# A Mesh Correspondence Approach for Efficient Animation Transfer

*A. Moutafidou, I. Fudos*

*Computer Graphics Research Group,*
*Department of Computer Science and Engineering,*
*University of Ioannina, Greece*

[http://cgrg.cse.uoi.gr](http://cgrg.cse.uoi.gr)

# Outline

# Outline

# 1. Goal and Objectives

*Produce a new animated character from a static mesh and an animated character*

- Develop a tool for animation transfer without the need of third-party software

- Create an efficient semi-automated method for mesh correspondence

- Expedite the transfer process by automating marker selection

# Outline

# 2. Introduction

Creating an animated character :
- is a complicated problem
- needs to employ several tools
- requires an iterative interactive pipeline

So tools are needed to :
- Determine the mesh matching alignment
- Transfer the skin and skeleton
- Compute the new skinning weights
- Determine the overall kinematics (animation)

# Outline

# 3. Mesh Matching

- An animation setup transfer is a method that given a source and a target model can turn the target model into an animated character by transferring the skin weights, skeleton and bone motion from source to target.

  - We use a mesh matching method between the source and target model driven by marker points that establish a correspondence of geometry between the two meshes.
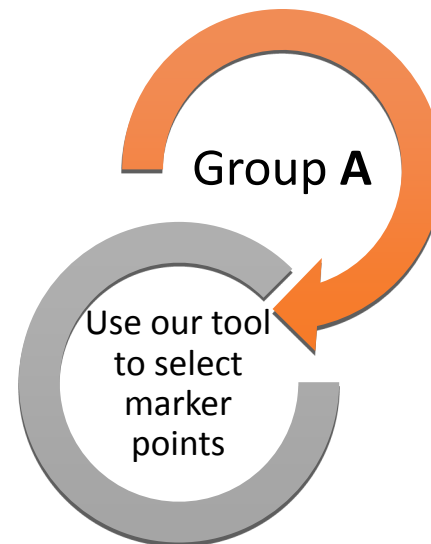
# 3. Mesh Matching
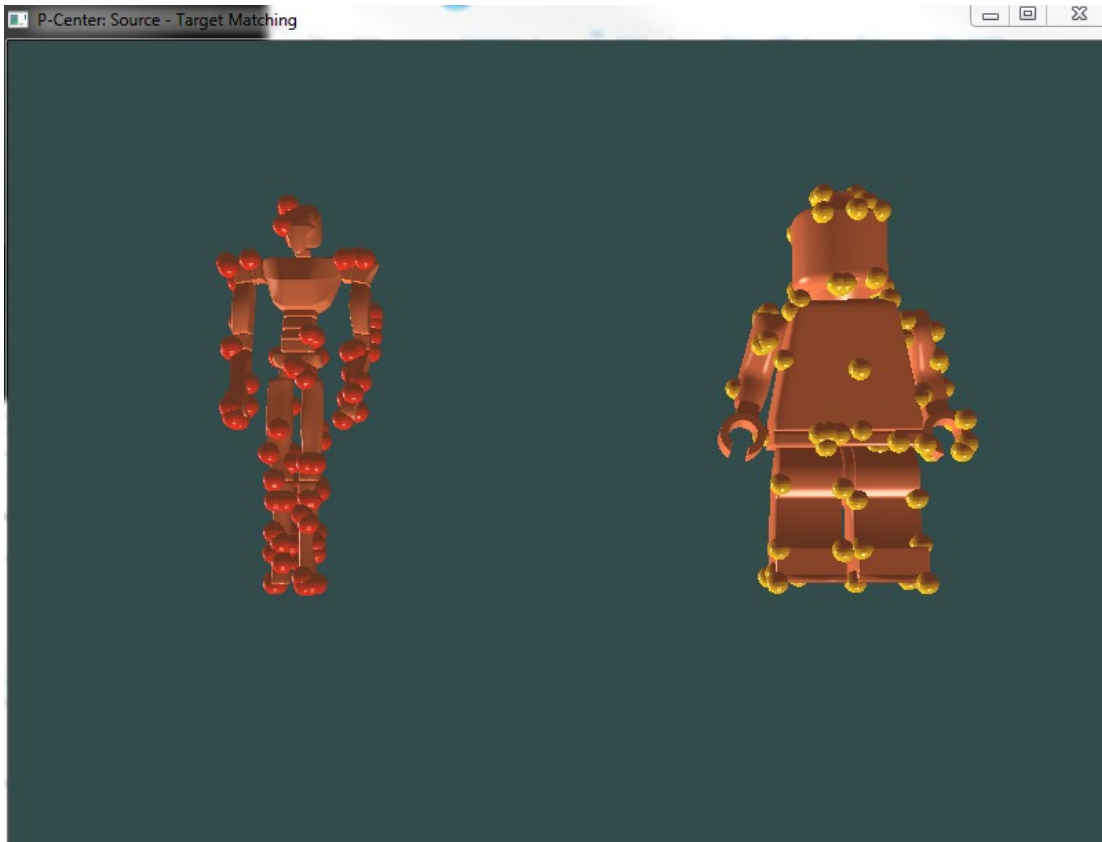


