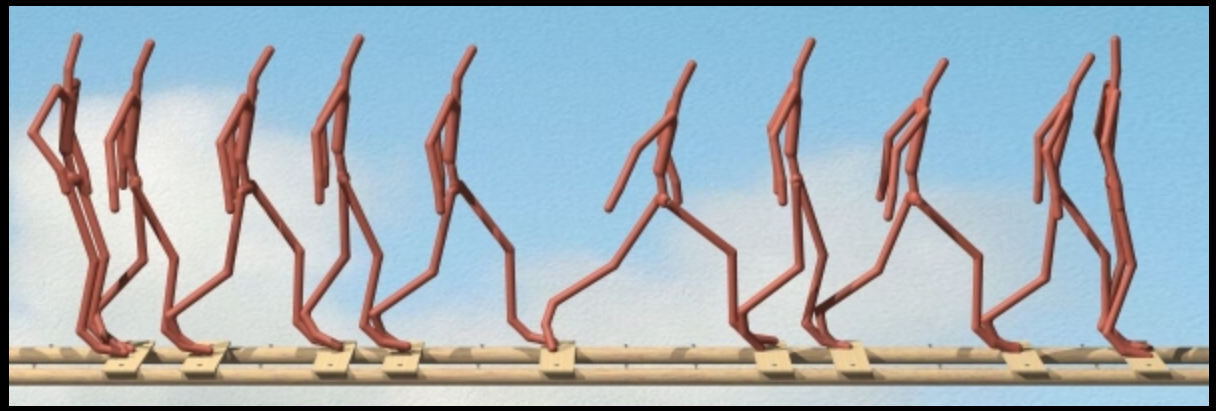
Locomotion



Jae Eisenmann
CSE 888.X14
Rick Parent

Introduction

- Locomotion is simply how a character moves from one place to another
- Locomotion has always been a central issue both to robotics and computer-driven character animation

Passive Dynamics Robot - Denise

Pneumatic passive-based biped

Martijn Wisse
Jan van Frankenhuyzen
2004

Delft Biorobotics Laboratory

TU Delft stw

Link

Dynamic Legged Locomotion

Marc Raibert
&
Jessica Hodgins

SIGGRAPH 1991

Locomotion Topics

- Path & Behavior Planning
- Level of and methods for user control
- Mocap segmentation and blending
- Use of dynamics to create physically plausible motion

Locomotion Topics

- Path & Behavior Planning
- Level of and methods for user control
- Mocap segmentation and blending
- Use of dynamics to create physically plausible motion

