Toward Virtual Actors

Progress and Prospects

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Motivation

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  - method of interaction dictated by tools
  - generally low-level, time-intensive
  - require specialized, *technical* knowledge and skill

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  - method of interaction dictated by tools
  - generally low-level, time-intensive
  - require specialized, *technical* knowledge and skill
- animation future?
  - directing a cast of "virtual actors"
  - mostly at task-level
  - occasionally at an arbitrarily lower level

Overview

- virtual actors
  - what's involved?
  - what's discussed?
- review of animation methods
  - path planning
  - character animation methods
  - motion graphs
- related open problems

What's involved?

- human $\longrightarrow$ computer
  - specification of desired motion
    - action
    - style

What's involved?

- human $\longrightarrow$ computer
  - specification of desired motion
    - action
    - style
- computer $\longrightarrow$ character
  - implementing motions using "animation methods"
    - path planning
    - character animation
    - object manipulation

What's discussed?

- focus on computer $\longrightarrow$ character
- focus on actions, rather than style
- object manipulation $=$ path planning in disguise

Path Planning

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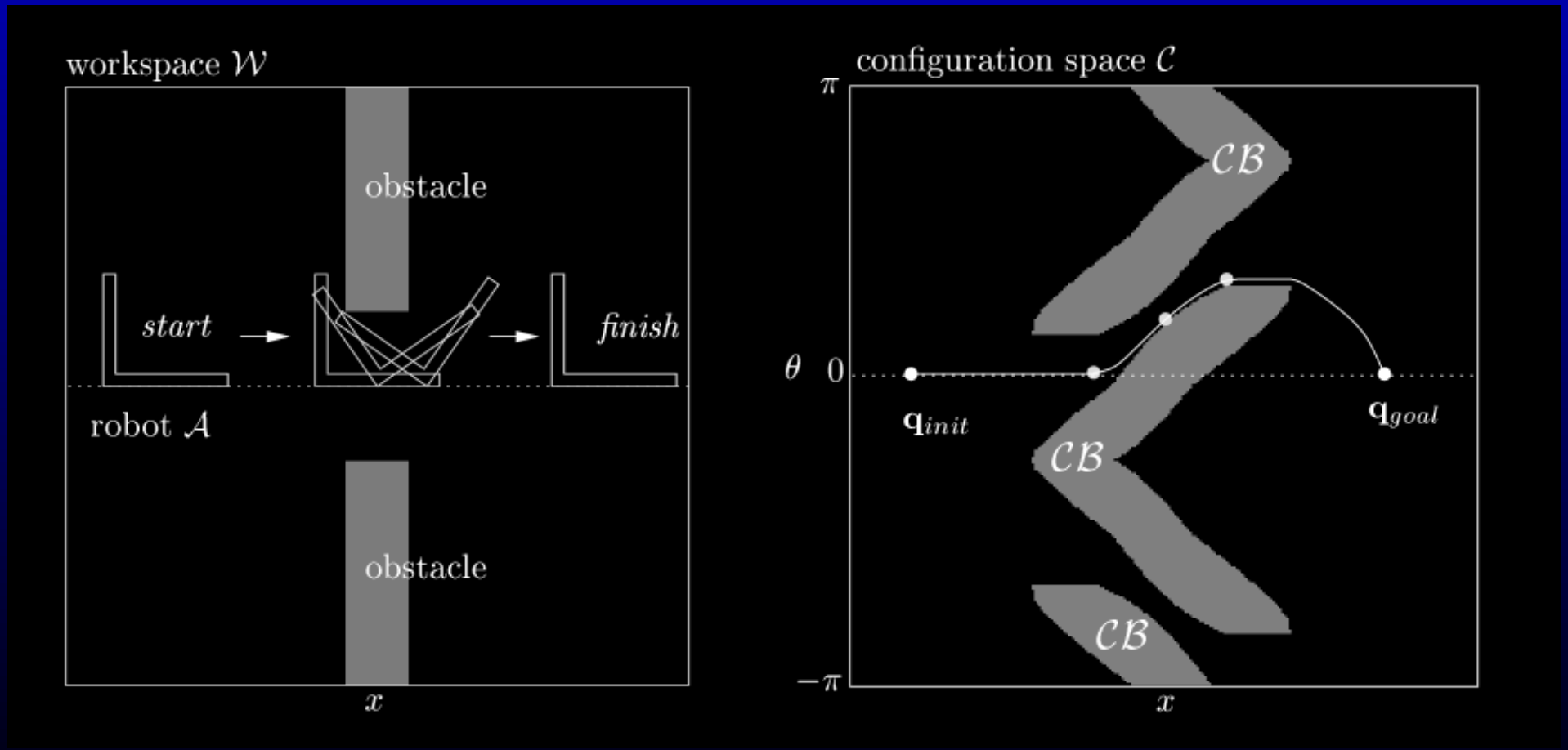
  set of all possible character configurations
- $\mathcal{C}_{free}$, the "freespace":
  set of collision-free configurations ($\mathcal{C}_{free} \subseteq \mathcal{C}$)
- basic idea: find a path through $\mathcal{C}_{free}$