- Marker points are needed to successfully align and map source and target model.

- These marker points should preserve not only the most important areas of the models but also all rigid and deformable components.

- We use a clustering *P-center* algorithm to obtain 2*k representative* marker points for the source mesh, and *k* marker points for the target mesh.

- The user will be able to select k out of the 2k points instead of k marker points among n points of the entire mesh.

Eurographics
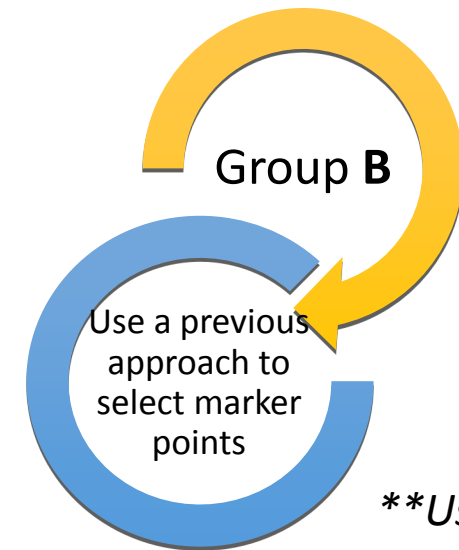EUROPEAN ASSOCIATION FOR COMPUTER GRAPHICS

CGRG

# 3. Mesh Matching

- We have performed a user study to evaluate the usability of the interactive marker selection method by measuring :

  1. The efficiency of our method in terms of the overall time needed by users.

  2. The quality of the set of selected markers.

  1) The percentage of marker pairs that were erroneous

  2) The percentage of that were not covered by a selected marker pair

**Group A**

Use our tool to select marker points

10%

15%

**Group B**

Use a previous approach to select marker points

*\*\*Use more points than users in group A.*

30%

35%

# Outline

**Eurographics**
EUROPEAN ASSOCIATION FOR COMPUTER GRAPHICS

# 4. Optimization and Mesh Correspondence

By selecting an appropriate :
- set of marker pairs and
- an optimization method

we can implement efficiently the mesh correspondence algorithm

1. align the source and target model based on the marker pairs

2. iteratively minimize an energy function to achieve mesh fairing (two models with simplified mesh morphology)