Planning

A 2-Stages Locomotion Planner for Digital Actors

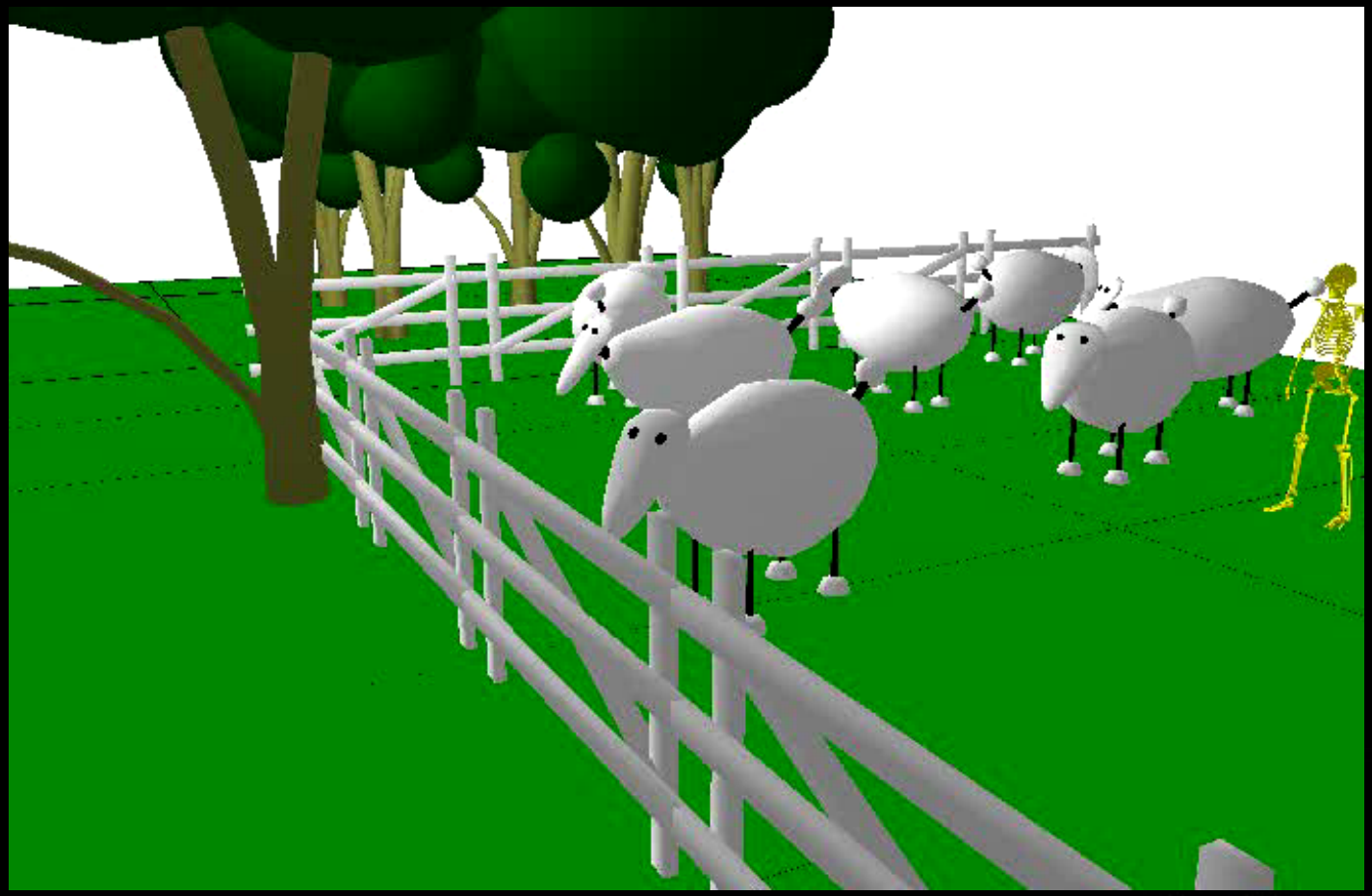
Julien Pettre, Jean-Paul Laumond, & Thierry Simeon

CNRS – LAAS, France

SCA 2003

Automatic path planning with upper and lower body collision avoidance in a complex environment

Planning



Link

Planning

Autonomous Pedestrians

Wei Shao & Demetri Terzopoulos
NYU, Media Research Lab
SIGGRAPH 2005

Autonomous path and behavior planning for characters operating individually within crowds in urban spaces

Planning

- Path planning uses the typical quad-tree and A* search methods
- Behavior planning ranges from simple reacting behaviors (see above) to complex mental states and action selection based on the desires of the individual

Planning

Autonomous Pedestrian Quicktime Movies... Link

Locomotion Topics

- Path & Behavior Planning
- Level of and methods for user control
- Mocap segmentation and blending
- Use of dynamics to create physically plausible motion

User Control

Automating Gait Generation

Harold Sun & Dimitris Metaxas
University of Pennsylvania
SIGGRAPH 2001

Describes a three-layered system that takes a motion path as input and provides physically accurate human walking motion with automatic gait adaptation for different landscapes and rates of path curvature

User Control

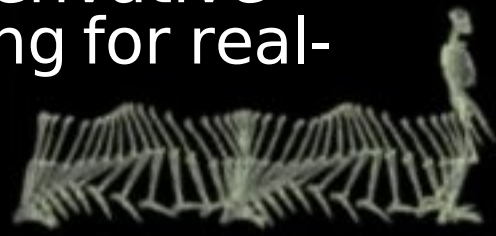
- MetaGait Quicktime movies... Link

User Control

SIMBICON: Simple Biped Locomotion Control

KangKang Yin, Kevin Loken, & Michiel van de Panne
University of British Columbia
SIGGRAPH 2007

Describes a controller creation system based on pose control graphs, proportional derivative controllers, and feedback error learning for real-time, interactive control



User Control

SIMBICON Quicktime movies...

