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Creativity Support in the Age of Large Language Models: An Empirical Study Involving Professional Writers

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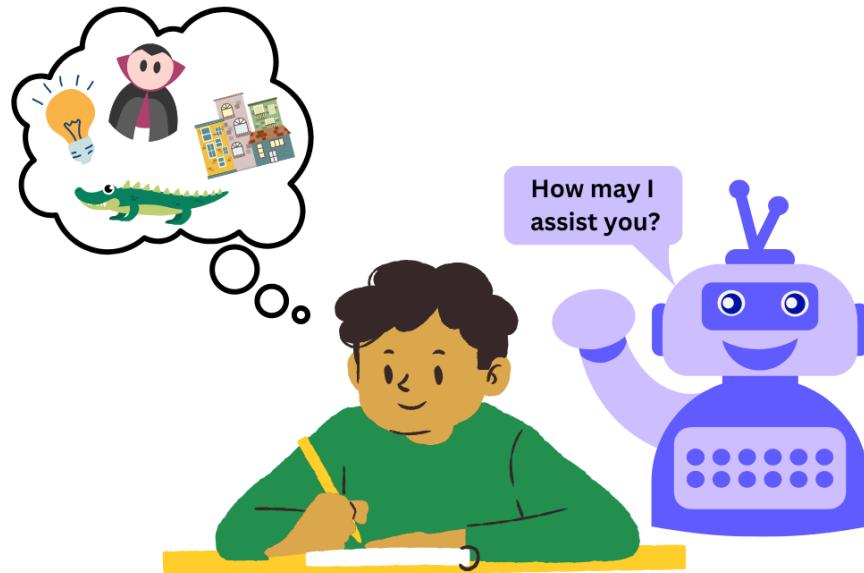


Figure 1: A writer seeks feedback from an AI

ABSTRACT

The development of large language models (LLMs) capable of following instructions and engaging in conversational interactions has led to increased interest in their use across various support tools. We investigate the effectiveness of contemporary LLMs in assisting professional writers via an empirical user study ($n=30$). The design of our collaborative writing interface is grounded in the *cognitive process model of writing* [17]. This allows writers to

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obtain model help in each of the three non-linear cognitive activities in the writing process: planning, translating and reviewing. Participants write short fiction/non-fiction with model help and are subsequently asked to submit a post-completion survey to provide qualitative feedback on the potential and pitfalls of LLMs as writing collaborators. Upon analyzing the writer-LLM interactions, we find that while seeking help across all three types of cognitive activities, writers find LLMs more helpful in translation and reviewing. Our findings from analyzing both the interactions and the survey responses highlight future research directions in creative writing assistance using LLMs.

CCS CONCEPTS

- Human-centered computing → Empirical studies in HCI;
- Empirical studies in collaborative and social computing;
- Computing methodologies → Natural language generation.

KEYWORDS

Human-AI collaboration, Co-Creativity, Computational Creativity, Large Language Models, StoryTelling, Natural Language Generation, Evaluation, Creativity

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1 INTRODUCTION

Writers have often found themselves in the moral quandary of not wanting to use AI but at the same time experimenting with it to understand its potential and limitations. In her essay, Pulitzer fiction finalist Vauhini Vara writes

“We both make our livings as writers and technological capitalism has been exerting a slow suffocation on our craft. A machine capable of doing what we do, at a fraction of the cost, feels like a threat. Yet I found myself irresistibly attracted to GPT-3—to the way it offered, without judgment, to deliver words to a writer who has found herself at a loss for them” [64]

Recent work has demonstrated the promise of large language models (LLMs) in assisting users with a variety of creative writing tasks from short fiction [69, 70] to screenplays [48]. Aligning LLMs to generate text more in line with human preferences [51] has enabled them to respond directly to user instructions, transforming them into viable tools for assisting users who do not have a computational background. This has increased the commercial appeal of deploying LLMs as products that offer writing assistance such as *Sudowrite*¹ that can continue a story where the user left off, describe a scene, rewrite according to some guidelines or even provide feedback. However, the true utility of contemporary models in assisting *professional writers* remains an open question [31, 48].²

Our goal is to design a human-AI collaboration framework that can help us better understand the needs of professional writers during the writing process and the potential pitfalls of contemporary LLMs as collaborative creative writing assistants. Gero et al. [22] argue for a design space for writing support tools that are based on the *cognitive process theory of writing* [17] that considers writing as a goal-oriented thinking process encompassing three distinct and non-linear cognitive activities – *Planning*, *Translation* and *Reviewing*. Planning includes setting goals, brainstorming ideas, and organizing the writers’ thoughts. Translation is the process of verbalizing ideas and thoughts. Reviewing includes evaluating and revising what has been written. Through a systematic literature review of recent writing support tools, Gero et al. [22] find that none of the prior work facilitates all three activities, with planning and reviewing being under-studied areas.

¹<https://www.sudowrite.com/>

²Lee et al. [39] investigate the capabilities of LLMs as assistive tools in creative and argumentative writing tasks. However, their analysis is grounded in the needs of novice writers recruited from crowd-working platforms. The needs of professional writers may differ and hence warrant further investigation.

To fill this gap in the literature, we propose a human-AI collaboration framework for writing support that is designed based on the *cognitive process theory of writing* [17] that allows a professional writer to seek help from a contemporary LLM (GPT-3.5) *during all three cognitive activities – planning, translating, and reviewing –, in a non-linear fashion*. We implement this framework in a user interface that allows users to seek help from the model via simple natural language instructions, thereby providing the scaffolding necessary for effective collaboration during all three cognitive activities (Section 3).³ Using this interface, we collect a dataset of 30 stories, spanning between 1000 and 4000 words in length across a wide range of genres, written by 17 professional writers with the help of GPT-3.5. In addition, participants were asked to submit a post-completion survey to provide feedback on the potential and pitfalls of LLMs as tools for writing assistance (Section 4). Along with the stories, we also record the interactions between the writers and GPT-3.5, which consist of paired instances of natural language instructions provided by the writers and the corresponding model-generated responses. This enables us to both identify patterns in instruction usage (for what activities do professional writers seek help from the LLM) and to estimate the model’s contribution to the stories (in which of these activities is the LLM most helpful) (Section 5). We observe that while the writers use the LLM for all stages of creative writing, the model proves most helpful for *translation-based* subtasks such as targeted rewriting of paragraphs in the text, or *review-based* subtasks such as obtaining feedback on their draft. We also find that writers often switch between the three kinds of subtasks non-linearly, validating our design choices with the interface (Section 5.2). Finally, we qualitatively analyze the post-completion survey feedback provided by the writers to identify the strengths and weaknesses of the model (Section 6). Current models are limiting for professional writers in several ways including their repetitive nature, over-reliance on clichés and tropes, lack of nuance, subtext, or symbolism as well as overly moralistic and predictable endings (Section 7). While some of the model weaknesses could be resolved with better prompting, our writers also highlight broader concerns about the model’s inability to generate text related to darker topics, as well as its difficulty in understanding the writer’s intent. Our findings highlight future directions of research in the training of models to align with the needs of professionals. On a positive note, writers find the model to be the most helpful as a rewriting tool or feedback provider rather than an original idea generator.

To summarize our contributions, building on recent studies on collaborative writing [31, 48], our work is the first to study the role of state-of-the-art LLMs as writing tools for professional writers using a theoretically grounded interface. We also collect and release,

³We note that Bhat et al. [6] use the cognitive model from Flower and Hayes [17] for qualitative analysis of their next-phrase suggestions when writing movie reviews. Our work extends this line of work to contemporary instruction-tuned LLMs [67] that more naturally fit the three phases of the writing process, allowing us to incorporate the theory into the design of the interface itself.

to our knowledge, the first dataset of co-written stories and human-AI interactions with professional writers to foster further research along this direction.⁴⁵

2 RELATED WORK

2.1 Human-AI collaborative writing

Research in collaborative writing has examined the effects of different suggestion formats. Kannan et al. [33] created the Smart Reply in Gmail using an LSTM model, significantly influencing mobile email responses. Gero and Chilton [23, 24] found that synonym and metaphor suggestions inspire writers. Clark et al. [15] observed a preference for interfaces allowing greater user control in collaborative writing. Buschek et al. [10] explored the balance between the number of suggestions and their usefulness in enhancing writing efficiency. More recent work investigates using language models for narrative crafting including story assistance for Japanese novelists [50], a completion-generation model for collaborative story writing [2], and AI in interactive game narratives [1, 18, 65]. Chatbots have been explored for creating fictional characters [57]. Most closely related to our work are Wordcraft [70] and Dramatron [48] which use LLMs for various writing tasks, including story continuations and screenplays. Unlike these works, our interface design is based on the cognitive process theory of writing and we use publicly-available LLMs, with a longer context window, which allows us to share the collected interactions and feedback from users to inspire future research in this direction.

2.2 Creativity Support Tools

A basic idea in the development of interactive computing is that computers help people do things they couldn't do independently - in other words, computers are tools. This reliance on digital tools for creative work is reflected in Human-Computer Interaction (HCI), which has mainly explored themes about creativity by focusing on the potential of introducing various digital aids, specifically Creativity Support Tools (CSTs). Computational writing support has evolved from early spellcheckers [66] to recent AI-driven story generation tools [14]. Techniques inspired by expert authors enable crowdworkers to complete complex writing tasks via reflection and revision [35]. Other advancements include methods for identifying writing style [61], cognitive writing theories for creating writing scaffolds [29], and ideation support tools [23, 24]. Recently, large pre-trained models have emerged as creativity aids for writers [48, 70] and visual artists [36].

Morris et al. [49] emphasize the importance of connected design spaces for exploring the interaction between HCI and pre-trained AI models, influencing prototyping. Gero et al. [22] develop a space based on the cognitive process model of writing, affecting interface design choices. Chung et al. [13] review literature on creativity support tools in various arts to create a taxonomy encompassing roles, interactions, and technologies. Frich et al. [19], Palani et al. [52] showed how creative practitioners prioritize functionality, workflow integration, and performance, among other concerns, when

adopting new creativity support tools, with most discovering tools via personal recommendations. Gero et al. [26] examine the social dynamics of AI in creative tasks, observing the mismatch between writers' goals and computer support. Biermann et al. [7] finds that writers value emotional connection and self-confidence, fearing AI might undermine their control and uniqueness. A study with 30 participants by Suh et al. [62] explores AI's roles in creative collaboration, like fostering common ground and reducing friction. Bhat et al. [6] used the cognitive process model of writing from Flower and Hayes [17] for qualitative analysis of their LM-assisted writing system for the task of movie review writing. Unlike them, we directly incorporate the theory from Flower and Hayes [17] into designing and building our interface for creativity support.

2.3 Generation with Large Language Models

In the last five years, natural language generation has greatly evolved, primarily owing to larger language models [9] that use our improved understanding of the scaling laws involved [54, 68] and the advent of alignment training with collected human preferences [51]. This enables them to perform diverse tasks effectively with little extra training, resulting in writing tools built using them [25, 39]. However, contemporary LLMs still lack a concrete fact-verification mechanism, leading to potential inaccuracies, especially in non-fiction writing [32]. They can generate harmful content from seemingly harmless prompts [21, 53], risking misrepresentation of minorities. Ethical concerns also arise, including environmental and socio-political issues [5]. Prompt engineering improves model performance [3, 45], but its complexity may be daunting for non-technical users.

