

Paratrouper: Exploratory Creation of Character Cast Visuals Using Generative AI

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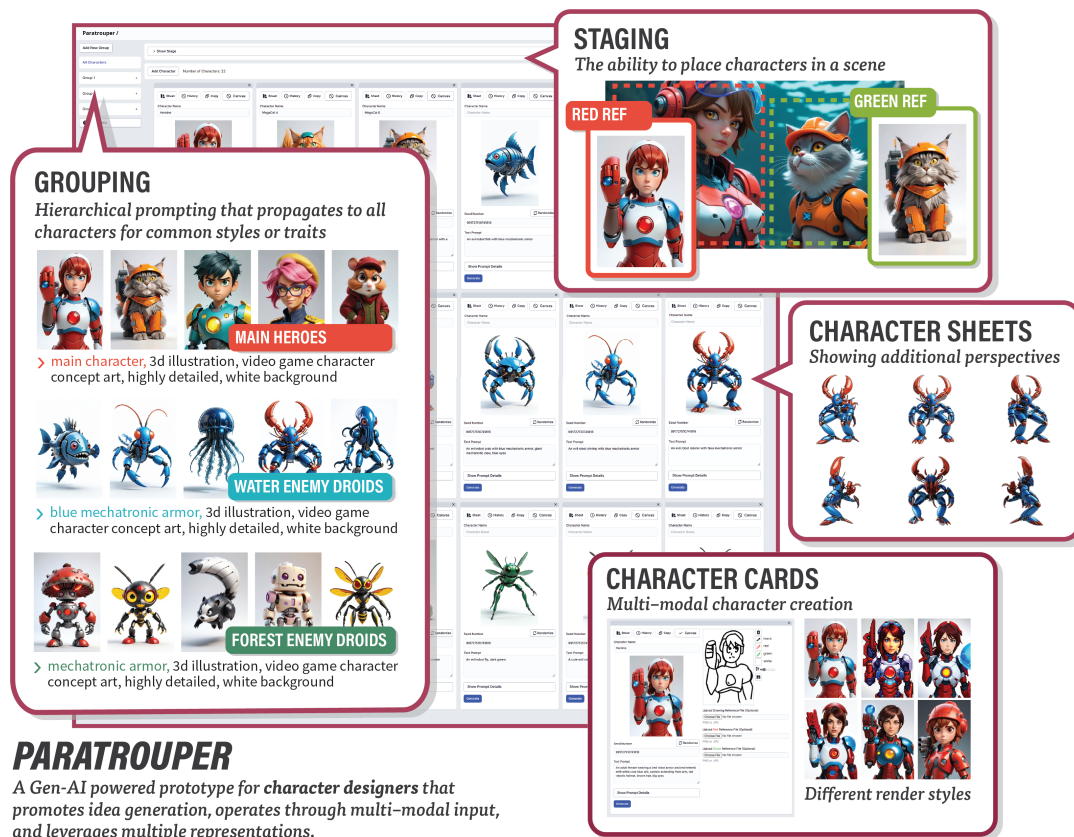


Figure 1: Paratrouper is a multi-modal tool for visual character cast design. One can use text, sketches, and image references to generate images of original characters within cards. Characters can be sorted and styled in groups, visualized from multiple angles in character sheets, and staged together in different settings. Note: Character images are AI-generated.



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CHI '25, Yokohama, Japan

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ACM ISBN 979-8-4007-1394-1/25/04

<https://doi.org/10.1145/3706598.3714242>

Abstract

Great characters are critical to the success of many forms of media, such as comics, games, and films. Designing visually compelling casts of characters requires significant skill and consideration, and there is a lack of specialized tools to support this endeavor. We

investigate how AI-driven image-generation techniques can empower creatives to explore a variety of visual design possibilities for individual and groups of characters. Informed by interviews with character designers, Paratrouper is a multi-modal system that enables creating and experimenting with multiple permutations for character casts and visualizing them in various contexts as part of a holistic approach to design. We demonstrate how Paratrouper supports different aspects of the character design process, and share insights from its use by eight creators. Our work highlights the interplay between creative agency and serendipity, as well as the visual interrelationships among character aesthetics.

CCS Concepts

• **Human-centered computing** → **Interactive systems & tools.**

Keywords

generative artificial intelligence, image generation, character design, character concept art, AI-assisted creativity

ACM Reference Format:

Joanne Leong, David Ledo, Thomas Driscoll, Tovi Grossman, George Fitzmaurice, and Fraser Anderson. 2025. Paratrouper: Exploratory Creation of Character Cast Visuals Using Generative AI. In *CHI Conference on Human Factors in Computing Systems (CHI '25)*, April 26–May 1, 2025, Yokohama, Japan. ACM, New York, NY, USA, 20 pages. <https://doi.org/10.1145/3706598.3714242>

1 Introduction

Characters are often at the heart of people’s favorite movies, plays, comics, stories, and games. They create possibilities for people to form a connection with the material and can make experiences memorable. However, designing characters is complex and multifaceted. It requires thinking about their appearance, backstory, motivations and goals, as well as abilities and personality traits with respect to other characters, their surrounding environment, and the overarching story line [2, 23, 59, 71]. Designing the characters’ visuals is its own discipline, wherein dedicated character artists engage in a multi-phase process that encompasses research, experimentation, and asset creation, often as part of a larger team [14].

Despite the complexity of this task, few tools have been created to support unique visual character cast design. At present, many character designers engage in a manual process of sketching or modeling to explore design possibilities and communicate with different clients and stakeholders [6, 68]. Besides pencil and paper, they may leverage digital art tools (e.g., Photoshop, Procreate, Blender, ZBrush, Maya) to draw or model their character concepts.

Existing character creation interfaces (CCIs) are typically avatar customization tools [47] that are focused on enabling people to design a single character for an existing universe. Popular examples include the character creation interfaces in video games (e.g., Sims [75], Hogwarts Legacy [58]), or the avatar creators for video calling platforms or the metaverse (e.g., Microsoft Teams Avatars [51], Ready Player Me[60]). These examples center around designing individual characters for the individual user, whereas most comics, games and films involve casts of characters. Furthermore, these tools offer limited customizability, and confine designs to their

respective worlds, thus it is difficult to manifest original character cast designs and aesthetics that extend beyond the tools’ boundaries.

Recent advancements in artificial intelligence (AI) have enabled generating images depicting people, animals, scenery, and more—by simply providing a text-prompt. This can accelerate visual experimentation and exploration [32], and be a source of serendipitous inspiration [50]. Nevertheless, most AI image generators such as Dall-E [55] and MidJourney [49] are general purpose and can be challenging to control. Recent research into text-to-image generation have explored novel multi-modal input techniques for prompt engineering and refinement for general imagery [5, 13, 79], with one work having focused specifically on fictional world building [18]. There have also been efforts to understand how people are currently engaging with text-to-image platforms [7, 46], and in what ways these may be able to support visual artists in their creative work [33]. However, there remains a gap in deeply understanding the specific needs of visual character designers, and there is an absence of a platform dedicated to help them in their line of work.

In this paper, we conducted interviews with five different character designers to gain an understanding of their work and associated challenges, as well as their perspectives on using generative AI. Besides demonstrating a diversity of projects and workflows, these interviews highlighted the potential for AI to accelerate sampling and experimentation. Based on these insights, we developed **Paratrouper** (Figure 1), a system that leverages diffusion-based AI image generation and conditioning techniques to empower a variety of creators, from comic artists to video game developers, in the early-stages of visual character conceptualization. The name is a portmanteau of “*parallel*” referring to parallel design, and “*troupe*” for a group of entertainers who tour different venues. The system enables users to (1) initiate and refine visual character concepts on an individual level through a combination of text-, sketch-, and image reference-based input while providing a visual overview of all characters, (2) design characters on a group level by enabling the specification of the underlying model as well as text prompts to be shared between subsets of characters, and (3) visually stage their characters within different settings and scenarios. In a user study, we invited eight creators to experiment with the system and design their own cast of characters. We found that Paratrouper facilitated the broad exploration and rapid refinement of design intent during the process of active creation, and was favoured for early-stage visual conceptualization and rationalization over producing finalized designs. In summary, the main contributions of this paper are:

- (1) A novel multi-modal system, Paratrouper, that leverages generative AI to empower creators to explore a range of design permutations for characters and casts of characters in different settings.
- (2) A novel set of generative-AI-driven workflows comprising diffusion-based image generation and conditioning techniques that enable robust image synthesis from multi-modal control signals (text, sketches, and image references).
- (3) Insights and design rationale that stem from formative interviews and an exploratory study that demonstrated how such a system can facilitate parallel exploration for character cast design, rapid design intent refinement, and the navigation of the tension between creative intent and serendipity.

2 Background & Related Work

Paratrouper builds on learnings from prior interfaces and tools that support character creation and previous research examining how generative AI can support image generation and creative processes.

2.1 Character Creation Interfaces

A multitude of dedicated visual avatar creation tools and character creation interfaces (CCIs) exist for gaming and online video conferencing platforms [47]. With these tools, users can typically choose from a library of options of bodily features and accessories to compose a custom design of a single character or avatar. Popular examples include the character creators for The Sims [75] or Hogwarts Legacy [58]. Another example is the avatar creator for Microsoft Teams [51]. However, these character creation interfaces are highly constrained given their preset libraries, and are typically meant for making characters or avatars for a specific use case. Generative AI is also giving rise to new types of character creators. For example, researchers have introduced interactive chat-based platforms dedicated to help develop their character’s personalities for literary works [59, 66]. In the commercial sector, there are interfaces to shape the personality and communicative behaviors of interactive non-player characters (NPCs) [8, 29]. However, these do not address visual character design. In our work, we focus our attention on creating a creation interface dedicated to the visual design of characters. Additionally, while the aforementioned avatar creation tools and CCIs focus on the design of a single character at a time, we aim to create a tool that facilitates the creation of casts of characters, since the majority of movies, comics, and games feature multiple characters that coexist with one another.

2.2 Interfaces for AI Image Generation

Beyond physical mediums such as pen and paper, a vast array of 2D image creation and 3D modeling software can be used for visual character design, including Photoshop, Procreate, Maya, Blender, ZBrush, and more. Now one can also use generative AI image generation platforms such as Dall-E [55], Midjourney [49], FLUX [24], and Stable Diffusion [1] to create images, including visual depictions of characters.

Stemming from this, there has been a surge in interest in understanding the perception and impact of AI systems on creators. In interviews, Ko et al. [33] found that visual artists may find value in adopting the use of diffusion-based text-to-image models to automate the creation process, expand ideas, and support communication and collaboration. Panchanadikar and Freeman [57] found that indie game developers, although worried about generative AI taking work from small artists, see the potential for generative AI to assist them in ideation and jump-starting their work.