3. establish the correspondence between the original meshes based on the common simplified mesh morphology
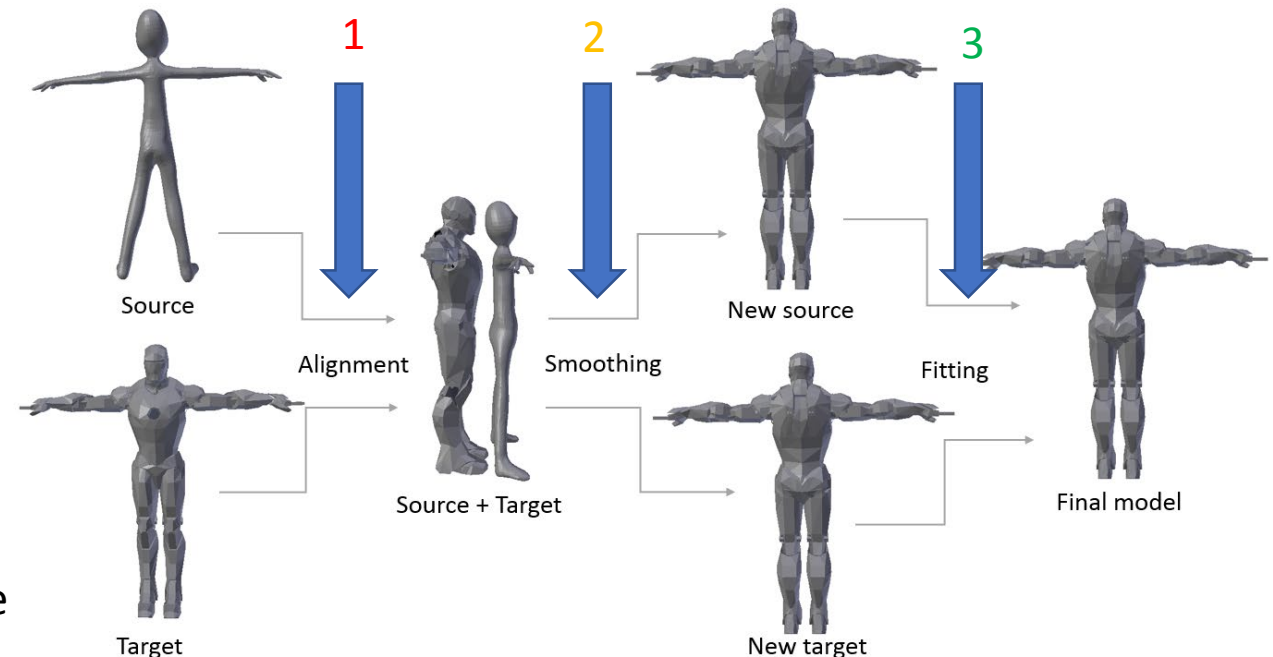
# 4. Optimization and Mesh Correspondence
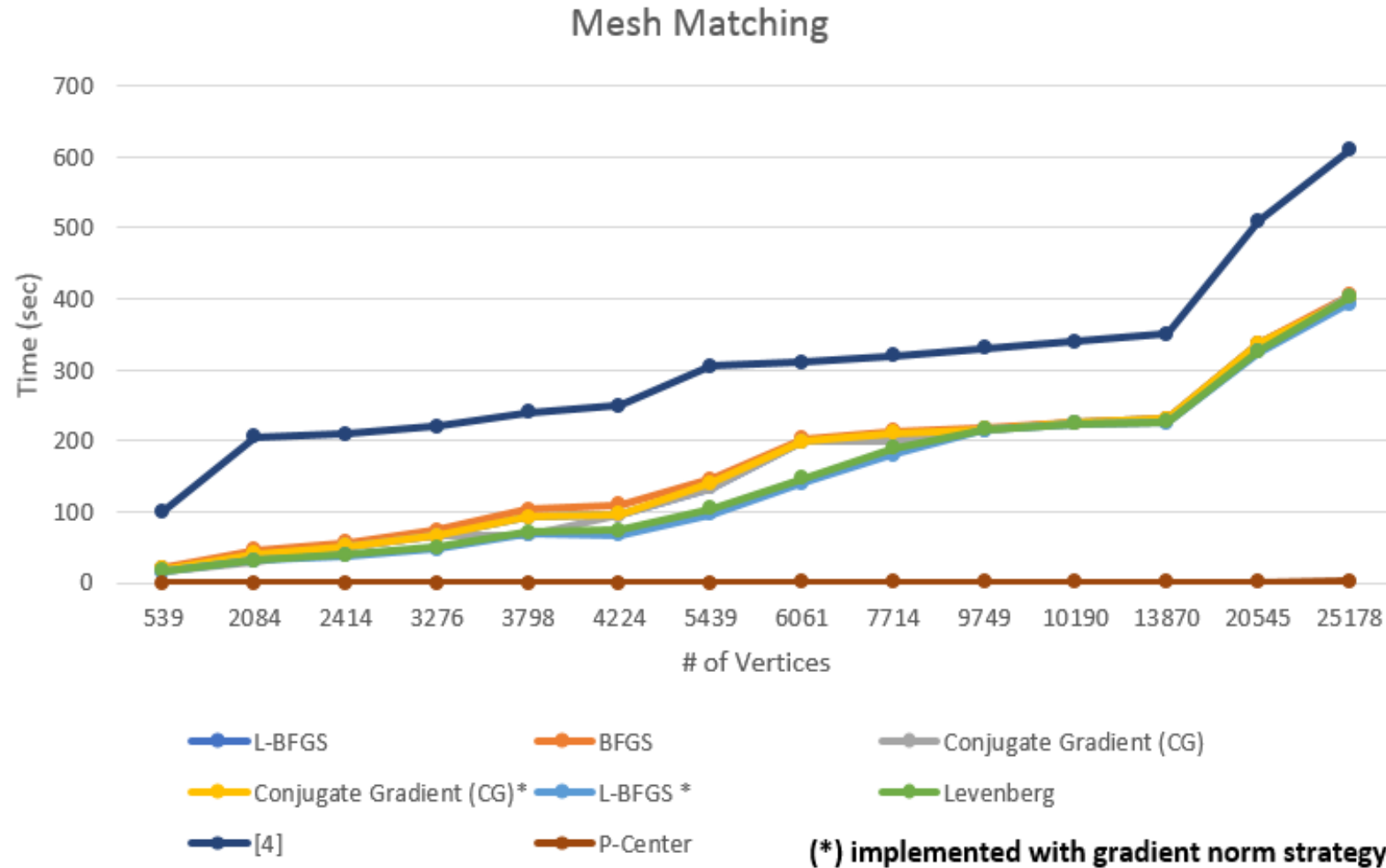


