

ANALYSIS OF SOFTWARE TOOLS FOR 3D CHARACTER MODELING

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Abstract. *This article analyses software tools for creating 3D characters in computer games. It examines the main stages of the production pipeline and the role of the relevant tools. A comparison of software is carried out based on key technical and production criteria. The industrial application of 3D tools in game development and related fields is analysed separately.*

Keywords: *3D modelling, game development, Blender, Zbrush, Maya, substance painter.*

The modern computer games industry is based on complex technological processes for creating digital content, in which software tools for three-dimensional modelling play a key role. Creating a 3D character is a multi-stage process involving successive stages of geometry creation, optimisation, texturing and preparation for animation. The efficiency of this process is determined not only by artistic aspects, but also by the correct choice of software tools and their integration into a single production pipeline [1-3].

The aim of the study is to examine the process of creating a 3D character as a contextual model of production, thereby enabling an analysis of the functional role of software tools. Each of the key stages in the production of a digital character requires the use of specialised software, the functional capabilities of which determine the efficiency of the entire process.

In particular, digital sculpting tools enable the creation of highly detailed geometry, whilst polygonal modelling packages are responsible for generating optimised topology. Texturing software tools allow for the manipulation of materials in a physically accurate representation, and animation systems enable the deformation and movement of the model in real time.

Thus, the subject of this study is the functional specialisation of software tools within the production process. From the perspective of functional analysis of 3D modelling software, each tool is characterised by a unique set of technical capabilities that determine its place in the production environment. ZBrush is geared towards working with high-polygon geometry and provides highly detailed digital sculpting, but is not designed for optimising or preparing models for real-time use [4]. Autodesk Maya serves as a universal environment for polygonal modelling, retopology and animation, providing precise control over topology and deformations [5]. Blender combines a wide range of features within a single platform; however, its versatility comes at the cost of being less specialised compared to industry standards [6-8]. Substance 3D Painter specialises exclusively in texturing using physically based rendering (PBR), which allows for the creation of realistic materials without the need for geometric modelling [9]. Thus, software tools differ not only in terms of functionality but also in the architectural principles of implementation, which directly influence their effectiveness in a production environment.

Consequently, the differences between the software tools are determined both by their functional purpose and by the architectural principles underlying their implementation, which influence their effectiveness in a production environment.

Table 1 – Comparative analysis of software tools for 3D character modelling

Software	Functional purpose	Licensing	Performance	Learning curve	Role in the production pipeline
ZBrush	High-poly sculpting	Commercial	High	High	Character geometry detailing
Autodesk Maya	Modelling / Rigging / Animation	Commercial	High	High	Core production tool
Blender	Full 3D pipeline	Free	High	Medium	Versatile development environment
Substance 3D Painter	PBR texturing	Commercial	High	Medium	Material and texture creation
3ds Max	Hard-surface modelling	Commercial	High	Medium	Alternative modelling

An examination of the contemporary digital content industry reveals an uneven distribution in the use of software tools, depending on their functional specialisation. The most widely used tools in the field of 3D graphics are Blender, Autodesk Maya, ZBrush, 3ds Max and Cinema 4D, which form the basis of modern production pipelines in game development and related industries.

Autodesk Maya and 3ds Max are traditionally used in large AAA studios [10] due to their advanced animation, rigging, and modelling capabilities [11, 12]. ZBrush holds a dominant position in the field of high-poly sculpting, whilst Blender is gaining popularity as a versatile, free solution that supports the full digital content production cycle.

A typical production setup in game development involves the combined use of several software tools, where ZBrush is used to create detailed geometry, Maya for retopology and animation, and Substance Painter for texturing and material creation.

Analyzing the level of software usage in the digital industry shows that Blender, Maya and ZBrush have the highest penetration rates (fig.1), effectively establishing a de facto standard in the field of 3D graphics [9]. The distribution of tool usage is uneven and is determined by the specific nature of production tasks, the studio’s level and the type of projects.