However, it can be challenging for artists to guide AI models to generate their desired images [7, 46]. Hence, many efforts have been made to tackle this issue. Promptcharm [79] and Promptify [5] were interactive systems that helped users to craft, refine and optimize their prompts directly, whereas Promptpaint [13] explored the use of paint medium-like interactions for prompt generation. There have also been efforts to facilitate image generation for specific domains within the visual arts. For instance, Opal [43] was a system that guided users through a process of text-prompting

using a structured pipeline of GPT-3 suggestions to create news illustrations. Worldsmith [18] was a multi-modal and hierarchical tool to create images of fictional worlds. CreativeConnect [11] was a system that helped extract and combine features from various reference images to help generate new ideas for graphics design. Some AI-based interfaces have been designed to address specific lower-level tasks in the process of image creation. For instance, Flatmagic [81] and Shadowmagic [26] leverage AI to reduce the manual effort needed for colorizing and shadowing 2D drawings by comic professionals. Despite the surge in research at the intersection of generative AI and visual arts, there remains a gap in understanding and serving the specific needs of visual character designers. The task of character cast design is unique in that it is rooted in sets and subsets; individual designs must be compelling on their own, but must also be cohesive and complementary to each other as a collection, and must service a broader story.

2.3 Interplay of Generative AI & Creativity

Prior efforts have been made to formalize creativity and the creative process, and to outline influential factors. While many models have been created [31, 77], Sawyer’s model attempted to consolidate these in a creative process comprising eight stages [64]: *ask, learn, look, play, think, fuse, choose and make*. These stages are characterized by eight features [63]: *iteration, ambiguity, exploration, emergence, failure and dead ends, deliberate and intentional, conscious reflection, the importance of constraints*. The early stages require understanding the problem, gathering, and processing information [65]. This is typically manifested through sampling [21, 74]. Thus, practitioners transition from a vague problem definition, to an active process known as “*problem construction*” [31], in which the interplay of curation and active creation answers questions that clarify the problem at hand as the solution is being derived [31]: problems and solutions co-evolve [16]. The creation process in itself is a constant conversation with an artifact [67] — a practitioner brings their knowledge and understanding of the world (*knowing in action*), they constantly reflect through the actions as they perform them (*reflection in action*), and then they further reflect on what has been made and how it connects to the bigger picture (*reflection on action*), meaning that ideas become objects of thought [19]. These general principles apply broadly to all areas of creativity across arts, sciences, and design [65], and character design is no different.

In line with this, AI systems have been created to support particularly early stages of the creative process for *problem construction*. For instance, they have been used to provide inspiration [70, 83] as well as help generate ideas [10, 11, 83]. However, it is worth noting that there is contention around how to ensure that suggestions amplify human creativity [22, 80] and how to help people refrain from anchoring to ideas [76]. AI-image generation platforms have also been found useful in helping with idea exploration by showing unexpected content [33]. This helps with the process of *learning* in Sawyer’s model and feeds into *sampling* [30, 74]. Furthermore, AI has also been used to aid in reflection [17, 42].

Rather than focusing on the curatorial elements of problem construction, we seek to create a more active system that serves as an experimental playground for creators to rapidly traverse a vast design space of possibilities for designing their characters. We adopt

the perspective outlined by Lim et al. [41, p. 2] that prototypes be used as “tools for traversing a design space where all possible design alternatives and their rationale can be explored.” We also intend for the system to support critical reflection. We leverage two key concepts. One is that of *parallel prototyping* [20], which unlike serial design exploration can yield better and more diverse design results. Working on and seeing many design ideas at once promotes comparison, and can encourage people to distill key variables and how they interrelate in a process of reflection on action [67]. We also refer to the improvisational studio model of the creative process outlined by Sawyer [63], which emphasizes the features of *conscious reflection* and *constraints*. In creating a tool that allows designers to rapidly externalize their ideas and view them in aggregate, we aim to establish a workspace that is conducive for designers to consciously reflect upon their design choices as they shape their own creative constraints.

3 Formative Interviews

To inform the design of Paratrouper, we conducted a set of semi-structured interviews with people experienced in character design. Through this process, we aimed to understand: (1) what are typical workflows for the visual creation of a cast of characters; (2) what are the challenges they face; (3) what perspectives do they have on using generative AI in their work.

3.1 Participants and Procedure

Five people (2 male, 2 female, 1 non-binary) with varied experience in character design were recruited. We followed a purposeful sampling recruitment method [4], and reached out by email to a combination of direct contacts as well as artists whose portfolios are publicly discoverable online. The procedure was approved by institutional ethics review boards prior to being conducted.

The participants’ experience encompassed both professional and semi-professional settings, where participants either work on character design for a living, or work as creators within a discipline that requires character design as part of the process. Their experiences spanned across different use cases including table top games, video games, animated films, and comics (Table 1).

After providing consent, participants completed a demographic and background questionnaire comprising questions regarding their age, gender, occupation, educational background, as well as level of experience and target area(s) of focus for character design. Interviews were conducted online via Zoom and lasted approximately one hour. In the interview, participants were asked to summarize their experience with character design and to walk through one or more of their projects that was representative of their typical creative process. A prepared list of questions was used as a guideline for the interview, and additional questions were asked to more deeply explore ideas and concepts raised. Each participant received a gift card with a value equivalent to \$100 USD as token of appreciation. Refer to Appendix A.2 for full details.

3.2 Data Analysis

Interviews were automatically transcribed using Zoom’s transcription service. To analyze the data, the attending two co-authors engaged in 30-60 minute discussions after each interview. Once the

final interview was conducted, the co-authors identified a first set of themes, which then the first author iterated on through thematic clustering [9, 48]. These themes were then further elaborated and refined by the two co-authors in conjunction.

3.3 Key Findings: Design Lessons

Conversations with creators elicited insights into their workflows, and their key design considerations and challenges for designing characters. We also captured perspectives on using generative AI for character design, including potential risks and opportunities.

3.3.1 Character and Character Cast Design Process.

Problem Definition: Starting Points. Participants described various starting points for character design, ranging from riffing on existing ideas, building upon a design brief, or engaging in more free-form exploration. Creators may be inspired to make characters based on one’s friends (P1), earlier games (P4), or television series (P2). Others create characters to tell a particular story (P1), engage in a form of self-exploration (P3), or explore one’s own imagination (P5). If working for a client, artists may be given partial information, or whatever else is available at the time to begin (P2), in the form of a simple brief, an idea, or a few 3D images (P5).

Problem Construction: Elaboration, Reduction, and Sampling. When designing characters, participants reported actively engaging in **creative experimentation**, sometimes relying on strategies that create constraints to inspire creativity. For instance, P3 leverages the concept of Dungeons and Dragons’ universe species, whereas P4 has based his characters on themes from prior popular movies and games such as Rambo and Contra. Others follow a more **free form and open process**. P1 produces different sketches to arrive at a design he likes, while P5 engages in an iterative 3D sculpting and re-sculpting process, starting with larger shapes, and working down to the details of a character with no worries if he fails and needs to restart. The external visual references can sometimes be more explicit, such as sampling from “1930s clothes” (P1), or “Mongolian armor” (P5).

Tools. P1 and P4 mentioned designing by sketching on paper. P3 would often model visuals of her Dungeons and Dragons characters using Hero Forge¹ or commission an artist to make the experience more engaging for her fellow players. P5 explained how professional 3D modelers such as himself need to employ a “wide gamut of skills” such as photogrammetry and wrapping meshes to scans using tools such as Maya and ZBrush.

Derived Solutions: Determining the Final Design and Outputs. The role of character design can depend on whether the project is personal or for a client. In professional settings, some artists need to work closely with the director to develop the characters (P2, P5). They may need to produce **360-degree turnarounds of the characters**, pieces portraying characters’ expressions or poses, and a visual character cast lineup (P2). Sometimes artists need to dive straight into producing production-ready character concepts for efficiency (P2). For example, P4 used to convert character sketches into 16-bit characters for games, but now he creates

¹<https://www.heroforge.com/>

Table 1: Formative Interviews — Participant Demographic Information.

ID	CREATIVE ROLE(S)	MEDIUMS
P1	Writer, Concept Artist, Designer	Manga, Comics, Online Art Forums, Storyboards
P2	Animation Editor	Television Animated Series, Animated Films
P3	Writer, Actor, Tabletop Game Creator, Story Teller, Cosplayer	Tabletop RPGs (e.g., DnD), Film, Theatre, Cosplay
P4	Indie Game Designer, Writer, Animator, Concept Artist	Indie Games
P5	Concept Art, Character Creation, Costume Design, 3D Modeler	Films, Animation, Indie Games

the 16-bit versions directly to save time and effort. P5 creates 3D models of the character that can be *viewed from different angles*, or which could be rigged by a collaborator to create a short video. For personal projects, the outputs of the character design process may be less formal. For example, stopping at a sketch of a face and one full-body concept art piece (P1).

3.3.2 Design Values for Character Concepts. Our interviews show a variety of key values to create good characters, including strong artistry, nuance, and visual distinguishability. Participants also noted the impact the medium can have on decisions. Moreover, characters do not exist in a vacuum, which means that for them to belong in the same story, they must be visually cohesive.

What Makes a Character Design Good? P1 noted that design is very subjective and personal. P2 mentioned that TV and film are visual mediums, so good character design comes down to strong artistry and also *“whether you can look at a character and see something more. [...] the look of the character has to be fetching enough, that it will keep the audience’s attention and keep them interested.”* P3 emphasized that characters should be **nuanced**, not predictable. P4 mentioned that for video games, they should be **easy to visually distinguish** for playability reasons. P5 mentioned that their visual designs should follow base level artistic principles such as visual harmony and rhythm, empty space, and light quality.

Good design may also be contingent on the medium it should serve. P1 and P4 mentioned that sometimes it’s necessary to **simplify** a character’s design for practical reasons. Needing to easily and repeatedly draw the character, P1 decreased the level of detail of a character’s tattoos. To make sure the rendering works in a 16-bit style game, P4 changed a character’s pixel art to have solid green pants rather than striped pants. Also, since rigging is an expensive process, oftentimes they will choose to **reuse character assets** and simply swap hair and color. P4 also emphasized re-using shapes to keep effort and cost low in producing the character assets for games. P4 mentioned that he adapted the colors of the characters to be visually distinct from one another, so that players can easily identify the character they’re controlling on-screen in the game.

What Makes a Good Character Cast? All participants agreed that characters should share a *similar artistic style* to look like they belong together. This can manifest as characters wearing similar outfits if they belong to the same group (P1), sharing similar eye styles (P1), head and body shapes or proportions (P2), textures (P1), color intensities (P2), color palettes (P5), shading (P5), or overall style, as well as rendering style (e.g., pixelated-look) (P5). Generally, for an animated show, characters look cohesive when they *“appear*

to be drawn by the same person... but should still be somewhat individualized” (P1). In line with this, P2 noted that with larger casts, it can be poor design if they *“start looking too much like each other”* as it can lead to confusion and compromise the story.

3.4 Reflecting on The Use of Generative AI

We investigated character designers’ current views on generative AI to understand concerns that may arise and to learn what boundaries may be required when designing a tool that meets their needs.