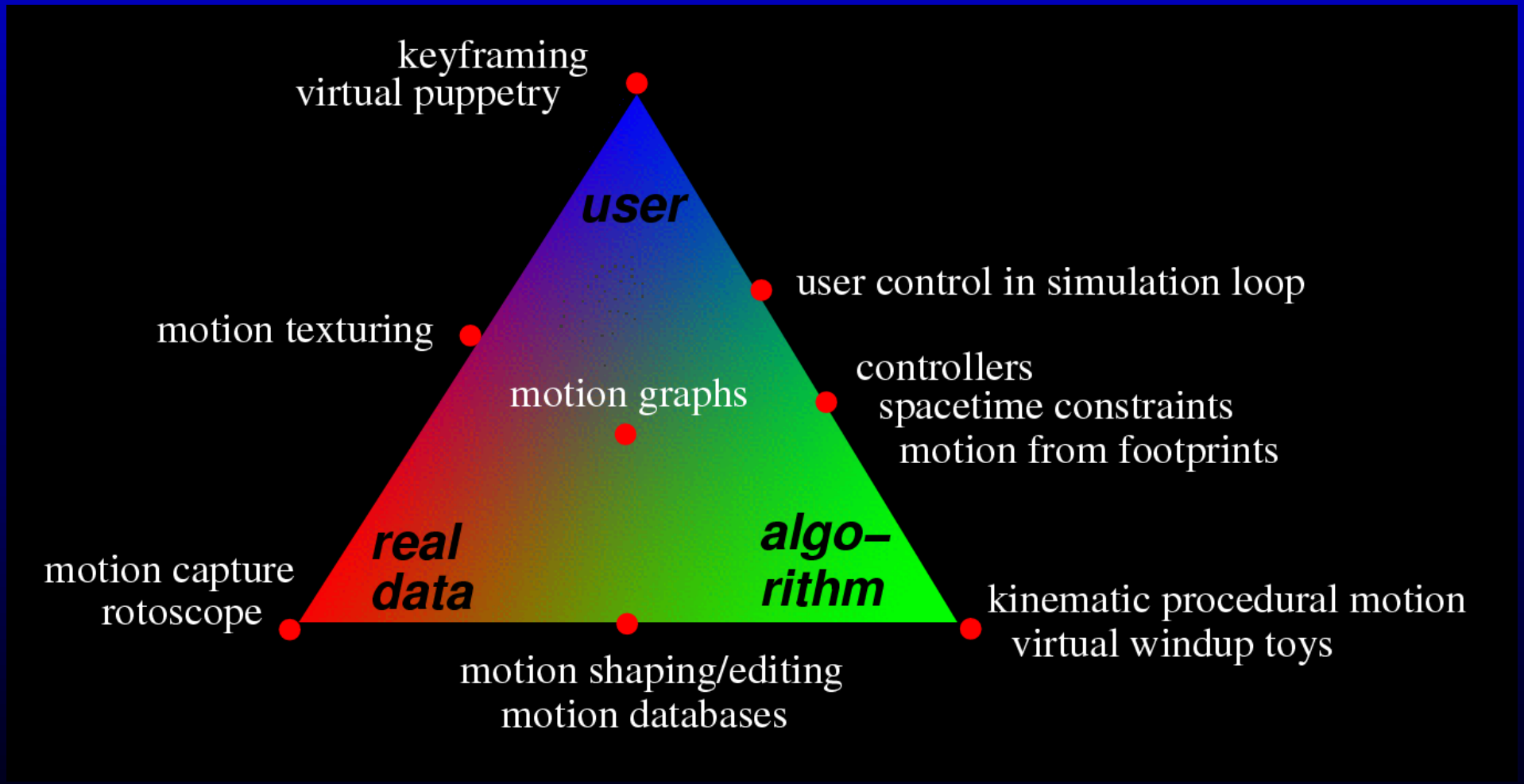
Path Planning: Example

- L-shaped robot that rotates and moves only along x

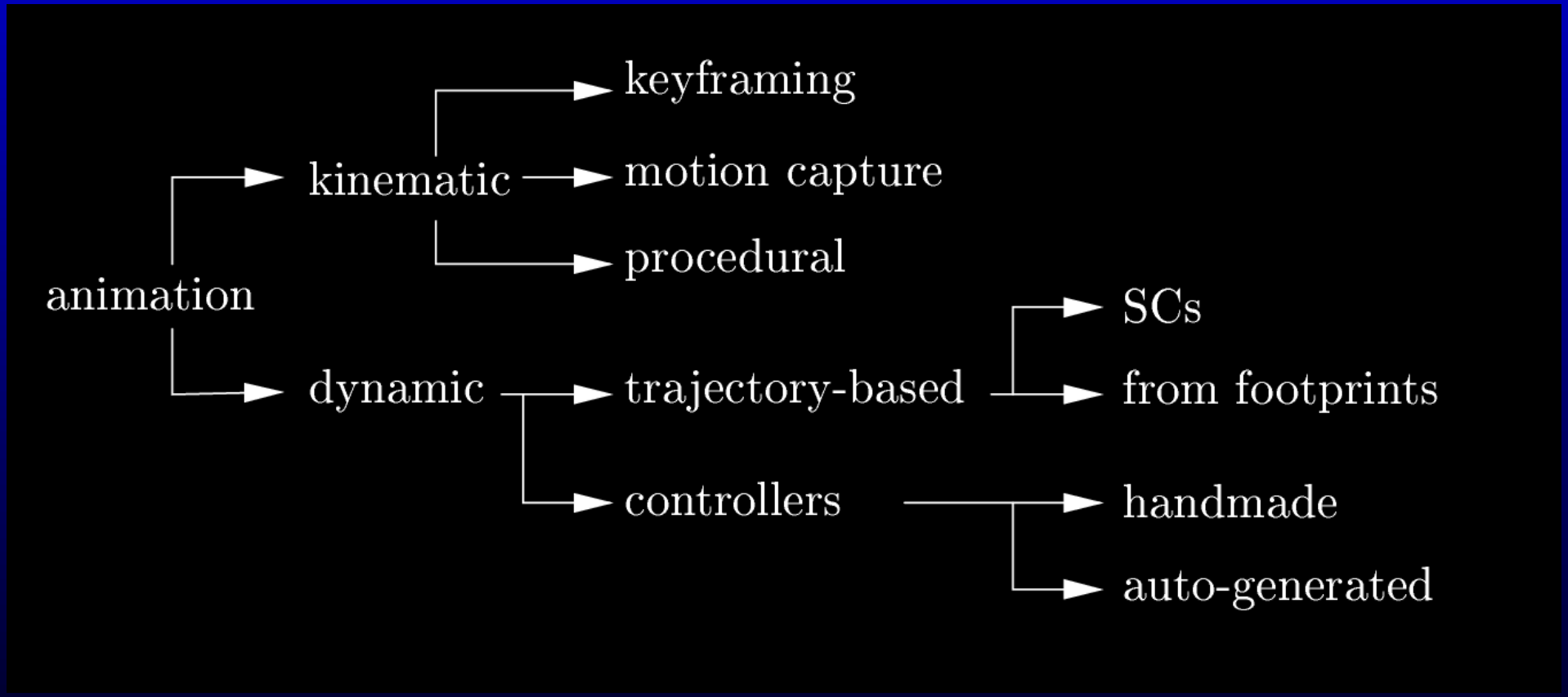


Character Animation

