

# The Relationship Between Evolvability and Bloat

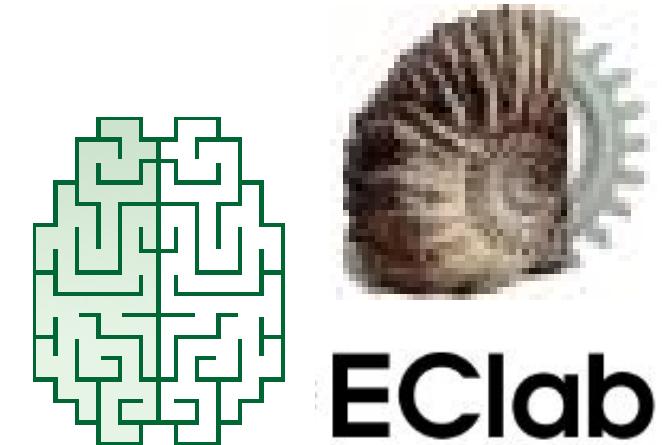


Jeffrey K. Bassett  
jbassett@cs.gmu.edu

Mark Coletti  
mcoletti@gmu.edu

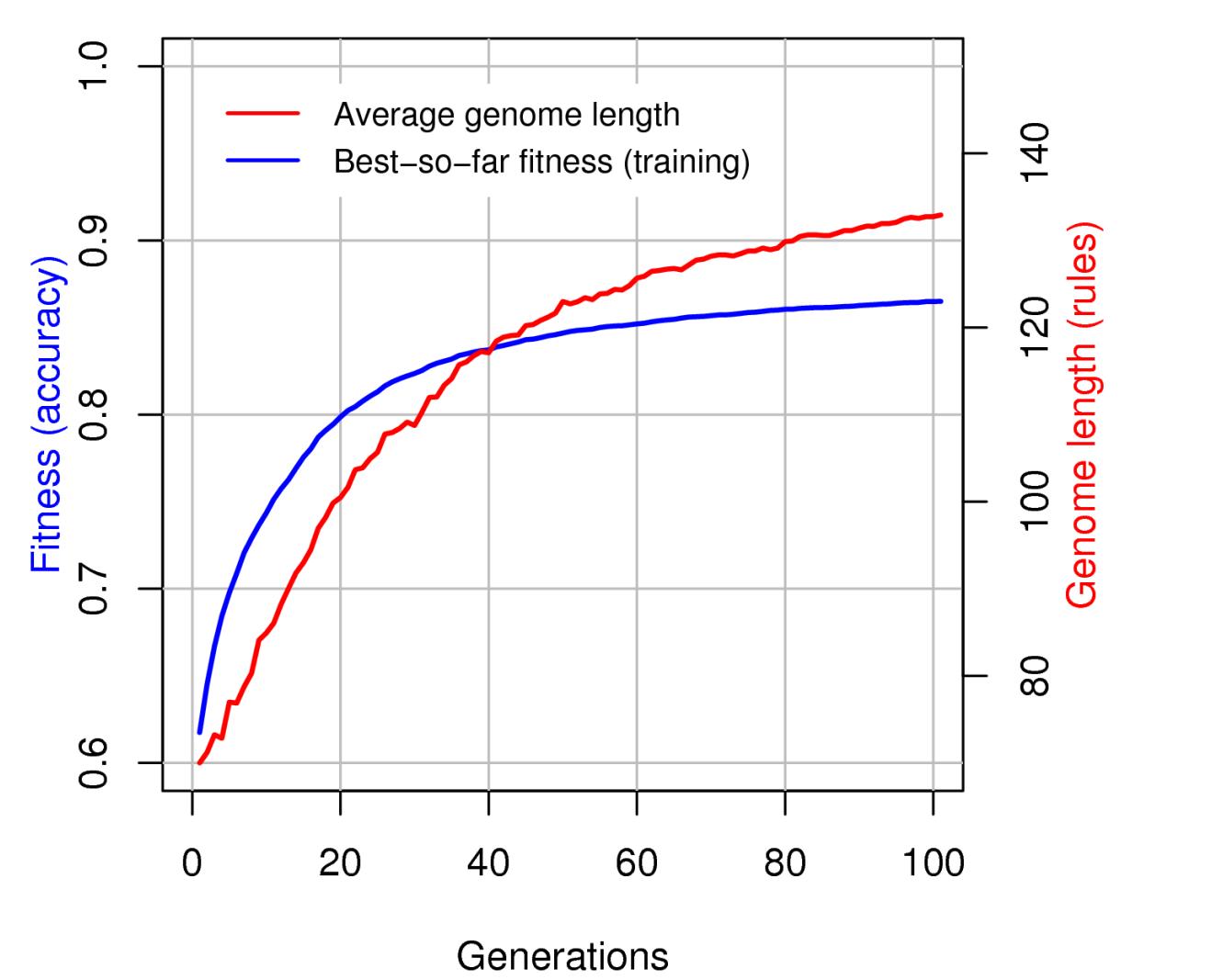
Kenneth A. De Jong  
kdejong@gmu.edu

George Mason University, Fairfax Virginia USA

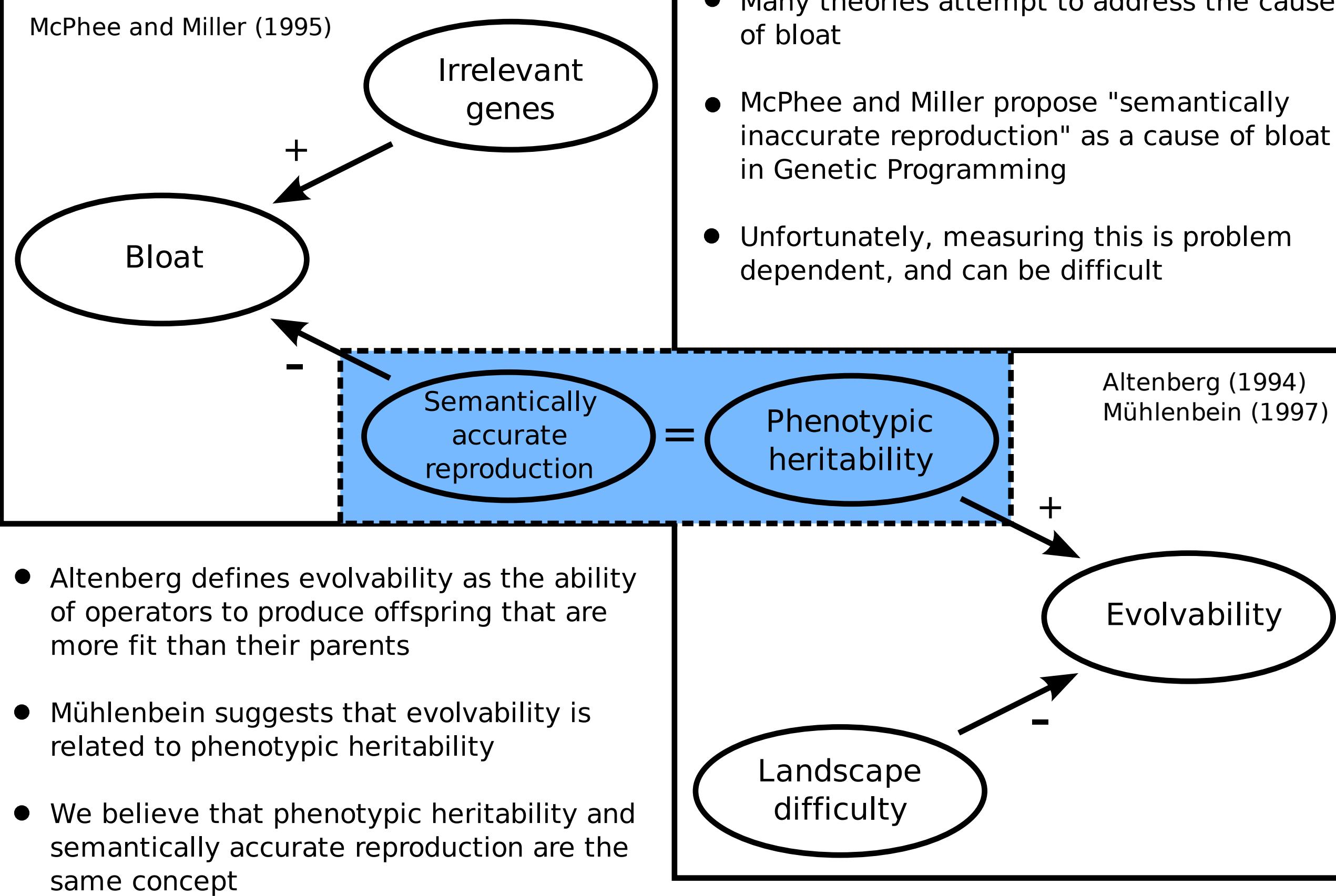


## The Problem

- Bloat occurs when the size of genomes in a population grow uncontrollably, even after a solution is found
- Most variable length representations suffer from bloat
- There are some reproductive operators that cause little to no bloat at all
- But there is little guidance for designing such an operator