3.4.1 Risks and Challenges Around the Use of Generative AI.

Participants raised some concerns regarding the use of generative AI for character design, and more broadly, visual arts. P2 noted rising **unemployment** and a general climate of uncertainty and fear driven by advancements in AI. She emphasized that AI should be something that *“helps the process and helps the artists,”* but should not *“take away artistic jobs.”* In line with this, P3 worried about *“the human side of art being cut out, because a machine can do it better and faster... we should be using tools to help us do the human experience.”* From a usage standpoint, P5 felt that AI might cause people to **waste time**: *“...the time of me prompting to get what I want, I could do it in Zbrush faster. [...] You gotta be careful. You’ll get into the scroll hole.”* P5 was also concerned that using AI could hinder **learning**: *“You may ‘get lucky’ with using AI, but eventually it’s gonna come out in the wash [...] I quite like the AI stuff because I can tell why and what is good about what. But if you don’t, and you’re constantly getting lucky, that’s not great because you’re not learning—there’s no feedback loop.”* As a video game creator, P4 raised concerns with **reputation** and the long-term **legality**: *“...if people know [I’ve used AI, it] could affect the reputation of the game with my customers. These technologies are still in progress and the legal aspects of it are not quite set.”*

3.4.2 Opportunities for the Use of Generative AI.

Participants also highlighted potential benefits of generative AI for character design. For instance, P4 saw it as promising to **overcome a blank page**: *“In general I’m drawn to not start from absolute scratch. It helps me a lot as a creative to have some sort of starting point already in place... that helps ignite creativity.”* P5 saw great potential in using generative AI to get a *“quick feel... on what [the characters] would look like in different environments, like, what’s a Greek theme of this version? What’s an Egyptian theme? [Or] can you give me a set of like military rank costumes for a sci-fi soldier [or] examples of different types of ancient Mongolian armor?”* Similarly, P4 stated *“If it’s a tool for helping the character designer to kind of sketch out a concept, like just general ideas... just get pen to paper, so to speak... we’re all for it.”*

P4 cautioned that the human should remain in charge of the artistic direction: “...you already know what you want and you have everything in place. You just want a little bit of help. [...] I wouldn’t use [what the AI makes] — I would use that as a base and then draw on top of that and make necessary changes [...] It will be more like the inspiration, but this is the art I’m providing.” In line with this, participants envision offloading unwanted or less significant tasks to AI. In terms of artwork, P5 envisioned being able to ask AI to “generate a bunch of granite rocks for me” or “create in-between frames” for animating a character’s punch (P4). Outside of artwork, AI could take over scheduling and organizing (P2), marketing, communication, and business aspects (P4). Ultimately, P2 saw that AI could be useful in general to speed things up and reduce budgets, so long as it does not take away creative jobs.

4 Design Rationale

To develop a system that enables character creation, we integrated lessons from a variety of sources, including the formative studies, hours of watching online videos of character designers, and our understanding from creativity theory. We also created different characters under a variety of themes to test different platforms for character creation, from analog, to digital, to experiments using Generative AI. As we iterated through our prototype, we continually used it and refined it with further character creation experiments, and leveraged this first-hand experience to further iterate on the system prototype itself [37, 53, 72, 87]. This informed us to design a tool that makes the character design process (R1) rapid, (R2) multi-modal, and (R3) contextual, so that character designers can work with elements familiar to their design process (Section 3.3.1), to achieve compelling characters and character casts (Section 3.3.2). These three principles are guided by the bounds of what character designers deem acceptable of AI (Section 3.4), while also providing them with agency and means to control the overall artistic direction.

R1. Rapid: Facilitate Fast Parallel Externalizations to Shape and Finesse Design Intent. One key emphasis in the design of Paratrouper was to enable people to rapidly iterate through ideas, and make it so *as part of the active creation process, one can continuously make design decisions* that aid in problem construction [31]. Yet, the character creation process is non-deterministic, and fosters many ways of thinking. This led to focusing on a *non-destructive parallelized* approach, where creators can iterate on characters, and see them all at once. This, coupled with AI’s rapid generation, would steer towards a tool where it can be *easy to get started and cultivate playful experimentation*. By not prescribing a set workflow, we ensure *free and constrained forms of thinking* can take place.

R2. Multi-Modal: Enable Multiple Types of Input for Intent Expression. To enable different ways of thinking, we found that designers use a wide array of tools. There needs to be a balance in ensuring the character designer has control over the tool while leaving room for serendipity and surprise. This means creators need a variety of ways to express their design intent. To do so, we enable an open-ended combination of (1) *prompting* (to fetch visuals from natural language), (2) *drawing* (to allow artistic craft), and (3) *direct sampling* (to encourage remixing, and make it so outputs reflect the understanding of the problem at a given point).

R3. Contextual: Leverage Multiple Output Representations for Intent Reflection. Seeing character concepts next to each other can begin to provide an overview of the story development. However, we believe that additional types of outputs can help creators get a better grasp of the characters and their interrelationships, all while potentially triggering new ideas, enticing curiosity, and creating new resources that creators can later sample or gain inspiration from. Thus, we found it important to (1) facilitate viewing different angles, (2) simulate characters in different scenarios, and (3) allow for various artistic styles that can maintain the visual coherence.

5 Paratrouper

Paratrouper is a visual character cast design tool that enables character designers to use multi-modal text, sketch and images to generate concept images of characters that make up a cast and visualize them in different scenes. The system was designed to fulfill the goals of allowing characters to be designed in parallel, and defining constraints between characters to form logical groupings.

5.1 Multi-Modal Character Design

Each character is created within a **Character Card** (see Figure 2, left). All cards are situated adjacent to one another on the workbench, which enables users to have a visual overview of all the characters they have made within one page and to keep track of how they look with respect to one another.

Within a card, a user can specify the character’s **name** (see Figure 2a). They can also manually modify or randomize a 15 digit **seed number** (see Figure 2c) which determines the noise that is used to generate the image and ensures the reproducibility of an image. To specify the character appearance, the user can write a positive **text prompt** (see Figure 2d). For UI simplicity, we opted to exclude a negative text prompt field.

For greater agency over the look of the character, users can toggle the optional **Canvas** control (see Figure 1e) which allows the user to sketch a desired pose and integrate image content. The black pen can be used to draw lines that control the overall **body structure, proportions, and pose** of the character and guide the generation of details such as hair, clothing, and accessories. The red and green pens can be used to specify **mask regions**. In this paper, the term “mask” refers to any user-specified region that controls where an effect is to be applied. A slider is available to change the brush size of the active pen. Markings can be erased using the white pen, or the entire canvas can be cleared by clicking the trash icon. Mask regions can be mapped one-to-one with uploaded **reference images**. This can be seen with how the robot turtle’s shell in part 3 of Figure 4 resembles the uploaded amethyst gemstone image mapped to the red mask region. One can make a **copy** of the character card (see Figure 2g) if they wish to maintain the existing character and attempt a separate variation. Character cards can be deleted by clicking the ‘x’ button in the top right hand corner of the card.

5.2 Designing Groups of Characters

Characters typically have various relationships and interactions with others in a cast. For example, they may belong to different groups (e.g., races, clans, etc.) that share visual traits (e.g., all elves may have pointed ears). In Paratrouper, users can sort characters

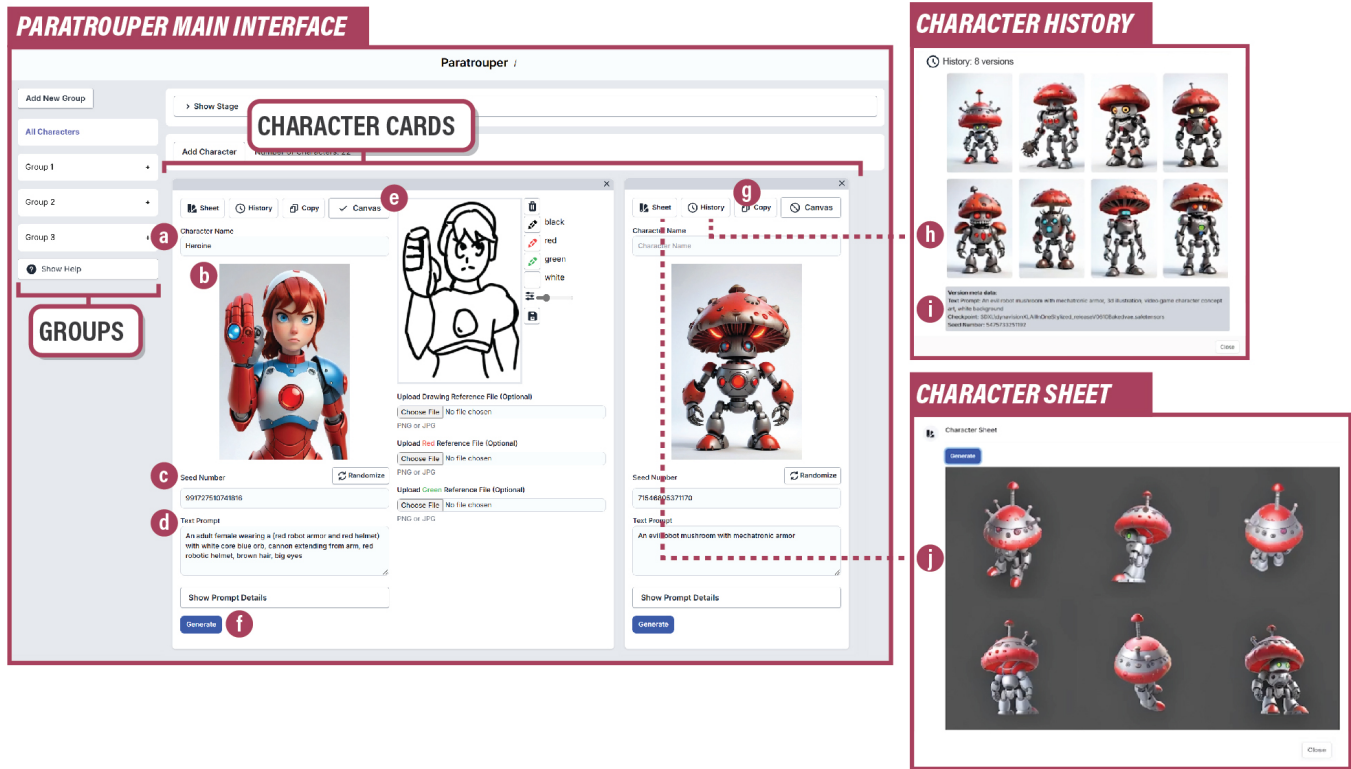


Figure 2: Designing characters using Paratrouper’s character cards. One can (a) name a character and (b) generate an image of that character by specifying the (c) seed number, (d) text prompt, or by sketching in the (e) canvas and pressing the (f) generate button. Users can browse prior generations within the (h) character history and (i) inspect each image’s corresponding meta data. Users can also generate a (j) character sheet comprising depictions of the character from six different perspectives. All images in the figure besides the sketch were AI-generated.

into different **Groups** (see Figure 1, 2, and 4). They can then specify a group-level text prompt to be applied to all characters within that group. Clicking the group *regenerate* button triggers all characters to update accordingly. This way, users can rapidly tweak groups of characters to look visually similar.