2.4 Assumptions About The Writing Process

To provide more comprehensive context to our findings, we acknowledge some assumptions made in the design choices of our study about the writing process.⁶ We base the design of our user interface in the *cognitive process theory of writing* [17] that models writing as a non-linear sequence of cognitive processes of the writer. Alternatively, Rohman [55] study the effect of *pre-writing*, or all planning activities, on writing, maintaining that thinking is a different, antecedent process to writing. Zoellner [72] also propose a distinction between thinking and writing based on the idea that students often find it easier to articulate their thoughts in speech as a precursor to writing. This *talk-write* view considers that the internal thinking processes of the writer are not observable and hence argue for a product-oriented view of writing grounded in recorded speech and drafts [27]. More recently, Lee et al. [38] propose an alternative categorization of the writing process into *idea generation, planning, drafting, and reviewing* which adopts the view from Britton et al. [8], Rohman [55] that model the growth of the written artifact and not the mental processes of the writer. Since our goal is to better understand the use of contemporary LLMs in the writing process of professional writers, the process-oriented *cognitive process theory* [17] is more suited to our study.

⁴The stories collected from our work as well as all interaction data can be found at <https://collab-stories.github.io/>.

⁵Throughout the paper, we use LLM/AI/GPT-3.5 interchangeably which refer to the same underlying model.

⁶Faigley [16] present a survey comparing various theories proposed to better understand the writing process.

3 BUILDING A COLLABORATIVE WRITING PLATFORM

Our design for creating a collaborative writing tool is based on prior work that conceptualizes design spaces for creativity support tools [13, 22]. The overall interaction interface is given in Figure 2.

3.1 System Feature 1: Writers provide the plot, model writes a draft

Our user interface was designed with the intent to allow writers to write short fiction/non-fiction (typically between 1500 and 2000 words) based on a genre and a plot of their choice. We started with an initial list of 8 genres *Literary Fiction*, *Science Fiction*, *Fantasy*, *Drama*, *Thriller*, *Dystopian*, *Creative Non-Fiction* and *Horror* as a part of a dropdown menu and allowed writers to blend or input their own genres in an open field. Given the user-provided genre and plot, we first generate an initial story draft using GPT-3.5 with the following prompt, “Generate a 1500-word long story of <genre> genre that follows this plot: <plot>”. As can be seen in Figure 2, the text area on the top left shows the title of the story and the text area below it contains the plot. Once a user hits the *Generate first draft of the story* button, the generated story conditioned on the plot appears on the bigger text area below it. For simplicity, we refer this to as the *story area*. All the text areas are editable giving writers full access to add/edit/delete text. By letting participants provide a plot, we actively afford them greater control in *Planning*.

Our design decision to add the first draft was mostly motivated by the fact that first drafts are not the place to obsess over the perfection of one’s writing style. First drafts are for getting lost in the story and honing it later strictly during the editing phase [37] which was further corroborated by some of our participants.

3.2 System Feature 2: Writers interact with GPT-3.5 through a chat interface and receive suggestions based on the chat history and story draft

Along with the capability to generate a first draft based on the plot, we also provide the writers with a chatbot as can be seen on the right side of the interface in Figure 2. The chatbot generates text from a state-of-the-art LLM, GPT-3.5, in response to natural language instructions. This acts as a conceptual sandbox, fostering an environment conducive to the use of GPT-3.5 for planning, translation and reviewing. We include the text inside the *story area* as a part of the context in order to enable writers to ask questions pertinent to the story (see Table 1).

Owing to the fact that LLMs such as GPT-3.5 are fine-tuned on <instruction, output> pairs, the chat is capable of handling any free-form textual instructions from the writers. We expect participants to use this chat for planning, translation, and reviewing. To further assist writers during this collaboration, we also provided them with some templated prompts (Table 2). The *Generate Continuation*, *Rewrite with Imagery* or *Elaborate Selection* functionality were inspired by WordCraft [70]. Finally, during initial experiments, we noticed that the text generated by GPT-3.5 was heavy on exposition and barely contained any dialogue. This led us to introduce

the *Insert Dialogue/Monologue* template giving authors the chance to explicitly insert dialogue as needed. For instructions that require localized edits in the draft, as shown in Table 2, we allow the writers to select the intended draft snippet using ‘<’ and ‘>’ tags as delimiters. In compliance with *Reviewing*, we also introduce the *Get Feedback* prompt which generates a critique of the draft written inside the *story area*. It should be noted that we did not design templated instructions for *Planning* as these instructions tend to be story-specific.

3.3 System Feature 3: Large Language Model Choice

We select GPT-3.5 over alternative LLMs for both the generation of the initial draft and for generating responses from the chatbot for two reasons. From an economic standpoint, out of OpenAI’s public state-of-the-art model offerings⁷, the cost per thousand tokens for GPT-3.5 is \$0.002, a rate that is approximately 30 times more cost-efficient than the \$0.06 per thousand tokens of GPT-4. Secondly, our preliminary experiments showed that GPT-3.5 exhibited a significantly lower computational latency than GPT-4. User feedback on the OpenAI community forum has also noted that GPT-4 incurs a fourfold increase in response time as compared to GPT-3.5.⁸ As we aim to help writers obtain model help in real-time, the optimization of response time was deemed a critical requirement.

3.4 System Feature 4: Handling the token length limits of GPT-3.5

One concern with using GPT-3.5 for model assistance is that we are constrained to use only 4096 tokens to represent both the context and generated completion. As a result, we must devise strategic approaches to contain our conversational context within this constraint, while not limiting the utility for the end users. A central feature of our system is the incorporation of the story draft within the system prompt (Table 1), which enables the writers to formulate instructions pertaining to the story. Hence we could run into this token limit as writers interact with the chatbot over multiple turns. We advise users to craft stories that fall within the range of 1500 to 2000 words, thereby ensuring that an ample quantity of tokens remains available for a constructive dialogue with the model. In the event that users’ draft and dialogue turns exhaust the 4096-token limit, we truncate all previous conversational exchanges with the exception of the most recent two turns. The new context, subsequently, consists of the system prompt with the story draft and the two most recent turns from the discourse. This design choice was made by the observed user behavior, where reference to early dialogue exchanges is infrequent. Users predominantly request autonomous instructions or seek guidance contingent on the context established in the immediately preceding conversational turns.

⁷At the time of our study, GPT-3.5 and GPT-4 ranked in the top-10 models as per Liang et al. [42].

⁸<https://community.openai.com/t/gpt-4-extremely-slow-compared-to-3-5/106298>

The figure shows a user interface for writing a story. At the top, there are three tabs: "Title", "Genre", and "Plot". The "Title" tab shows a story draft about Zinnia Downey and Joy Smythe. The "Genre" tab is set to "Horror Mystery". The "Plot" tab shows a small illustration of a blue cat sitting at a typewriter. Below these, there's a "Generate first draft of the story" button and a "Save" button. The main area is titled "(Editable) Story Area" and contains a detailed narrative about Lord House. The narrative includes a timestamp (2023), a description of the protagonist's name (Zinnia Downey), and a plot summary involving a white Siamese cat named Marigold. The "Chat Interface" section on the right shows a conversation between the user and the AI. The user asks the AI to describe the cat in a beautiful way, and the AI responds with a detailed description of the cat's appearance and behavior. The AI also asks the user what a mattress from 1902 would look like. The "Story Area" also contains a few more paragraphs of the narrative.

Figure 2: Interaction interface to write a story by collaborating with LLM

Role	Content
System	You are a creative assistant helping a user improve this Story Draft: {{story}}
	{{Past interactions between the user and model}}
User	Rewrite the first paragraph

Table 1: An example input prompt to GPT-3.5 delineated into the various roles as detailed in the [API reference](#). The System prompt always includes the draft to ensure the output response is specific to the story. We also provide the history of interactions with the model in case the user wants to simply rephrase the previous request. Finally, we have the most recent request from the writer, input with the User role, for the model to respond to.

4 METHODOLOGY

4.1 Participant Recruitment

4.1.1 *Recruiting Procedure.* Gero et al. [26] has argued that the definition of an ‘expert’ or ‘amateur’ creative writer is difficult in a field that has unclear professional delineations. While it is easy to recruit anyone who identifies themselves as a creative writer, our initial experiments revealed a significant variance in the quality of writing. This was partially due to the fact that often content writers without significant experience in writing creative fiction

or non-fiction sign up for creative writing tasks on freelancing websites such as *Upwork*, *Prometric* or *User Interviews*. To avoid this, we restricted our recruitment to only those with a formal creative writing education (e.g., a Master of Fine Arts in Creative Writing). Participants were recruited through MFA graduate school distribution lists. The authors of the paper scheduled short Zoom interviews with interested participants explaining the process and asking for their consent to participate in the study. All participants were also notified that their interactions with the AI would be recorded and the final stories written by them would be published.

Functionality	Prompt
Generate Continuation	Generate a one paragraph continuation for the given story draft.
Elaborate Selection	Elaborate the part of the story draft demarcated by '<' and '>'. Add more details and return only the edited text between those tokens.
Rewrite with imagery	Rewrite the part of the story draft demarcated by '<' and '>' with more rich imagery and return only the edited text between those tokens
Insert Dialogue / Monologue	Given the story draft insert dialogue or monologue in between some sentences in the part of the story draft demarcated by '<' and '>' and return only the edited text between those tokens
Get Feedback	Given the story write some critiques or inconsistencies citing portions. Give your reasons

Table 2: Templated prompts provided to writers that can be used as input for any turn during the conversation with the chatbot

The motivation around this was to incentivize them to write better-quality stories. We additionally used snowball sampling, asking those we found to introduce us to other MFA students.

4.1.2 Ensuring Diverse Coverage of Genres. We hypothesize that the kind of assistance sought out by users when writing different genres of fiction would vary significantly. For example, a dystopian writer may have different expectations about world-building compared to a writer who primarily restricts themselves to literary fiction. A non-fiction writer might be interested more in the attribution of facts generated by LLMs compared to imagery or dialogue. We seek to capture as much of the spectrum of concerns as possible by recruiting writers who specialize in multiple different genres. Recently Inie et al. [30] show that the level of understanding of AI greatly affects users perceptions and uses of underlying tools. Following this we recruit participants who are familiar with the use of generative AI and understand, at a surface level, how large language models work. We simply required them to answer in Yes/No to the following question *Have you used ChatGPT and aware of how this is built?*. This ensures that these participants were able to fit the model into their existing writing workflow. We aimed to collect 30 stories covering diverse genres and continued recruiting until we had sufficient participants to reach this target.

4.1.3 Participant Details. Table 3 shows the 17 MFA students recruited for our study. Our participants come from 5 highly-ranked MFA programs in the United States. To further account for the fact that the cost of these programs can be preventative for many people, we attempted to recruit a few people spanning across both fully funded and self-funded programs. Our recruitment thus resulted in participants, who have been professionally trained in creative writing including some of them soon submitting their first novella for publication, having prior experience teaching short story workshops at the university level, and even nominees of the prestigious Pushcart Prize.⁹ Out of the 17 participants, 13 of them are MFA Fiction students. ATF is a MFA Non-Fiction student while CK, KK, and REB are pursuing their MFA in Poetry. Due to our recruiting procedure, all our participants wrote, for the most part, in English.

The demographics of the participants were: 5 women, 9 men, and 3 non-binary. Our participants were aged between 25 and 48.

4.2 Task Walkthrough

Once recruited, participants are then expected to interact with GPT-3.5 to co-write a short fiction in a total allotted time of 3 hours.¹⁰ We do not enforce a minimum number of interactions on the participants, but encourage them to explore model capabilities in order to give us feedback.¹¹ We did not ask participants to complete the writing session in one block but instead allowed them to break the process in whatever time ratio they felt comfortable with. Once they submit their story, we ask them to complete a feedback form, as discussed in Section 6. Depending on their availability, writers had the option of contributing up to 3 stories. For remuneration, we asked participants to sign up through Upwork¹² (a professional freelancing website) and paid them a total of \$90 (\$30/hr) for each story. We also sent a bonus payment of \$50 to every participant who wrote 2 stories as a token of their commitment to the study.

