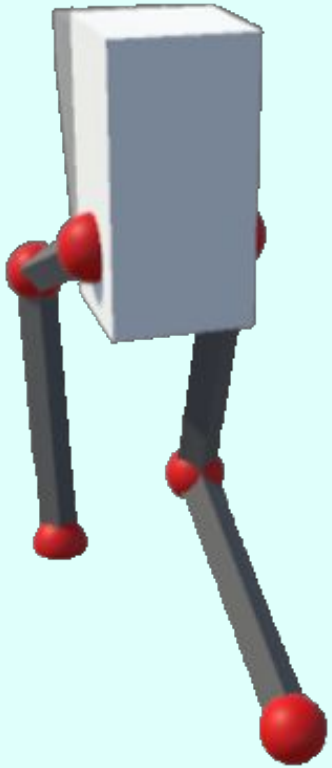
# Inverse Kinematic Based Procedural Animation

Reese Todhunter
s4002577

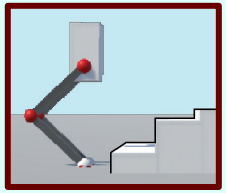


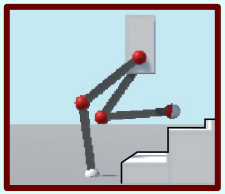
## Introduction

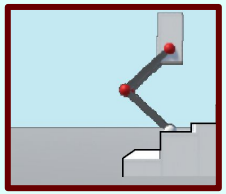
This investigation examines the use of Procedural Content Generation (PCG) and how Inverse Kinematics(IK) can be used to create an animation system.
The resulting output of this investigation will be a rig animated using this animation system to evaluate the techniques used and gauge their functionality within the industry.

## Procedural Content

PCG is the automatic creation of content through the utilisation of algorithms (Togelius et al, 2011).
A useful utilisation of this is in making keyframed animations more fluid, allowing for rigs to dynamically react to stimulus, (Rosen, 2014) and helping to greatly reduce the number of needlessly complex animations a rig needs.







## Inverse Kinematics

Each component of a rig using IK is made up of segments which can be animated using a target point, this is done by calculating how to move each segment so that the end point is at the target, then calculating the reverse such that the root point does not move and the end point touches the target position (EgoMouse, 2016)

## Conclusion

In conclusion, the use of PCG to dynamically maneuver a rig utilizing IK alone, produces very precise and robotic movements, lacking in character. However, reacting well with a dynamic environment.
Procedural IK proves to be a useful base for realistic rig animations but still requires a lot of setup along with lots of trial and error to reach a desired result as concluded by (Brochu et al. 2010 and Henshall et al, 2016).
This makes Procedural IK animations best exploited as an additional aid to traditional animation. Though through the combination of both IK and rigid body simulations a more characterised and natural animation may be possible.

Brochu, E., Brochu, T. and De Freitas, N., 2010, July. A Bayesian interactive optimization approach to procedural animation design. In Proceedings of the 2010 ACM SIGGRAPH/Eurographics Symposium on Computer Animation (pp. 103-112).

EgoMoose, 2016. FABRIK (Inverse kinematics). Available at: https://www.youtube.com/watch?v=UNoX65PRehA

Henshall, G.I., Headleand, C.J., Teahan, W.J. and Ap Cenydd, L., 2015, October. Towards crowd-sourced parameter optimisation for procedural animation. In 2015 International Conference on Cyberworlds (CW) (pp. 379-381). IEEE.

Rosen, D., 2014. Animation Bootcamp: An Indie Approach to Procedural Animation.

Togelius, J., Kastbjerg, E., Schedl, D. and Yannakakis, G.N., 2011, June. What is procedural content generation? Mario on the borderline. In Proceedings of the 2nd international workshop on procedural content generation in games (pp. 1-6).