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Declarative narrative: New interfaces for AI-supported writing

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Abstract: Generative artificial intelligence (GAI) is disrupting the cultural practice of writing while supporting the emergence of new writing practices. However, emergent writing practices, and the identities and relationships they support, are dependent on the affordances of commercial GAI infrastructure, leading to a concentration of power over how we read and write. In support of critical literacy pedagogy, we present three new interfaces for GAI-supported writing we have embedded into an existing web application for interactive storytelling. We report on how these interfaces were taken up in a ten-week high school writing club, and compare GAI-supported stories with a corpus of non-GAI stories. We identify several ways in which authors use GAI affordances for rhetorical effect, and find that GAI stories are similar in structure to non-GAI stories. The writing process of GAI stories differs from non-GAI stories, suggesting that GAI may compete with attention to code.

Introduction

Since the release of ChatGPT in 2022, the rapid advance of generative artificial intelligence (GAI) has led to the mass adoption of GAI tools in work, school, and daily life. These tools make it easy to produce and synthesize text, transforming the cultural practice of writing in ways we do not yet understand while disrupting the economic value of writing as well as writing instruction. Some skills students are expected to learn (e.g. summarizing texts; writing in a professional voice) can now easily be accomplished with generative AI, making them appear obsolete. Many tasks designed for productive struggle can now be easily completed with generative AI, denaturing their potential learning opportunities. Because it is now impossible to reliably identify student writing produced with generative AI, writing-based assessments and cultural forms such as the college application essay are losing their legitimacy.

At the same time, GAI tools are supporting the emergence of new writing practices. Writers may use a GAI tool as a brainstorming partner, to come up with ideas when they are stuck, to provide critique of their written work, change the voice of a piece of text, or even to write significant portions of a text. The relationship between writing, identity, and interpersonal relationships is changing as we become more comfortable incorporating synthetic voices into our self-expression. However, these emergent writing practices, and the identities and relationships they support, are dependent on the affordances of generative AI platforms controlled by a few corporations. This concentration of power in the platforms means AI companies have great influence over how we read, write, think, and relate to each other. There is a need for critical AI literacy.

Rather than trying to continually keep up with rapidly-changing media infrastructure, we are working toward a future in which writing classrooms are the sites of co-development of new interfaces for writing with generative AI, emergent practices depending on their affordances, and pedagogies for supporting communities of new literacy practices. Design-based research (Design-Based Research Collective, 2003), which iteratively introduces changes into learning environments and studies their effects, is a methodology well-suited to these goals. This paper reports on the technological development of three new interfaces for collaborating with GAI on writing which we have embedded in Unfold Studio, a web application for reading and writing interactive stories. After framing our goals in theoretical terms, we explain each of the new affordances, and then analyze how they were taken up in a ten-week high school writing club, focusing on the following research questions:

1. How do authors make rhetorical use of the new AI affordances?
2. How is the structure of GAI stories different from the structure of non-GAI stories?
3. How is the writing process for GAI stories different from the process of non-GAI stories?

Background

AI literacies

There have been numerous proposals for what students ought to learn about AI, including frameworks for its ethical use (e.g. Dwivedi et al, 2019; Touretzky et al, 2019; Ng et al, 2023). However, if past upheavals in the technologies of literacy are any guide, these kinds of a priori prescriptions are likely to fail (Street, 2003). For

example, some initial responses to the emergence of generative AI argued that everyone needs to be taught "prompt engineering," a proposal which already feels dated. It is still too early to know what cultural roles GAI may assume, which GAI writing practices may become powerful, or what kinds of critical responses are needed to resist new forms of injustice and oppression. That said, there remains an urgent need for critical literacy education: digital natives do not automatically become skillful even when they are frequent users of media (Margolis, 2008). Our aim is to develop infrastructure which supports teachers and students in developing the AI literacies they need (Proctor & Rish, 2025), so that schools can become sites of organizing our social futures (Penuel & O'Connor, 2018).

Interactive storytelling

Interactive storytelling is a generalization of interactive fiction, a medium authored with text and code to create single-player text-based games and stories. Interactive storytelling had a widespread following from the late 1980's through the 1990's, bounded chronologically by the emergence of personal computers and early access to the Internet and its displacement by graphical games made possible by improvements in processors and displays (Labrande, 2011). Over the last several decades, interactive storytelling has retained a small but active community, often articulating feminist and queer critical responses to the ideologies dominant in the discourses of mainstream video games (Anthropy, 2012).

There have been numerous educational studies of interactive storytelling, focusing on its potential to support participation in communities of practice (Bruckman, 1997; Kafai & Fields, 2013), incorporating computer science into existing literacy practices (Burke & Kafai, 2010), as a narrative form in its own right (Montfort, 2005), to support critical computational literacies (Lee & Garcia, 2014), and specifically to support dialogism in digital media (Nelson et al., 2008; Yardi, 2008). Nelson & Hull draw on Bakhtin's concept of the chronotope, "the intrinsic connectedness of temporal and spatial relationships that are artistically expressed in literature" (p. 84) to argue that there are different representational possibilities in different media. Murray (2017), among others, considers the nature of storytelling in cyberspace. Although these ideas were developed to grapple with the emergence of hypertext, they are newly resonant when considering GAI-supported writing.

