

The Development of a Multi-Angle Modular Brush Toolset as an Efficient Solution for 2D Character Production

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Abstract – The digital creative sector necessitates an efficient production method for 2D character art and animation that maintains visual quality and character consistency. A primary challenge for artists is preserving the anatomical proportions and visual identity of characters when depicted from diverse perspectives. This procedure is frequently labor-intensive as characters must be repainted individually for each alteration in perspective. This study seeks to create a Multi-Angle Modular Brush Toolset utilizing Clip Studio Paint to enhance the productivity of the 2D character illustration and animation process while preserving the character's visual coherence. The study employed Research and Development (R&D) methodology encompassing the phases of needs analysis, design, development, testing, documentation, and publication. The toolkit was created using a modular approach that segments the character structure into anatomical components, which can be viewed from multiple perspectives: front, side, three-quarter, and back. Testing was conducted via toolset implementation, production efficiency assessment, user evaluation, and asset feasibility analysis for skeletal animation requirements. The findings indicate that the toolset was effectively implemented as a modular brush system within the Clip Studio Paint workflow. Efficiency testing indicates that using the toolset can markedly reduce the time needed to produce character illustrations compared to traditional approaches, as users can leverage existing anatomical assets without redrawing the fundamental character structure. User evaluation results indicate a significant degree of acceptability regarding usability, anatomical and visual coherence, flexibility in posture arrangement, and overall user pleasure. The rigging test results demonstrate that the assets possess an orderly structure, uniform proportions, and are adequately prepared for skeletal animation. The results indicate that the Modular Brush Multi-Angle Toolset enhances the efficiency of 2D character illustration production, maintains visual consistency across characters from various perspectives, and facilitates integration between illustration and animation workflows. This research advances the creation of modular digital materials tailored for character illustration and animation within the digital creative sector.

Keywords: Clip Studio Paint, Modular Brush, 2D Character Illustration, Multi-Angle Character Design

I. Introduction

The advancement of the digital creative industry has spurred a growing demand for high-quality 2D character illustrations and animations, especially in entertainment, digital gaming, webcomics, social networking, and advertising [1]. During production, illustrators and animators must create uniform figures across multiple perspectives, expressions, and stances [2]. As the complexity of visual projects escalates, the demand for tools that accelerate production without sacrificing quality becomes paramount [3]. Clip Studio Paint is widely used software in the creative industry, thanks to its features that

enable the creation of high-quality digital illustrations and animations [4]. The success of the production process is significantly determined by the efficacy of the instruments that facilitate the creator's workflow [5].

The process of depicting characters from various angles poses a challenge for many illustrators and animators [6]. Every alteration in angle requires the user to manually adjust the proportions, shape, details, volume, and visual components of the character to preserve the integrity of the original design [7]. This method is both time-consuming and may result in visual inconsistencies between photos if not performed with precision. This issue becomes very intricate when applied to animation projects, necessitating

extensive frame counts and consistent character representation in each scene. Consequently, manufacturing productivity frequently declines due to the substantial time spent making recurrent graphic modifications.

To resolve these challenges, numerous features and digital assets have been created in illustration software, including digital brushes as drawing tools. Digital brushes enhance production efficiency by offering immediate application of precise shapes, textures, and effects [8]. Nevertheless, the majority of available brushes remain tailored for general sketching and do not particularly facilitate character visualization from diverse perspectives. Users often need to combine multiple brushes or manually create additional assets to meet character design requirements. This scenario highlights the ongoing need for more precise, organized tools to facilitate the 2D character illustration and animation process.

Numerous prior studies have examined the utilization of digital assets to enhance the efficiency of the visual art production process. Studies indicate that digital brushes can expedite the processes of coloring, texturing, and finalizing illustrations in comparison to traditional techniques [9]. Additional research has focused on creating character templates and rigging methods to ensure visual uniformity in 2D animation production [10]. Moreover, studies investigating modularity in digital asset production indicate that a modular strategy can enhance flexibility and facilitate asset modifications to align with project requirements [11]. Nevertheless, the majority of the research remains focused on general visual asset creation and has not particularly addressed the development of brush toolsets tailored to meet the requirements of multi-angle character illustrations.