"Motion Source" Space



Traditional Taxonomy



Kinematic Animation Methods

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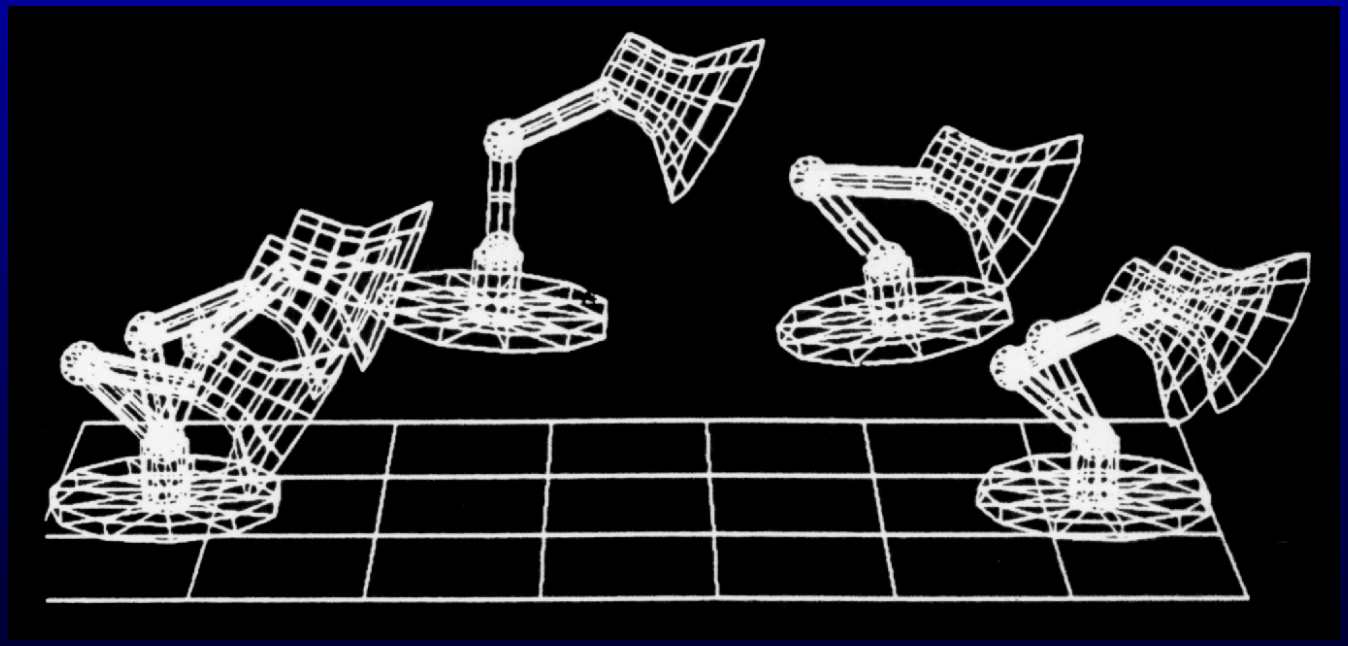
- procedural [Per95]

