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COMPARISON OF 3D MODEL DEVELOPMENT PROCESSES FOR FILMS AND GAMES

Nowadays 3D technologies are very popular. They are widely used in different spheres of human life, for example engineering, design (of buildings, premises and clothing), film and advertisement making, design of web resources, game development and much more. For all of those areas of human activities different 3D models are used. Depending on the purpose of creating the model, specialists use various software and approaches. In the professional slang of 3D modelers, a system consisting of people, hardware, and software aligned to work in a specific sequential order to do pre-determined tasks in a predetermined time frame is called «pipeline» [1]. Each company or team of developers choose their own particular pipeline for doing models for particular projects. The choice is based on various factors, for instance: the time allocated for the project, the style of the project, the experience of the developers, financial resources, the company/team policy regarding certain equipment and software and, of course, the final purpose of the model.

Different pipelines have different complexity and require different time commitments. The purpose of this work is to compare classic pipelines for creating models for games and for films, in order to determine the difference in the intensity of the labor required to produce models, according to the requirements of these approaches. In this case the objects of study are the most common and standardized pipelines of creating models for films and games. For clarity purposes, it was decided to make models in a relatively realistic style for both pipelines. It is important to note that in the context of this work the processes of rendering, implementing models into a game engine, and others are not examined - only the processes of creating the models themselves are studied. The subject of the study is the difference between these two pipelines, namely the difference in the amount of labor required to complete the model, expressed in the complexity of the approach.

Before starting the comparison, it is important to briefly describe the reason why the two types of models under study cannot be created using the same pipeline. This reason lies in the specifics of their purpose. When creating models for films, 3D artists are practically unlimited in terms of time for post-processing (rendering) of the model and in the technical capabilities of the devices on which post-processing takes place. However, artists need to carefully develop the visuals of the model, which gradually leads to its complication. In the case of creating 3D graphics for games, developers need to take into account that the rendering of models will occur directly on the devices of users of the game they are developing. At the same time, if when creating a film, it is absolutely acceptable to render a model over the course of hours, in a game this should happen instantly. Players' devices will also need to detect the position of these objects, and display the textures that are superimposed on the objects. In order not to slow down the game process, developers try to simplify game models as much as possible before adding them to the game - artists specializing in films are not obliged to do this. However, the graphics in games are often as realistic as the graphics in films. The study will also examine how such realism can be achieved while keeping the model lightweight and suitable for implementation in the game.

The process of creating a model for a film begins with creating a draft. This step is also called blocking. As an example, we made a small model of an abstract form (Fig.1-1). It will represent an

object that needs to be inserted into the film. In order to add detail, this object has to be converted to a high poly version. Highly poly means having a high polygon count and complex geometry [2]. When converting a model from a low poly version to a high poly version, programs usually divide each polygon into 4 parts many times, which gives the object mesh more density, but removes all the corners. To save the corners, artists add so-called «stiffening ribs» on the model along the corners, which should not be smoothed during the conversion process (Fig.1-2). However, if each polygon is repeatedly divided into 4 parts, as indicated above, then the object mesh will be uneven, which will complicate further work with it. Therefore, it is necessary to recalculate the mesh using a special tool so that all polygons (squares) are distributed evenly (Fig. 1-3).

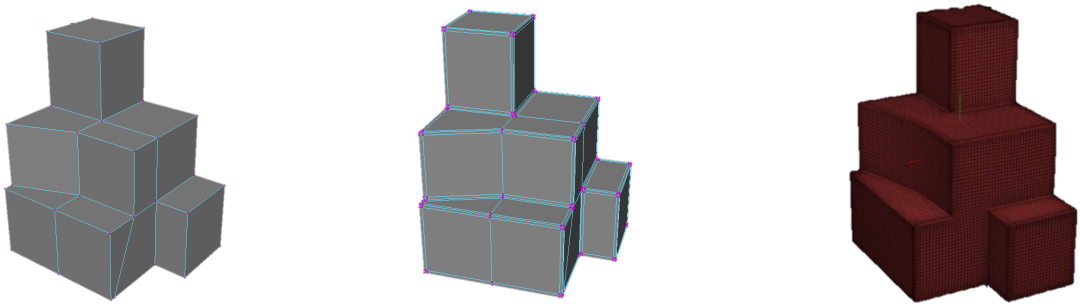

Fig. 1. Balance chart

When the high poly object is prepared, the developers begin to detail it. This stage of development is often compared to working with a lump of clay (Fig. 2-1). As an example, the object has some chips and scratches, but the detailing of the elements can reach much greater limits. At this stage of development, it is possible to have from several sites to several million polygons (squares) on the object. However, even for inclusion in a film, such an object is too heavy (Fig. 2-2). To simplify it, a specialized tool can be used that recalculates the topology, reducing the number of polygons where possible, while maintaining the shape and the details of the model (Fig. 2-3).