5.3 Character History

Users can browse prior image generations for a particular character by opening the **Character History** (see Figure 2h). These are shown in reverse chronological order to keep track of past generations. When a particular thumbnail is clicked within the history, the relevant metadata that was used to generate that image, including the text prompt, checkpoint, and reference imagery is displayed (see Figure 2i). Users can refer to this information to regenerate the image and also to reflect on the progression of their ideas.

5.4 Character Sheet

Character artists commonly produce turnarounds of their characters to show how they would look from different perspectives. Defining how they look from different angles helps ensure consistency in how the character is represented in different scenes after being exported from Paratrouper. For video games, character

turnarounds are helpful to communicate to 3D modelers how to produce assets that align with the original artistic vision. Users can generate six different views of particular character by clicking the *Generate* button within the **Character Sheet** view (see Figure 2j).

5.5 Staging Characters

Characters are designed in the context of a greater story. It is therefore important that their designs align with the surrounding context, such as the environment and the time period. With the **Stage** feature (see Figure 3), users can visualize their characters in different scenarios to facilitate reflection on how well the characters fit with respect to one another and the greater context. To use the stage, users can firstly select the underlying **checkpoint** (i.e., base model) to attain their desired rendering style. Secondly, they can select a color, click and drag to draw a rectangular mask region on the canvas, and map it to an existing character using the corresponding dropdown menu. These mask regions give users some control over where the characters will be placed in the generated image. The menus are populated with the names of the characters within the active selected group. Finally, users can write a **text prompt** and click the generate button to generate an image of the selected characters within the described scenario.

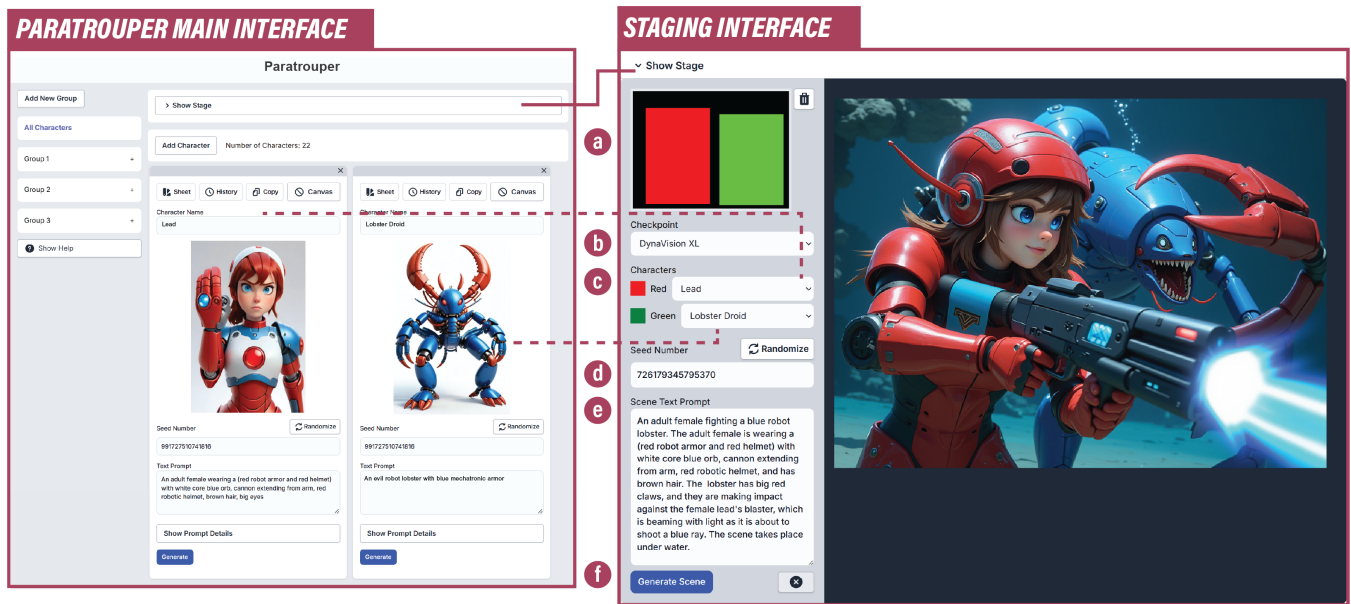


Figure 3: Staging feature. One can (a) draw colored rectangular masks in a thumbnail, (b) set the checkpoint, (c) assign characters to the colors, (d) adjust the seed number, (e) write a text prompt describing the desired scene, and (f) trigger image generation.

5.6 User Walkthrough

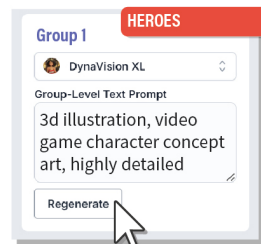
To illustrate a workflow for Paratrouper we present a scenario (see Figure 4, Supplementary Video, Video Figure) for an indie game designer named Paris. She uses Paratrouper to come up with initial character concepts for her next game. She starts with a gameplay concept of a character that can absorb robotic parts from enemies.

Starting Up and Creating a Main Cast. Paris opens Paratrouper and creates three groups, one for the heroes, and leaves the other two to design enemies for different levels. She chooses the first group, and writes a common prompt to ensure all characters will align to basic stylistic settings: "3d animation render, video game character", and then Selects the "DynaVision XL" checkpoint. She adds a new character and enters an initial prompt for a strong female lead: "A female wearing a red robot armor, blaster gun in one hand, red robotic helmet, brown hair, big eyes." Paris clicks on "Generate", and quickly sees a character is rendered. She then creates the next character, a feline companion "Maine Coon wearing a Robotic Armor." She is unhappy with the pose and structure of the generated character, so she opens the canvas and draws out how she wants the cat to look. Once the new cat is generated, it follows the overall structure of her drawing. She now decides she wants to better define the colours, and creates a copy of that card. She sets one of the copies to be an orange cat wearing teal armor, and the other one to be a gray cat wearing orange armor, and adds a helmet. These changes and iterations are rendered rapidly. She decides she also wants her lead character to have more fidelity to her drawing, so she uses the canvas object to draw, actively refining the prompt. Throughout this process, she experiments with different styles by updating the group's description, and switching between models trying out settings such as anime, pixel art, realism, and finally deciding on a 3D rendered style.

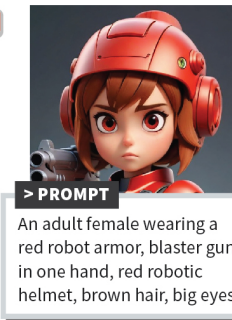
Working with Groups, Rapid Ideation. Paris is unsure as to what kinds of enemies she would like to see, and goes back to the idea of robotic parts. This inspires her to quickly test out characters for a water level. She sets the group prompt to: "with blue mechatronic armor, 3d illustration, video game character concept art, white background," so that all characters will have those visual similarities. She creates a card and types out "Evil robot" and creates many copies. She quickly populates the cast with the first creatures that come to mind "fish," "trout," "shark," "jellyfish," "piranha fish," and "lantern fish". As she sees the characters get generated, she gets excited and tries to think of more sea creatures: "lobster," "crab with giant mechanistic claw," "shrimp," and "squid." Paris is already getting interesting ideas for different enemies, and she can delete those she was not as interested in, such as the shark. She moves on to the third group, for a forest level, and continues creating characters. At one point, she creates a frog that she feels could have a counterpart in the water stage. She copies the frog and moves the copy to the group holding the water enemies. She opens the water enemies group, and renders the frog, already seeing how she quickly gets an alternate version of the same character.

Working with Images. As Paris iterates through enemies, she creates a robot turtle. However, the resulting robot turtle looks humanoid, and the shell looks quite dull. She opens the canvas to make the turtle move on all fours with a drawing. Yet, the shell still looks dull. Paris colours the shell area in red, and assigns a reference image — a photo of an amethyst she had previously sampled. The newly generated render makes the shell look much more like a gem. As Paris is iterating through the forest characters, she wants to create a macaw robot, but the result looks too much like a final boss. She uploads an image of a macaw into the canvas as a base image for a result more aligned with her vision.

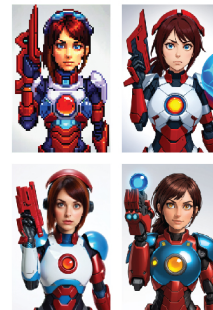
1. STARTING UP AND CREATING A MAIN CAST.



Paris creates a group for the main cast and enters a general prompt that will apply to all generated characters.



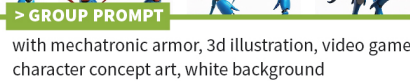
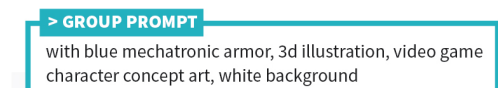
Paris generates a strong female lead. She then uses the canvas to draw the structure and experiments with different styles via the group's checkpoint



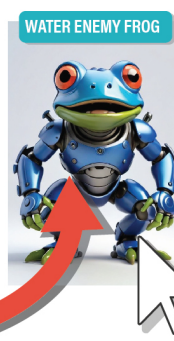
She also creates copies of the cat companion to try out some variations.



2. WORKING WITH GROUPS, RAPID IDEATION.



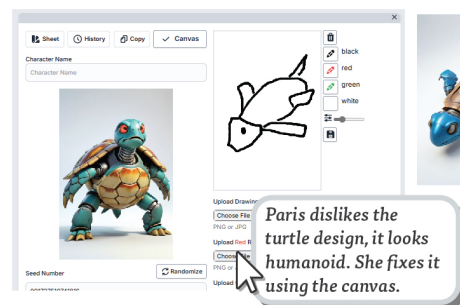
Paris now works in generating enemies for different stages, and very rapidly creates many robot designs based on animals leveraging the group prompt.



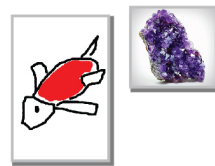
She later creates a frog in the forest group, copies it and moves it to the water group to see its water counterpart.



3. WORKING WITH IMAGES



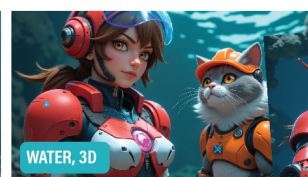
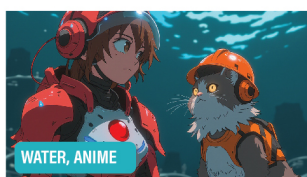
The design is still missing something. She adds an image reference of an amethyst rock as a red mask to obtain her final turtle.



To adjust the parrot's design, she adds an image reference.



4. STAGING AND META-REFERENCES



Staging with the lobster inspires the thought of what if the heroine stole the lobster's claw?



Paris creates a canvas with two references.