Mesh Matching

[4]. AVRIL Q., GHAFOURZADEH D., RAMACHANDRAN S.,FALLAHDOUST S., RIBET S., DIONNE O., DE LASA M., PAQUETTE E.: Animation Setup Transfer for 3D Characters. *Computer Graphics Forum 35*, 2 (2016), 115–126.
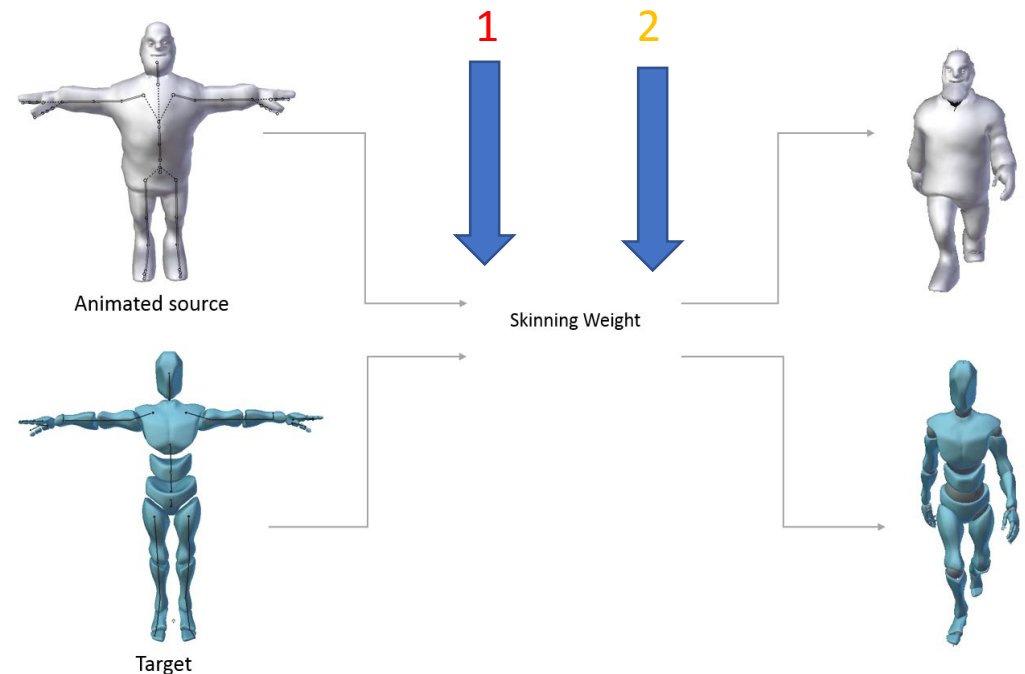
# Outline

# 5. Skin and Skeleton Transfer

- As skeleton we refer to a set of joints which represent the motion properties of the object.