An analysis of prior studies indicates a research gap that needs to be addressed. Research on digital brushes predominantly emphasizes improving visual quality or accelerating the drawing process, often neglecting the need for character consistency across multiple viewpoints. Conversely, research on modular systems has predominantly focused on creating character assets or independent visual components, rather than prioritizing the development of brushes as a fundamental tool in the drawing process. No research has been identified that particularly develops and assesses a modular multi-angle brush toolset in Clip Studio Paint to enhance the efficiency and consistency of 2D character illustration and animation production. This gap presents an opportunity for innovation to meet the practical needs of digital creators.

This study aims to create a modular, multi-angle brush toolset for Clip Studio Paint, addressing the highlighted issues and research gaps to enhance the 2D character drawing and animation workflow. This invention incorporates modularity, allowing each brush to be used flexibly across diverse character views. This study seeks to assess the usefulness of a functional toolset for

enhancing work-time efficiency, preserving the visual consistency of characters, and, ideally, meeting the requirements of illustration and animation production.

This study's outcomes are anticipated to yield both academic and practical contributions to digital illustration and 2D animation. This research can enhance the academic study of modular-based digital asset development in illustration software. This research can provide illustrators and animators with a reference for using a more efficient toolset to create characters that maintain consistent visual quality across multiple viewpoints. Moreover, animation studios, creative sectors, and digital asset creators can leverage the findings of this research to establish production support systems that enhance productivity, minimize processing time, and uphold visual quality standards in 2D character illustration and animation.

II. Research Methodology

This study employs the Research and Development (R&D) methodology, focusing on the creation and evaluation of a multi-angle modular brush toolset for 2D character drawing in Clip Studio Paint. This strategy was used because the research seeks not only to create a product but also to ensure that the generated product effectively and efficiently meets user needs and enhances the character illustration process. The research process is conducted methodically through numerous interconnected stages, beginning with the identification of needs and culminating in the publication of the generated product.

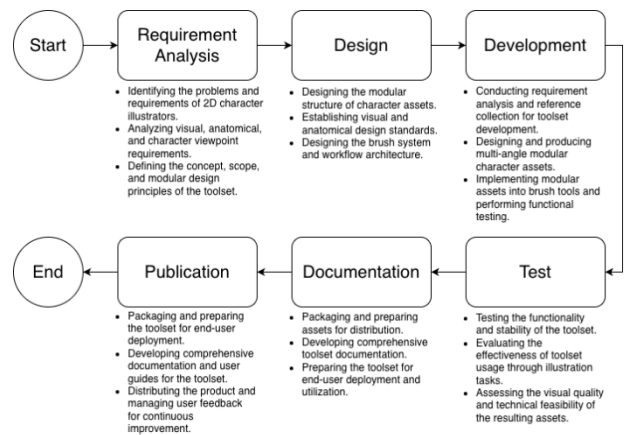


Fig. 1. Research Methodology

As shown in Fig. 1., the research phase encompasses needs analysis, design, development, testing, documentation, and publication. Each step serves a specific function in developing the toolset. A needs study is conducted to understand user issues and requirements, whereas the design phase focuses on defining the concept and framework of the toolset. The development phase converts the design into a functional product. Subsequently, testing is performed to assess the functionality and efficacy of the toolset. Documentation is

used to create user manuals and supplementary materials, whereas the publication phase disseminates the product to users and gathers input for subsequent development.

A. Requirement Analysis

The needs analysis step was conducted to identify the challenges and requirements of 2D character illustrators in developing characters from multiple perspectives. This phase sought to understand the issues commonly encountered with consistent character proportions, anatomical precision, and visual uniformity across the art and animation production process.

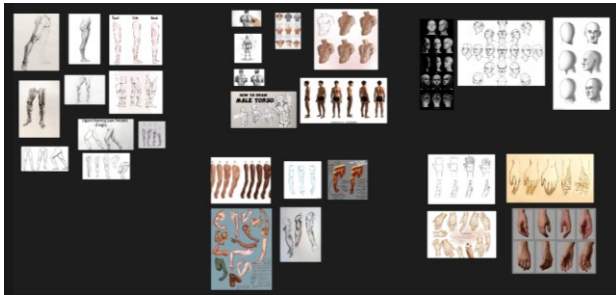


Fig. 2. Human Body Illustration References

Fig. 2. illustrates the examination focused on character illustration methodologies, design references, and digital workflows commonly employed by illustrators. The analysis primarily focused on the need to maintain visual consistency across character views while improving manufacturing process efficiency.