Link

Locomotion Topics

- Path & Behavior Planning
- Level of and methods for user control
- Mocap segmentation and blending
- Use of dynamics to create physically plausible motion

Mocap Segmenation & Blending

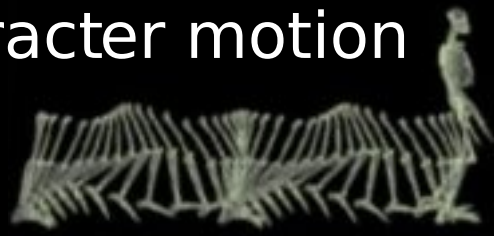
Construction & optimal search of interpolated motion graphs

Alla Safonova & Jessica K. Hodgins

Carnegie Mellon University

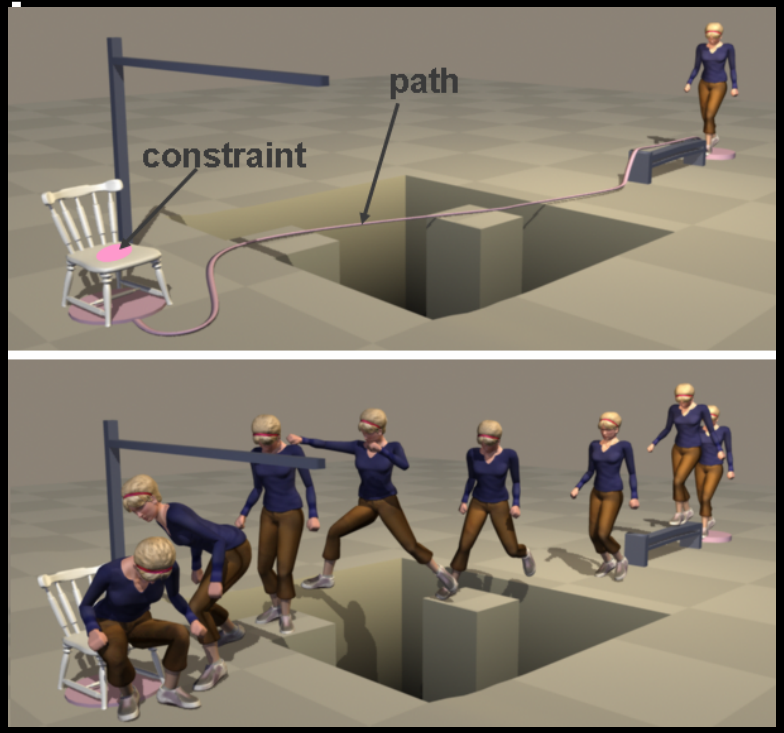
SIGGRAPH 2007

Presents an anytime version of A* search to find a globally optimal solution in a motion graph that satisfies the user's specification for character motion



Motion Segmentation & Blending

- Interpolation Graphs Quicktime movie…



Link

Locomotion Topics

- Path & Behavior Planning
- Level of and methods for user control
- Mocap segmentation and blending
- Use of dynamics to create physically plausible motion

Dynamics

Efficient Synthesis of Physically Valid Human Motion

Anthony Fang & Nancy Pollard

Brown University

SIGGRAPH 2003

Proposes a set of objective functions & constraints that lead to analytical linear-time first derivatives for efficient, physically correct motion synthesis

Dynamics

Synthesis of Physically Valid Motion Video...