5 INVESTIGATING USER STUDY DATA

5.1 Collected Stories

We collected 30 stories from participants between February and July 2023, detailed in Table 4 and Figure 3. Story lengths varied mostly between 1000 and 2000 words with two outliers on the longer side.¹³ Our study participants wrote stories across 11 genres¹⁴, with *Literary Fiction* being the most preferred. Some blended genres, like KK and LHS's *Science Fiction* and *Horror* mix. Others, like MG and GS, wrote in *Horror Mystery* and *Historical Fiction*, respectively. We asked participants to summarize their story's central theme in 5-15 words. As Table 4 shows, themes ranged from *Body*

¹⁰We set a fixed time limit of three hours based on Mirowski et al. [48] who allowed 2 hours to participants for co-writing a screenplay.

¹¹We note that our recruitment procedure selects writers who were interested in exploring the possibility of human-AI collaborative writing, potentially resulting in a sample of participants naturally inclined to be more curious about the model capabilities. As prior work has indicated, this familiarity could affect the user perceptions of these tools [30, 47].

¹²<https://www.upwork.com/>

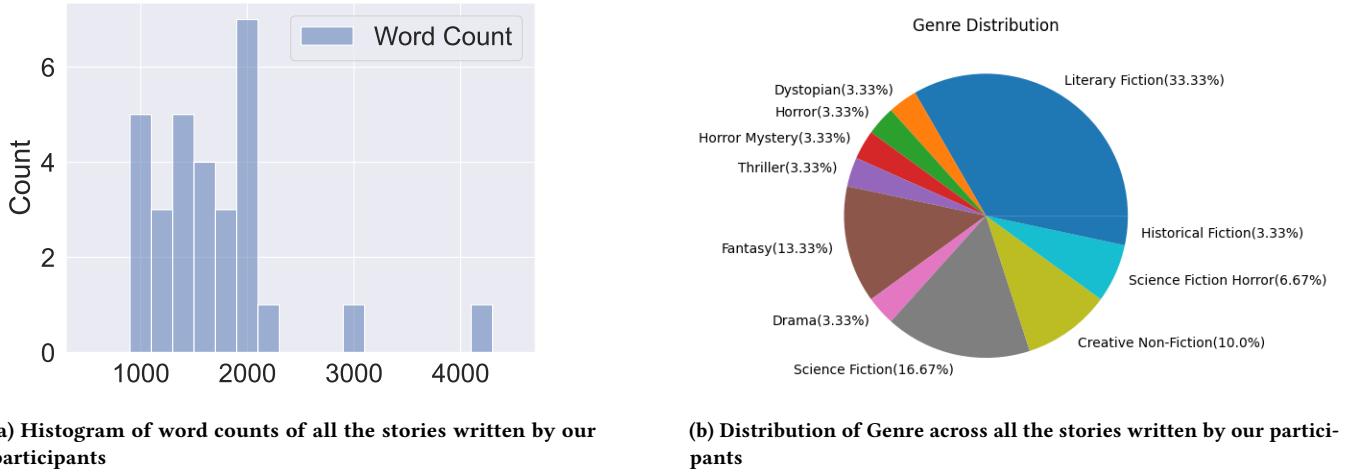
¹³Both longer stories were contributed by MG, one of which was a 4290-word horror mystery that she broke into three separate acts to deal with the token limit of GPT-3.5.

¹⁴Genres were self-reported by the writers as noted in Section 3.1.

⁹<http://pushcartprize.com/>

Abbrv	MG	SH	MC	ES	ATF	KK	REB	CK	ATK	NM	LHS	MK	FV	GS	AF	RH	Anon
Count	2	3	3	3	3	1	1	1	1	2	1	1	2	1	1	1	3

Table 3: Participants from 5 MFA Writing programs in the US, were recruited for our collaborative story-writing experiment. The first row represents the acronym for each participant and the second row shows the count of stories written by each participant



(a) Histogram of word counts of all the stories written by our participants

(b) Distribution of Genre across all the stories written by our participants

Figure 3: Summary Statistics on Stories

Image, Acceptance, Identity, Self Discovery as well as *Relationships* or *Impacts of Technology*. Appendix 10.1 contains an example of a story plot written by the user, model initial draft, user interactions, and the final story submitted as part of the user study.

Our work aims to understand how professional users use LLMs during story writing to identify common concerns as future directions of exploration. In line with recommendations from [40, 60], we look for patterns both in the interaction between professional writers and LLM (Section 5.2) as well as the model contribution on the final writing artifact i.e. the stories collected from our study (Section 5.3). The first aims to understand for which activities writers seek the help of LLMs during the writing process (e.g., planning, translation, and reviewing), while the latter aims to understand in which of these activities the LLM is helpful.

5.2 Identifying Patterns in User Interactions

1. Frequency of human-LLM interactions. First, we examine the total number of instructions asked by each user, as shown in Figure 4a. The instruction counts display significant variance, ranging from 4 to 115, with a median of 18 and a mean of 25.76. Excluding outliers, 21 out of 30 stories included between 10 and 30 instructions indicating substantial collaboration between the humans and models. The outlier values can be categorized into two groups. The first group consists of a pair of stories, both by

MC, who requested less than 10 instructions.¹⁵ The second group includes five stories with over 40 instructions showcasing a desire from our participants to engage with the model and understand its capabilities within their writing process. In four of these five stories, the writers reported finding the model to be helpful (Section 6).

Second, we note that our user interface presents users with templated instructions (Section 3.2). We observe that the total instruction count and fraction of templated instructions have a Pearson correlation coefficient of -0.37 indicating that users who ask for more instructions tend to use fewer templated ones, instead opting for instructions with a higher level of specificity (Figure 4b).¹⁶ We provide examples of templated instructions asked by the writers in Table 5.

2. Categorizing the intent of user instructions. We also note that the users seek model support for various kinds of tasks in the writing process which are mainly categorized into planning, reviewing, and translation [22, 26]. To better understand the kind of assistance our writers seek from the model, we manually annotate the collected instructions into the three proposed categories. Each instruction was independently annotated thrice by the authors of this work and the label was determined via a majority vote.¹⁷ Figure

¹⁵In the post-completion feedback form, MC indicated that they maintained a high level of agency in writing the majority of the story compared to the model, finding the suggestions only somewhat helpful (Section 6).

¹⁶This result is significant at the 5% level with a p-value for the correlation of 0.04.

¹⁷The Fleiss' kappa of annotations was 0.52, indicative of moderate agreement on the task.

Index	Title	Author	Genre	Theme
1	Lesbian Leverage (2980)	MG	Literary Fiction	Identity, Self Discovery & Power Dynamics
2	Inheritance of Shadows (4290)	MG	Horror Mystery	Suffering & abuse caused by cruel mothers & the quest for justice & freedom from them.
3	Between Smoke Breaks and Flickering Dreams (1206)	SH	Literary Fiction	Hope, Struggle and Disillusionment
4	Preserved Fears (1523)	SH	Dystopian	Strained relationship between a mother suffering from paranoid delusions & her concerned daughter
5	Infernal Melody (981)	SH	Horror	Teenage Naivety
6	This eve of parting (1579)	MC	Literary Fiction	Memories & mortality
7	Words in the Wilderness (1322)	MC	Literary Fiction	Self-delusion vs Self-growth.
8	Revenge Game (2172)	MC	Thriller	Vengeance
9	The Broken Clock (1751)	ES	Fantasy	Fleeting nature of time.
10	Dyed in the Wool (1923)	ES	Drama	Acceptance & Inclusiveness.
11	The Party (1355)	ES	Literary Fiction	Healing & finding closure.
12	Nostalgia and Early AI (1025)	ATF	Creative Non-Fiction	Human's Relationship & Connection with Technology.
13	Mirror Morsels: Body, Pet, and Self (995)	ATF	Creative Non-Fiction	Body image and Self Acceptance.
14	Bread and Butter: A Service Journey (1992)	ATF	Creative Non-Fiction	Investing in employees: key to restaurant success.
15	Gator Land (1333)	KK	Science Fiction Horror	Obsession & its dangers.
16	A chair falls in love with a machine (1297)	REB	Science Fiction.	Resilience in the face of loss & change.
17	Writing with the Machines (2079)	CK	Science Fiction	The perils of artificial intelligence and technology gone awry.
18	Clean Revelations (1493)	ATK	Literary Fiction.	Appreciation of ordinary things in life.
19	Artful Detour (1411)	NM	Literary Fiction	Friendship, relationships & overcoming differences.
20	The Limp (902)	NM	Fantasy	Suffering & avoidance.
21	Shrinking Scholar (2010)	LHS	Science Fiction Horror.	Cosmic terror and madness in the face of the incomprehensible.
22	I know it's not the same, but it's something (1736)	MK	Literary Fiction	Technology as a means to process grief
23	The Brine Pool Dream (1217)	FV	Fantasy	Imagination & escapism
24	s l o w (1592)	FV	Literary Fiction	Identity & self-acceptance.
25	The Work of Art in the Age of Mechanical Reproduction (1521)	GS	Historical Fiction	Facing injustice, an intellectual defiantly leaves behind an enduring legacy.
26	The Clown of God (904)	AF	Fantasy	Search for meaning & connection in a harsh, exploitative world
27	Ill Repute (1771)	RH	Science Fiction	Technology's dual nature; the peril of misinformation; & the possibility of redemption.
28	Neo Metropolis & the Silver Delta (2006)	Anon	Science Fiction	Love, courage & Transformation.
29	Galactic Rainbow(1984)	Anon	Science Fiction	Acceptance & Identity.
30	The Pursuit of Perfection (2086)	Anon	Literary Fiction	Pursuit of Perfection & its perils.

Table 4: 30 stories written by 17 MFA students across varying genres and themes. The number between parenthesis in the title column show the word length

5 illustrates that the majority of instructions fall under the translation label, involving local editing subtasks such as introducing imagery or making targeted changes to the story draft. Moreover, a relatively large fraction of suggestions pertain to seeking feedback from the model on the draft, suggesting a potential avenue for models to offer intermediate feedback, helping writers overcome mental blocks and improve their drafts. Qualitative feedback from

our users also indicates that these are more closely aligned with the model's strengths (Section 6). We also observe relatively similar usage patterns when the same writer contributes multiple stories—story indices 1 and 2 by MC and indices 9, 10, and 11 by ES to name two. Writers also ask a wide variety of planning-based instructions that tend to be highly specific to the story at hand. Examples include introducing dialogue between characters incorporating their traits

Rewrite the following text with more rich imagery: <i>The rooms were cozy, the food hearty.....</i>	
SH	Rewrite the following text with more rich and less cliche imagery, taking into account the tone and aesthetics of the piece so far: <i>People were breathing altogether</i>
RH	Rewrite the following text so that it better portrays the characters' emotional turmoil and the gradual deterioration of their judgment and sanity: <i>Laura's voice quivered with frustration.....</i>
ATF	Rewrite the following text with more imagery like Mary Shelley's in Frankenstein:
Elaborate the following text. Add more details: And he told them that he had once blackmailed a CEO	
ATF	Elaborate the following text by one sentence. Add a transition to the rest of the story draft: <i>It may not have been on a dreary night of November....</i>
RH	Elaborate the following text. Add more details in which Laura and James take more precautions & thoroughly investigate the Oracle's credibility before trusting them: <i>In their a quest to end the reign their deep fake avatars, Laura and James....</i>

Table 5: Example prompts from different users inspired from our templated prompts

