

MIMICKING BIOMIMICRY: WHAT CAN WE LEARN FROM A SWARM OF HUMANS?

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MIMICKING BIOMIMICRY

- × Biomimicry
 - + Good ideas from Natural World
 - + Humans part of Natural World



HUMAN SWARMS



HUMAN SWARM IN ACTION



HUMAN SUDOKU

- ✘ 81 participants
- ✘ 9 groups of 9
 - + Colored T-shirts
 - + Numbers
- ✘ Only Instructions:
 - + Get on grid
 - + Make no conflicts



SUDOKU VIDEO 1

Observed Low-Level Behaviors

Homesteading

Wandering

Conflict Discoverers

Human Swarm begins Sudoku Puzzle

SUDOKU VIDEO 2

Observed High-Level Behaviors

Decentralized Efforts

Centralized Take-over

Decentralized correction

Centralized Take-over of Swarm

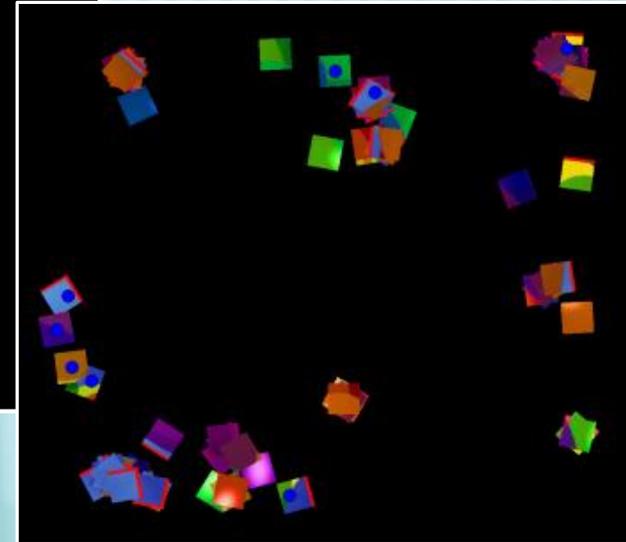
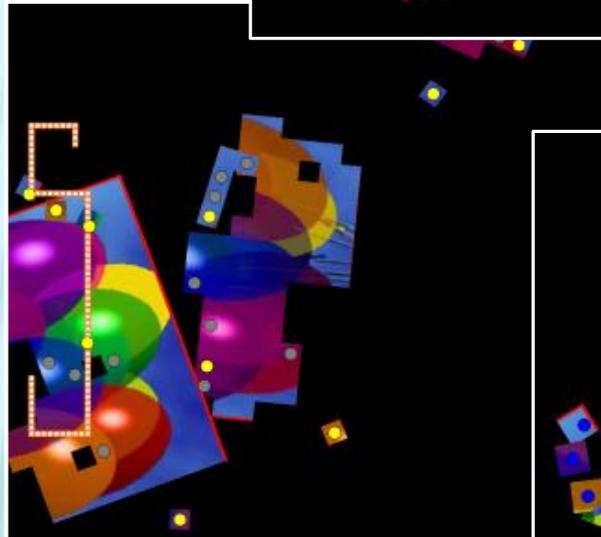
HUMAN SWARM SOLVING JIGSAW PUZZLE

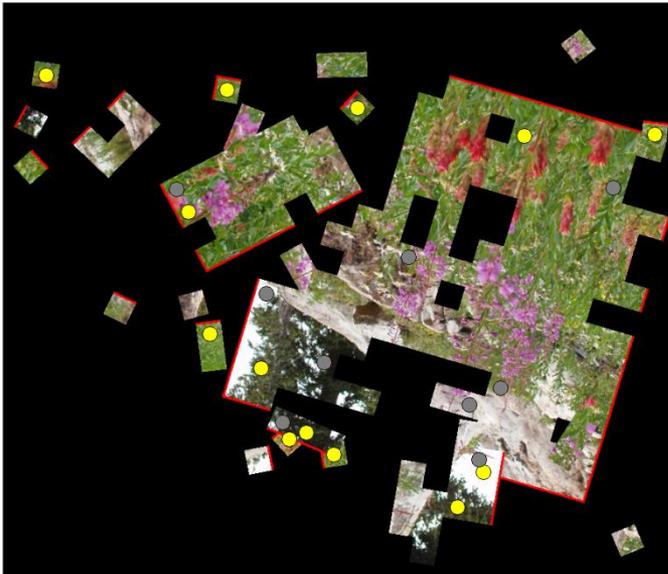
- ✘ Connectors
- ✘ Detectors
- ✘ De-selectors
- ✘ Transporters
- ✘ Leaders