The analytical results established the concept, scope, and objectives for developing a modular brush toolkit. Modular design concepts were established to ensure that the resulting toolset offers significant flexibility, user-friendliness, and reusability for creating multi-angle character images.

B. Design

The design step converts the specified requirements into a systematic toolset concept. Figure 3 shows the approach commences with the construction of a modular asset framework that will underpin the brush system, enabling the reutilization of each character component across several perspectives.

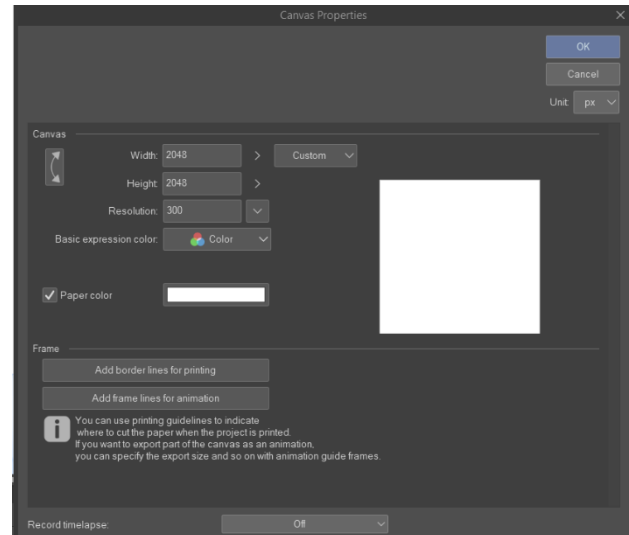


Fig. 3. Canvas Setting on CSP

Subsequently, visual and anatomical design standards are instituted to ensure uniformity in character appearance [12]. These standards encompass directives for body proportions, facial structure, anatomical characteristics, and perspective modifications necessary for each character's viewpoint.

After the visual standards are determined, the brush system and workflow architecture are developed. The workflow is structured to enhance the efficiency of the illustration process, enabling users to generate diverse character perspectives rapidly while maintaining visual consistency and anatomical precision.

C. Development

The development step involves transforming the design into a functional toolset. The process commences with the collection of visual references and technical specifications to facilitate the development of modular assets in accordance with the criteria stated in the prior phase [13].

The gathered references serve as the foundation for the design and creation of multi-angle character assets [14]. These materials are created with anatomical accuracy, visual appropriateness, and versatility for different character viewpoints is presented in Fig. 4.

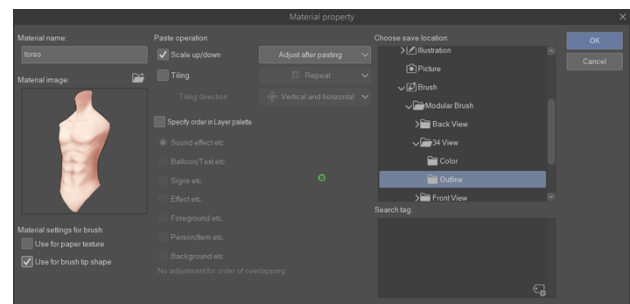


Fig. 4. Material Property Setting on Asset Registration

Upon creating all modular elements, they are integrated into the brush system in Clip Studio Paint. Functional testing is thereafter performed to verify that all components operate in accordance with development objectives and can be utilized efficiently in the illustration process [15].

D. Test

The testing process was implemented to assess the functionality, stability, and performance of the developed toolset. The preliminary assessment focused on evaluating each brush component to ensure seamless operation of all functionalities without technological malfunctions during use.

The toolset's effectiveness was assessed through illustration tasks focused on character creation from multiple perspectives. This review sought to determine the toolset's capacity to enhance labor efficiency, facilitate usability, and maintain visual consistency throughout the production process.

The visual quality and technical feasibility of the resultant assets were evaluated alongside functional factors. Evaluations were conducted on anatomical precision, form consistency, usability, adaptability, and appropriateness for 2D character illustration and animation requirements.

E. Documentation

The documentation step is conducted to compile the necessary supporting resources for utilizing the toolset. This activity entails organizing and packaging the created assets for use and dissemination to consumers.