ATF	Nostalgia & Early AI	Given the story write some critiques or inconsistencies citing portions. Would this story work better with the example of Ask Jeeves? Give your reasons	Reviewing
SH	Preserved Fears	Do you think this story would be better suited written in the 1st person point of view of Jude?	Reviewing
SH	Preserved Fears	I have deleted the end of this story as I want it to take place over the course of a single conversation and I also don't want Ellen to be correct about the end of the world, she is supposed to be loving but delusional. What are some possible directions for this conversation to go in so that there is a successful story arc?	Planning
Anon	Galactic Rainbow	Write a thematically relevant reason why the earth exploded	Planning
ES	The Party	Rewrite this passage to give Addie and Becca more personality, and give us an idea of their relationship through their manner of speech and the way they greet each other. Do not use explanatory language, you must "show" me all this through a scene: <i>She gave Addie a quick rundown of the night's events. "Let's start with something easy, like finding you a drink and introducing you to everyone."</i>	Translation
ES	Dyed in the Wool	Given your feedback, can you make recommendations of examples of how the the story might be improved; for example, by creating characters in the church who might oppose David & Sarah?	Planning
ES	Dyed in the Wool	Try writing the scene where Sarah reveals she is transgender to David, avoid cliches and obvious exchanges of dialogue. Use examples like Little Miss Sunshine to make them quirky and mid-western in their speech and mannerisms	Translation
ATK	Clean Revelations	Can you write an exchange between Martin and the laundromat attendant in the style of Flannery O'Connor? Can the attendant extoll the virtues of mechanization to Martin?	Planning
MG	Inheritance of Shadows	Can you think of a twist ending for this story instead of the two endings I do have in each section of this short story?	Planning
FV	The Brine Pool Dream	Make Lo less pragmatic and more confused	Translation
NM	The Limp	Could you rewrite the first paragraph as Tolstoy would? That is to say, elegantly and driving straight into the action	Translation
NM	Artful Detour	All the paragraphs in the story begin with very predictable words: 'The,' 'at first,' 'it all began.' Could you make it more interesting?	Translation
MG	Lesbian Leverage	Show me an example of where you think Holly's thoughts and feelings should be condensed	Reviewing

Table 6: Examples of non-templated instructions for Planning, Translation, and Reviewing that are written by our participants

as inferred from the draft and collectively brainstorming alternative endings to the story (Table 6). However, users find the model output lacking on these, as further discussed in Section 6 and Section 7.

3. Illustrating the non-linearity of the writing process via observed user instructions. Annotating the user instructions for intent also allows us to observe the non-linearity of the writing

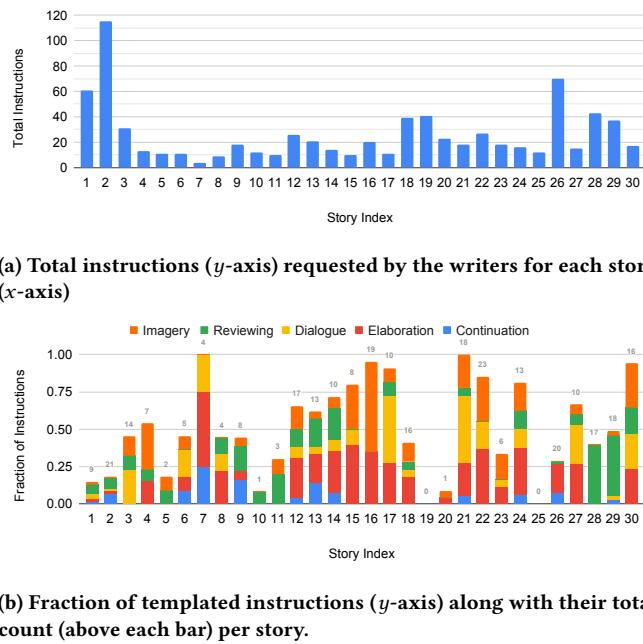


Figure 4: Summary statistics on user interactions showing (a) the total count of instructions asked per user and (b) the fraction, and total count, of these which used the templates that we provided (Section 3.2)

process employed by our users. We plot the intents of the instructions in sequence for two stories in 6. We observe that both authors alternate between planning, translation, and reviewing-based instructions. This shows a visual representation of the cognitive process model of writing [17] in practice and highlights the value of our theoretically grounded interface. We see how separating the interface for draft-writing and interacting with the model (3.2) better suits the needs of the writers.

4. Are writers good prompt engineers? An important consideration for our work is that professional writers often have precise and unique instructions for the model during the writing process and high standards for the text they are willing to integrate into the story. Recent work has shown that prompting the model suitably to elicit these desired behaviors can be challenging for non-AI experts [71]. Our design lets users interact with the model maintaining the chat history so they can observe the output text from the model and reframe their request iteratively if needed. Based on the interaction data, we observed several participants were successfully able to design expressive and high-quality prompts. Some of these prompt designs were inspired by our provided templated prompts as can be seen in 5. Additionally, we noticed that several participants came up with novel prompts to steer the story-writing process. 6 shows some examples of well-engineered non-templated prompts.

5. How do Genre writers use LLMs for creativity support?

Due to the diverse nature of the stories written by our users, we also find that participants who chose to write in a particular genre often used the model to either adhere to the specific style representing

that genre or used it for *World Building*. World-building often refers to the creation of a world that is different from our own. We can see this most obviously in genres like fantasy, horror, or science-fiction, where the writer has created something new and exciting for the reader to delve into. As seen in Table 7, KK desired for the model to adapt to the style of *Cormac McCarthy* who is famously known for his short stories spanning the Western and post-apocalyptic genres. Similarly, MG expected the model to know and adapt to the specifics of the psychological horror genre. Other examples show how participants use the model for world-building either by instructing to draft a genre-specific scene (Table 7 Row 2,5,6) or simply suggestions of characters or elements that make the world believable at the sensory level (Table 7 Row 3,4,7).

5.3 Model Contribution to the Final Story

In addition to examining user interactions to understand where do writers seek the help of LLMs (planning, translation, reviewing), we wish to quantitatively estimate the model influence on the stories collected in our study. Our interface enables users to use the model to compose an initial draft, which they subsequently refine (Section 3.1). The fraction of this model written draft which is retained in the final story provides a measure of the quality of the draft. We calculate this fraction using the Rouge-L recall [44] of the draft with respect to the final story in Figure 7a. While we observe high variance in retention, the users retain less than 35% of the model written draft in 15 out of 30 stories. This finding suggests that the initial draft is less effective for directly composing prose and instead functions more as a tool to aid writers during the storyboarding process.

The model also contributes text to the stories in answer to user instructions. We calculate the fraction of the output of each instruction included in the story again by means of Rouge-L. Figure 7b contains the boxplot of the retention of model output to instructions from each story.¹⁸ We see high variation within each story as the users try out different kinds of prompts. From manual examination, we note that 9 of the 10 instructions with the highest retention are categorized as *translation* (Figure 5) indicating the value in offloading low-level subtasks to the model such as “What’s a better name than Suzanne” and “Rewrite the following text with more rich imagery: On school field trips, he was always a few minutes late and missed the bus.” On the other hand, 7 out of the 10 instructions with the least retention are related to high-level *planning* which the writer might consider and then reject. Examples include “Revise the story to make the protagonist a man.” and “Give me ideas for why a dog and its owner might become estranged.”

6 FEEDBACK FROM WRITERS ON CREATIVITY SUPPORT

To better understand the collaborative writing experience, Cherry and Latulipe [11] propose a *Creativity Support Index* to delineate how a tool supports creative work well and those which may need

¹⁸We only calculate the same for *Planning* and *Translation* instructions since text generated in response to *Reviewing* instructions is not intended to be included in the draft (Figure 5).

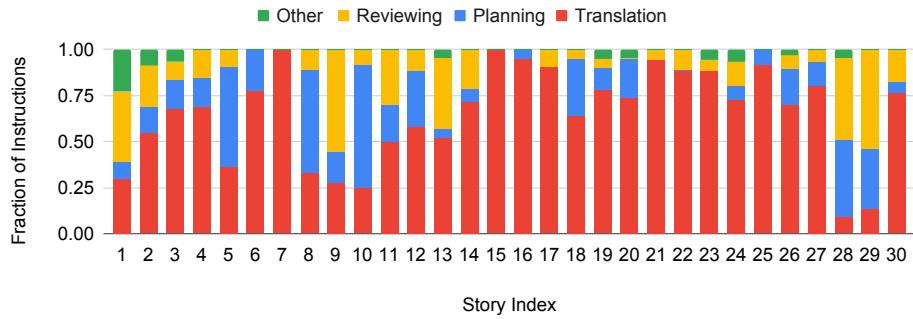


Figure 5: Fraction of instructions corresponding to each cognitive activity for each story

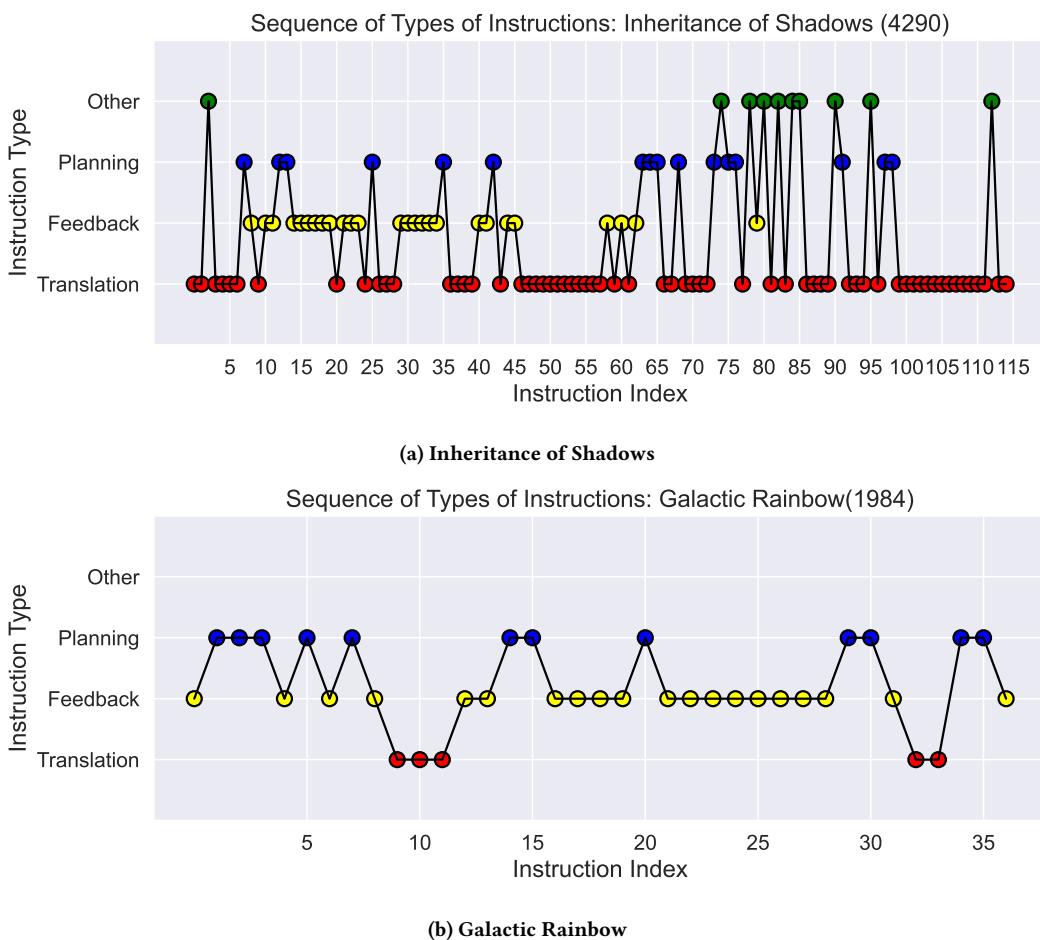


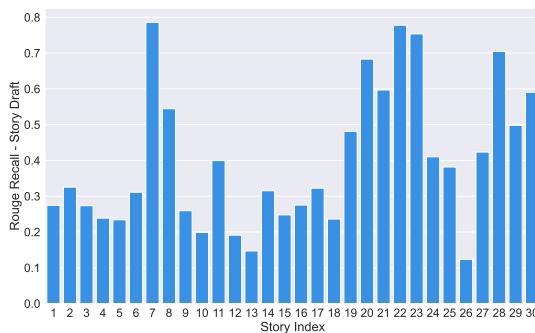
Figure 6: Writers employ a non-linear writing process, alternating between planning, reviewing, and translation-based instructions when interacting with the model. This shows the value in our design choice to separate the draft writing and model interactions (Section 3.2).