HUMAN-SWARM HYBRID SYSTEM

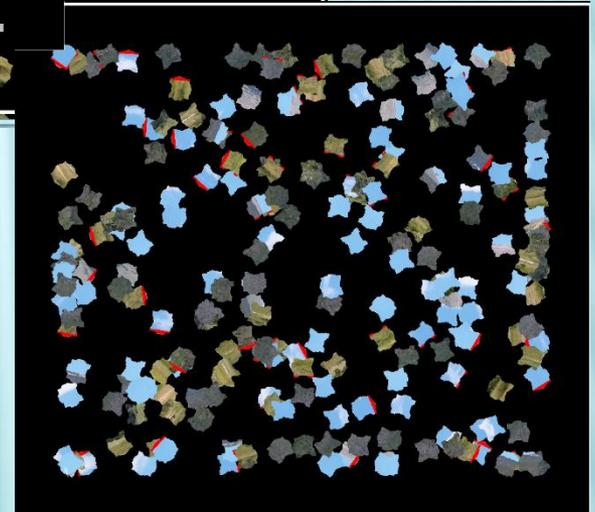
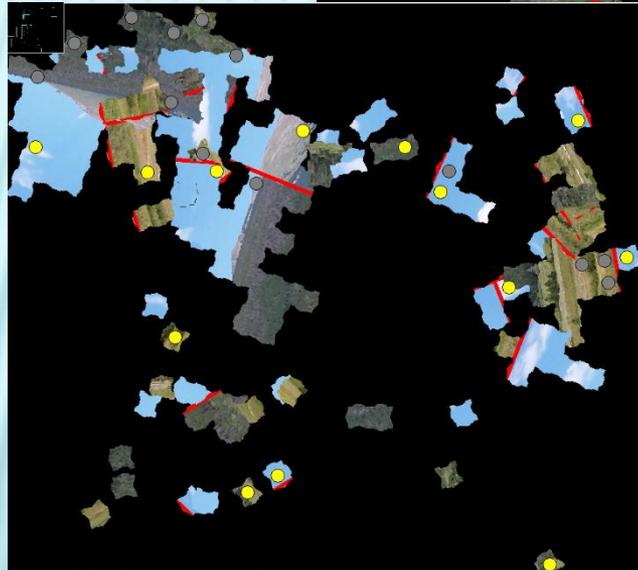
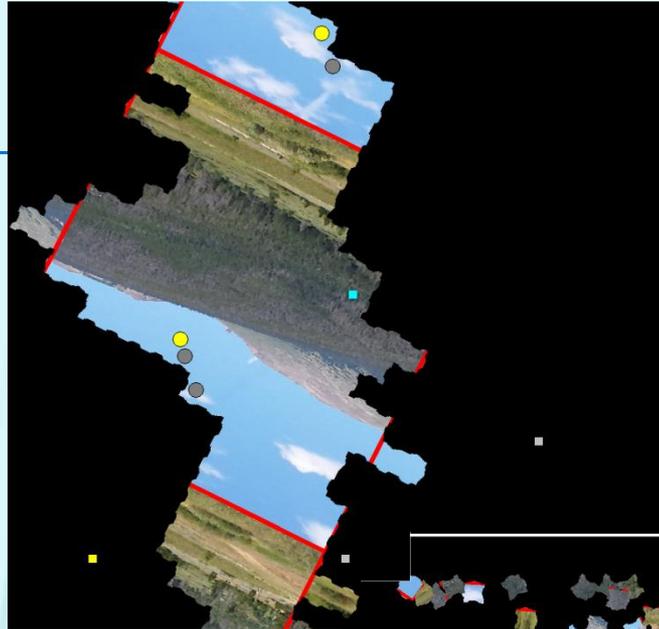
- × Digital Jigsaw Puzzle
- × Agent Population Ratio Control
- × Humans address “big picture”
- × Swarms leverage parallelism and randomness





