Relative Building Block Fitness and the Building Block Hypothesis

“Royal Road” function

Building Block Hypothesis:

short, low-order, highly-fit schemata recombine to form even more highly fit higher-order schemata

What types of fitness landscape for which crossover will be an effective operator?

“Royal Road” (for the GA to follow to the global optimum) function as a fitness landscape to investigate

Stepping Stones in the Crossover

Two landscape features for the GA

1. short, low-order, highly-fit schemata
2. intermediate “stepping stones”: intermediate-order higher-fitness schemata that result from combination of the low-order schemata, and that in turn can combine to create even higher-fitness schemata

What is the effect of step size of the intermediate stepping stones on the GA’s performance?

R1 and R2

Experiments on R1 and R2

R2 is expected to find optimum more quickly than R1

But the experiments shows the opposite!

What slows down the GA in the case of R2?

- "Hitchhiking"
- 0's close to the highly fit schema's defined position in a string hitchhike along with the schema
- R2 causes S_{11} to rise very quickly compared to S_4
  - S_{11}: 00001100, $R2(S_{11}) = 32$
  - S_4 : 00010000, $R2(S_4) = 8$

Hitchhiking effect causes the GA to find the optimum on R2 relatively slower times

The power of crossover to combine lower-level building blocks is hampered on R2

Discussion

Performance of GA effectively depends on

- Presence of building blocks
- Relative fitness of the building blocks

Too much fit intermediate stepping stones causes premature convergence and slows down the discovery of some necessary schemata