- Our approach consists of 2 steps :
    1a) re-target each joint of the source based on the corresponding vertices

    1b) adapt it to the target by adjusting its orientation and rotation to match the corresponding vertices in the target

    2) compute the correct orientation and rotation to confirm that the target model has the same animation behavior as the source



Source

1    2

Source Skeleton
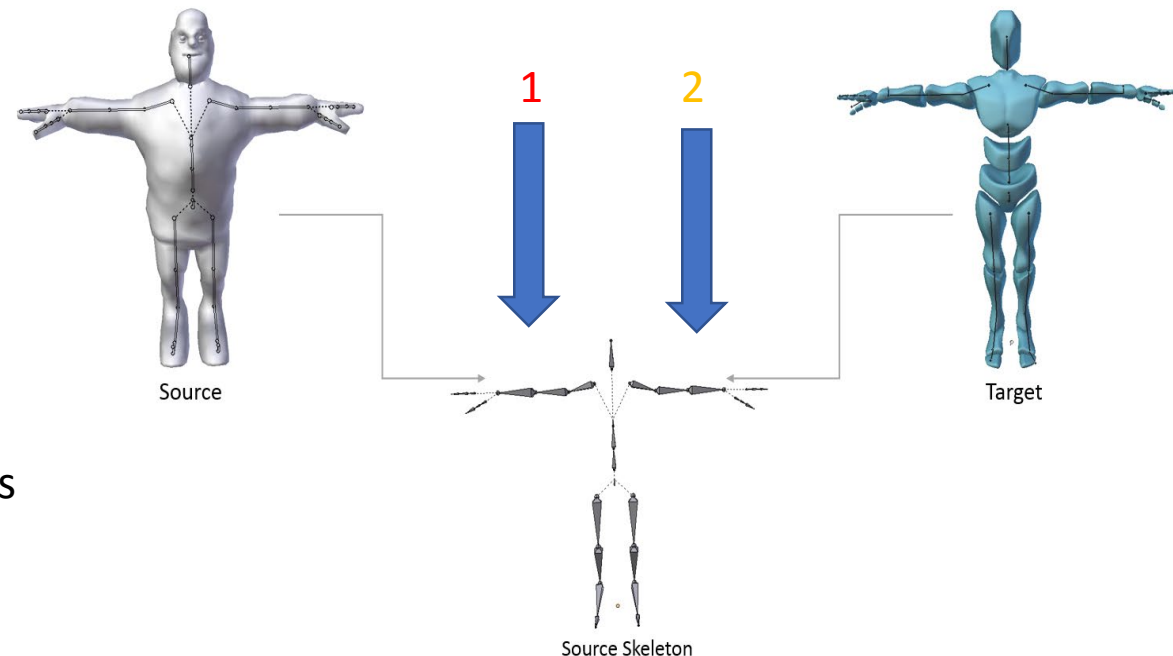
Target

# 5. Skin and Skeleton Transfer

- The set of weights among joints and vertices is called skinning and determines how the bone movement will affect the mesh.

- Our approach consists of 2 steps :

  1) generate a new set of weights for the target based on an existing source vertices by using a simple linear combination

  2) generate a new set of target vertex weights when we have less or more than one vertices that lie close enough on the simplified common mesh topology (filtering - blending)