AGENT TYPES

- × Connectors
- × Sorters
 - + Color
 - + Edge
 - + “Shape”
- × Finishers



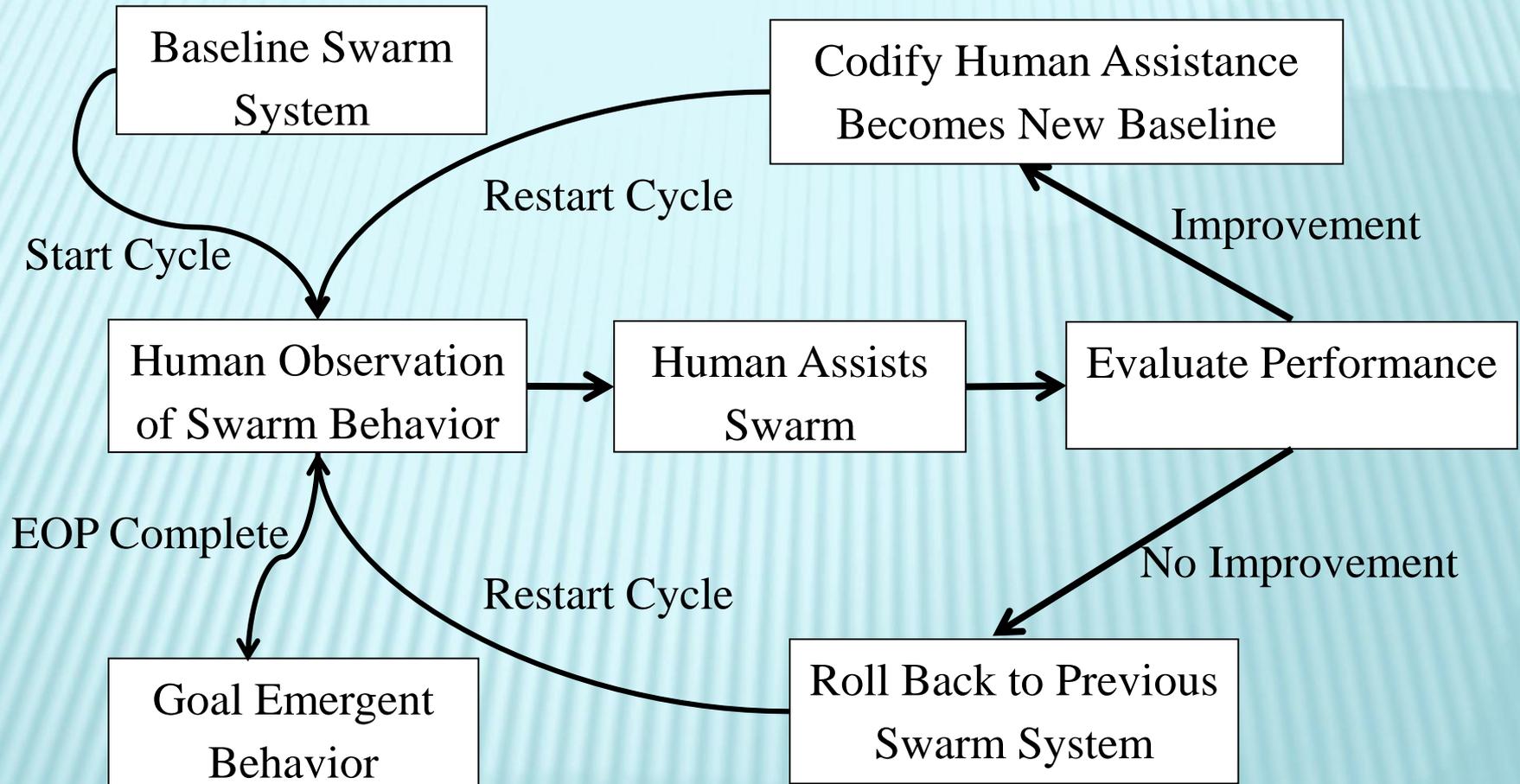
SWARM PROGRAMMING

- × **Writing Agent Rules**
 - + Low level actions

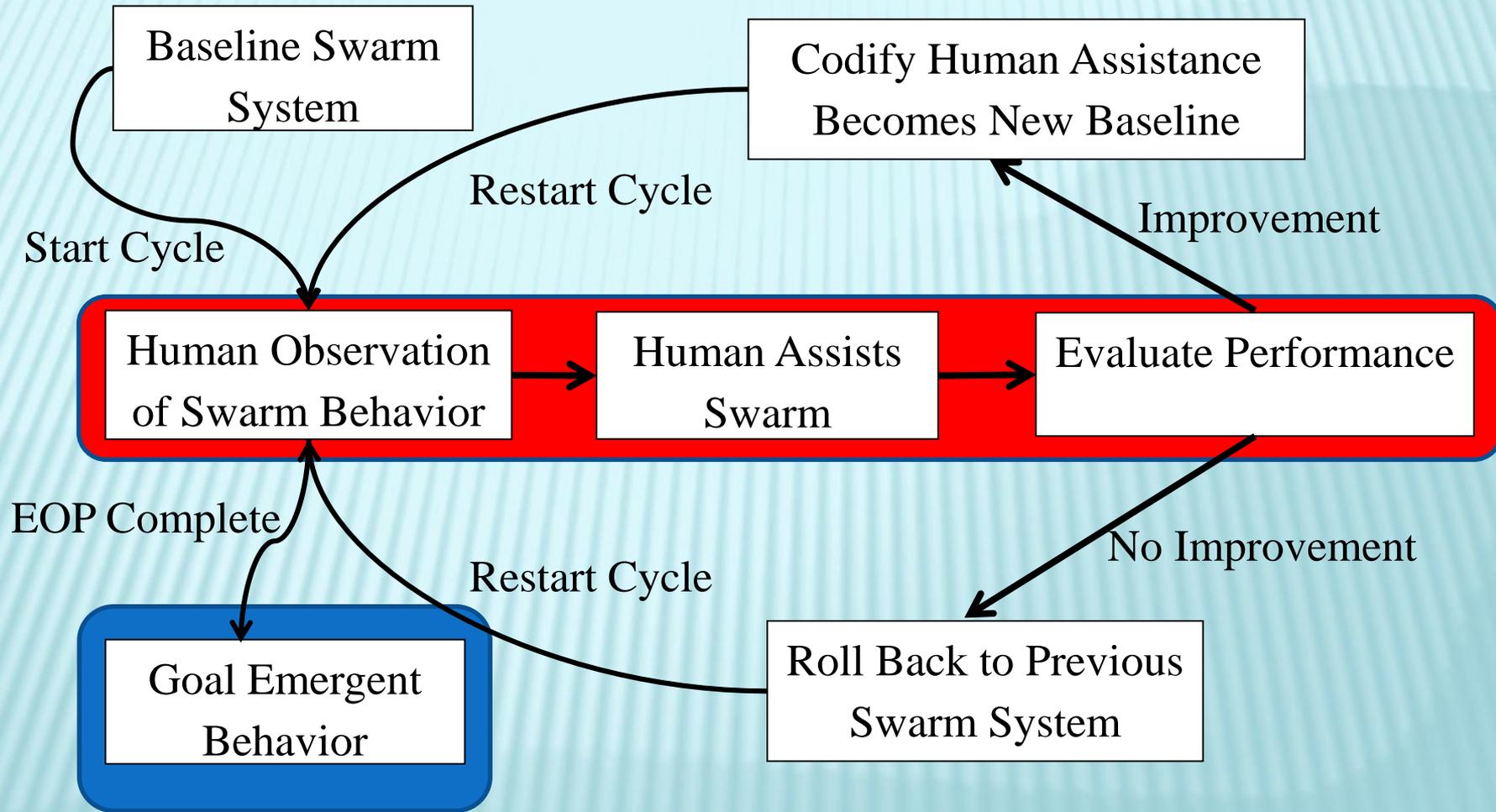
- × **Realizing Global Behavior**
 - + High level actions