## Proposed Solution



### Hypothesis:

- Reproductive operators with high evolvability will produce less bloat
- If so, evolvability will provide a useful metric for guiding the design process

## A Demonstration

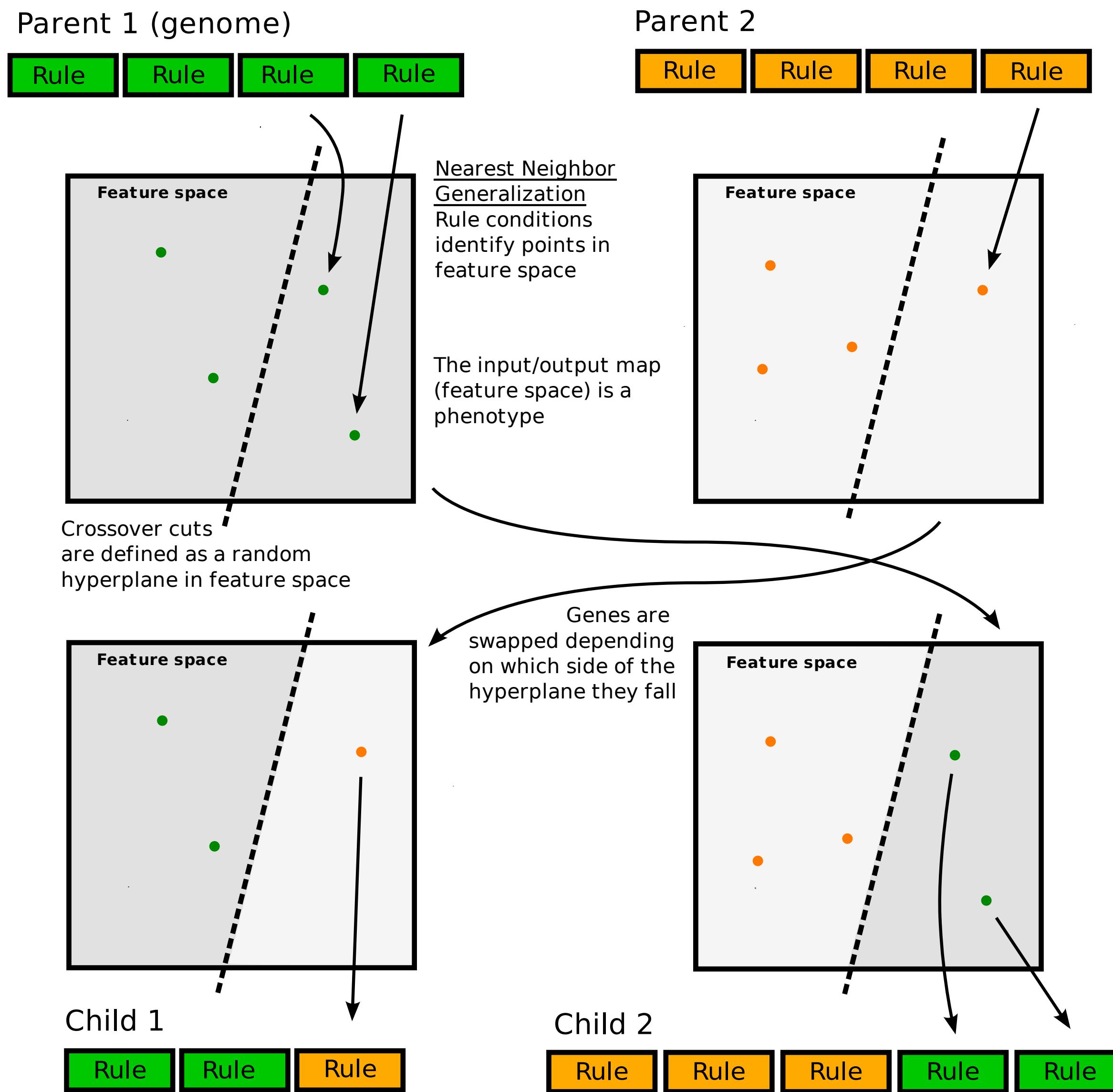
- Develop a new crossover operator for Pittsburgh Approach rule systems
  - Design Principle: improve phenotypic heritability
  - Phenotype = mapping from feature space (inputs) - to classifications (outputs)
  - The Nearest Neighbor representation offers an opportunity
    - Rule conditions identify points in feature space
    - The relationship between genotype and phenotype is very clear
  - "Feature space crossover"
    - Perform gene swaps based on a rule's location in feature space
    - See next frame
- Compare our operator to a standard Pittsburgh Approach crossover operator
  - Test suite: several common concept learning problems
  - Evolvability = Correlation(Fp, Fc)
    - Fp = Fitness of mid-parent, Fc = Fitness of child