Subsequently, documentation is prepared that comprehensively elucidates the framework, functionalities, and protocols for utilizing the toolset. The manual aims to provide explicit instructions for users to understand and effectively use the modular brush system.

In the final step, all assets and accompanying documentation are consolidated into a single bundle, prepared for user use. This preparation is conducted to ensure the toolset can be used effectively and consistently in alignment with its developmental goals.

F. Publication

The publication phase is the final stage of the toolset development process. At this juncture, all assets, ancillary files, and distribution materials are meticulously prepared to guarantee excellent user experience.

The created documentation and user guides are further revised to facilitate installation and enhance user learning. This documentation encompasses installation instructions, feature utilization, integration with illustrative workflows, and suggested usage protocols.

Upon completion of all preparations, the toolset is disseminated to users via suitable channels. User feedback is subsequently gathered and analyzed to guide the development and enhancement of the toolkit in later phases.

III. Results and Discussions

This section delineates the implementation and evaluation outcomes of the Modular Brush Multi-Angle Toolset, designed to facilitate the 2D character illustration and animation process in Clip Studio Paint. The research findings are examined throughout multiple phases, encompassing toolset deployment, production efficiency assessment, user evaluation, and asset feasibility analysis for skeletal animation requirements. Each phase is conducted to evaluate the extent to which the developed toolset fulfills the research objectives, specifically enhancing the efficiency of the illustration workflow, ensuring consistency in character anatomy and visuals, and generating assets suitable for the animation production process. The results are thereafter examined and interpreted to ascertain the benefits, contributions, and possible advancements of the toolset in the realm of 2D character illustration and animation within the creative business.

A. Multi-Angle Brush Modular Toolset Implementation

The implementation step involves actualizing the outcomes of the modular multi-angle brush toolset created during the design phase. The implementation was executed using Clip Studio Paint software, employing the Image Material, Sub Tool, and Custom Brush features as the principal development tools. The objective of this solution was to provide a collection of modular elements to accelerate the 2D character illustration process while ensuring anatomical consistency from various perspectives.

The created toolset was formulated on the principle of modularity, which disaggregates character structure into multiple autonomous, reusable components. Each component is designed for flexible integration, obviating the necessity for illustrators to redraw the complete figure whenever a new character is generated. This method enables character development by organizing existing modules while preserving creative autonomy.

Modular Toolset Structure

The resultant toolkit has various anatomical asset categories that represent the principal components of the human body. Each asset group is organized independently to enhance usability, management, and prospective development. The configuration of the created toolset is illustrated in Table I.

TABLE I
MULTI-ANGLE BRUSH MODULAR TOOLSET STRUCTURE

Asset Group	Component
Head	Front, side, three-quarter, and back head
Body	Front, side, three-quarter, and back torso
Arms	Upper and lower arms at various angles
Hands	Various basic hand poses
Legs	Thigh and calf at various angles
Feet/Palms	Basic foot poses
Additional Features	Neck, ears, and anatomical joints

Each element is preserved as a material image and subsequently included in a bespoke brush. This method enables illustrators to swiftly position body parts with drag-and-drop functionality or pre-set custom brushes.

Implementation of Viewpoint Variation

A fundamental feature of the created toolset is its ability to facilitate numerous character perspectives. This research generated assets for four principal perspectives frequently utilized in 2D character drawing and animation: front view, side view, three-quarter view, and rear view.

These four perspectives were selected as they encompass the predominant visual necessities in character design and animation production. All assets were designed with uniform anatomical proportions to ensure that variations in perspective do not compromise the character's visual identity under development.

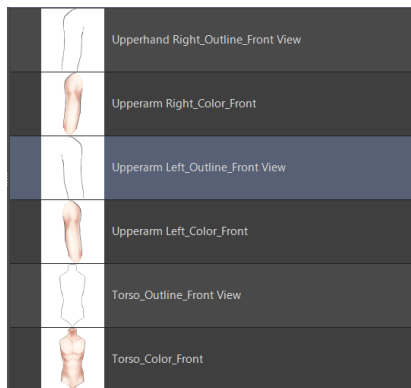


Fig. 5. Viewing Angle Variations in the Multi-Angle Modular Brush Toolset

The multi-angle implementation was executed by preserving standard dimensions, proportions, and anatomical joint placements in each module. This standardization ensures that body parts from different perspectives can be consistently used in the illustration and animation rigging process.