- × **Most Difficult Aspect of Swarms**

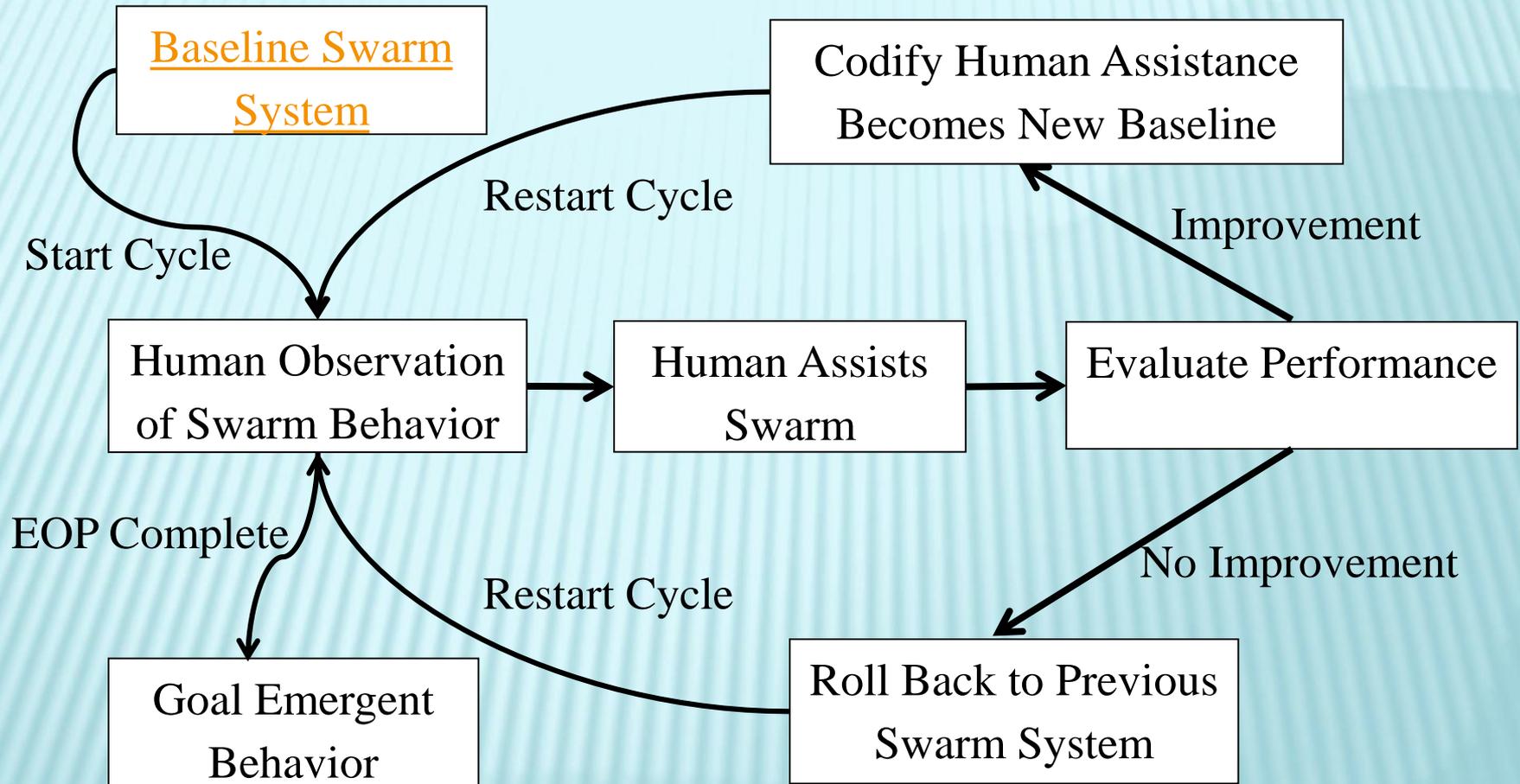
EMERGENCE-ORIENTED PROGRAMMING



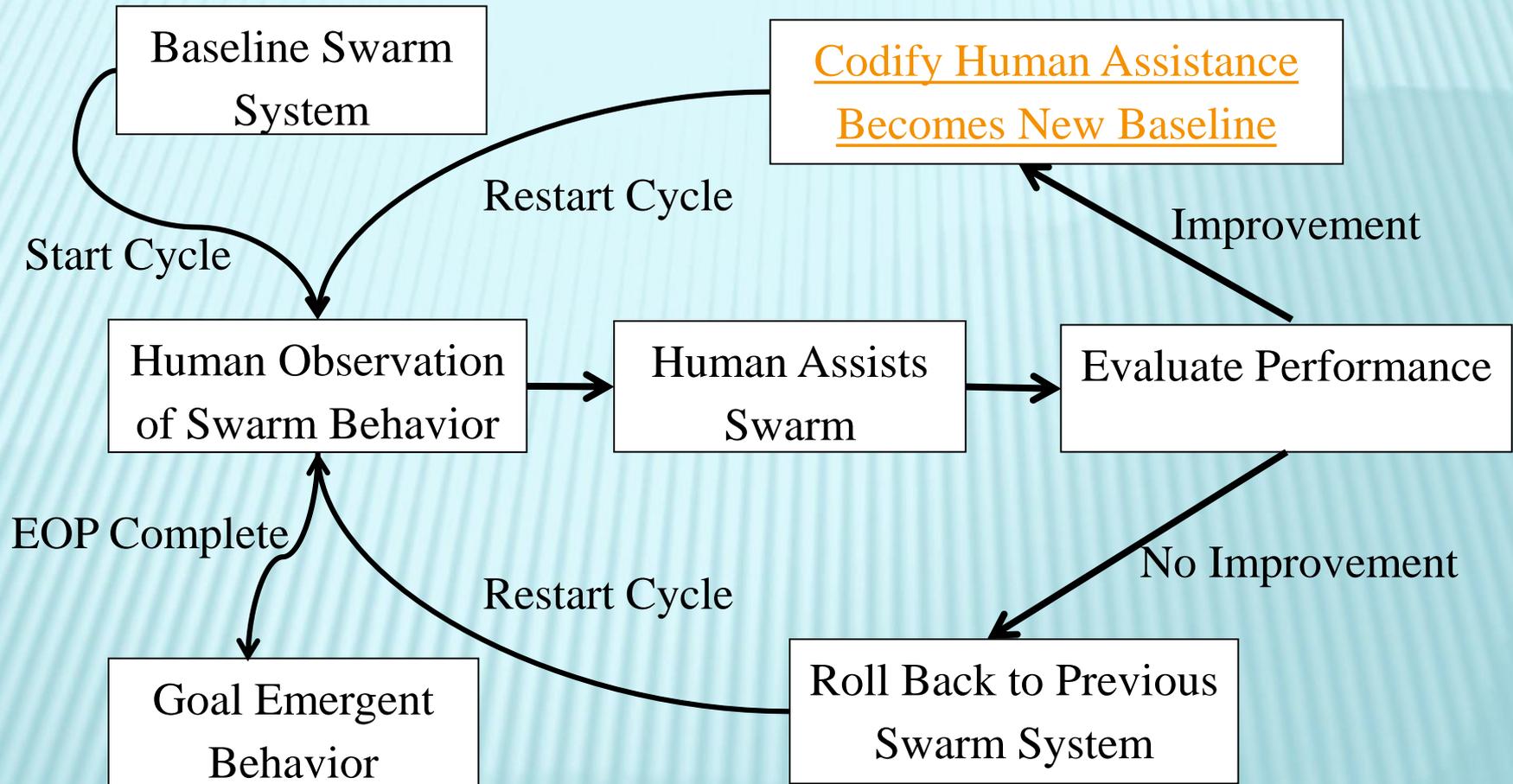
EMERGENCY-ORIENTED PROGRAMMING