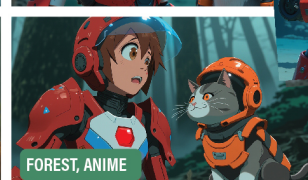
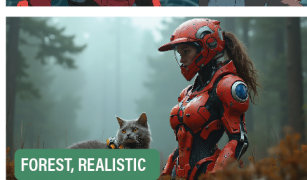


Figure 4: Scenario showcasing some key activities within Paratrouper.

Staging, Character Sheet and Meta References. Paris decides to try the staging feature, so she opens the staging dropdown and selects the two characters she wants to see together. She draws bounding boxes for their locations and types a description so she can see her heroine and her cat in the water and forest levels. She renders different styles and already starts to think of both scenic and story elements. At one point she renders the main character fighting against the blue robot lobster, and this inspires her to create a variation of the main character that has incorporated the lobster’s claw. She copies the main heroine’s card and uses two colours to assign references: the claw is coloured green, and is assigned an image of the lobster character as a reference, while the character is drawn in red, and is mapped to the image of the original design of the character to preserve the style. Paris takes more interest in the lobster, so she clicks on the card and generates a character sheet.

In less than an hour, Paris has explored a myriad of possibilities for her new game concept, and she is ready to take it to the next level, drawing from her many skill sets.

6 Technical Implementation

Paratrouper was implemented as a local web application that connects to a local instance of ComfyUI which generates the images.

6.1 System Architecture

The interface was implemented in as a local web application using NextJS². The novel image generation workflows were implemented through ComfyUI.³ ComfyUI is a node-based programming interface that supports different AI models and architectures through ‘workflows.’ A workflow is a visual program with nodes and parameters that execute when queued to generate outputs. ComfyUI provides an API that allows accessing, modifying and queueing these workflows. Data was exchanged via websockets and ComfyUI’s API. Zustand⁴ was used for state management and persistent storage. The system ran on a machine with 16GB GPU VRAM.

6.2 Character Image Generation Workflow

■ **Base Model.** To generate a character image (Figure 5), we use multiple **Stable Diffusion XL (SDXL)** fine-tunes, formally referred to as checkpoints (i.e., *DynaVision XL*,⁵ *ProtoVision XL*,⁶ *AIRtist Animated XL*,⁷ *RealVisXL V4.0 XL*,⁸ *Pixel Art Diffusion XL*⁹). These checkpoints are trained on different sets of images and therefore shape the type of content and the style of images that can be generated. Specifying the checkpoint happens at the group level, which contributes to common visual styles. The group prompt is appended to all individual character prompts, which guarantees artistic consistency (e.g., style details, age, clothes) across all characters. The text input (positive prompt) is encoded into a ■ **CLIP**

node that guides the diffusion model to generate the desired character image. We also abstracted a hidden negative text prompt to restrict inappropriate content (e.g., nudity). To reduce the number of inference steps and generation time, Paratrouper uses a Latent Consistency Model (LCM) **LoRA** [45] sampler.

■ **Structural Guidance.** When one draws a sketch on the free-form canvas, the sketch becomes a ■ starting image for the diffusion process (0.95 denoise). Moreover, we extract the black lines from the sketch and use them as an input to a ■ **ControlNet** [85] to guide the visual structure. Specifically, we used Controlnet Union [86], which is agnostic to the image pre-processing, and can thus infer lineart, depth, poses, etc.

■ **Image Referencing.** The red and green brushes make it so one can assign image references. We leverage ■ **IP-Adapter** [82] to embed ■ image references into the model. Input images are separated into image masks (Figure 5) based on the colors: red (reference 1), green (reference 2), and black (lineart). These masks isolate the regions of the final image for each IP-Adapter to leverage their respective ■ image reference.

Dynamic Workflow Manipulation. Nodes are dynamically connected in the app to create precise workflows that grant different degrees of control for generating images (i.e., text only; text and sketch; or text, sketch, and masking with up to two image references). This ensures that the right resources are accessed depending on the activity while also saving on VRAM. This information forms the positive and negative conditioning that is passed to the **KSampler** node with specified parameters: (steps: 10, cfg: 1.5, sampler_name: lcm, scheduler: exponential, denoise: 0.95).

6.3 Character Sheet Workflow

The character image goes through a background removal process, which is then padded into a square format. This new image is used as input to StableZero123¹⁰ (a wrapper for **Zero123++** [69]), to generate multiple view perspectives for the character (Figure 2j).

6.4 Staging Workflow

The staging workflow is similar to the character image generation workflow. However, instead of uploaded reference images, the main generated images of the selected characters are used as inputs to the IP-Adapter, and the mask comprises red and green rectangular regions that represent the rough position of each character in the desired scene (see Figure 5). One challenge with the original staging workflow (which did not use sketches as constraints) was that it was prone to an undesired effect known as “prompt-bleeding.” For example, a text prompt of “blue shirt” could trigger all characters’ eyes to be blue. After the user study, with the release of FLUX,¹¹ we found a way to address this challenge and updated our implementation. After generating the original staging image, we pass the resulting latent to a second KSampler powered by FLUX (denoise: 0.85) (see Figure 5, bottom). This yielded much higher quality images, which showed stronger prompt adherence.

²<https://nextjs.org/>

³<https://github.com/comfyanonymous/ComfyUI>

⁴<https://zustand.docs.pmnd.rs/getting-started/introduction>

⁵<https://civitai.com/models/122606/dynavision-xl-all-in-one-stylized-3d-sfw-and-nsfw-output-no-refiner-needed>

⁶<https://civitai.com/models/125703/protovision-xl-high-fidelity-3d-photorealism-anime-hyperrealism-no-refiner-needed>

⁷<https://civitai.com/models/254053/artist-animated-xl>

⁸<https://civitai.com/models/139562?modelVersionId=344487>

⁹<https://civitai.com/models/277680/pixel-art-diffusion-xl>

¹⁰<https://github.com/deroberon/StableZero123-comfyui>

¹¹<https://blackforestlabs.ai/>

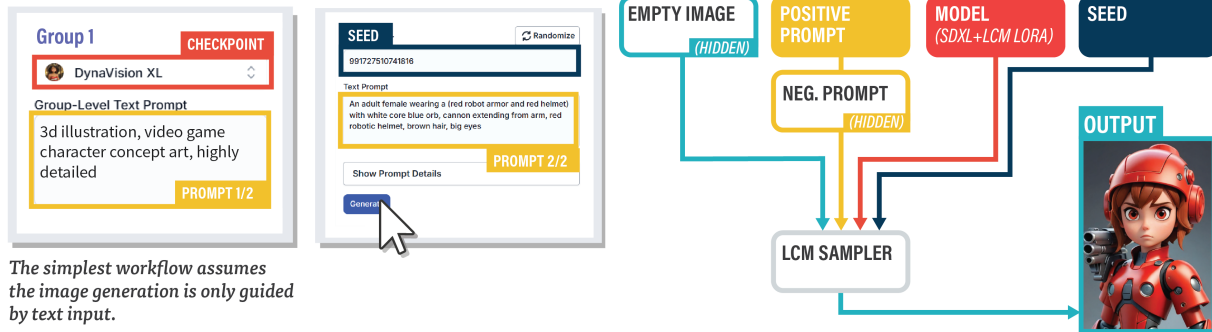
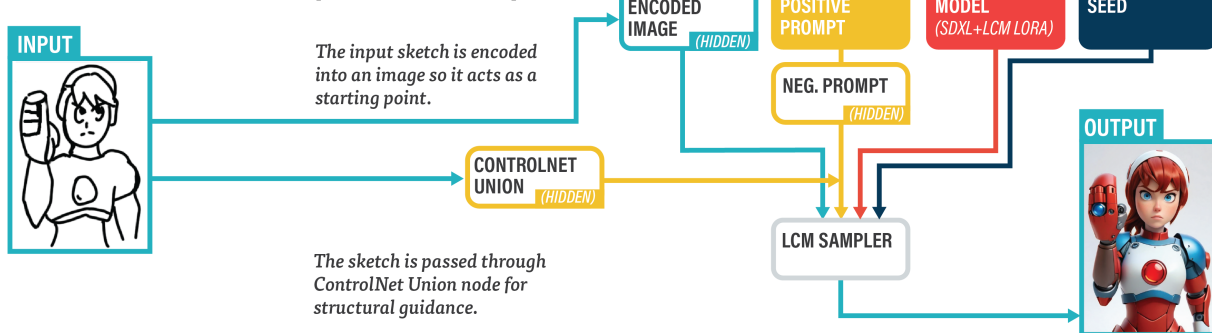
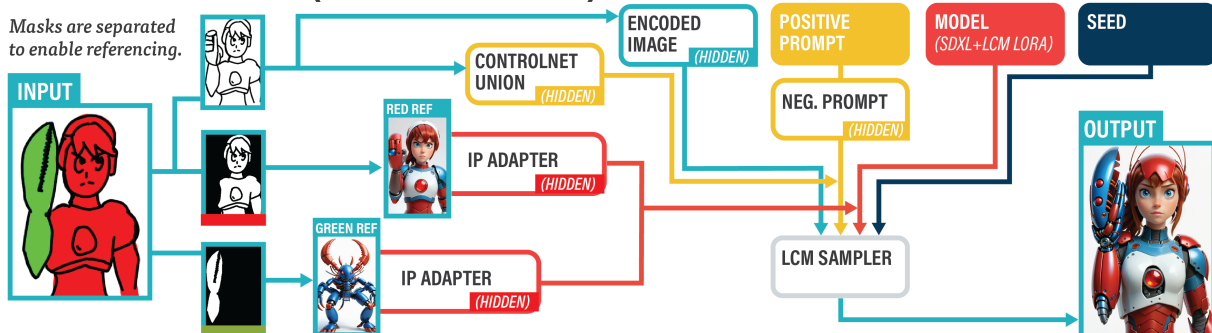
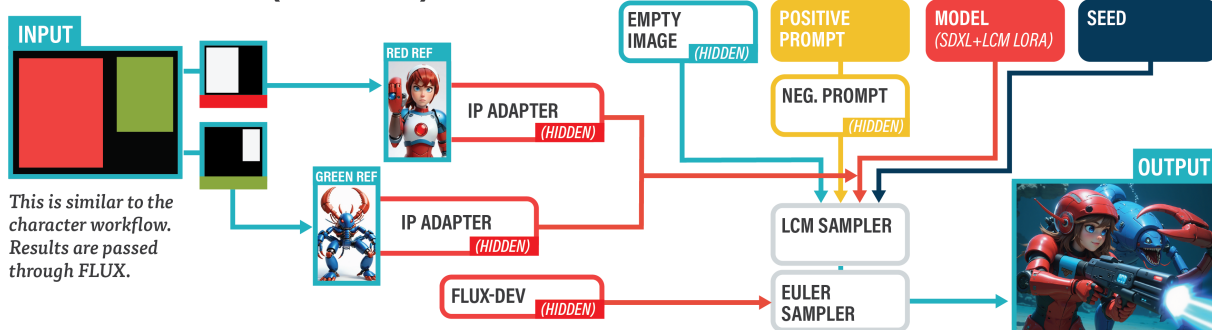
CHARACTER WORKFLOW (ONLY TEXT PROMPT)**CHARACTER WORKFLOW (TEXT + SKETCH)****CHARACTER WORKFLOW (TEXT + SKETCH + REF)****STAGING WORKFLOW (TEXT + REF)**

Figure 5: Flow diagrams representing the character image generation and staging workflows. There are three main flows of information: the ■ model, ■ the image inputs, and ■ the CLIP conditioning.

