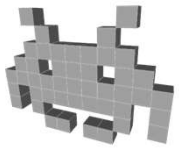
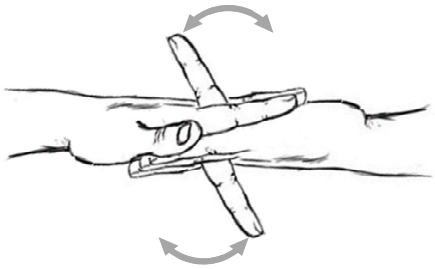
3D VideoGames
Unimi

Animations in games



Marco Tarini



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Course Plan

lec. 1: **Introduction**
lec. 2: **Mathematics** for 3D Games
lec. 3: **Scene Graph**
lec. 4: Game **3D Physics**
lec. 5: Game **Particle Systems**
lec. 6: Game **3D Models**
lec. 7: Game **Textures**
lec. 9: Game **Materials**
lec. 8: Game **3D Animations**
lec. 10: **Networking** for 3D Games
lec. 11: **3D Audio** for 3D Games
lec. 12: **Rendering Techniques** for 3D Games
lec. 13: **Artificial Intelligence** for 3D Games

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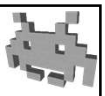
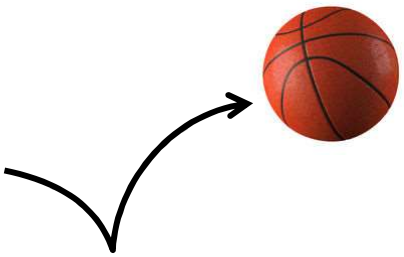
Computer animation in games



1. of rigid objects
   - animate scene transformations



(6 DoF per object)

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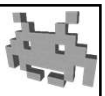
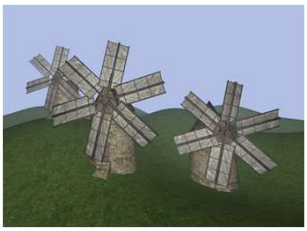
Computer animation in games



1. of rigid objects
   - or objects made of rigid sub-parts



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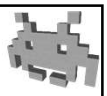
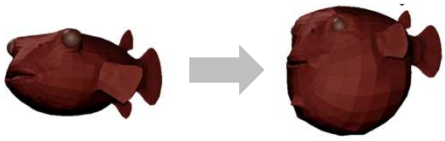
Computer animation in games



2. Free-Form deformations
   - generic transformations of the object



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Computer animation in games

3. of articulated models
   - internal skeleton
   - most virtual characters!
   - “skinning”

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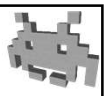
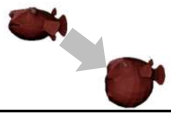
Types of animation and DoF (per keyframe)



DoF = Degrees of Freedom

Rigid 	6 DoF per object (or, e.g., 9, with anisotropic scaling)
Articulated 	~50-100 DoF per object (e.g. 3 DoF per joint x 25 joints)
Free form 	300-10.000 DoF per object (e.g. 3 per-vertex)

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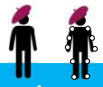
Animations in games



Authored

- Assets!
- Control: easy.
  full control by artists
  (e.g. for dramatic effect)
- Realism: hard
  it's up to the artist skill
- Flexibility: little
  Doesn't adapt to env.
- (consumes RAM)

Procedural

- Physic engine
- Control: hard
- Realism: easy
  built-in physical laws
- Flexibility: great
  Adapts to env. / context
- (consumes GPU)

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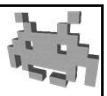
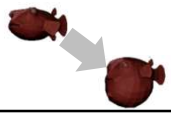
Animations in games



	Non-Procedural (ASSETS)	Procedural (PHYSIC ENGINE / ETC)	
Rigid 	Kinematic Animations	Rigid body dynamics	
Articulated 	Skeletal Animations	Ragdolling	Inverse kinematics
Free form 	Blend-Shapes	~~(general) soft-body simulation~~ *usually too expensive*	Cloth/ garments Ropes

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Types of authored animations

- of objects made of rigid subparts
  - including joints: robots, cars…
  - → use "(forward) kinematics" animations (scripted changes of the modelling transforms in a scene graph)

  ← as we know

- of deformable articulated objects
  - with some internal skeleton
  - e.g: most virtual characters: humans / animals / monsters
  - → use "skinning" / "rigging"

  ← see in 2 lectures

- of generic deformable objects ("soft bodies")
  - e.g., human faces making expressions, an umbrella opening, a puffefish puffing
  - → use "blend shapes"

  ← next lecture!

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