Three new interfaces for AI-supported writing

We have implemented new interfaces for AI-supported writing as extensions to Unfold Studio (Proctor & Blikstein, 2019), a web-based platform for reading and writing interactive stories. Stories in Unfold Studio are written in a programming language called Ink (Inkle, 2019) which offers familiar features of programming languages such as variables and control structures, while giving primacy to text, not code. When a reader plays a story, they are presented with text and then are presented with choices. The reader makes a choice, and then sees more text and choices in a cycle which continues until the story ends. Each of the interfaces (described in detail below) is implemented as a built-in function which can be called during the execution flow of a story to generate text. When these functions are invoked during story runs, they make calls to Unfold Studio's server, which calls a generative AI service and does additional processing before returning the generated response. The reader does not interact with these functions directly, and generated text is not marked as such in a story run–although readers are always free to examine a story's source code.

We call this form of story-writing **declarative narrative**: just as declarative programming is a paradigm in which the coder expresses an intent and the computer figures out the details, the author of a declarative narrative delegates components of the text to generative AI, while retaining overall control of the text. The three functions described below, generate, continue, and agent, provide affordances for delegating sensory detail, plot, and characterization respectively. Unfold Studio stories can import components from other stories, making it possible to modularize and recombine literary elements from other stories. Figure 1 shows the source code for a student-authored story which uses the generate and continue functions. A play-through of the story is shown in Figure 2; each of the new interfaces is explained with reference to Figures 1 and 2.

```
00 You were walking to your car on your way home from work when suddenly
01 you saw a very strange object flying through the air. Down from this
02 object a beam of light strikes down and you slowly hovers from the
03 air. After getting summoned onto this ship you find a strange creature
04 that you can speak to.
05
06 + [Tell a joke]
```

```
07   -> joke
08 + [Ask Him Questions]
09   -> question
10 + [Run for it] Seeing your opportunity, you dash through the door.
11   -> run
12
13 === run ===
14 {generate ("One sentence describing an alien ship's long halls with
15 three doors.")}
16 + [Door 1] You choose the first door.
17   -> room1
18 + [Door 2] You choose the second door.
19   -> room2
20 + [Door 3] You choose the third door.
21   -> room3
22
23 === room1 ===
24 This room is filled with test tubes and you get stuck by some alien
25 goop on the ground. An Alien finds you in the room.
26 -> continue(-> ending5)
27
28 === ending5 ===
29 The alien grabs you, puts you into one of the tubes, and leaves you
30 there for centuries.
31 -> END
```

Figure 1. Source code for a story using GAI affordances: *generate* (line 14) and *continue* (line 26).

You were walking to your car on your way home from work when suddenly you saw a very strange object flying through the air. Down from this object a beam of light strikes down and you slowly hovers from the air. After getting summoned onto this ship you find a strange creature that you can speak to.

(User choice: Run for it)

Seeing your opportunity, you dash through the open door.

The hallway's endless metal panels gleamed under cold violet luminescence, and three silent doors—one etched with shifting glyphs, one glowing with liquid emerald light, and one veiled in crackling blue plasma—stand like sentinels to the unknown depths of the alien ship.

(User choice: Door 1)

You choose the first door.

This room is filled with test tubes and you get stuck by some alien goop on the ground. An Alien finds you in the room.

(User input) Act like you work there.

You straighten your back, wipe a smudge off your coverall, and adopt a brisk, purposeful gait as if you belong here. The alien tilts its head, clicks softly, then shifts its weight. It steps closer, studying you with those gleaming eyes. A long, spindly arm lifts, the clawed fingers hovering just inches from your shoulder. Your heart pounds as it seems to weigh your every move.

The alien grabs you, puts you into one of the tubes, and leaves you there for centuries.

Figure 2. Text of a story play-through generated from the source code in Figure 1.

Generate

The `generate` function generates text in response to a provided prompt. This interface is similar in function to generative AI interfaces such as ChatGPT, although in this context, control flow returns to the story after the generated text.

Continue

If `generate` involves delegating details to GAI, *continue* involves delegating components of the plot. The `continue` function requires one argument, a target knot elsewhere in the story. `continue` prompts the story to automatically generate a series of talk turns: open-ended user input followed by a response. `continue` requires one argument, the target knot where the story will resume. The responses within the series of talk turns guide the story toward this knot; at each turn, the continue function evaluates the user's input and decides whether it is a plausible continuation of the story heading toward the target knot; if not, the user input is rejected. When the user's input is sufficiently close to the content of the target, the story resumes with the content of the target knot. If the target story knot contains multiple options (not shown here), then the generative AI will guide the story toward whichever option is assessed to be most reachable, allowing the open-ended interaction to resume the scripted story at one of multiple re-entry points.