7 Example Use Cases

We used Paratrouper to create a set of examples of character cast designs demonstrating the system’s versatility across a variety of use cases and highlighting its key features (see Figure 6 and Main Video Figure). The examples span different contexts for potential playing cards, video games, TV series, etc.

Campfire Stories features a cast comprising human and non-human characters including Scout, Mushroom Girl, and Evil Marshmallow, staged in different environments.

High School Highs Cool explores how one might have a diverse cast of five characters in a simple minimalist storybook artistic style. To achieve this style, we embedded the Little Tinies LoRA¹² to the A1rtist Animated XL checkpoint.

President Choice explores a fighting video game concept inspired by various world leaders. This example demonstrates how different character references together can be used, and how alternative style representations such as 3D or pixel art can be achieved.

Elemental Cards demonstrates different characters with the same structural reference sketch representing shape language across different prompt groups (using the copy feature).

Renaissance shows a concept for a TV series pitch based on characters of the Renaissance Era that are later animated and composited with external tools (e.g., Luma’s Dream Machine¹³).

OverDroid showcases all of the features of the tool to its fullest expression for video game character design, which is used throughout the User Walkthrough.

¹²<https://civitai.com/models/501021/little-tinies>

¹³<https://lumalabs.ai/dream-machine>

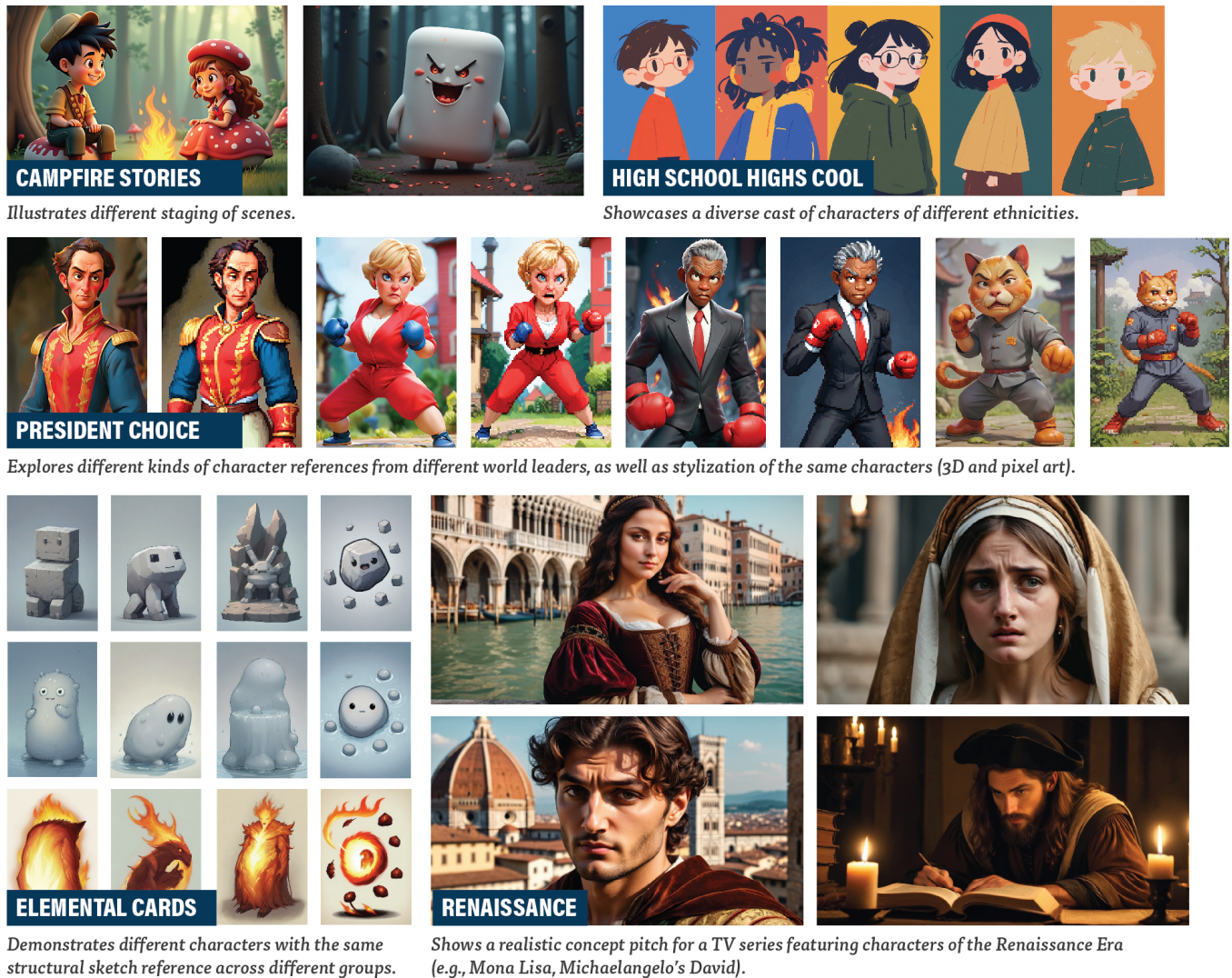


Figure 6: Paratrouper can be used to create casts of characters for a variety of use cases, including playing cards, video series, and video games. Image outputs from Paratrouper can be input into other image and video editing tools to achieve new artifacts.

8 Exploratory User Study

We conducted an exploratory user study where we asked creators to experiment making an original cast of characters using Paratrouper. Rather than focusing on evaluating the usability of the system, we conducted this study to yield deeper insights into how generative AI can be leveraged to support people’s character design needs and see if there are any emergent strategies of use. This would lead to a better understanding of the tool and its capabilities, and can also help outline future research directions and potential improvements.

8.1 Participants & Procedure

We recruited eight creators (3 male, 4 female, 1 non-binary) to use Paratrouper. Their experiences spanned designing characters for illustrations, graphic novels, indie games, advertising, films, and theater costume design (Table 2). We followed a purposeful sampling recruitment method and reached out by email to a mixture of direct contacts with different levels of expertise. The procedure was approved by institutional ethics review boards prior to being conducted. Note that some people were returning participants (i.e., P2, P5, and P7 were P1, P4 and P5 from the formative study).

After providing consent, participants answered a background questionnaire with their age, gender, occupation, educational background, and prior experience designing characters. In the main study, participants joined two researchers on an online Zoom call. Participants were introduced to the system (approximately 10 minutes). They watched a six minute video tutorial, with an opportunity to ask questions. Afterwards, they were given remote access control to the researcher’s machine that was hosting Paratrouper. Each participant was tasked to design two or more original characters that could form a cast, for any purpose that they wanted, using Paratrouper (approximately 30 minutes). The goal of the task was to understand the expressiveness of the system as well as identify some early usage strategies. During the session, participants were encouraged to think aloud and ask questions, and the researchers provided suggestions to try different features (e.g., character image reference sampling) depending on their unique character design goals (e.g., making armor with a chrome texture). The remaining 20 minutes was reserved for a semi-structured interview.

Table 2: User Study — Participant Demographic Information.

ID	EXPERIENCE	DESIGNED CHARACTERS FOR
P1	Interested	DnD Campaigns
P2	Published/Monetized	Graphic Novels, Manga, School Projects
P3	Hobby	Independent 3D Animation, Illustration
P4	Hobby	Indie Games, Anime/Fandom Commissions
P5	Published/Monetized	Indie Games, Animation
P6	Published/Monetized	Theatre
P7	Primary Specialization	Films, Indie Games, Advertising
P8	Published/Monetized	Trading Card Game, Personal Projects

8.2 Data Analysis

The data collected includes answers to the pre-questionnaire, audio and video screen recordings from the call, and the corresponding text-to-speech transcriptions from Zoom’s transcription service. After each session, the two attending researchers discussed their observations. This involved retracing the participant’s design process and reviewing the images that were produced with the guidance of the think-aloud data while reflecting on patterns and trends. After all sessions had been completed, the first author engaged in thematic clustering [9, 48]. The clusters were then further elaborated upon and refined by the two co-authors in conjunction.

8.3 Key Findings

On a high level, participants created a variety of characters spanning people of different roles and cultures (P2, P2, P4, P7), powerful and mythical animals (P1, P8), inanimate objects (P4), and monsters (P3, P5). Paratrouper was found to be a comprehensive (P1, P7, P8) and powerful tool (P2) that was fun to use (P1, P4, P6, P7), and could produce images that seem professionally made (P5). They appreciated the focused and streamlined experience it offered for character design (P8) and that it felt like using a private personal notebook (P7). P1, P5 and P8 noted how the tool could greatly accelerate their work. However, P7 cautioned that it may be easy to fall into a never-ending cycle of using the system since it was fun and fascinating to use. To better examine the expressiveness and usage of Paratrouper, we outline findings pertaining to key features of the prototype (e.g., cards, multi-modal input, image referencing, character sheets, staging), the impact of unexpected outputs, and Paratrouper’s applicability to real workflows.

8.3.1 Cards and Groups Enable Parallel Design and Accelerate Design Space Exploration. The copy and group features played a large part in being able to experiment with different designs in parallel (see Figure 7). P2 and P6 copied cards to preserve designs and compare versions, which was an unanticipated application of the feature.



Figure 7: Examples of participants engaging in a parallelized workflow. P3 created separate groups for adventurers and monsters, and made multiple cards per group to experiment with different designs. P6 copied character cards to iterate on the design of a paper wedding dress. As she designed, she discovered more precisely what she wanted to create.

P6 got new ideas about how to construct dresses out of paper as she worked through iterations. P3 quickly instantiated multiple character cards to create many different characters in a rapid fashion. She created different groups, one for a group of protagonist children and another to experiment with different monster designs. P5 mentioned that when making video games, one wants to avoid having too much visual redundancy between characters on screen. He appreciated being able to see many characters side-by-side in Paratrouper, since it is easier to catch this type of mistake early on in the game creation process.

8.3.2 Multi-Modal Input: Balancing Between Rapid Creation and Creative Control. Participants had mixed preferences between text- and sketch-input. P1, P5, and P8 appreciated words, since it offered an element of surprise (P5) and enabled more control than image searching (P1). Additionally, although P5 was wary of a steep learning curve, he was impressed that he could quickly generate 34 images with satisfying quality. However, several participants eventually struggled to produce images that could precisely match their design intent using text-input alone. For example, P8's ninja capybara character more closely resembled a gopher, and P2's idea of a blue-skinned tattooed water buffalo was often generated with a flesh skin tone. P2 likened text-prompting to a "game of telephone," or having someone "create fan art" of their ideas—particularly for artists who are accustomed to thinking and working visually.