Animated source

1    2

Skinning Weight

Target

# Outline

# 6. Experiments

We have conducted two types of experiments :
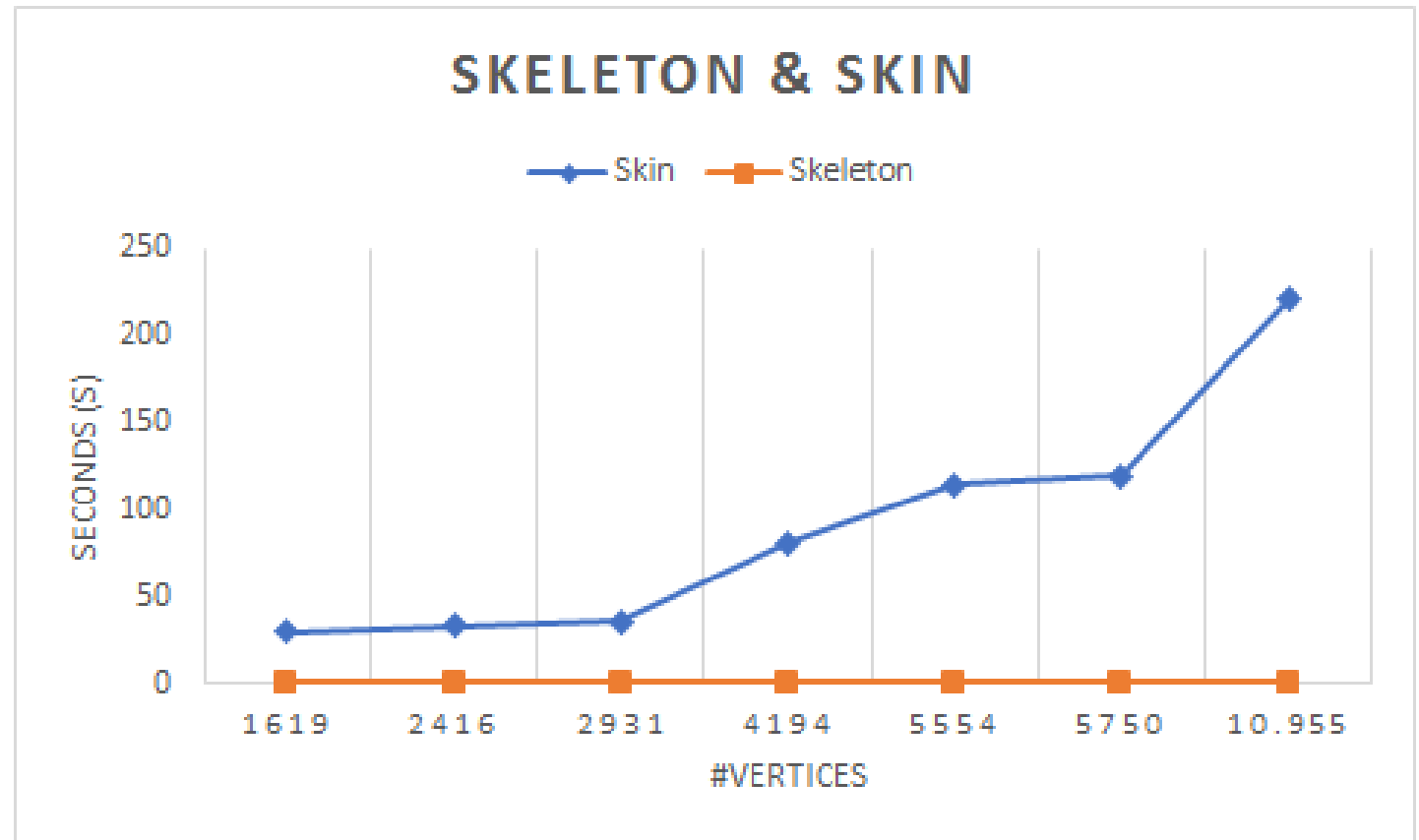
1. *Quantitative results*