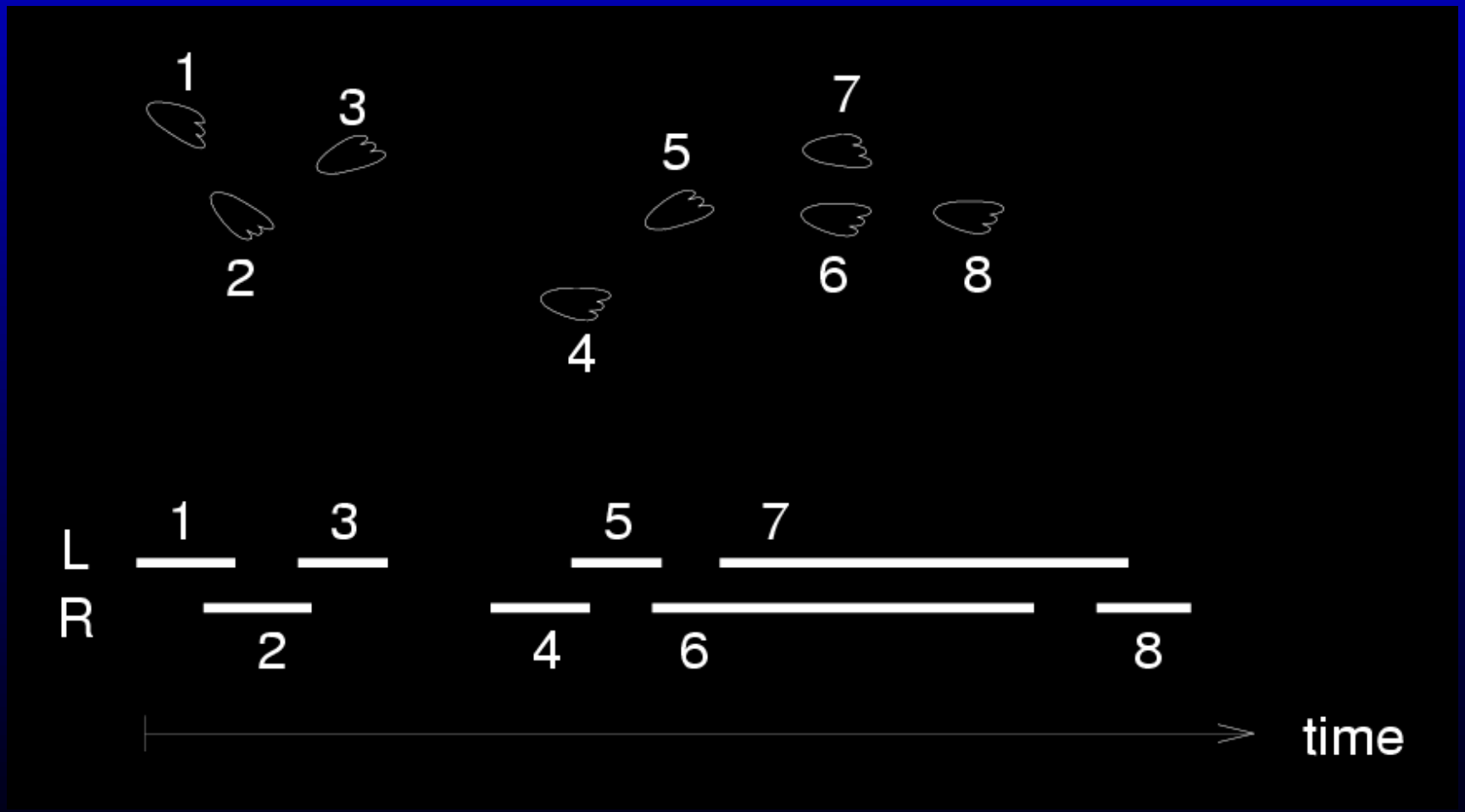
Trajectory-based Methods

- Spacetime Constraints (SCs) [WK88, Coh92, LGC94]