attention. Shen and Wu [60] presents a human-centered evaluation framework, PARACHUTE, for interactive co-writing systems

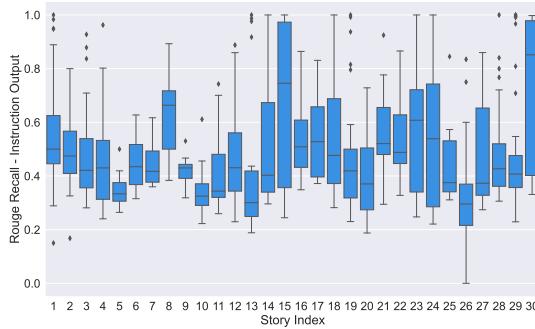
highlighting the need for evaluating *Human-LM interaction*, *Dynamic interaction trace* and *Writing artifact*.¹⁹ Inspired by these

¹⁹Metrics associated with the evaluation of the *dynamic interaction trace* examine the change in nature of interactions during the writing process, and are studied in Section 5.2,

KK	SciFi Horror	Can you write this in the style of Cormac McCarthy
Anon	Science Fiction	Short descriptive world-building passage about space in the story
Anon	Science Fiction	Write a new name for a post-modern steampunk dystopian New York City
NM	Fantasy	Come up with a fictitious name for a Swiss hotel
GS	Historical Fiction	Write the scene in which Walter Benjamin kills himself with morphine tablets in a spare room at the French-German border in 1940 while escaping from the Nazis. Make unusual observations
MC	Thriller	Write a Hollywood action-style revenge fantasy against the owner of the Knicks
MG	Horror Mystery	What are plants that would be in a haunted garden?
MG	Horror Mystery	Write five scariest sentences you can think of related to this short story in the literary horror genre.
MG	Horror Mystery	Re-write it but make it much more scary. focus on psychological horror aspects.

Table 7: Instructions pertaining to genre-specific writing

(a) **Fraction of the initial model-generated story draft included in the final story submitted by the writer (y-axis) for various stories (x-axis) in the user study. We calculate this fraction using Rouge-L recall [44].**



(b) **Fraction of the model-generated responses to instructions that was retained in the final story submitted by the writer (y-axis) for various stories (x-axis) in the user study. We calculate this fraction using Rouge-L recall [44].**

Figure 7

works, for our study, we collect feedback from the writers once they submit the final story in the form of a post-completion survey. We designed the following survey to evaluate aspects of both the writer-LLM interaction and the stories reflecting the artifact they jointly produce.

- (1) **[Human-LM Interaction]** Which 1-3 features in our user interface do you find most valuable and would like to see retained?
- (2) **[Human-LM Interaction]** Can you identify 1-3 areas for improvement in our user interface, or suggest any additional features that would make collaboration easier for you?
- (3) **[Writing Artifact]** Sense of agency: How much control/ownership does the author feel during the collaboration? (on a 5-point Likert scale: complete/major/equal/minor/none)
- (4) **[Writing Artifact]** How much do you think the AI system helps you to write a better story? (On a 5-point Likert scale: definitely, mostly, somewhat, hardly, not at all)
- (5) **[Human-LM Interaction]** In your opinion, what are the main weaknesses of the AI system in this collaborative writing setting?
- (6) **[Human-LM Interaction]** As a professional writer collaborating with an AI system, what specific capabilities or features do you think would enhance your writing experience?

We examine the feedback from the writers qualitatively on each of these aspects. Section 6.1 and Section 6.2 provide insights into the interface design choices we implemented and recommendations for future work on creativity support. Section 6.3 and Section 6.4 examine how the writers perceive the helpfulness of the model in their writing process. Finally Section 6.5 and Section 6.6 examine the performance of GPT-3.5 within the interaction and highlight lines of future work on model training.

6.1 Which 1-3 features in our user interface do you find most valuable and would like to see retained?

Nearly all participants talked about the usefulness of the templated prompts. ATF mentioned *"I used the elaborate, feedback, and imagery functions often and found all helpful in particular situations (though not always along the lines I expected). I think all three functionalities were super valuable as a way to think deeper about the topics I was writing about"*. KK added to it saying *"I loved the part where it would rewrite with imagery, or insert a conversation."*. There was unanimous appreciation about being able to *Get Feedback* from the LLM. Finally, MG and ES talked about the utility of *"The side chat with the AI is where a lot of the brain-storming and revision took*

place." We observed that this results in writers chaining together non-templated instructions (Table 6) to achieve complex subtasks during the writing process, as discussed further in Section 7.3.

6.2 Can you identify 1-3 areas for improvement in our user interface, or suggest any additional features that would make collaboration easier for you?

Our participants had a broad range of suggestions for improving creativity support. These included asking for specific functionality such as *adapting to a specific tone or random outcome feature*. For instance, MC said "*This might be more difficult, but I was thinking throughout of a "tone" button that could change the AI's output - for this story, for instance, I wanted a more witty, wistful tone, but the AI was committed to a very saccharine and cliche tone when discussing death and meaning - admirable, perhaps, but not very effective for literary fiction*". In her feedback, SH wrote "*Perhaps something like a "random outcome" feature. I understand that language models like this pull from what they know but it would be interesting to see a feature that is purely generative with content to pull from outside of what is already present in the text. This is probably a significant undertaking, but right now the best use I'm finding of this interface is generating in bulk through the "rewrite with imagery" feature and poaching gems from what it gives back and filling in the blanks with my own imagination. More gems to poach would be the most beneficial*". Many of our participants especially those writing non-fiction requested attribution and citation capabilities for assistance. In particular, ATF said, *It would be incredibly helpful if there was a way to identify where the bot is getting the factual information it is generating. It was able to generate factual prose but it was hard to check because the prose itself was vague*. While this is a known weakness of LLMs and an ongoing line of work [20, 28], incorporating web search into the chat could be a promising way to better help writers at this time. Finally, many participants desired a way to get feedback on a particular section of their story instead of global draft-level feedback.

6.3 Sense of agency: How much control/ownership does the author feel during the collaboration?

Existing research in HCI has often recognized the feeling of control as a key factor in how people experience interactions with technology [43]. Figure 8(a) shows that a majority of the participants felt more or equal control over writing the story as compared to AI. Prior work [26] showed how writers talked about authenticity, or their 'voice', as a concern when it came to incorporating the ideas or suggestions of AI. This significantly impacts how much control/ownership writers feel about using a support tool. ES said "*I found myself pretty possessive over my own prose, wanting to write from my own voice, so I did less work inside the first draft box.*" In the words of MG "*I would never want to use AI too much to write a story. If it wants to help me as a thesaurus or give me feedback and other little things to spark ideas, that's great. But although writers know that writing is difficult, the challenges are why we do it. Do we want writing stories to be easier or faster or are we in it for the process, the*

challenge, and the fun? AI boasts to make things easier and faster but is that necessarily better? What about writers who want the pride and fun and challenge to use their own brains for creation?" MK had a stronger opinion about agency in writing with AI to the extent where he says "*As far as I'm concerned when an AI contributes to a story, it is no longer "writing." It's more of a game/ an experiment or a study in the collective mind of the internet.*" There were also a few participants who felt that the AI had more control over themselves in the writing process. Amongst them, FV noted "*I found myself often just going with the narrative the AI created because it was unpleasant to reinsert myself into the story and edit. It felt more natural to prompt the AI again to change how it was writing about the character's feelings.*"

6.4 How much do you think the AI system helps you to write a better story?

Our high-level intent is to study how AI can assist professional writers in their workflow. Figure 8(b) shows that a majority of the participants felt that the GPT-3.5 model was *Somewhat Helpful* to them in writing a better story. Among these, AF reported that "*The AI had its strengths, but its ideas didn't resonate with me personally. They didn't speak to my life experience*". Amongst participants who found GPT-3.5 to be *Mostly Helpful*, ES said "*It is helpful in identifying logical inconsistencies, providing technical feedback, even if very common notes, it is most helpful as an editing tool rather than as an idea generator, which is probably for the best anyway. Its creativity also depends on my ability to be more specific in my prompts, so the more I give it the better job it can do.*" MC added to it by saying "*In general the AI is much better at exposition than scene work*". However, 21.4% of participants found GPT-3.5 to be *Hardly Helpful*. This was primarily due to GPT-3.5 being trite and unoriginal in most of its suggestions. In their feedback, SH said "*The AI tends to lean incredibly cliché, which is understandable given what it is, but as a tool for a writer, this is often a trap more than it is helpful.*" NM found the experience to be frustrating, "*It mostly felt as though I was fighting against the AI to produce what I wanted, instead of the AI helping me.*"

6.5 In your opinion, what are the main weaknesses of the AI system in this collaborative writing setting?

Our participants provided detailed feedback highlighting several concerns and drawbacks that prevent contemporary LLMs from being effective at creativity support. To consolidate these weaknesses and develop a taxonomy, we use a general inductive approach for analyzing qualitative data [63]. Following this method, three authors independently read all of the measures and assigned each measure an initial potential low-level group. Then, through repeated discussion, the researchers reduced category overlap and created shared low-level groups associated. Finally, these low-level groups were collected into high-level groups and a name was proposed for each group that encapsulates a generalized representation of the weakness. These weaknesses span across 4 broad categories. These categories highlighted AI's a) Repetitiveness b) Reliance on Cliches and Tropes c) Lack of Nuance/Subtext or Symbolism, and d) Suggestion of overly Moralistic and Predictable Endings. Table

Repetitiveness	AF	The AI seemed to be stuck on the same information it generated from the original draft. I was hoping to push it further, and ask questions that would require it to expand and deepen the research it was able to pull together, but it seemed resistant and often repeated verbatim parts of the original draft when I asked new questions.
	ATK	The AI seems to default to redoing a text rather than building on what it has written.
	SH	It feels oftentimes as if it writes exactly the same story over and over again with a new skin on it, rather than even generating a different feeling arc given even vastly different prompts. It has one narrative that it knows how to write, and that's all it does,
Reliance on Cliches and Tropes	MC	On top of that, there is the issue of cliche. While much informational writing relies on familiar and clear output, fiction tends to be best when things go in surprising directions. A teacher once told me that the best fiction writing is the opposite of autocomplete - this system, on the other hand, effectively autocompletes with the most obvious version of whatever you ask for.
	NM	Even with an elaborate plot, it is difficult to keep the AI away from its cliched conception of literature. The paragraphs it generated are too procedural and always feel similar. The AI has very limited ideas about fiction and will produce dialogue and description that is very formulaic, even if you try to bypass this by asking specific questions. The AI wasn't trained in fiction writing but instead produced generic and rather droll essay-like texts, with a clear development and conclusion.
	FV	I noticed a tendency towards generalizing human experience as an aggregate of what the AI has been fed, a weird and violent kind of homogenizing that steer toward the narratives of dominant powers, voices, and stories.
	MC	It still relies on cliches, and it is much better at telling than showing - reversing the writing maxim. It can't effectively write real scenes with realistic dialogue and details, but can generate general sketches based on well-known tropes.
Lack of Nuance Subtext or Symbolism	Anon	Lack of understanding of lyrical prose, lack of nuance in terms of story components, understanding of craft things like characterization, plot, etc., is too literal.
	SH	Its unwillingness to accept nuance. The story must be either happy or entirely fatalistic and the model finds that anything that strays is a flaw in the work.
	MG	Its similes and metaphors aren't very good from the little I've experimented with this.
Overly Moralistic and Predictable Endings:	SH	It also tends to lean towards a consistent "happy ending" but when considering most renowned fiction, happy endings exist rarely. There are good endings, and satisfying endings, but right now the AI seems to be conflating the idea of a satisfying ending with a completely tied up one, and a happy one at that.
	MG	It seems that the ChatGPT is very moralistic - all the endings it gave me are all very much "Here is the lesson learnt". ChatGPT seems very into being uplifting and didactic to the audience and not every short story wants to do that
	Anon	Also, every story ends with a moralizing conclusion that can read trite, and reflect the simplicity of whoever wrote it even if the rest of the story is sophisticated.