   - To evaluate the performance of our approach
2. *Qualitative results*
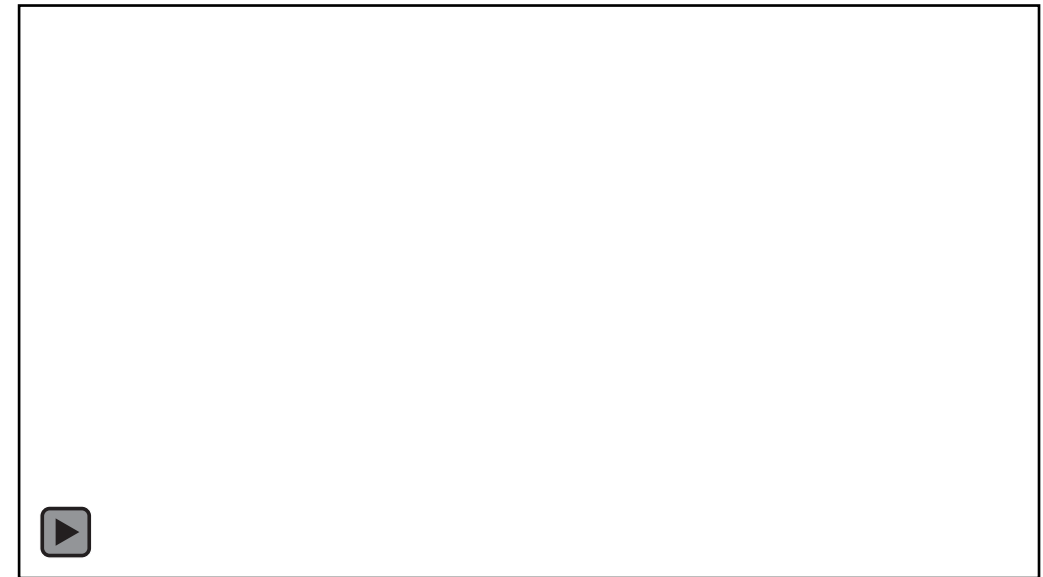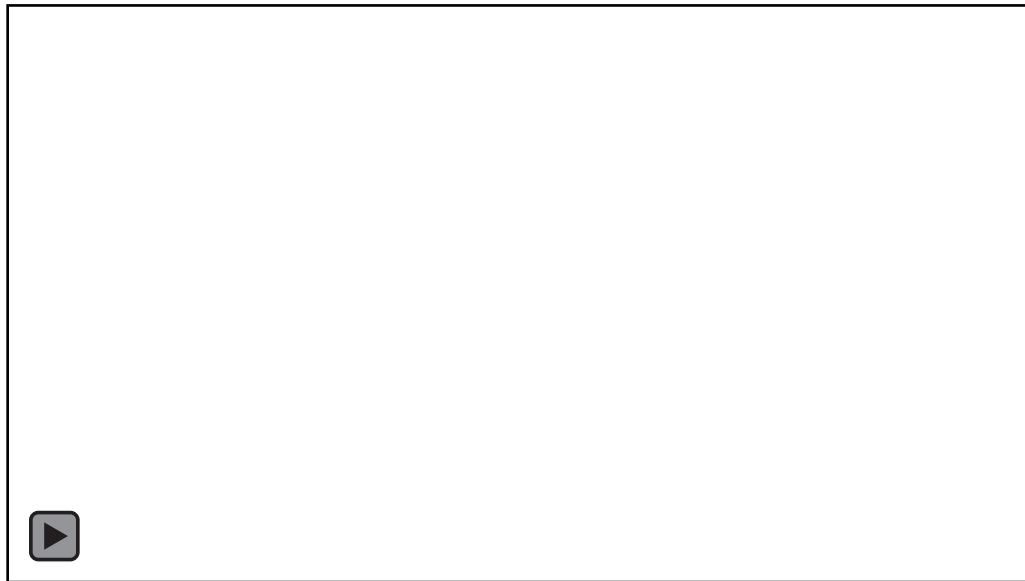   - To visualize new animated characters from scratch