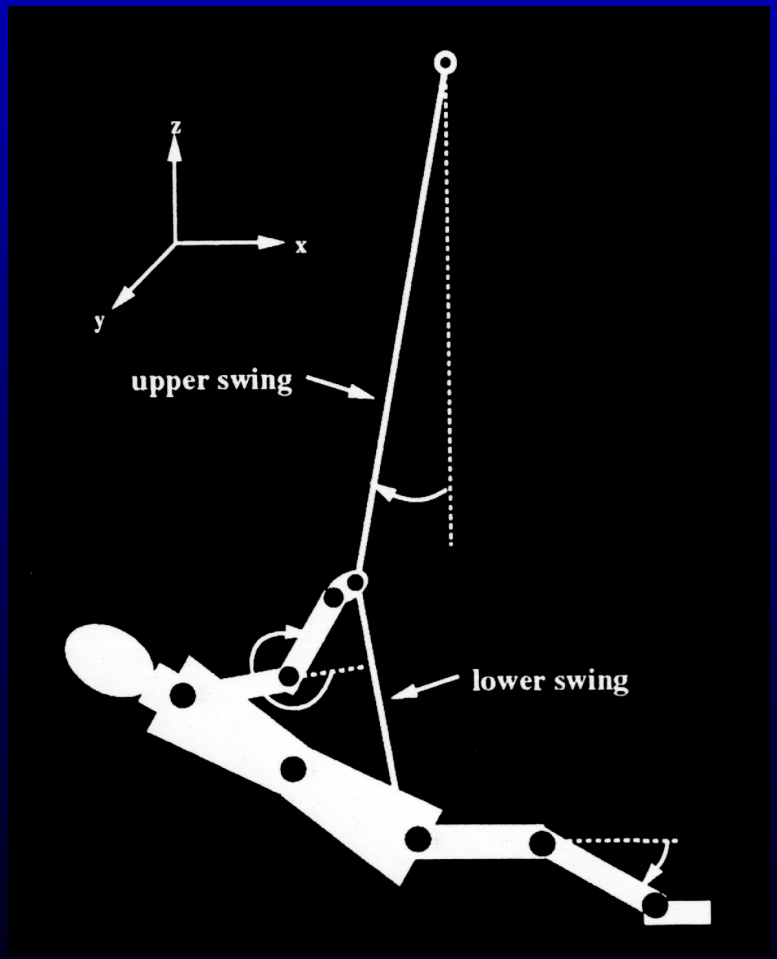
Trajectory-based Methods

- motion from footprints [vdP97, TvdP98]