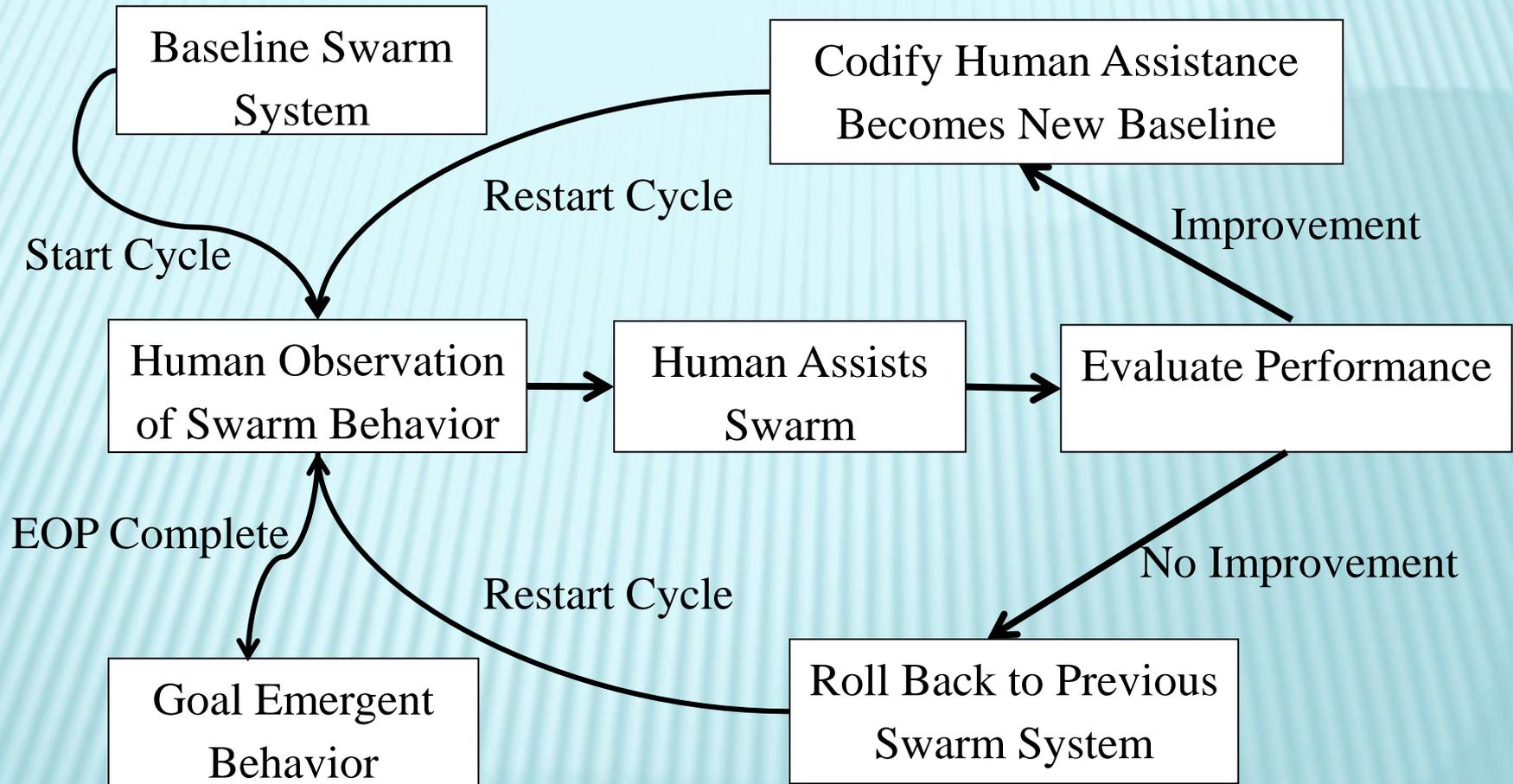
EOP – ITERATION 1, CONNECTORS ONLY



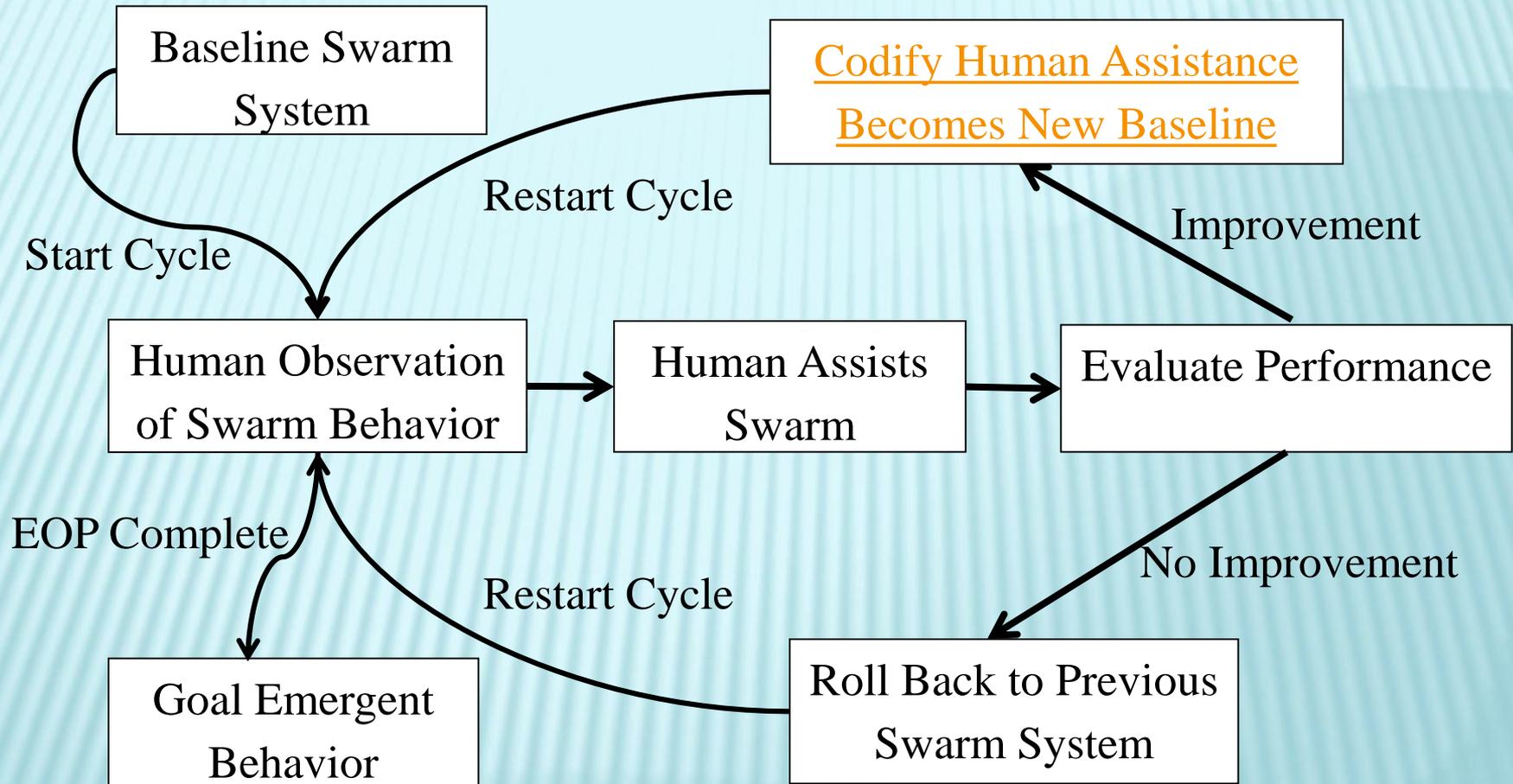
EOP – ITERATION 2, ADD SORTERS



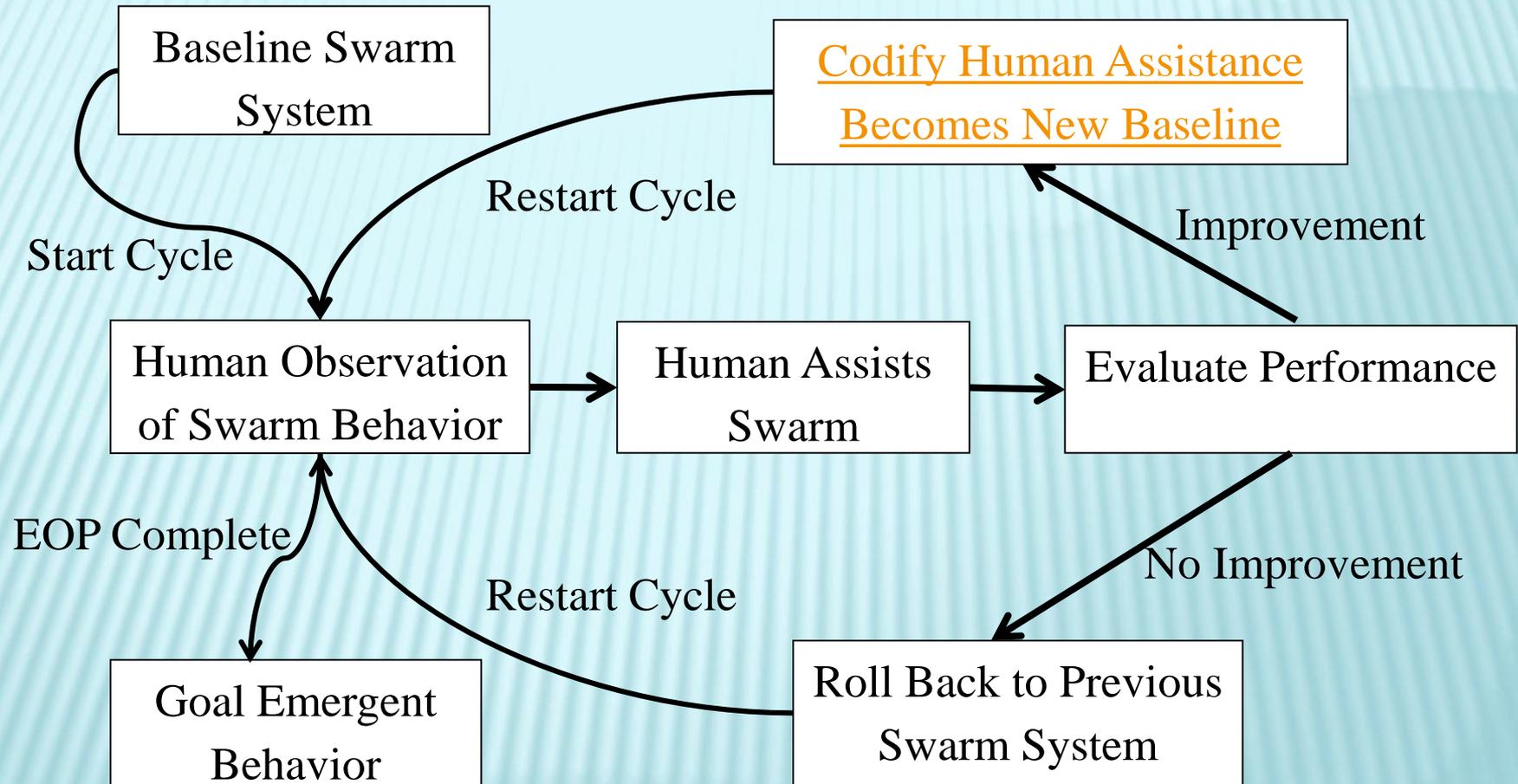