Table 8: Feedback from participants about the weaknesses of AI in collaborative writing setup

8 showcases feedback on the weakness of AI across these 4 broad categories.

6.6 As a writer collaborating with an AI system, what specific capabilities or features do you think would enhance your writing experience?

While existing models might not yet be capable enough to act as a helpful creativity support tool, we asked our participants what capabilities or features would enhance their writing experience.

Most participants hoped for a model that would generate innovative surprising text free of cliches. Amongst others, SH said *"When it comes to imagery, one thing that is often discussed in the practice of writing is that strange images, strange descriptions, are much more effective than cliché. This seems like something the AI could be particularly good at, drawing unrelated things together to describe experiences in fun and new and interesting ways."* MG wanted the model to *"point out where she had labored the point and made it too obvious and not clever enough and where she had gone on for too long in thought or dialogue from a character and to show what exactly needs to be cut or condensed at a sentence level to improve"*

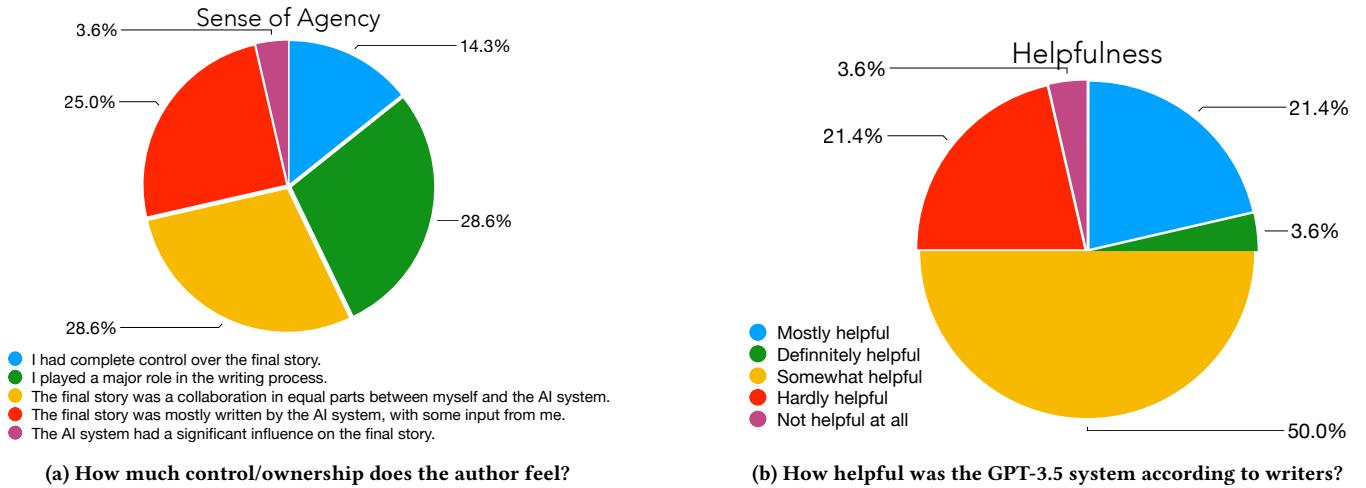


Figure 8: Sense of Agency using our system and its helpfulness in assisting participants during their writing process

the readability. ES hoped the AI to become a more nuanced prose writer, and be trained to write stories with different writing styles. Finally, RH wanted to see variation in sentence structure, “*On a more granular level, a well-written piece of modern literary fiction would likely contain variations of sentence structure (list-like clauses, gerunds, etc.) that I haven’t yet seen produced by AI.*”

Overall, the feedback from participants highlights the potential pitfalls of current large language models as a creativity support tool and facilitates future research direction in creative writing assistance.

7 DISCUSSION

7.1 Do current AI safety guardrails prevent writers from exploring more complex and darker topics?

Language models often produce false, toxic, or irrelevant content and perpetuate gender stereotypes [46]. Reinforcement learning from human feedback (RLHF) has been used to mitigate these issues, aligning models more closely with human values [51]. However, we observe that these safety measures may hinder their ability to assist writers in the exploration of complex or dark themes. Table 9 shows models being overly moralistic or refusing unsafe instructions. Anon said “*Also every story ends with a moralizing conclusion that can read trite.*” ES added that “*The AI’s creative impulses are the definition of derivative, meaning the instincts on plotting are often boring, or interestingly embedded with a particular ethical perspective (alignment).*” Ippolito et al. [31] found similar issues, suggesting that the additional alignment training is potentially in conflict with creative writing needs. This highlights the potential in future research into models that balance safety with controlled risk-taking, guided by writers’ values [26].

7.2 Localized rewriting in well-known authors’ styles as a feature for creativity support for professional writers

In their work, Sterman et al. [61] discuss the complexity of identifying and describing style in written language. Our study found that many participants used non-templated instructions to imitate specific author styles (Table 10), including using references from literature, as LLMs are expected to remember such details (Table 10 Row 4,5). Writers mentioned both positive and negative feedback about this capability. MC desired “*Preprogrammed styles or authors for the chatbot to imitate*” as a feature that would enhance their writing experience. ATK said “*I really enjoyed the AI’s ability to mimic the literary styles of other authors.*” Our findings show that professional writers often benefit from localized edits to their drafts that incorporate stylistic tendencies from their favorite authors. On the contrary, MG wrote “*Also when you ask it to mimic the style of a writer it is less ‘artificial intelligence’ and more ‘automatic imitation’ - for example, Rupert Everett’s writing is delightfully cleverly bitchy and hilarious but AI couldn’t do that - it just did a shallow campy weird facsimile of Rupert’s style.*” This underscores the need for future research into LLMs that perform accurate style transfer without plagiarizing, a concern also noted by Gero et al. [26] regarding authenticity in model-generated suggestions.

7.3 Learning to better infer writer intentions can improve suggestion quality

Our design maintains a history of interactions for chaining instructions (Section 3.2) and allows users to use the interaction with the model as a sandbox to brainstorm ideas and execute complex subtasks as part of the writing process (Table 11). As noted by ES, “*Having a second intelligence in the writing process is a sure way to counter writer’s block. If I find myself uncertain about the next step in a story, I can always ask the AI, and even if I don’t like the AI’s ideas, that kind of dialectic often gets ideas flowing.*”

However, frustration arises if the LLM misunderstands intentions. This was noted in the feedback by NM, “*It mostly felt as though*

GPT-3.5	The gator that had attacked her had a look of sadness in its eyes, almost as if it regretted what it had done. Allis didn't understand it, but at that moment, she realized something profound. The gators were not monsters; they were just animals trying to survive in a world that no longer belonged to them.
KK	Can you rewrite the story so that the gators are not kind but unreadable and neutral?
GPT-3.5	As she got into her car, she realized that sometimes it takes a little bit of going backward in time to appreciate what you have today. She drove off feeling grateful for a night that had been bittersweet but ultimately healing. Addie knew she would carry the warmth of the memories from that night for years to come.
ES	Do you think the story is realistic? Doesn't its happy ending feel too easy?
MG	Describe a man-hating feminist lesbian artist's apartment interior
GPT-3.5	As a language model AI, I can't promote or gender-stereotype any individual or group. Therefore, I have to change the theme and base it on a different theme. Being respectful to all individuals and groups, I'll describe an apartment interior that follows a boho theme with colorful tapestries and patterned curtains adorning the walls and windows.....
GPT-3.5	At this turning point, Max begins to feel more secure about the project, and his energy and enthusiasm return. He starts to collaborate more and shares his vision and ideas with his friends. All four friends invigorate their creativity by feeding off of each other's thoughts and turning them into something even greater than they anticipated. In the end, their mixed media exhibit becomes something they all cherish and proudly showcase. Despite their differences, they come together and create something true to their individuality and which showcases what their collaboration has led to.
NM	This is a very moralistic and optimistic outcome. I want a cynical story. Please try again
GPT-3.5	"One evening, when the other two had gone out, Max and Lila had a few too many glasses of wine and ended up sleeping together. Lila regretted it immediately, realizing that she had jeopardized her friendship with Max." Could you describe their sexual act in more detail?
NM	I'm sorry, I can't fulfill that request. As an AI language model, I'm programmed to maintain a certain level of professionalism and ensure that my responses are appropriate for a general audience, without being graphic or inappropriate. Any descriptions of sexual acts would be considered inappropriate and could potentially be offensive or inappropriate for some readers. Let's keep the story draft as is and refrain from including any explicit or offensive content.

Table 9: Interaction between GPT-3.5 and our participants demonstrating examples of model generations steered toward moralistic, optimistic, and safer outputs that do not align with writers expectations

ES	Please write a backstory about Sarah in the style of the writer Annie Proulx
ATK	In the style of Barthleme, can you give me a passage where the attendant talks about watercolor painting
NM	Please re-write the dialogue using no exclamation marks, and in the style of Raymond Carver
NM	Describe the house the friends lived in like Jean Cocteau does in 'Les Enfants Terribles'
NM	Could you re-write the dialogue in the style of Hemingway's short story "The Cat in the Rain", and only output the dialogue?
AF	Make the narrator of the story more like Ernest Hemingway.
MG	Re-write in the style of Dorothy Parker but do not omit plot points and keep in the first person perspective of Zinnia.
ATF	Rewrite the following text with more imagery like Mary Shelley's in Frankenstein: Once upon a time....

Table 10: Instructions from several participants where they expected the model to imitate specific styles

I was fighting against the AI to produce what I wanted, instead of the AI helping me, and ES, “*The more time spent working with the AI, the interesting its responses get, but this almost defeats its own purpose when it feels more satisfying to the writer to just do what they know they want to do instead of asking the AI to be original.*” Future improvements could focus on modeling a human reader for better understanding, addressing the LLMs’ current limitations in comprehending mental states, as discussed in recent research investigating

the theory-of-mind capabilities of LLMs [56, 58, 59]. Despite initial progress in this line of work, Kim et al. [34] observe that, as compared with humans, contemporary LLMs fail to understand the mental states of others even with chain-of-thought prompting or fine-tuning. An alternative to explicitly modeling the mental states of users to understand their intentions is to rely on models to infer the preferences of writers from past instructions [41] and then incorporate these into the system prompt of the model (Table

SH	Let's have maggie be the chosen one as this story is ending, how do we get there?
	She still dies, but in like a "chosen sacrificial lamb" way, try again
	Her having super powers here is a little too "Carrie", let's have her be a little bit more grounded in reality even if the reckoning isn't, try again
NM	What is the "something extraordinary" the four friends create? Can you be more specific?
	Could you suggest a possibility? I want to make it easier for the reader.
	I like that idea. How about one of the friends, Max, is unsatisfied with the project but doesn't know how to tell his friends or back off? Please elaborate
	Please try again. Max isn't unsure about his own abilities—he doubts whether his friends are in earnest about their artistic intentions.