Controller-based Methods

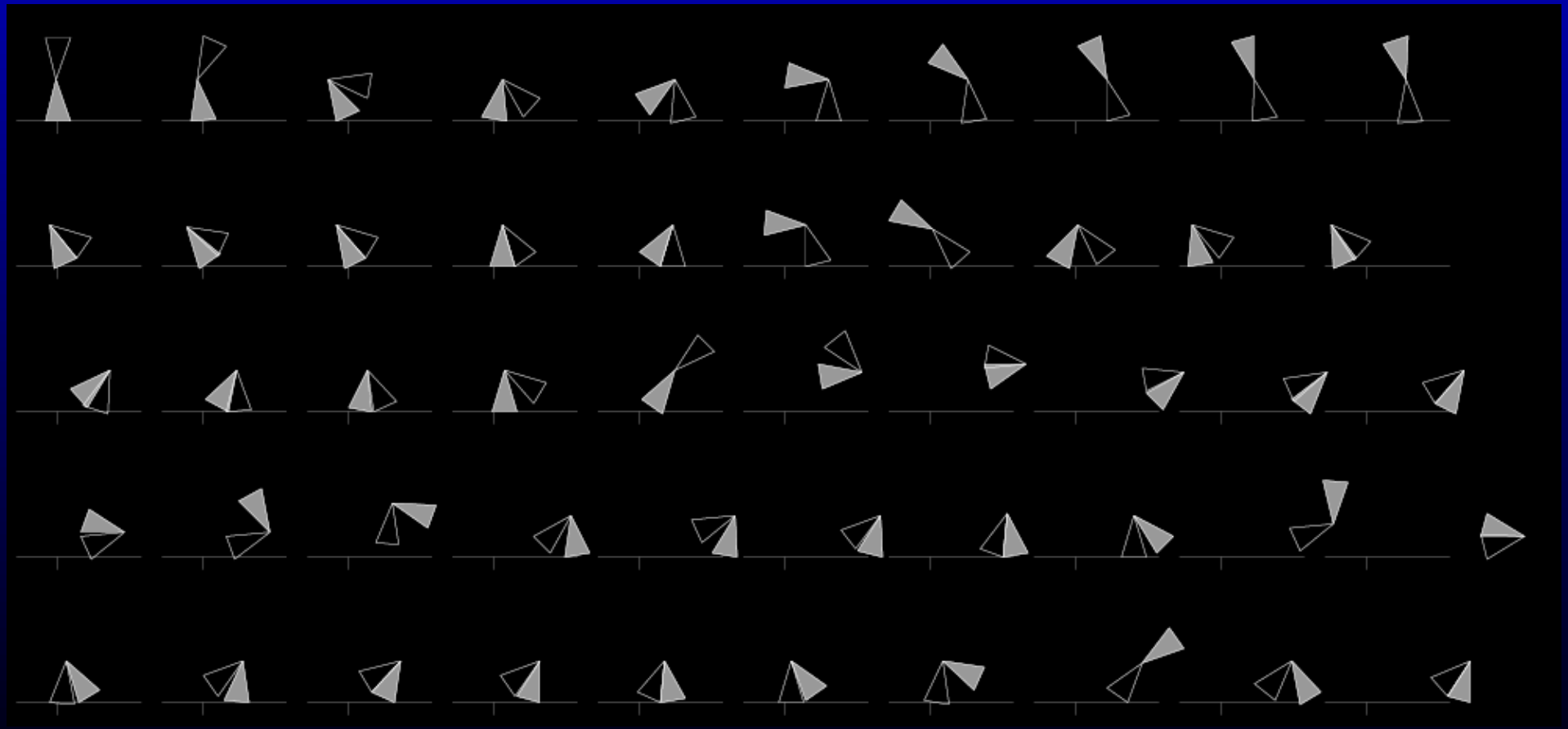
- hand-designed controllers [MZ90, HSL92, HWBO95, HP97]



