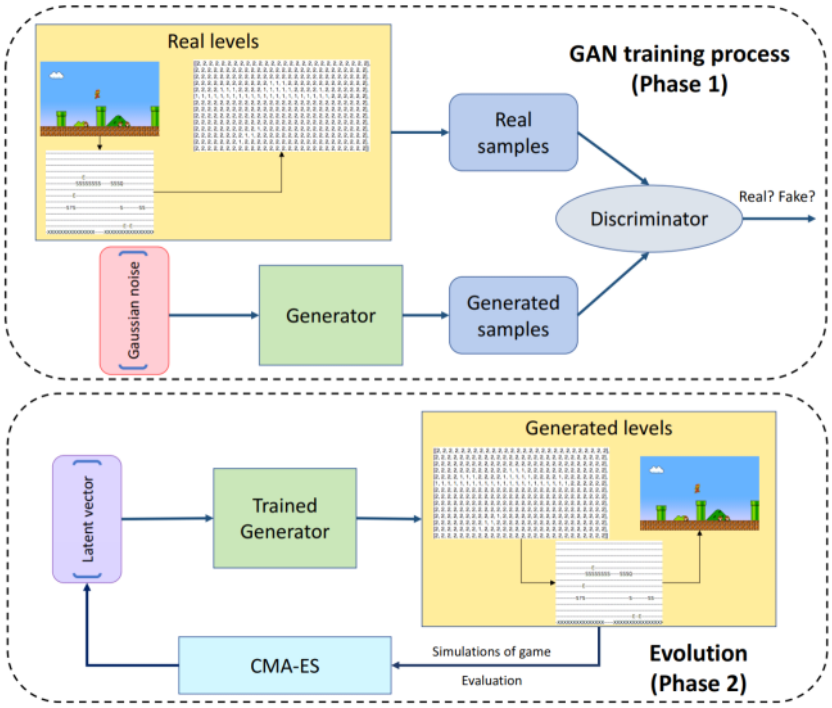
Criteria	Weight
5. Goal (group)	0.0818
6. Goal (stack)	-0.0804
8. Goal (block)	-0.1055
13. Piece capture	0.0585
17. Convergence	-0.0221
21. Clarity (variance)	-0.3763
25. Uncertainty (late)	0.2023
26. Drama (average)	0.2167
28. Killer moves	0.3585
29. Permanence	0.1027
30. Lead change	-0.2769
32. Decisiveness threshold	0.1311
36. Momentum (1)	0.1244
39. Correction (1)	0.1622
45. Puzzle quality	0.0826
46. Completion	0.0788
51. Duration	-0.0907
Bias	-0.2576



Generate new games by genetic algorithms

fitness using model

Vanessa Volz et al



From V. Volz, J. Schrum, J. Liu, S. M. Lucas, A. Smith, and S. Risi, "Evolving Mario Levels in the Latent Space of a Deep Convolutional Generative Adversarial Network", GECCO '18, July 15–19, 2018, Kyoto, Japan ISBN 978-1-4503-5618-3/18/07, https://doi.org/10.1145/3205455.3205517