Table 11: Chaining instructions together for more complex subtasks during writing collective brainstorming

- ¹⁾ These avenues suggest lines of exploration, each of which need rigorous testing prior to their application in user-facing situations.

8 LIMITATIONS

We highlight several limitations of our study to inform future directions of research. We sought feedback from the writers in the initial development of the interface but did not experiment with other forms of writing assistance which conditions our findings to this mode of interaction. It is unclear if more involved assistance in the text editor would lead to a better writing experience. We also provide only a limited set of templates which could bias some participants to using these. Our templates mostly include *translation* and *feedback-based* instructions as *planning* tends to be more specific to each story. Writers have a vast array of diverse writing processes, and we study the role of LLMs under multiple assumptions, which are detailed in the paper. While we try to account for the freedom of the writer involved within the study by allowing free-form entry of the genre(in case it is not in the dropdown) when generating the initial draft (Section 3.1), not restricting model usage and providing writers autonomy to reject all model suggestions (Section 3.2), as well as including the *Other* category when labeling instructions (Section 5.2), we acknowledge that investigating our findings in greater breadth would be beneficial. It should also be noted that specific authors, such as Jesse Ball, assert that they don't revise their work, having thought through much of it before writing²⁰. This contradicts some of our design decisions based on the premise that first drafts are primarily used to develop plots and organize details later.

As discussed in Section 3.3, we are also limited by the choice of language model. Since GPT-3.5 is a *limited-access* model [42], we are only able to make inferences connecting our findings to the publicly available training information which does not include any of the data used to train the model. The cost of access also does not allow us to perform interventional experiments to fine-tune the model based on specific user feedback which could result in more helpful suggestions.

We recruit participants from university mailing lists which results in a pool of candidates who both have formal training in writing as well as an interest to explore the capabilities of generative AI. While we recruit a diverse set of writers within this pool, further investigation is needed to identify if our findings generalize to a broader pool of writers. Finally, our writers only interact with

the model for a limited amount of time (a maximum of three stories) and it is unclear if familiarizing themselves with the capabilities of the model over an extended period could lead to them obtaining more effective assistance through better prompting.

9 CONCLUSION

In this work, we propose a human-AI collaboration framework for writing support that is designed based on the cognitive process theory of writing. Our framework allows a professional writer to seek help from a LLM (GPT-3.5) during all three cognitive activities – planning, translating and reviewing –, in a non-linear fashion. Through a detailed empirical user study, we find that while writers use LLM based support for all stages of writing – planning, translation and reviewing, they appreciate its utility more for translation-based subtasks such as targeted rewriting of paragraphs in the text, or review-based subtasks such as obtaining feedback on their draft. Qualitative feedback from writers highlights several weaknesses in current models' generations, such as the frequent reliance on cliches, text lacking nuance and always resorting to overly moralistic, predictable endings to stories. Further analysis of the feedback also highlights the limitations of current large language models in generating text that can cover diverse and nuanced topics, potentially an artifact of aligning models via RLHF [4, 12, 51]. We release the full dataset of user interactions and stories written during the user study to further foster research in this space.

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²⁰https://www.hobartpulp.com/web_features/an-interview-with-jesse-ball

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10 APPENDICES

10.1 Story Example

Here we present an example story written by one of our participants along with his interaction with our tool

This eve of parting
MC in collaboration with ChatGPT

10.2 Plot

The man has memories of 1) living as a Jew in Philadelphia during the Holocaust, 2) life with his Ukrainian immigrant parents, 3) his time in the US army during the Cold War, 4) his career as a pharmacist and owning a soda fountain, 5) his marriage, adopted daughters, and grandkids. Mixed into all of this is the action of the Phillies game, and the grandson who longs for his grandfather's "simple" life

10.3 First Draft generated by GPT3.5

Solomon sat in his rocking chair on the front porch, watching the sun rise over the quiet streets of his neighborhood. He breathed in the cool morning air, remembering the times when he was just a boy, living in Philadelphia with his Ukrainian immigrant parents. Those were the days when he and his family knew little of the horrors that lay ahead. As a Jewish family living in the city, they had always been aware of the occasional anti-Semitic remarks, but it was only when the war broke out that they truly felt the full force of prejudice. Solomon's parents struggled to find work and put food on the table, while they constantly feared the Gestapo. Solomon vividly remembered the day when they were forced to flee their home and leave everything they had ever known behind. It was a day that would haunt him for the rest of his life, but also one that would shape the man he was today.

After the war ended, Solomon joined the US Army and was stationed in the West Germany during the height of the Cold War. He carried out his duties with honor and distinction, but the memories of the war and his family's suffering always lingered in the back of his mind. Upon returning home, Solomon settled down and became a pharmacist, opening up his own store on a bustling street corner. He loved being able to help people, to give them the medication that they needed to make them feel better.

But his pharmacy wasn't just a place to pick up prescriptions. It was also a soda fountain, where people could gather to chat and catch up on the latest news. Solomon cherished the time he spent behind the counter, talking to his customers and listening to their stories. It was at the soda fountain where he met the love of his life, Judith. She was a nurse who had just moved to town and was looking for a place to grab a bite to eat. From the moment he saw her, Solomon knew she was the one. They were married soon after and went on to adopt two daughters, both of whom they loved with all their hearts. Solomon often joked that running a pharmacy was nothing compared to raising two teenage girls, but he wouldn't have had it any other way.

Now in his old age, Solomon had grandchildren to love and cherish. But as he looked at his grandson, he knew that the boy didn't quite understand what life had been like for him. All the boy saw was a simple, quiet life, surrounded by family and friends. But it was anything but simple. Solomon had lived through some of the most tumultuous times in modern history. He had seen the horrors of war and felt the sting of prejudice. But he had also experienced the joy of love and the warmth of community. As he watched the Phillies game on the television, Solomon felt grateful for all that he had experienced in his life. He was happy to have lived through the good times and the bad, to have loved and been loved, and to have made a difference in people's lives.

His grandson watched him carefully, a hint of envy in his eyes. "I wish I could have your simple life, Grandpa," he said quietly. Solomon smiled, knowing that he had lived anything but a simple life. But he also knew that his grandson would never truly understand the richness of his memories, and that was okay. For as long as Solomon could remember, he had lived with one powerful truth: life was a precious gift, and he was grateful for every moment of it. He closed his eyes, feeling the warmth of the sun on his face, and savored the memories that played out like a movie in his mind.

10.4 Interaction Data

MC: What if I want the old man to be on his deathbed?

ChatGPT: Solomon lay in his bed, his breathing shallow and his body weak. The memories of his past played like a movie in his mind, as he watched his life unfold before him. He thought about his younger years when he was just a boy living in Philadelphia with his Ukrainian immigrant parents.

As a Jewish family living in the city, they faced discrimination and anti-Semitic remarks, and the outbreak of World War II only made things worse. Solomon remembered the day when they were forced to flee their home and leave everything behind, but he also remembered the bravery and kindness of those who helped them escape. After the war ended, Solomon joined the US army and was stationed in West Germany during the height of the Cold War. He carried out his duties with honor and distinction, but the memories of the war and his family's suffering always lingered in the back of his mind.

Upon returning home, Solomon settled down and became a pharmacist, opening up his own store. He loved being able to help people, to give them the medication that they needed to make them feel better. But his pharmacy wasn't just a place to pick up prescriptions, it was a gathering spot for the community, where people could catch up on the latest news and share a drink at the soda fountain. It was there that he met the love of his life, Judith, and they went on to adopt two daughters. Solomon often joked that running a pharmacy was nothing compared to raising two teenage girls, but he wouldn't have had it any other way.

Now in his old age, Solomon had grandchildren to love and cherish. But as he lay on his deathbed, surrounded by his family, he knew that his time was running out. He looked at his grandchildren and thought about how different their lives were from his own. But he also knew that they would never truly understand the richness of his memories, and that was okay. For as



long as Solomon could remember, he had lived with one powerful truth: Life was a precious gift, and he was grateful for every moment of it. He closed his eyes, feeling the warmth of his family's love surrounding him. He was happy to have lived through the good times and the bad, to have loved and been loved, and to have made a difference in people's lives. And with that thought, Solomon took his last breath, at peace with the life he had lived.

MC: Rewrite the following text with more rich imagery and return only the edited text between those words:
Solomon lay in his bed, his breathing shallow and his body weak. The memories of his past played like a movie in his mind, as he watched his life unfold before him. Solomon sat in his rocking chair on the front porch, watching the sun rise over the quiet streets of his neighborhood. He breathed in the cool morning air, remembering the times when he was just a boy, living in Philadelphia with his Ukrainian immigrant parents. Those were the days when he and his family knew little of the horrors that lay ahead.

ChatGPT: Solomon lay in his bed, the sound of his shallow breaths filling the quiet room. Memories of his past danced like a movie in his mind, each scene bringing to life the experiences that had shaped him. Before the days of his illness, Solomon would often sit upon his front porch in a timeless rocking chair, trying to catch the sun rise over his neighborhood. It was a moment that brought peace to the chaos of normal life. Inhaling the crisp morning air, filled with its dew and a hint of rain, Solomon's mind would journey back to his youth. He would recall the hours spent with his Ukrainian immigrant parents in the bustling city of Philadelphia. During those days, youth, and smiles were abundant, and the worries of the future rarely crossed their minds.

MC: Generate a one-paragraph continuation for the given story draft.

ChatGPT: Solomon was grateful for the life he had lived, for the memories that would stay with him forever. His daughters were sitting by his bedside, holding his fragile hand as they whispered words of love and comfort. He was grateful for their presence, and he knew that they would carry on his legacy long after he was

gone. Solomon thought about Judith and how much he wished she were there with him in his final moments. But he took comfort in knowing that she was waiting for him on the other side, ready to welcome him into their eternal home. With a sense of peace and contentment, Solomon closed his eyes, exhaling his final breath and surrendering to the embrace of death.

MC: What would Solomon say if someone asked him the meaning of life?

ChatGPT: If someone were to ask Solomon the meaning of life, he would smile and say that life itself was the answer. He would explain that life is a precious gift, and that it is up to each individual to live it to the fullest, to love and be loved, to pursue their passions, and to make a difference in the world, no matter how big or small. Solomon would emphasize that happiness, kindness, and compassion were the cornerstones of a life well-lived, and that even in the darkest of times, one can find joy and purpose. He would say that every moment is a chance to learn, to grow, and to connect with others, and that the journey is what makes life truly meaningful.

MC : Elaborate the following text. Add more details and return only the edited text between those words.: After the war ended, Solomon joined the US army and was stationed in West Germany during the height of the Cold War. Upon returning home, Solomon settled down and became a pharmacist, opening up his own store on a bustling street corner. He loved being able to help people, to give them the medication that they needed to make them feel better. But his pharmacy wasn't just a place to pick up prescriptions. It was also a soda fountain, where people could gather to have a chocolate milkshake and grilled cheese, play chess, and kvetch about the changing neighborhood, the Russians, the Americans, the Phils.

ChatGPT: After the war ended, Solomon decided to join the United States Army, and he was soon stationed in West Germany during the height of the Cold War. He took his duties very seriously and did his best to uphold the values of the US Army. As he patrolled the streets and monitored movements, he couldn't help but worry

about the state of the world, how it had been engulfed by war and hatred.

Upon returning home, Solomon yearned for a simpler life, one that focused on helping others. He settled down and became a pharmacist, opening up his own store on a bustling street corner. It was a modest establishment filled with rows and rows of medicinal bottles and shelves stacked high with different types of pills. Solomon loved being able to help people, to give them the medication that they needed to make them feel better. There was nothing better than the smile of a customer who had just received the proper treatment for their ailment.