Link

Dynamics

Layered Dynamic Control for Interactive Character Swimming

Po-Feng Yang, Joe Laszlo & Karan Singh
University of Toronto

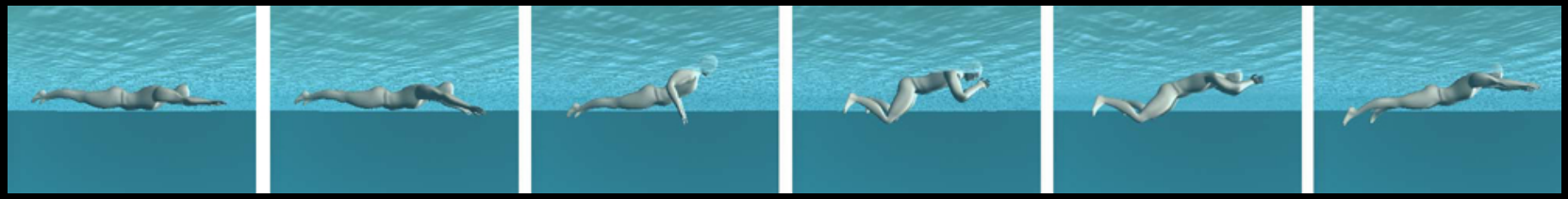
SCA 2004

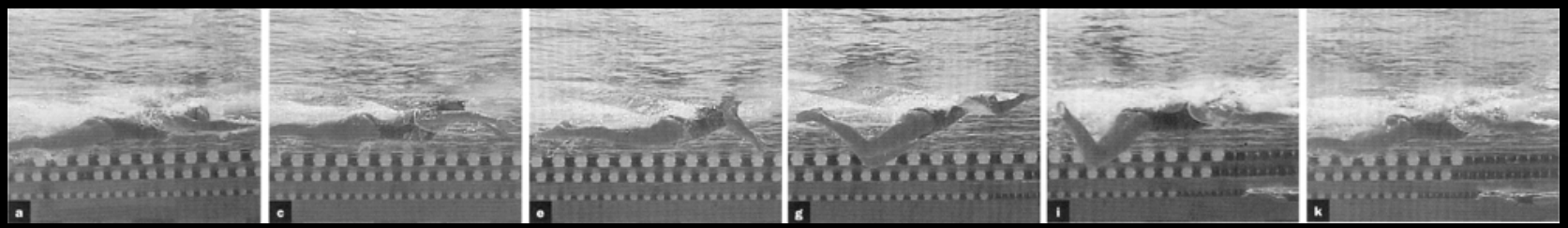
Presents a method for swim control in a dynamic environment

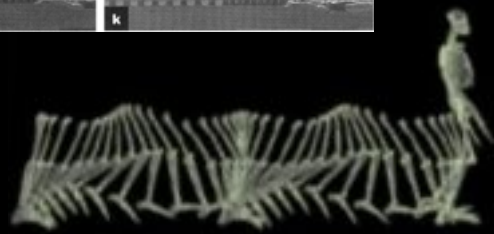
using an interactively user-controlled target, a simplified

Dynamics

Comparison of a real and a synthesized breast stroke







Dynamics

Three-Layered approach to control

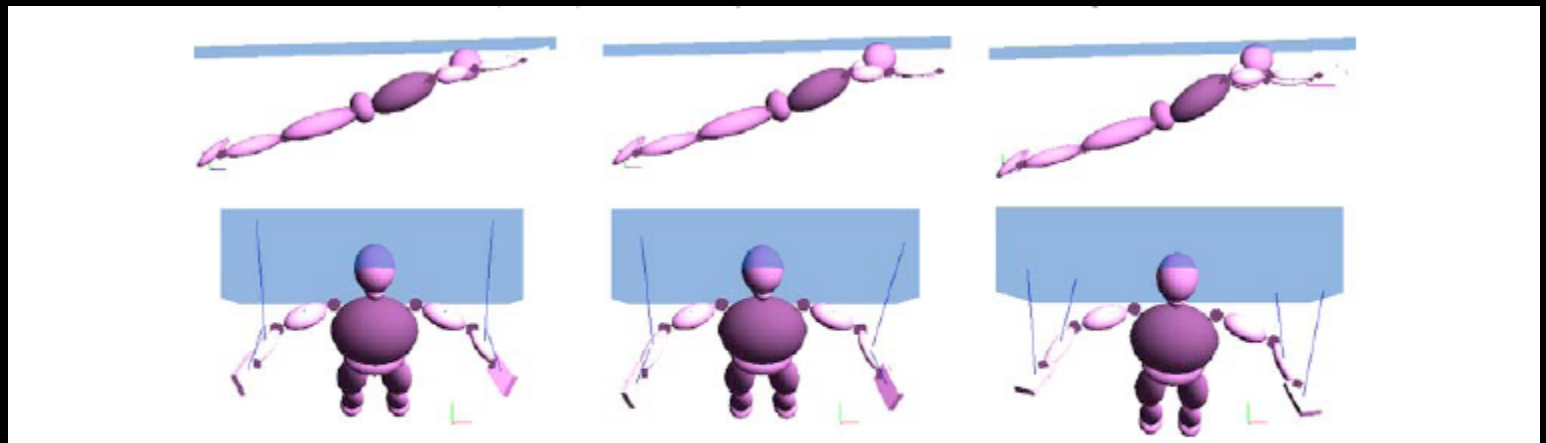


Figure 8: *The effect of subsequent layers on the resulting motion. a) Basic stroke layer drives the character's desired pose. b) A per-cycle perturbation aligns the character's arms with the fluid surface. c) A continuous perturbation reorients the palms to maximize forward thrust on the palm.*

Dynamics

Interactive Character Swimming Video…

Link

Concluding Discussion

- There is a definite trend towards new and creative uses of motion capture data
- The perfect balance between dynamics and motion capture seems to be the holy grail of locomotion

  (i.e. How do we produce new natural-looking motions using a library of segmented mocap data?)
- There will never be a one-size-fits-all control strategy