

# Procedurally Generated Variations of a 3D Model

Author: Igor Santesteban  
University of the Basque Country

Supervisor: Alex García-Alonso  
University of the Basque Country

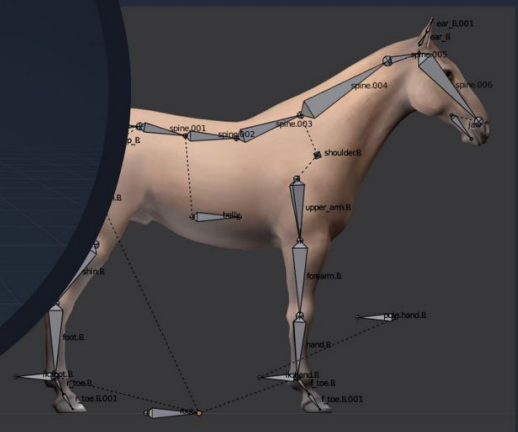
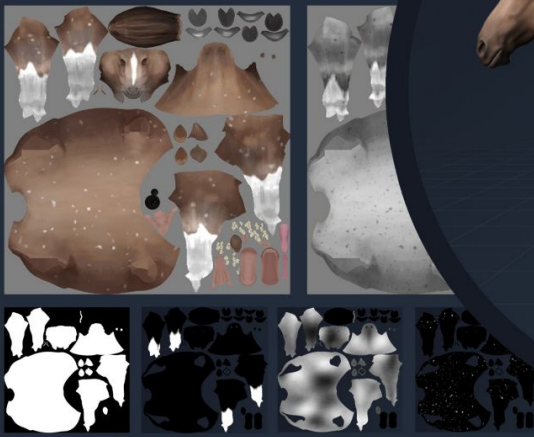
## The problem

This project addresses the problem of capturing the variability present in real-world objects. This problem has special relevance in the creation of scenes that contain multiple instances of the same object (a forest, a herd, a crowd...), in which the use of a single model produces unrealistic results. Modelling variations by hand could be one way of tackling this issue, but it would require significant development time. Moreover, it would also increase the size of the application.

## The proposed solution

The proposed solution uses procedural techniques to generate variations of a given 3D model. Due to the challenges that would pose trying to generalize to all kinds of models, this work focuses on the model of a horse. The coat of horses exhibits great variability and presents distinctive spots and markings. Therefore, it serves as a good example to test the capabilities of the developed solution.

Initial  
3D model



## Variations of the texture

The variations of the texture are generated using a combination of *filters* and *procedural textures*. The filters affect the *lightness* and *saturation* of the original texture and their area of effect is controlled using *masks*. The masks used to add spots and markings are generated procedurally from *simplex noise*.

The proposed parameterization of the noise is able to reproduce a wide range of effects. Furthermore, these parameters can be easily randomized to make each horse seem unique.

## Variations of the shape

The shape of the horse has three degrees of freedom: *height*, *weight* and *tail size*. To achieve the desired effect, these parameters manipulate the model's underlying *skeleton*, which is composed of 48 bones.

This way of varying the shape generates more realistic results than simply scaling the horse, but the creation of the skeleton can be time-consuming. Fortunately, since skeletal animation is widely used, this structure is already available in most applications.