Fig. 2. 1 The high-poly model with details; 2 – the heavy mesh; 3 – the decimated high-poly model

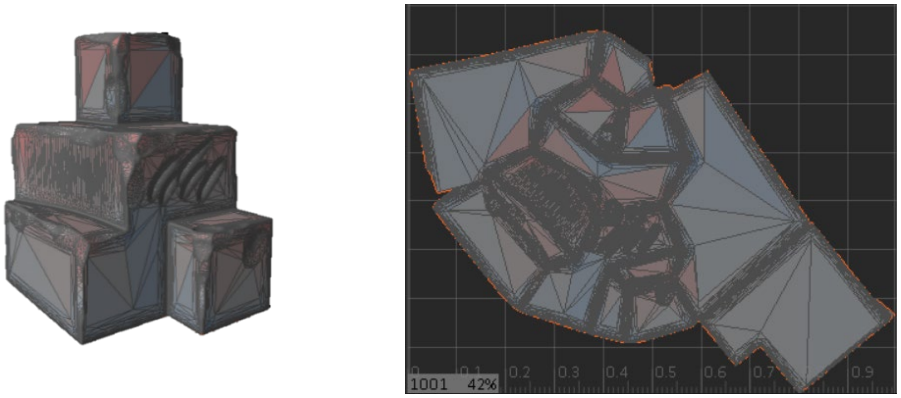

Fig. 3. The model and it's UV map

After simplification, which is also called decimation, has been carried out, the model is technically ready to be rendered, but at this moment it does not yet have textures. In 3D, textures are extremely rarely applied directly to model points – there is too much information to keep on it. In order to apply textures to a model, UV mapping is usually used (both in the film industry and in game creation). UV maps are a 2D interpretation of a 3D object, and each point on the UV map corresponds to a point on the model itself. Thus, these cards allow developers to assign many characteristics to the model, but not directly. In order to create a UV map, a process called «unwrapping» is used (Fig. 3).

At this point, the model is ready for texture application. When texturing is completed, the model can be considered ready (Fig.4).

Considering the process of creating a model for games, it can be argued that the first steps of creating a model are identical. The differences begin after creating a decimated high-poly version of the model. As stated above, it may be suitable for implementation in a film, but not in a game. To solve this problem, a process called «baking» is used. Baking is a technique in 3D modeling that generates texture maps with lighting information for 3D scenes. This technique involves rendering a 3D scene with a specific lighting setup and saving the results as texture maps [3].

Fig. 4. The model with the textures assigned

In order to bake textures, the initial low-poly model is placed inside the high-poly model (Fig.5-1) (in this case, transparency and a red tint are applied to the high-poly model for convenience) and is adjusted so as to repeat its basic shapes as much as possible and not go beyond its limits (Fig.5-2). In this pipeline we also need to unwrap the model, but this time we work with the low-poly one. This is necessary in order to record the baking results on its UV map (Fig.5-3).

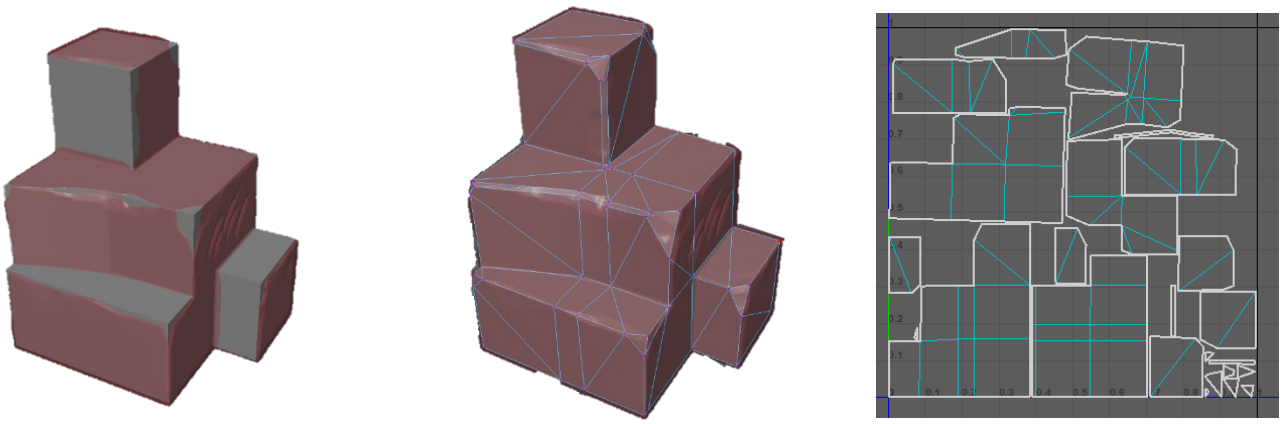

Fig. 5. 1 – the low-poly model inside the high-poly model; 2 – the adjusted low-poly model inside the high-poly model; 3 – the UV map of the adjusted low-poly model

Once the UV Map is ready and the model is adjusted, you can begin the baking process itself. As a result, we get a low-poly model that looks like a high-poly model (Fig.6-1). The difference can only be seen when viewing the model up close from a certain viewing angle. Then you can see that the seemingly smooth corners are actually sharp, since this is still a low-poly model (Fig. 6-2). However, such an artifact is acceptable and inevitable, so it can sometimes be noticed when peering at objects in games. After baking, a texture can be applied to the model. This process is not significantly different (Fig.6-3).

Fig. 6. 1 – the baked low-poly model; 2 – sharp ages on the baked low-poly model; 3 – the baked low-poly model with the textures assigned

As a conclusion, we can say that while there are certainly similar elements in these two pipelines, the need to simplify models for games requires the use of «baking». This process is extremely common and very popular, but its implementation requires additional skills, time, and generally complicates the process of creating each individual model for the game.

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