# 1. Quantitative

- **Skeleton and weight transfer performance evaluation**

4. AVRIL Q., GHAFOURZADEH D., RAMACHANDRAN S.,FALLAHDOUST S., RIBET S., DIONNE O., DE LASA M., PAQUETTE E.: Animation Setup Transfer for 3D Characters. *Computer Graphics Forum 35*, 2 (2016), 115–126.
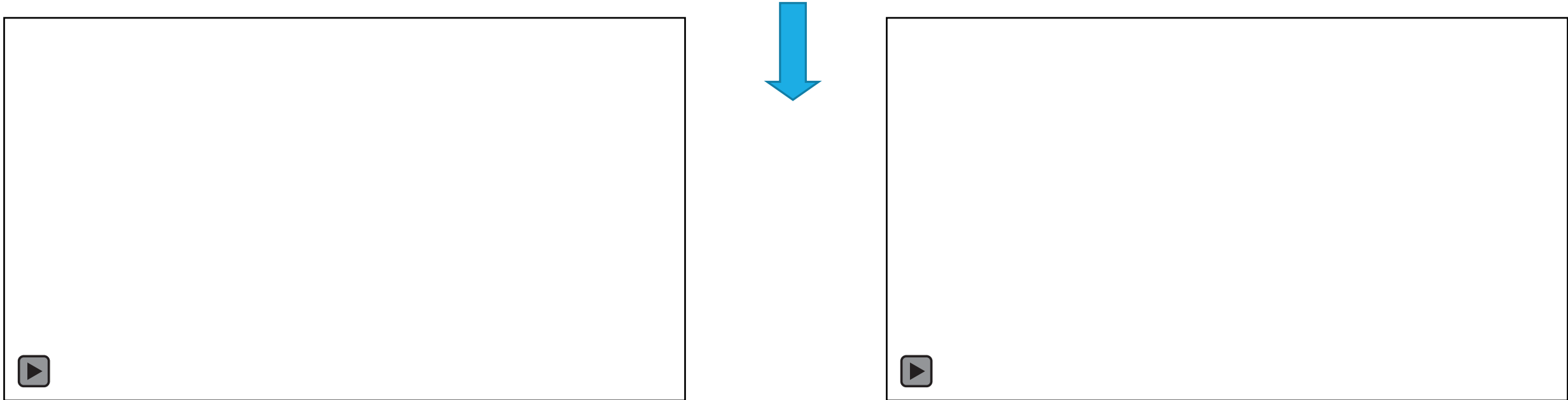
# 2. Qualitative
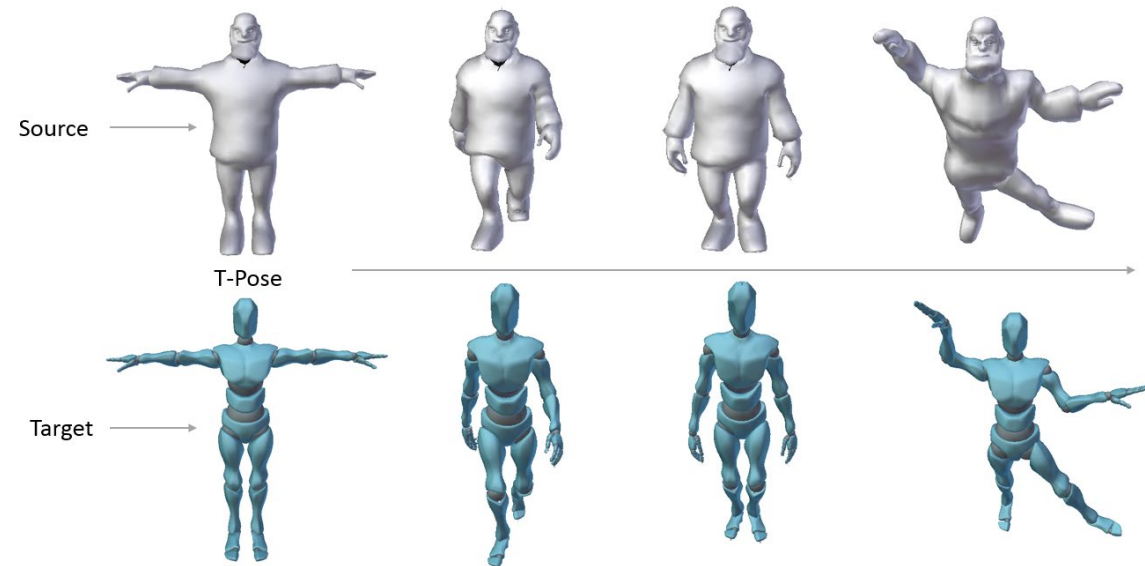
Source + Target

# 2. Qualitative



Animation Transfer

# Outline

# 7. Conclusions

We have developed a user-friendly integrated tool for :

- *transferring an animation setup*
- *creating new animated characters*

# THANK YOU!