Controller-based Methods

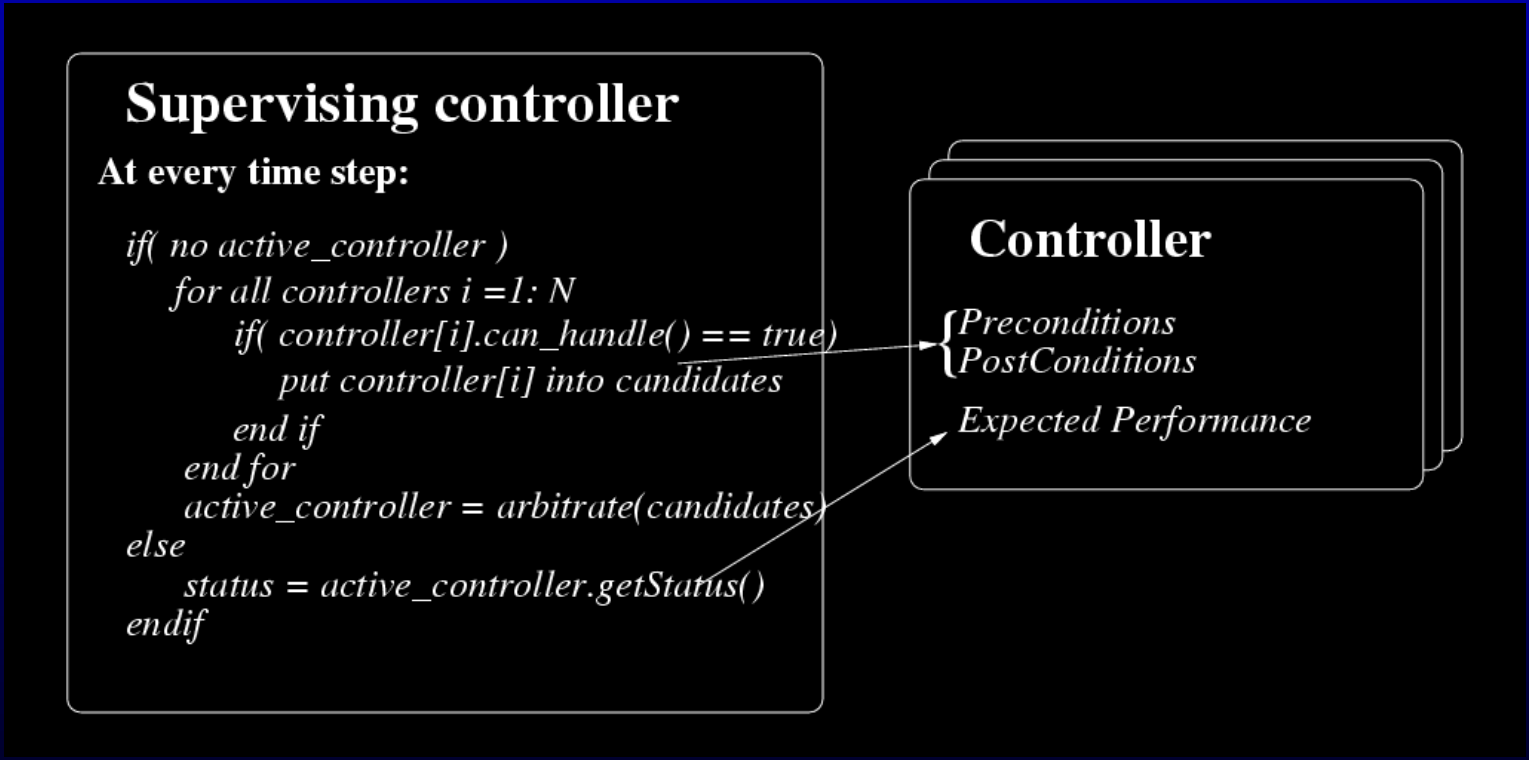
- auto-generated controllers

  [vdPFV90, vdPF93, vdPKF94, NM93, Sim94]



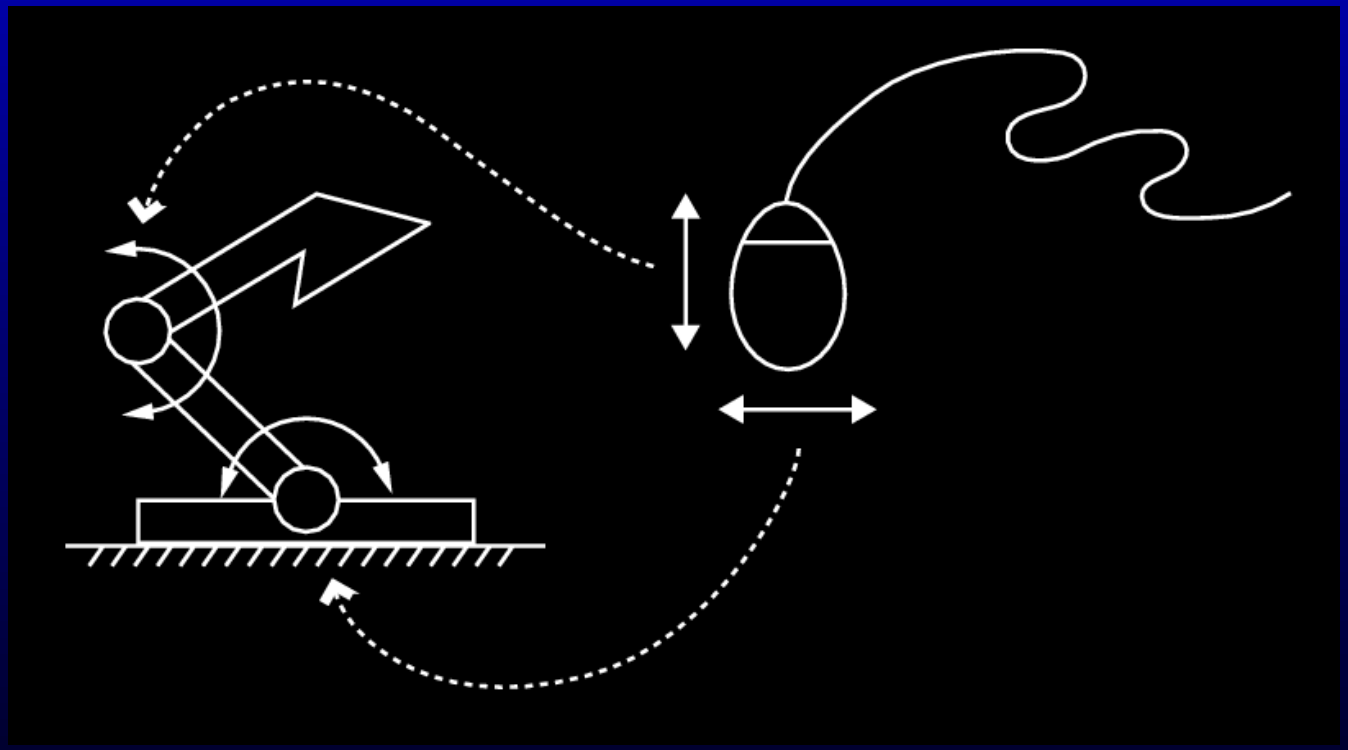
Controller-based Methods

- composable controllers [FvdPT01]