Modular Brush System Implementation

Upon completion of the anatomical materials, all elements are included in Clip Studio Paint's modular brush system. This is done through the custom brush feature, which enables the use of image components as brush tip shapes.

Fig. 5. illustrates the approach enables illustrators to promptly position anatomical assets by merely applying brush strokes to the canvas. This method contrasts with the traditional process, which necessitates users to physically construct body structures from the ground up.

The implementation of modular brushes not only enhances production speed but also ensures consistent anatomical forms throughout images. All utilized assets originate from a singular source, hence reducing the proportional discrepancies frequently associated with hand illustration.

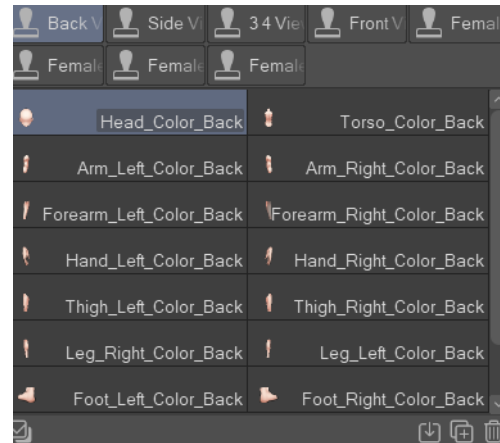


Fig. 6. Modular Brush Implementation in CSP

The brush system includes size, rotation, and transformation parameters, enabling users to modify assets to meet the pose requirements is presented in Fig. 6. This guarantees usability, even when character creation uses conventional assets.

Character Creation Workflow Implementation

Initiating the toolset involves picking an anatomy module that aligns with the character's pose specifications. The illustrator systematically assembles the head, torso, arms, and legs to create a whole character framework.

Fig. 7. shows the construction process utilizes the transformation function in Clip Studio Paint to modify the location, scale, and orientation of each module. Once the foundation is established, the user may proceed to details, line art, coloring, and polishing the character design in accordance with the project's requirements.

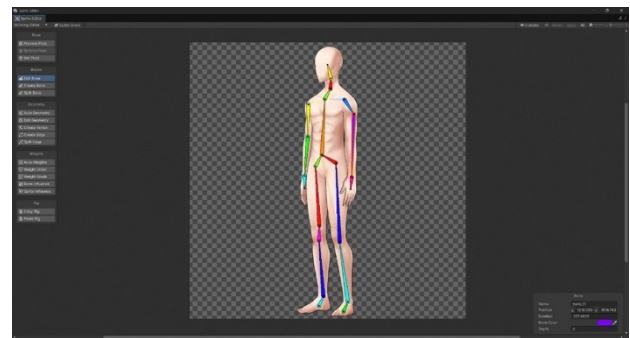


Fig. 7. Character Creation Stages Using the Modular Brush Toolset

This process reduces the time required for the anatomy assembly phase compared to traditional approaches, as most fundamental components are readily available in pre-assembled modules. This enables the illustrator to focus more on creative elements such as outfit design, expression, and character development.

Toolset Implementation Results

The implementation findings indicate that the modular multi-angle brush toolset effectively fulfilled the requirements established during the analytical phase. The toolkit offers standardized anatomical materials, accommodates various character viewpoints, and can be seamlessly incorporated into a digital drawing workflow utilizing Clip Studio Paint.

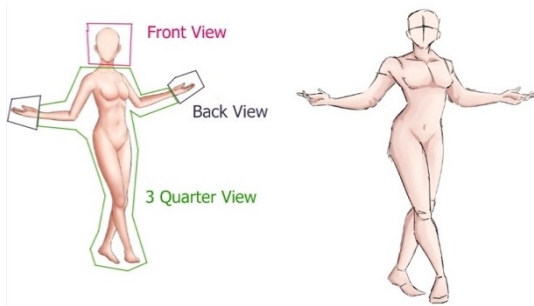


Fig. 8. Character Asset Arrangement Combination

As shown in Fig. 8., the developed toolset not only serves as an illustrative assistant but also generates a more structured asset framework, prepared for the following production phases, including the segmentation of body parts for skeletal animation. These attributes indicate that the modular approach enhances the productivity of the illustration process while facilitating integration between character design and animation production phases.