## References

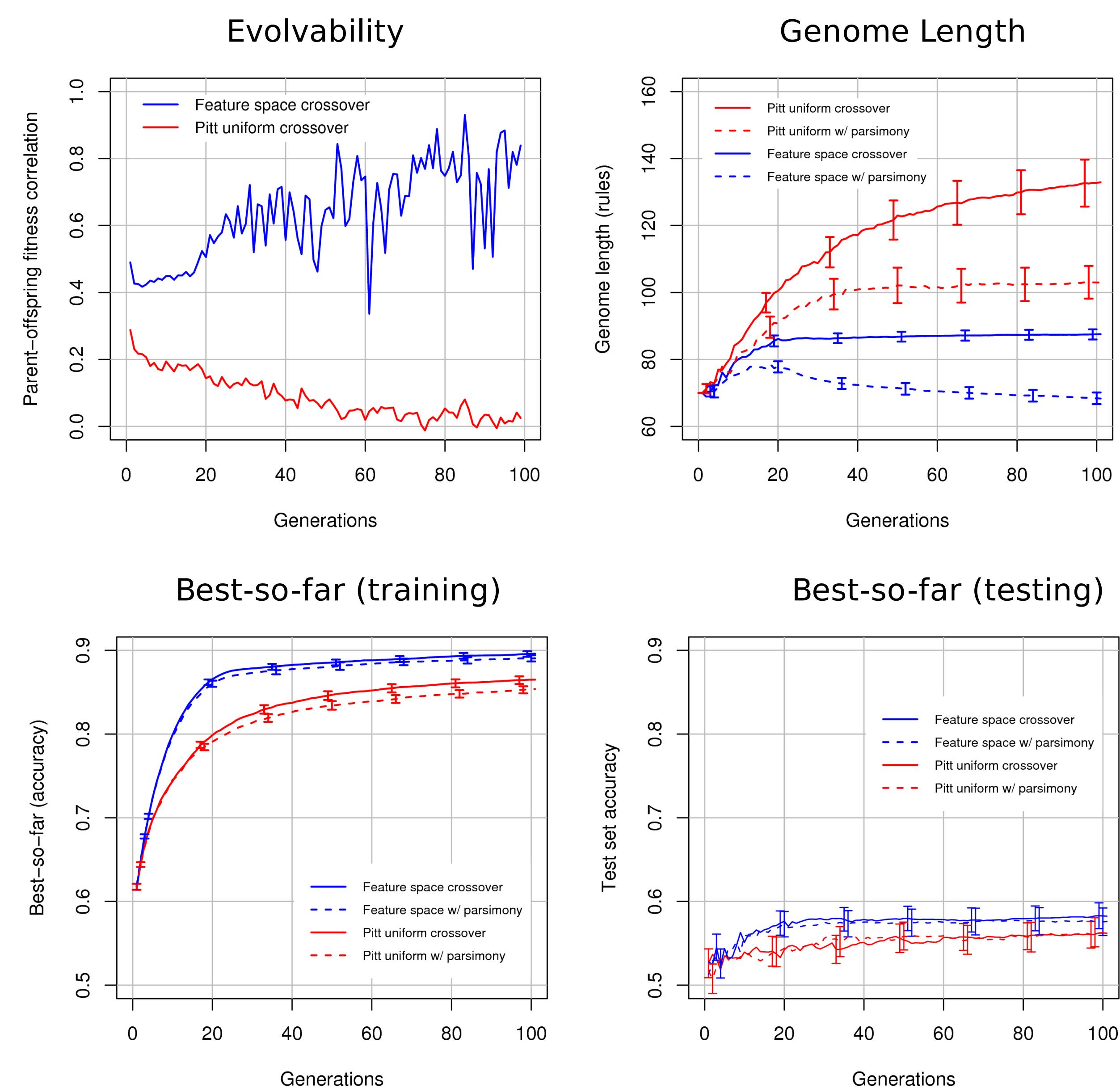
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## Improving Phenotypic Heritability

"Feature space crossover"  
for Pittsburgh Approach rule systems



## Results



## Conclusions

- In all experiments, feature space crossover produced significantly less bloat at no cost to fitness
- Evolvability metrics can aid in the development of customized reproductive operators that cause less bloat