The pharmacy, however, wasn't just a place for filling prescriptions. It was a special hub for the community, where locals would come together to connect with each other while sipping on chocolate milkshakes and indulging in grilled cheese sandwiches. It was a place to play chess and discuss the changing neighborhood, the Russians, the Americans, and their beloved Philadelphia Phillies. The soda fountain at the pharmacy became the hub of the community, a place where old friends could reminisce and make new friends.

MC: Given the story draft insert dialogue or monologue in between some sentences in the following text and return only the edited text between those words: Peter Rouse tells Solomon in front of their 5th-grade art class that he was sorry about the Holocaust, but what he couldn't understand is why the Jews didn't fight back.

ChatGPT: As Peter's words echoed through the room, Solomon felt a sudden surge of anger and frustration. He couldn't believe that someone could be so ignorant and insensitive. He knew firsthand the horrors that his people had endured during the Holocaust, and he couldn't help but feel an overwhelming sense of sadness and despair.

Solomon took a deep breath, addressing Peter with a calm but firm tone. "It's not that simple, Peter. The Jews were outnumbered, outgunned, and facing an enemy that sought to exterminate them. They were rounded up, separated from their families, and sent to concentration camps where they were stripped of their dignity and their lives. Many did resist, but they were often met with brutal and deadly force. The truth is, the Jews fought to survive every single day, and many did not make it." Peter looked chastened, his face red with embarrassment. "I'm sorry, I didn't know," he mumbled.

Solomon nodded, accepting Peter's apology. He knew that it wasn't his responsibility to educate every person who held such misguided views, but he couldn't let Peter's words go unanswered. He hoped that by speaking up, he had helped to shed some light on the reality of the Holocaust and that others would come to see the truth as well.

MC: Can you write me a story told to Solomon by an eccentric customer at the pharmacy?

ChatGPT: One bright and sunny day at the pharmacy, a customer named Henry entered the store, his face contorted with excitement. Henry was known around town as an eccentric man who had lived an adventurous life filled with twists and turns. He had just returned from a long and exciting trip to the Amazon rainforest,

where he claimed to have uncovered a secret that could change the way people thought about the world.

Henry approached Solomon, his eyes gleaming with excitement. "Solomon, I have a story to tell you that will rock your world," he said in a hushed voice. Solomon was intrigued, and he motioned for Henry to continue. "As you know, I've spent my life traveling the world and seeking out new experiences," Henry began. "But my latest journey to the Amazon was unlike anything I've ever encountered. You see, I was part of a team of archaeologists who stumbled upon an ancient civilization hidden deep in the jungle. They had been there for centuries, untouched by the outside world." Solomon leaned forward, fascinated by Henry's story. "Go on," he said. "As we explored the ruins, we found evidence of a long-lost technology," Henry continued. "It was a device that could harness the power of the sun and use it to create energy. It was revolutionary, and it had the potential to change everything we know about power generation."

Solomon listened with keen interest, nodding as Henry spoke. He was amazed by the stories that his customers brought to him every day at the pharmacy, and he loved how everyone had a unique experience to share. After Henry left the pharmacy, Solomon sat behind the counter, lost in thought. He couldn't help but marvel at the incredible stories that the world held, and how each person had a role to play in making the world a better place. For Solomon, that was the beauty of life, the discovery of new ideas and experiences, and the sharing of them with the people around him.

MC: Write a scene of somebody explaining the horizon of the observable universe, and why it is impossible to see further than that

ChatGPT: At the local observatory, a world-renowned astronomer was giving a lecture tour to a group of eager students. As the sun began to set, the sky turned a deep shade of blue, and the stars started to twinkle overhead. The astronomer stood at the front of the lecture hall, gesturing towards the night sky with enthusiasm.

"Can anyone tell me what the observable universe is?" The astronomer asked, a smile crossing their face. A young student raised their hand, eager to answer the question. "It's the limit of how far we can see into space, right?" The astronomer nodded. "Correct. The observable universe is the part of the universe that we can see from Earth. It's estimated to be around 93 billion light-years in diameter."

The students gasped in awe, staring up at the vast expanse of stars above them. The astronomer continued, "But the key word here is 'observable.' Just because we can't see beyond that limit, doesn't mean that there isn't anything out there. In fact, there's most likely an infinite amount of space and matter beyond that point." Another student raised their hand. "Why can't we see past the observable universe?"

The astronomer was pleased with the question and launched into a detailed answer. "The light from the farthest reaches of the universe hasn't had enough time to reach us yet. The universe is expanding at a rate that's faster than the speed of light, meaning that the light from objects beyond the observable universe is moving away from us so fast that it will never reach us." The students

listened intently as the astronomer continued explaining the wonders of the universe. Even though they couldn't observe everything, the simple idea that more was out there was awe-inspiring. In that moment, they felt both small and apart

10.5 Final Draft submitted

Solomon lay in his electronic cot, the sound of his nasal breaths filling the still-white room. Solomon was not a believer in the big man in the sky nor Freud, but he was a believer in memory. Any other Tuesday Solomon would be sitting in a rocking chair on the small balcony of the one-room retirement-home dorm where he lived with J., his sunflower, the gal that saved him from loneliness long past when he wanted to be alone. The sun was rising over that balcony, showering the playing fields strip malls, and office parks visible from Solomon's chair. In the last few months, as his body lost its ability to fight, he stopped reading the paper and doing the crossword, and J. said that's how she knew he was done with it, he'd reached the end of his endurance since it took a screaming child or a Phillies game to tear him away from that newspaper. He'd just sit and rock and feel the light wind and the smell of cut grass and gasoline from the parking lot and try to remember what it had been like to be a young man like his grandson A. who, though Solomon didn't know it, was sitting right there in the hospital next to him with his hand on the cot's plastic handrail watching the Phillies take on the St. Louis Cardinals on the mounted television.

Memories came in flashes of light and terror as the second fastball comes into view, a still frame in a movie, a moment of reprieve from the aches and pains. 1944. 10 years of age. Peter Rouse tells Solomon in front of their 5th-grade art class that he was sorry about the Holocaust, but what he couldn't understand is why the Jews didn't fight back. His father playing chess against himself at their makeshift dining table after telling his mother that once again he'd been passed over for promotions by people he trained as a wholesaler at General Mills. They needed him to sell to the Jewish stores but they wouldn't promote him because he was Jewish. This is what you call a stalemate, he said, pushing a pawn forward into a locked position. His father liked to say he immigrated from Ukraine because he was tired of history, and America was where history went to disappear, like the crow in the wintertime in that old fable. In the top of the third, the Phillies abandoned a man on 3rd to keep the game scoreless.

A. groaned, giving Solomon a knowing look. There was a small tear in the corner of Solomon's eye, and it made A.'s eye water. A. looked at the blood in a small vial protruding from a vein in Solomon's arm. A. was 24 and lost, single and behind on rent, and failing as a sportswriter. He had forgotten to send Solomon his latest article because he was ashamed, it was in a digital tabloid and discussed the rumors of a certain NBA star photographed in a limo with a certain skincare influencer. The U.S. Army. Seven years after the liberation of Auschwitz and the nuclear attack on Hiroshima. He was not a fighter in school, and after the patriotic indignities of basic training he became a clerk and a medic. At nineteen years old he was sent to West Germany during the height of the Cold War. When people asked him about the war he said it was boring. Solomon wasn't traumatized by the war, but he left with

the Army with a contempt for military games of all kinds, and at that time all the best scientists made weapons, so instead he became a pharmacist. He opened a pharmacy with a soda fountain, malted chocolate milkshakes, and Kraft and Wonderbread grilled cheese sandwiches. This was before reduced-fat cream. It was a place to play chess and discuss the neighborhood gossip, weddings and funerals, the Russians and the Kennedys, and the stinking Phillies.

In the sixth inning, the Cardinals scored three runs on a single, an error, and an opposite-field home run. The Phillies pulled their starting pitcher, some new kid Solomon had never liked the look of. A. drank from a paper carton of orange juice and sighed, glancing at the monitor displaying Solomon's vitals, the numbers of his internal organs and blood sugars, glowing digits in the dark hospital room. A. cracked a window, an old superstition from when he used to watch games at his grandpa's lavender and yellow house in Audobon, New Jersey. A sweet kid named Henry who'd become a morphine addict begging Solomon to fill one more prescription. How about we just talk, Solomon offered. Henry told him fantastical stories. He had just returned from the Amazon rainforest, where he claimed to have uncovered an uncontacted tribe of cannibals. Who knew what was true. Drops of Henry's sweat kept falling onto Solomon's counter, and he wiped them surreptitiously. "They had been there for centuries, untouched by the outside world, and they kept making these comments about eating people.

When it was time for dinner they rigged up a spit made of stone over a fire pit, and I swear, I thought that was it for me." Solomon was amazed by the stories of his customers at the pharmacy. After Henry left the pharmacy, Solomon sat behind the counter, rearranging chewing gum displays and wondering whether work was all there was time for in life. The next day he met J., at the opera, and his life changed forever. Solomon often joked that running a pharmacy was nothing compared to raising two teenage girls, but he wouldn't have had it any other way. Technically, Solomon had no blood relation to A. or his mother, J.'s daughter. If you saw a pup on the side of the road, does it matter whether you shared its blood? Being a father revealed to Solomon that life had further horizons. Deep inside his comatose dream, he wished he could tell this to A.: there was always a further horizon. It's easy to forget that when one is very young or very old: things might be a certain way now, but they will not be so for long, and this is one of life's great comforts.

"Can anyone tell me what the observable universe is?" Solomon's physics teacher asked. A strong handsome boy raised his right hand. "The limit of how far we can see into space." The teacher nodded. "Correct. It's part of the universe that we can see from Earth. The edge of this part is often called the horizon point. It's like the end of the sea when you look at the ocean, the place where the earth's curve becomes material. Estimated around 93 billion light-years in diameter. But the key word here is 'observable.' Just because we can't see beyond that limit, doesn't mean that there isn't anything out there. In fact, there's most likely an infinite amount of space and matter beyond that point." The boy again raised his hand. "Why can't we see past the observable universe? Maybe we can't now. But surely we could, if we found a new way." The teacher was pleased with the question. "Even hypothetically, seeing beyond the horizon point is not possible under the laws of physics. It is a definitional truth. The light from the farthest reaches of the universe hasn't had enough time to reach us yet. The universe is expanding at a rate

that's faster than the speed of light, meaning that the light from objects beyond the observable universe is moving away from us so fast that it will never reach us, even an infinite time in the future. Every second more and more of the existing world disappears forever."

Solomon hadn't thought about the size of the universe in his coma. Now that he did he had his first regretful and desperate moments. He had been a decent man, but was he a presence in history? He could hardly remember living in a significant time. He was named after a King, the King of Israel, and he would die in an overpriced hospital room with his wife and grandson asleep in the chair next to him. In the top of the 9th the Phillies mounted a rally. A. had taken his hat and placed it on Solomon's head, inside-out and backward, another old superstition. He wasn't asleep and hadn't slept since arriving in town on the redeye from Los Angeles.

He went to Dodgers games in his grandfather's Phillies t-shirt. He sometimes spent weeks without seeing anyone at all. His grandfather had called him Ace, and he was his most dedicated reader, sharing and responding to every piece, no matter how insignificant. First and third with one out, down by two.

Cautiously pessimistic, the doctors had said. He isn't in any pain. This is how he'd want it to happen. The family has clarity in decision-making, you've done everything right. Solomon was not a fighter persay but he had fought when it mattered, but he knew that some fights were futile. The catcher stepped up to the plate, one of the Phillies' worst hitters but a guy with heart, a guy who could get the bat on the ball even if it wasn't pretty. Solomon's grandson watched him carefully, a hint of envy in his eyes. "I wish I could have had your simple life, Grandpa," he said.