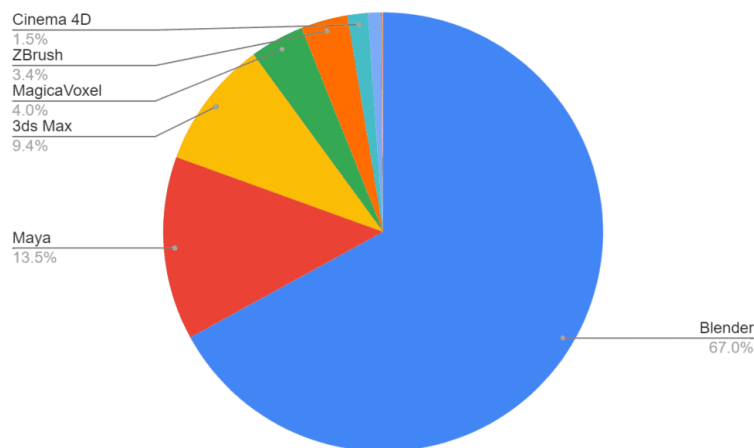


Figure 1 – Diagram of software usage for character creation

The outcomes demonstrate that the modern approach to creating 3D characters is based on a multi-tool production architecture, in which each software tool performs a clearly

defined functional role. The efficiency of the production pipeline is determined not by the characteristics of individual tools, but by their mutual integration into a single technological system. A particular role is played by the interaction between the high-poly and low-poly stages, where retopology acts as a critical transitional process that ensures a balance between visual quality and computational efficiency [1].

The results of the study indicate that the efficiency of 3D character creation is determined by the judicious combination of specialised software tools. The optimal combination is as follows: ZBrush is used for high-poly modelling, Autodesk Maya or Blender for retopology, optimisation and animation, and Substance 3D Painter for PBR texturing.

For indie projects, it is advisable to use Blender as a universal end-to-end tool, whereas in AAA production, a multi-tool approach utilising highly specialised software is more effective. This approach allows for a balance to be struck between visual quality and performance in real-time environments.

References.

1. Huttula, S. (2025). Building Game-Ready Characters: A Complete 3D Workflow for Game Engines – Essential Techniques for Game-Ready 3D Character Creation. https://www.theseus.fi/bitstream/handle/10024/886236/Huttula_Sami.pdf.
2. Мартиненко, Ю.С., & Вовк, О.В. (2026). Аналіз особливостей пайплайну AAA-студій та інди-розробників у створенні 3D-моделей. Інформаційні технології в сучасному світі: дослідження молодих вчених. (с. 182).
3. Товма, С.С., & Вовк, О.В. (2025). Препродакшен в анімації. Етапи підготовки та оптимізація робочого процесу. Радіоелектроніка та молодь у XXI столітті. Т. 6. (с. 612-613).
4. Pixologic. (2024). ZBrush Documentation. <https://docs.pixologic.com>.
5. Autodesk. (2024). Maya. <https://www.autodesk.com/products/maya/product-details>.
6. Fonseca, A.C. (2018). 3D Modeling Pipeline for Games. https://www.theseus.fi/bitstream/handle/10024/156811/Gomes_Sarmento_Da_Fonseca_Ana.pdf.
7. Біла, Д.С., & Вовк, О.В. (2025). Використання Blender, Unity, Three.js для анімації в мультимедіа. Радіоелектроніка та молодь у XXI столітті. Т. 6. (с. 558-559).
8. Вовк, О.В., Григор'єв, О.В., & Біла, Д.С. (2025). Особливості створення 3D-анімації для трейлерів відеоігор у середовищі Blender. Поліграфічні, мультимедійні та web-технології. Т. 2. (с. 12-13).
9. Indie Game Cloud. (2024). Most common software used for game development. <https://indiegamecloud.com/most-common-software-used-for-game-development/>.
10. Чеботарьова, І.Б., & Трохін, К.О. (2024). Проектування тривимірних моделей для комп'ютерної гри AAA-проекту. Поліграфічні, мультимедійні та web-технології. Т. 2. (с. 226-230).
11. Дзеніс, Є.С., & Вовк, О.В. (2026). Оптимізація 3D-персонажів відповідно до технологічних вимог комп'ютерних ігор. Інформаційні технології в сучасному світі: дослідження молодих вчених. (с. 163).
12. Dzenis, Y., & Vovk, O. (2026). The use of procedural modelling in the creation of 3D objects. *Memorias de SYNTOPIA*. (p. 34-36).