While sketch-input required more effort P3, P4, and P8 appreciated that it gave them greater control over their generated images. P8 (see Figure 8) drew carefully and was impressed how closely the generated image resembled his sketch. He noted that sketching provided a greater sense of control and authorship compared to the text-only image generation tools he had tried in the past. At the same time, he felt it was lower effort than drawing from scratch as the system could understand rough shapes, and felt similar to assembling IKEA furniture. P4 wanted to create a knight wielding a vegetable shield and sword, and was satisfied with how the system interpreted her sketch for her intended placement of these props (see Figure 9, middle). With text-only, the system was heavily biased towards generating humanoid bipedal monsters. However, through drawing, P3 liked that she could attain her vision of a multi-legged leech-like creature more closely.

8.3.3 Direct Sampling Enables Design on Various Levels of Detail. Participants leveraged image referencing to design on various conceptual levels (see Figure 9). P1 and P4 used references to introduce props for their characters. In these cases, full pictures of objects were used one-to-one in the generated image. For instance, P6 utilized references to achieve a desired mermaid silhouette of the dresses she wanted her dog character to wear. P4 used a picture of a carrot to create the weaponry for her soldier character. P3 took swatches of red canvas material to texture the backpack for one of her characters, while P7 used a swatch of chrome to adjust the armor of his minotaur character (see Figure 10).

8.3.4 Character Sheets as Reference for 3D Forms. As an expert 3D modeler, P7 took inspiration from the physical forms and the use of lighting and character proportions/silhouettes generated by Paratrouper. Despite the character sheet offering low resolution images, he appreciated how different perspectives gave him ideas

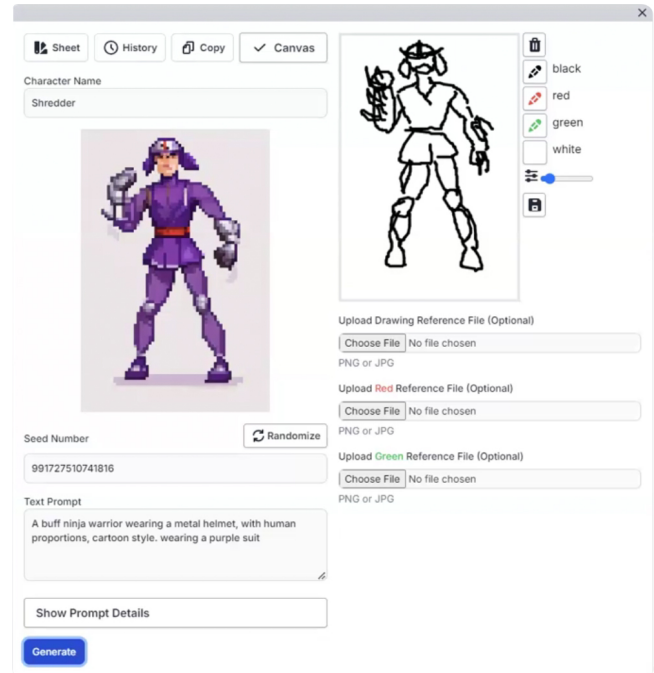


Figure 8: P8 put time and effort into his sketches and reported feeling stronger feelings of ownership than others.

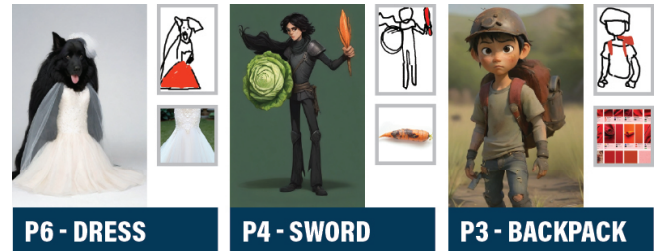


Figure 9: Participants sampled using the masking and reference image feature to design on various levels of granularity, including shaping silhouettes (P6), introducing props (P4), and achieving desired textures (P3).

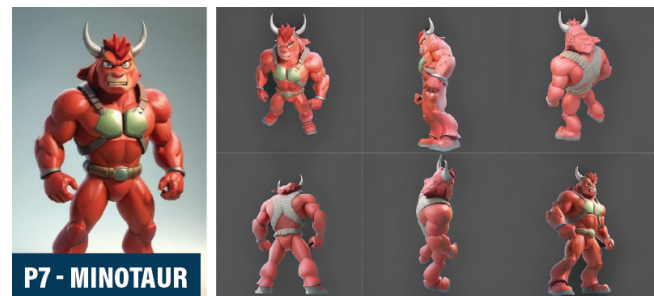


Figure 10: Character sheet created by P7. Seeing different perspectives of his character concept fueled his imagination for what he would like to 3D model himself.

for how he could later go about sculpting his own version of the character, better understanding what to extract and what to modify (see Figure 10). At present, he would consider it as a means to accelerate imagination — to get the broad strokes, proportions, shapes and styles. Moreover, he envisioned the character sheet could eventually output an initial 3D mesh. This would accelerate his process, since it is already common practice to start with a base model.

8.3.5 Staging as a Holistic Thinking Tool. Several participants thought about settings and backgrounds (P5, P6, P7) when using Paratrouper (see Figure 11). P5 enjoyed the of haunted carnival rides that were generated when staging his alien and ninja clown characters, and was inspired to integrate such rides into a potential video game concept. P7 was also inspired by the backdrops that were created when staging characters. After seeing these, he proceeded to experiment using the character cards to create backdrops and settings. P6 wished there were a way to upload backgrounds that could be used as settings rather than needing to have them generated. As someone who works in theater, she often has to visualize how several aspects come together. Nevertheless, the generated backdrops were helping her visualize how her designs might work on a real stage. As a manga artist, P2 appreciated staging and imagined importing characters directly to pose them like dolls to create covers for graphic novels.



Figure 11: Participants (P5, P6, P7) created different background settings during the study. P6 and P7 used staging, and P5 used cards specifically to explore design alternatives.

8.3.6 Inspiration from Unexpected Outputs. While participants did not always generate what they anticipated, all reported being inspired by unexpected outputs. P1 valued her dwarf having a tuft of white hair on the top of his head, despite not specifying it. P2 reported thinking of creating a new tribe of creatures based on some of their results. P4 felt that the generations helped her come up with new ideas. For example, while she intended to make a potato character that would yield a fry like a sword, some images depicted a potato with fries stuck to its body, which she thought would be an amusing way for a potato to carry items (see Figure 12). P6 felt that seeing different generated images was a “*positive distraction*” for new ideas on how to construct a dress out of paper, such as using one large sheet to create the skirt, or piecing together multiple smaller sheets to construct a bodice.

8.3.7 Applicability to Real Workflows. Participants described Paratrouper as excelling for early-stage ideation. For those with a particular concept in mind, they felt the system did not generate images matching their precise visions. Nevertheless, all participants reported that the tool gave them new ideas and aided their thinking.

Participants had varied opinions about the generated images, which shaped how they envisioned the tool. P5 was satisfied with the images after only a few attempts at text-prompts. In contrast, P3 noted inconsistencies with character details, objects, and lighting that would make the images unsuitable to use directly for 3D rigging and modeling. P7 also noticed inconsistencies, but was delighted by seeing different variations and found them very inspiring to fuel his own 3D sculpting efforts. P3 and P8 expressed hesitation with using of generated images as a final product given questions around intellectual property and re-traceability of sources, and P5 cited possible reputational repercussions for using generative AI to create games. Stemming from this, P5 believed it would be better for the tool to output imperfect images. Thus, people would be more inclined to use images as inspiration and deterred from using the assets directly in their projects. Given the big gap between an image and the actual construction of a costume, P6 would not be concerned with using generative AI to ideate. However, she would seek her collaborators’ consensus before engaging with a tool like Paratrouper, especially if it were to run on a server as opposed to locally, as this could lead to undesired data collection. While this study was a solo activity, participants expressed excitement for using the tool as a collaborative workspace, such as P1 using it collaboratively for Dungeons and Dragons with her team, and P6 suggesting it could aid her creative collaborations for rapid brainstorming with her collaborators.



Figure 12: P4 experimented with styles and renderings for a potato character. She was surprised by the one that had fries stuck to it, but found it inspiring to carry items this way.

9 Discussion

We investigated the possibility and implications of leveraging generative AI to support visual character designers. This entails reflecting on our system, its role in the creative process, the role of control and serendipity in Generative AI, the ethical implications, our system limitations, and the work that lies ahead.

9.1 Paratrouper as a Dedicated System to Support Visual Character Cast Design

Extending prior work, we contributed a new tool that is tailored towards helping people visually conceptualize original casts of characters. Formative interviews with character designers highlighted the open-ended diversity of goals and approaches, and showed that generative AI is well-positioned to help people get a “quick feel” of ideas. This inspired us to center our rationale around being (R1) rapid, (2) multi-modal, and (3) contextual. These rationales embodied the ideas of (1) *reflection in action* [67] through the refinement and parallel iteration of prompts and characters, and (2) *reflection on action* [67] via additional representations such as staging and character sheets to think about the bigger picture of how the different characters might interrelate within the particular story. Paratrouper goes beyond the curatorial nature of *problem construction* and shifts towards an active prototyping and solution-finding approach. The result is a seemingly refined first pass of a holistic idea that goes beyond individual characters and spreads to the broader cast and even elements of the story, setting, mood, etc.

The design of Paratrouper required careful consideration of different building blocks and how designers will think when using the system [37]. The combination of both our own demonstrations and walkthrough with the exploratory study show how Paratrouper addresses the challenges within character design. Paratrouper supported creating a diverse range of projects in an open-ended manner, where one can move freely between adding characters, creating groups, and staging different pairs. This highlights “*wide walls*” [61] within creativity support tools and demonstrates high flexibility [54], with means to quickly start and experiment through a low-threshold open-ended interaction [56]. Accommodating different ways of thinking provides many paths of low resistance, leading creators towards “*doing the right things, and away from doing the wrong things*” [52]. In particular, we noted how using character cards to generate backgrounds, and copying cards to create multiple versions of the same character demonstrate the tool’s reappropriation and flexibility to work around the tool’s “*margins*” [25], further supporting different ways of thinking. Through participant think-aloud, we saw how the tool reflected many descriptive models of creative design [15], in particular, mutation and combination, as well as creative emergence.

Paratrouper excelled in helping designers articulate and refine their design intent through a process of rapid externalization. Many of the images generated with Paratrouper act as “*boundary objects*” similar to prototyping [3, 38, 39, 73, 73]: a conversation with the problem or situation [67]. Visualizing characters side-by-side facilitated parallel design [20], and empowered engaging in conscious reflection [63]. We found that Paratrouper blends the acts of prototyping and sampling. The generated images act both as filters and

manifestations of design ideas [41], while facilitating exploration. Generated images also served dual purposes as outputs and raw material for new cycles of reinterpretation [21, 44, 74]. With Paratrouper, we saw clear malleability of one’s design intent, showing how one is concurrently constructing the problem [31], and devising the solution [16]. Thus, Paratrouper joins a suite of existing tools that can assist with design reflection [12, 28, 30, 34–36, 74].