The adoption of the modular multi-angle brush toolset effectively yielded a flexible, consistent, and user-friendly illustration asset system. The outcomes of these implementations formed the foundation for efficiency testing, user assessment, and asset feasibility analysis, which will be further discussed in the subsequent subsections.

B. Preliminary Performance Evaluation Results

A preliminary performance evaluation was conducted to examine the potential impact of the Modular Brush Multi-Angle Toolset on the time required for the character construction stage in 2D illustration. Rather than establishing a generalized measure of production efficiency, this evaluation was intended to provide an initial comparison between the conventional workflow and the proposed modular approach under controlled conditions.

Each participant completed one assigned illustration task using two different workflows: (1) the conventional method, in which anatomical structures were constructed

manually, and (2) the proposed modular toolset, which utilized pre-built multi-angle anatomical assets. To minimize external influences, all participants performed both workflows using the same hardware, software environment, and drawing settings. The completion time was recorded from the beginning of the character construction process until the base character was ready for the detailing stage.

The illustration tasks assigned to each participant were intentionally varied to represent several common character construction scenarios encountered in digital illustration, including standing poses, walking poses, running poses, and reference poses. This design was intended to evaluate whether the proposed Modular Brush Multi-Angle Toolset could provide workflow benefits across different pose configurations rather than being limited to a single gesture. Consequently, the evaluation focused on comparing the conventional and modular workflows within the same assigned task for each participant. Nevertheless, because the complexity of the assigned poses was not identical across participants, direct comparisons of completion times between respondents were intentionally avoided. Future evaluations should employ a standardized pose or gesture completed by all participants to enable a more rigorous and statistically comparable assessment.

TABLE II
RESPONDENTS' TASK SPECIFICATION

Respondent	Task	Without Modular Brush (minutes)	With Modular (minutes)
Danang	Female Walk Pose (Side View)	28:41	15:30
Ahmad	Male Run Pose (Side View)	21:20	18:38
Alfina	Male Standing Pose (Front View)	12:54	02:11
Fathan	Reference Pose	35:26	16:18
Adimas	Reference Pose	42:13	18:50

Based on Table II, the results consistently indicate that the Modular Brush Multi-Angle Toolset reduced the time required for the character construction stage across all tested tasks. However, given the limited number of participants ($n = 5$) and the variation in assigned illustration tasks, these findings should be regarded as preliminary evidence of the toolset's practical benefits rather than as statistically generalizable proof of production efficiency. Future studies involving a larger sample size and standardized drawing tasks are necessary to provide more robust quantitative validation.

IV. Conclusion

This research effectively developed a Modular Brush Multi-Angle Toolset in Clip Studio Paint to enhance the efficiency of 2D character illustration and animation workflows. The project was executed using a Research

and Development (R&D) approach, including needs analysis, design, development, testing, documentation, and publication. A modular strategy was employed by segmenting character structures into reusable anatomical components from multiple perspectives, addressing the issues of visual consistency and prolonged production times frequently encountered by illustrators in creating multi-angle characters.

The implementation findings indicated that the created toolset integrates effectively into digital illustration workflows and facilitates a more methodical character production process. Testing production efficiency revealed that the toolset reduced processing time compared to traditional approaches, enabling users to leverage existing modular assets without redrawing anatomical structures from scratch. User evaluation results indicated a high level of acceptability for simplicity of use, anatomical and visual consistency, flexibility in pose composition, and overall user happiness. The data demonstrate that the toolkit enhances labor productivity while simultaneously ensuring a more uniform visual quality of characters.

The feasibility assessment for skeletal animation indicates that assets created with the Modular Brush Multi-Angle Toolset are well prepared for the rigging and animation of 2D characters. The distinct asset structure, uniformity of anatomical proportions, and capacity to accommodate fundamental motion deformations suggest that the toolset is applicable not just during the illustration phase but also within the animation production pipeline. This research advances the creation of modular digital assets that efficiently address illustration and animation requirements, while also facilitating further development through the incorporation of asset variations, character expressions, and integration with more sophisticated animation systems.

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