

# Title

Abandoning Objective Abandoning Objectives: Evolution Through  
Through the Search for Novelty Alone

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# Introduction

- ▶ Discusses algorithms used for evolutionary computation (EC).
- ▶ Previous approaches primarily used objective functions.
  - ▶ Example: Chinese finger trap
  - ▶ Problem: Only finds local optima (deception)
- ▶ New Idea: search for novelty instead.
  - ▶ Completely ignores the objective
- ▶ How can we use these approaches to model evolution?
- ▶ Main idea: The objective function isn't as perfect as we used to think, sometimes novelty functions work better.



Figure 1: Chinese Finger Trap

# Background

- ▶ Deception – when lower-order building blocks are combined and don't lead to a global optimum.
  - ▶ Multi-Objective Evolutionary Algorithms can sometimes fight deception by training against multiple objectives.
  - ▶ Incremental evolution of objective functions can also help
    - ▶ Implies the need to track the “stepping stones” that lead to the objective
- ▶ Selection pressure restricts the scope and direction of search
- ▶ NeuroEvolution of Augmenting Topologies (NEAT)
  - ▶ Evolves artificial neural networks
  - ▶ Complexifies the network over generations

# The Search for Novelty

- ▶ Learning method is rewarded finding instances that are significantly different from any found before
- ▶ Biped locomotion example:
  - ▶ Novelty function would reward falling in new ways (maybe eventually walking)
  - ▶ Objective function would reward falling the furthest
- ▶ Novelty search is different from exhaustive search
  - ▶ Domain typically limits the variety of behaviors
  - ▶ Since NEAT starts simple and complexifies, it is much better than random.

# Novelty Search Algorithm

- ▶ point

# Experiment 1

► point

# Biped Experiment

▶ Video

# Discussion/Conclusion

- ▶ point