The study demonstrated the utility of multi-modal inputs and multiple representations. This helped to serve individual preferences in working styles. While text-input enabled rapid creation and greater serendipity, the drawing-input tended to instill greater feelings of agency and control. Finally, the tool also offered multiple representations of characters. In addition to providing an overview comprising a mosaic of character cards, characters could be sorted and filtered by group, shown from different perspectives in a character sheet, and visualized in different situations with other characters using the stage. We noticed staging was a particularly welcomed feature, in that people could think more holistically about their characters with respect to a greater context. It also served as inspiration for new elements beyond characters themselves.

9.2 Balancing Creative Agency & Serendipity

As people engaged with Paratrouper, we observed a constant tension between creative control and serendipity. People may start using the tool to ideate, but as they refine their design intent and develop greater clarity for what they want, it becomes increasingly difficult to produce renderings that precisely match their visions. It is well known that AI is susceptible to biases based on their training data. In the context of this work, the different checkpoint models generated very specific styles and struggled to generate content beyond the scope of their training data. For example, one participant wanted to make an eyeless monster, but the model consistently added eyes. In this case, the participant bypassed this with a different checkpoint. However, such biases may subtly and unconsciously reframe people’s ideas for aesthetics. Such an issue also underscores how AI may be more useful for experimentation rather than for the production of polished outputs.

We also noticed that there may be a relationship between a user’s core expertise and their wishes for the capabilities of the design tool. People who are well-versed in visual design may be frustrated by a lack of direct control over the aesthetics. However, for someone who primarily works in another medium outside of producing 2D images (e.g., in 3D modeling or fashion), they may be satisfied with using the tool for early-stage ideation before moving on.

We also reflected on the sense of ownership over Generative AI creations. One participant mentioned that the control afforded by drawing lent itself to stronger feelings of authorship and ownership. We speculate that ownership is a side effect of careful craft, and hypothesize that if people were given more time to work with the tool, their feelings of authorship would be higher. This would corroborate prior research that has found that more effortful creation can lead to greater feelings of value and attachment [40, 84].

9.3 Ethics

Open training on many types of intellectual properties could potentially lead to accidental plagiarism. For instance, keywords such as "Italian plumber", and even "plumber", force the generations to create characters that can infringe upon intellectual property. Beyond infringing on existing creations, the use of Paratrouper or any Generative AI system can impact individuals' jobs and entire segments of industries. Additionally, in the spirit of being an open-ended sandbox, Paratrouper lacks strict safeguards for misuse. While we added an 'always-on' negative prompt to prevent nudity, these constraints could be circumvented. With these concerns in mind, it will be important to foster intentional and mindful processes of sampling [27, 44, 62, 74]. It is interesting to note that while Paratrouper could not fully create perfect images and consistent characters, this may be helpful and possibly even desirable from an ethical standpoint. Restricting AI to outputting unrefined or unfinished content may help to protect artists from being replaced or displaced.

9.4 Limitations

The small sample sizes within our interviews and studies provided a first pass to better understand how character designers think and what they value. Nevertheless, recruiting a larger number of participants can provide broader insights and nuances between different subsets of character creators. Additionally, some participants were involved in both the formative and exploratory user studies, which may have positively biased their perception of Paratrouper if its features reflected their earlier opinions. Furthermore, in the user study, people only had 30 minutes to experiment with Paratrouper, which limited the insights to be based on first-use. The comments gathered with respect to ownership or integration into real workflows are therefore speculative in nature. In future, it would be interesting to deploy a version of Paratrouper longitudinally to gain insight on the overall usability of the system and to understand how much it aligns with creators' real needs and workflows.

9.5 Future Work

Several features of the system could be improved in future iterations. Firstly, while we did not focus on helping people prompt, we noticed that users did have difficulty writing them. Therefore, it would be important to consider integrating strategies to facilitate this process from prior works into future versions of this system. In the current implementation of Paratrouper, drawing controls are available on canvases distinct from the generated image. However, future versions of the system could enable people to draw directly on the image to directly manipulate its contents, making the interaction more fluid and intuitive [56]. Additionally, we anticipate that it will be possible to improve the character sheets. In the Paratrouper prototype, the sheet was limited to 6 views that Zero123++ produces by default. New algorithms however are becoming available to create 3D meshes from a single image, such as with Rodin [78], which will allow people to have the ability to view their characters from any angle. Additionally, its features could be extended to produce other outputs that could be useful for character design, such as expression sheets, or even move beyond character design to cater to designing settings.

10 Conclusion

Generative AI will continue to evolve and empower creatives in new ways. There is a need for tools that can harness the advanced algorithms so they can be used and configured by different audiences, both in an effort to democratize, but also specialize, the next generation of content creation. In this direction, we presented Paratrouper, a Generative-AI-powered system for character designers to generate new character concepts. Paratrouper promotes idea generation, provides different interaction modalities through multi-modal input supporting words and visuals, and leverages different types of visual representations to aid in concept creation. Through formative interviews and an initial usage study with creators, we found that by supporting the key design rationale, we can empower creators to generate high-quality characters quickly.

Acknowledgments

We thank everyone who participated in the formative interviews and user study. This research was supported in part by the National Sciences and Engineering Research Council of Canada (NSERC) under Grant IRCPJ 545100 - 18.

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A Appendix A: Semi-Structured Interview Materials

A.1 Pre-Questionnaire

- (1) Name (First and Last)
- (2) Email Address
- (3) What is your **age**?
- (4) How would you describe your **gender**?
- (5) What is your **educational background**? Please select the highest level you have completed. [High School, College, Trade School, Undergraduate, Master, PhD, Other: (Please Specify)]
- (6) What is your current **job title** (occupation)?
- (7) What are some creative role(s) you carry out in the context of character design? (e.g., writer, animator, concept artist, game designer, etc.)

- (8) What have you designed characters for? (e.g., indie games, comics, manga, films, etc.)
- (9) How many character design projects have you worked on? (i.e., number of projects)
- (10) How many years of experience do you have in character design? (i.e., years)

A.2 Appendix B: Semi-Structured Interview Questions

A.2.1 Character Design process. We would like to ground the discussion in a specific example of your character design work. Can you pick one of your projects and run us through your overall process/experience? (Please share your screen with us to step through your work and process.) Does the process you explain generally describe your process for character design?

- (1) Can you run through this project and what it is about?
- (2) Can you outline/describe your overall process of designing characters?
- (3) How much does your process differ between projects?
- (4) How often do you have to design an **individual character** versus a **cast of characters**?
- (5) How **long** does it take you to design a character?
- (6) What parts of the process are most **challenging**? What parts of the process are most **time-consuming**?
- (7) When you design a cast of characters, do you follow a **serial procedure** by designing one character in-depth before proceeding to the next one? Or do you design them in **parallel** with one another?
- (8) Do you work independently? If not, who do you interact or work with as part of the character creation design process?
- (9) How do you **iterate and refine** your ideas to arrive at the final character concepts?

A.2.2 Key Considerations.

- (1) What key considerations do you have in designing a single character? In other words, what distinguishes **good from poor character design**?
- (2) What key considerations do you have in designing a good cast of characters? In other words, what distinguishes **good from poor character cast design**?
- (3) Are there any special **use-case-specific considerations** (i.e., differences between designing characters for video games versus film, etc.), compared to other use cases?
- (4) What makes a cast of characters (desirable property, e.g., cohesive, etc.)

A.2.3 Tools & Assets.

- (1) What **information or assets** do you need to support your process of character (cast) design?
- (2) What assets are you given when you start? (e.g., simple textual description of a character, a story outline, etc.)
- (3) What are the final assets you produce to fully specify your full character design for your projects? (e.g., a model sheet, an expression sheet, character turnaround, 3d model, etc.)
- (4) What kind of tools do you use as part of your process?

A.2.4 Perspectives / Experience with Generative AI. (If the participant has not seen such tools before, show examples (e.g., Mid-journey) to probe.)

- (1) What is your level of **knowledge and experience in using or working with generative AI for character design**?
- (2) What **opportunities**, if any, do you see with using generative AI for character design?
- (3) What **cons**, if any, do you see with using generative AI for character design?
- (4) If you use generative AI, what **tools** have you used and to what extent? Can you explain how you've used them?
- (5) What challenges have you faced when working with generative AI?

B Appendix B: User Study

B.1 Pre-Questionnaire

- (1) Name (First and Last)
- (2) Email Address
- (3) What is your **age**?
- (4) How would you describe your **gender**?
- (5) What is your **educational background**? Please select the highest level you have completed. [High School, College, Trade School, Undergraduate, Master, PhD, Other: (Please Specify)]
- (6) What is your current **job title** (occupation)?
- (7) **What have you design characters for** before? (e.g., indie games, comics, films, etc.)
- (8) How many **years of experience** do you have in character design? (i.e., including both professional and non-professional experiences)
- (9) **What option best describes your experience with character design?** [I am interested in character design. / I have designed characters regularly as a hobby. / I have designed characters that have been published or monetized in some way. I create characters for a living as my primary specialization.]

B.2 Semi-Structured Interview Questions

Show and tell with your cast of characters.

- (1) Walkthrough what you made in the tool with us.
- (2) Describe the actions you took and the thoughts you had while making
- (3) If you did not feel you completed your designs, what if anything did you have challenges with? And what would you want to change if you had more time?

What was your overall impression?

- (1) What stood out to you about the experience?
- (2) What did you enjoy? What are you excited about?
- (3) What did you not enjoy? What are you skeptical about?
- (4) Any surprises?

What are your thoughts about the different features?

- Text Prompts
- Sketching
- Image reference
- History
- Character Sheet
- Grouping
- Staging
- User Interface: Did you like seeing all characters on one page? Or would you prefer something different?

Did you feel that the tool/system influenced your...

- (1) Ideas? If so, how?
- (2) Creative process? If so, how?
- (3) How much did you have a design intent? How closely did you stick with it?

Process

- (1) How do you normally design a cast? Parallel or in series?
- (2) Do you focus on designing one character before moving to the next? Or did you do rough versions of each and iterate?
- (3) How does this compare to your regular character creation process? (phases, time, etc.)
- (4) Does this system complement how you work, or does it work against it?

Agency & Ownership

- (1) Did you feel a sense of creative control over your creations?
- (2) Did you feel a sense of ownership over your creations?
- (3) How much do you consider these characters as your own, versus created by something else?

Thoughts on AI?

- (1) The generated content made sense
- (2) The generated content matched my imagination
- (3) The quality of the generated content was good
- (4) The generated content gave me new ideas.

Compare to Other Tools

- (1) Do you feel it's different from other AI tools, and if so how?

Future

- (1) Would you imagine using Paratrouper in your future character design projects? Why or why not? What would it take for it to become part of your practice?
- (2) Do you think it has a place in different creative practices?