Styling and Real-Time Simulation of Human Hair

Challenge

- Approx. 200.000-400.000 hairs on the human head
- Hair has some dynamics

- Real-Time simulation of all single hairs is impossible !
- Tradeoff between performance and reality
- Previous approaches are limited to short / black hair or are not real time capable

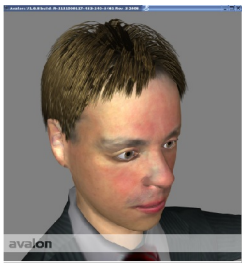
Our approach

Modelling and Simulation

- Reduce complexity by using wisps instead of single hairs
- Based on kinematic chains
- Length of hair remains static (in contrast to mass-spring)
- Small number of parameters (easy to control)
- Optimized normal and tangent calculation
- Collision detection using proxy sphere

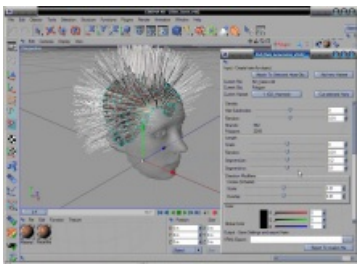
Rendering (based on study by [MarschnerJensen03])

- Real time capable using shaders
- Two specular highlights
- Anisotropic reflection
- Self-shadowing and backlighting (approximation)

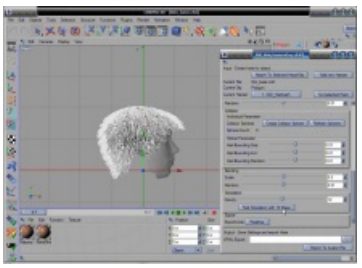



Hairstyling (The Barber)

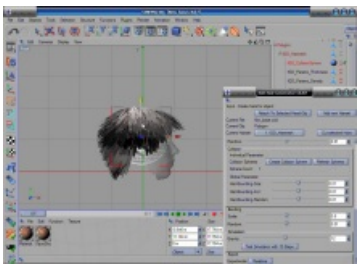
Realized as a Plugin for Cinema 4D using the described algorithm



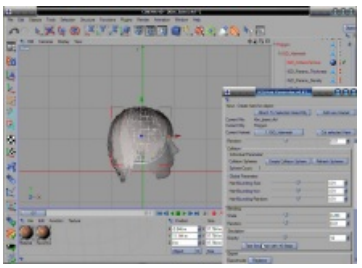
Add hair to selected areas



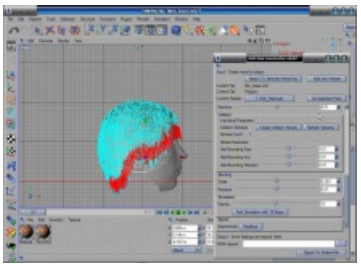
Run simulation



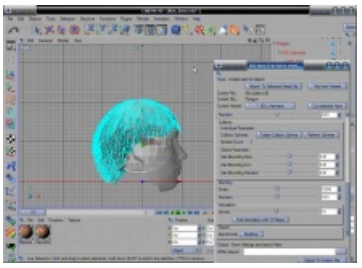
Add a collision object,
thus hair doesn't penetrate the head



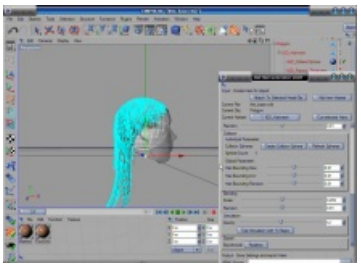
Run simulation,
taking care of collision object



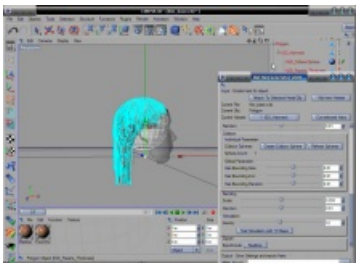
Mark hair, which should be cut away



After several cut operations



Hair can be made longer
(selected areas)



The final haircut

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