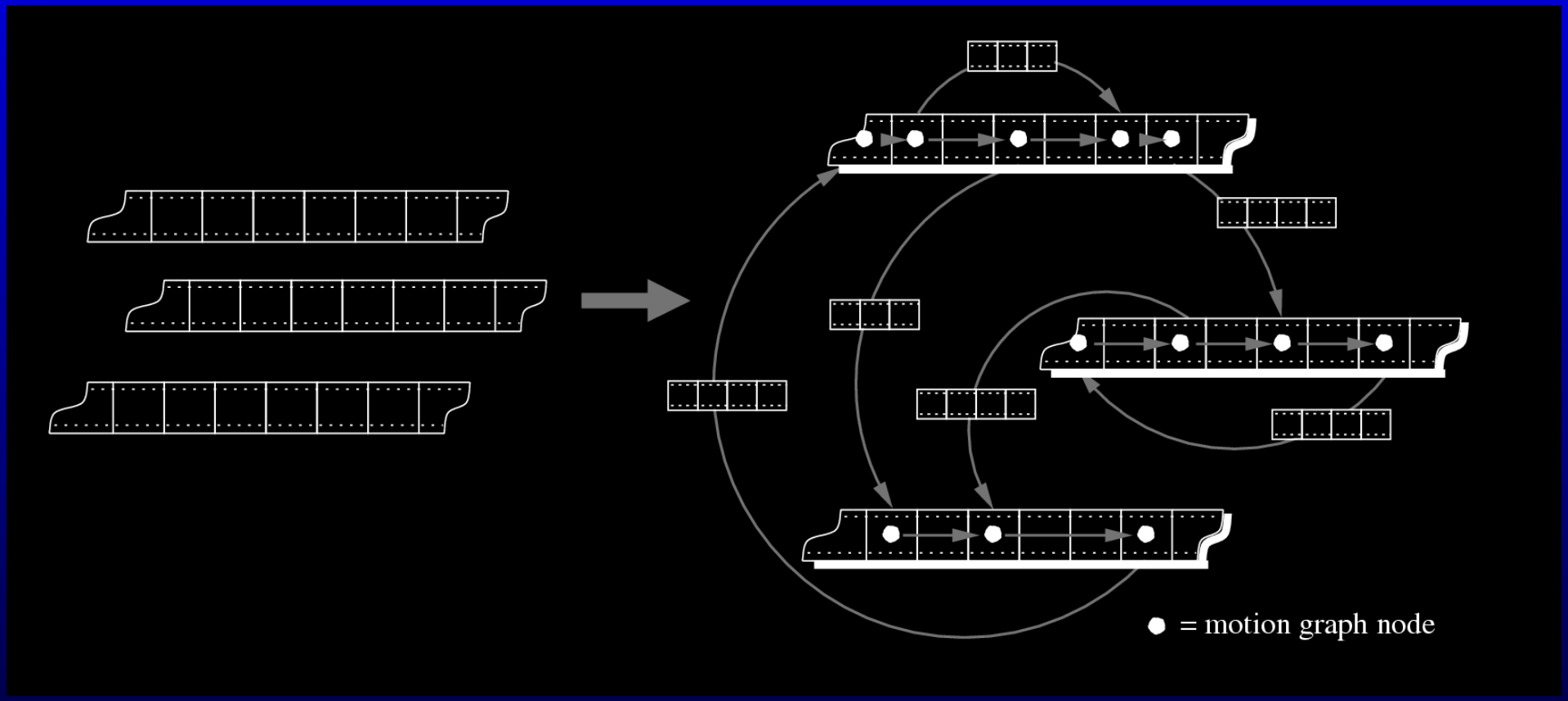


Controller-based Methods

- "human is the controller" [LvdPF00]



Motion Graphs



- augmenting motion data with transitions
- solves the "can't get there from here" problem

Motion Graphs

- recent work: [KGP02, LCR+02, AF02]
- related work
  - games: move-trees [MBC01]
  - motion DB [LvdP96]
  - statistical modeling of human motion

    [Bow00, TH00, LWS02]

Open Problems

- virtual actors: motion specifcation at various levels
- graceful motions; e.g., skating, ballet
- dressing/undressing (astronaut suit vs. a sweater)
- motion recognition: "what is he/she doing?"
- dense motion graphs

Dense Motion Graphs

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Dense Motion Graphs

- "uniform" sampling of state-space in area of interest
- method: state-space exploration through simulation
- benefits
  - impossible or dangerous motions
  - automatic detection of motion space
  - dynamic balance evaluator
  - recovery from statically unstable states
  - simulator replacement

Dense Motion Graphs

- key problem: curse of dimensionality
  - node density control
  - pruning functions
  - parametrized trajectories

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  - node density control
  - pruning functions
  - parametrized trajectories
- finding hard-to-reach parts of state-space
- getting "natural" transitions
- "natural" state similarity metric

— *FIN* —

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