EOP – ITERATION 3, ROLL BACK



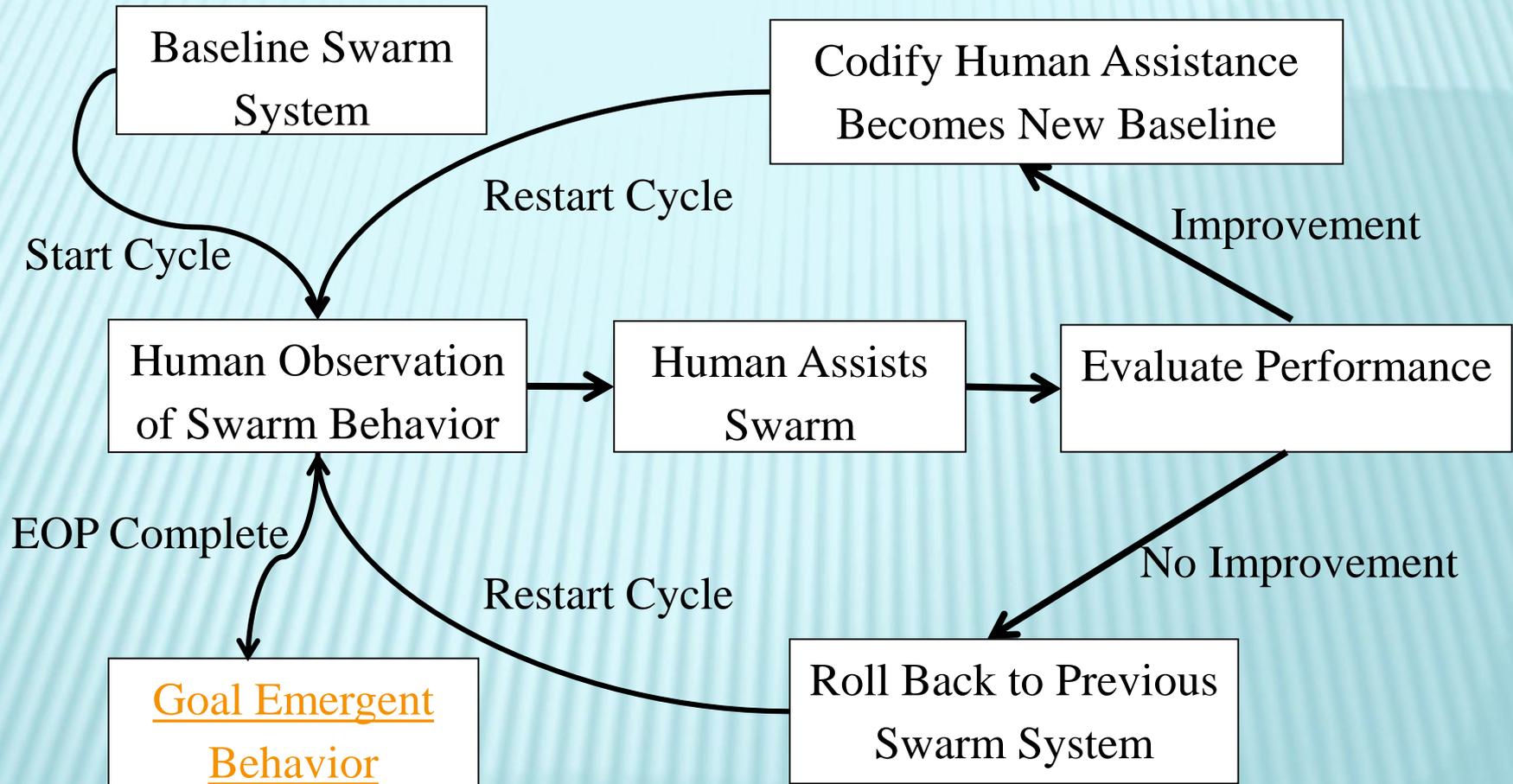
EOP – ITERATION 4, ADD CHILDREN



EOP – ITERATION 5, ADD FINISHERS

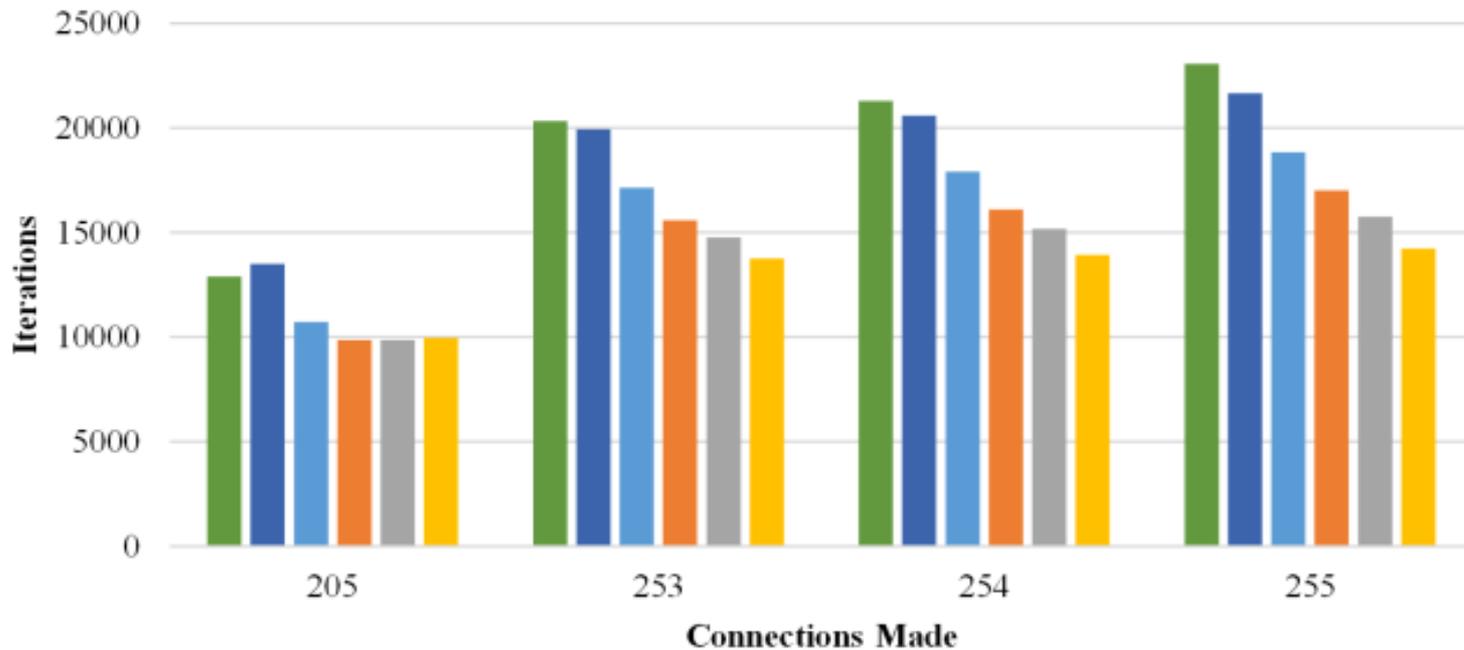


EOP – ITERATION 6, WRAP AROUND



GRAPHED RESULTS

Comparison of Algorithms as the Puzzle Completes



■ Connecting Only Without Children

■ Connecting only without wrapping

■ Dynamic distribution without wrapping

■ Dynamic distribution with wrapping

■ Human with finishers and wrapping

■ Human with manual connections and wrapping

THANK YOU! QUESTIONS?