Agent

Finally, the `agent` function can be used to delegate characters to GAI. `agent` requires two arguments, `target` and `character`, both knots in the story. `target` plays the same role as in `continue`: `agent` takes control of the story's execution flow until it determines that the story can continue at `target`. Before generating responses, however, `agent` plays through `character` as a sub-story and uses it to create a model of a character. The responses generated by `agent` are in the voice of this character. The character sub-story can take many forms, for example an interview, a compilation of facts about a historical person, or a rambling stream-of-consciousness narrative.

Methods

Context

This study took place during ten weeks of an after-school writing club at a high school in a small city in the northeast of the United States. The curriculum was structured as a writer's workshop (Dorn & Soffos, 2001) in which students spend most of their time writing personally-meaningful stories, sharing their writing with peers, and participating in optional mini-lessons focused on specific aspects of writing craft. Following Proctor & Blikstein (2019), mini-lessons were used to introduce the computational and GAI affordances described above, with an emphasis on the rhetorical possibilities of these affordances rather than on using them according to an a priori idea of correctness.

Data sources

13 of the 17 club members consented to participate in the research, which involved pre- and post-surveys (to be analyzed in a future paper) and consent to the use of their stories in this study. Over the course of the workshop, authors progressed from writing short stories based on templates to writing longer open-ended stories, with an average of 5.3 stories per author. At the end of the workshop, each student submitted a portfolio including their best story using GAI. In this study, we consider only the *portfolio story* from each author.

The Unfold Studio platform saves every version of authors' stories. (A new version is created every time an author edits a story and saves or re-runs the story.) We exported all the versions of each consenting author's portfolio story. For research questions 2 and 3, a comparable corpus of authors and portfolio stories was selected from another implementation of Unfold Studio which followed a similar curriculum, but which did not include the GAI affordances. This non-GAI group includes 67 authors. The corpora of GAI and non-GAI stories have similar characteristics: their distributions of story version counts per story and of story lengths are comparable.

RQ1: How do authors make rhetorical use of GAI affordances?

The first research question asks how students use GAI writing affordances. Proctor & Blikstein (2019) develop an analytical strategy for the relationship between (1) new media affordances (here, GAI), (2) rhetorical purposes, (3) figured meanings, and (3) critical potential. This study relies on Proctor & Blikstein's framework for operationalizing how changes in media infrastructure (e.g. the addition of GAI affordances) is used rhetorically, and ultimately contributes to how participants author identities and channel voices. In this study, we apply this analytical method to three stories, illustrating three different rhetorical effects achieved with GAI writing affordances.

RQ2: How is the structure of GAI stories different?

RQ2 asks how the structure of GAI stories differs from non-GAI stories. Unlike traditional narrative writing, interactive stories are nonlinear: they are composed of "knots," or knots of content (demarcated by a `=== knot_name ===` header), linked by diverts (`->`). Story source code can therefore be parsed into a directed graph with each node representing a knot of content and each edge representing a possible narrative path from one knot to another (Proctor, 2019). A story graph's out-degree distribution reflects the extent to which possible paths through the story diverge from a single linear flow. Thinking about interactive stories as computer programs, nonlinearity is achieved through manipulation of control flow via conditional statements, randomness, or user input. By comparing the degree distributions of GAI stories with non-GAI stories, we can see the extent to which the introduction of GAI encouraged or discouraged engagement with other computational affordances.

RQ3: How is the writing process of GAI stories different?

RQ3 asks how the writing process of GAI stories differs from non-GAI stories. Using the methods developed in Proctor (2019), each adjacent pair of story versions can be compared, and the differences between the versions can be classified. Therefore, a story with n versions yields a sequence of n-1 story edits, each classified as a "minor text edit," a "minor code edit," a "debug" (when the first version contains errors but the second version does not), etc. We extend Proctor's classification scheme by introducing "minor AI edit," when authors change a line containing the generate or the continue function. Finally, story development trajectories can be modeled as a Markov process estimating the probability of moving from one state to another. The sequences of story edits representing each story's history are aggregated into a matrix whose rows and columns represent the classifications of story edits, and whose cells count the number of times one class of story edit is followed by a second class of story edit. By comparing the transition probabilities for GAI and non-GAI stories, we can observe patterns in how stories tended to develop in each case.

Results

RQ1: How do authors make rhetorical use of GAI affordances?

After coding students' stories, we identified three distinct modes of using the new GAI affordances for rhetorical effect. Each mode configures the relationship between the GAI voice and the authorial voice to create a distinct effect. The first mode, **ghostwriter**, is illustrated in the example story excerpted in Figures 1 and 2 above. In ghostwriting, GAI functions as an unmarked writing partner; GAI is used to generate the story but it is not deployed for any rhetorical purpose. Instead, a unitary authorial voice takes responsibility for the narrative.

The second rhetorical mode, **narrator**, deploys GAI to support and contextualize the authorial voice. This mode emerged in a fan-fiction story set in the world of *Percy Jackson & the Olympians* (Riordan, 2006), a series of novels which juxtaposes the world of the Olympian gods with today's world. As *dragonbaby*, the story's author, experimented with GAI, she was delighted to discover that the large language model powering Unfold Studio's GAI features was aware of the content of the novels, and that she could produce descriptions of settings from the book using `generate` and could interact with the book's plot using `continue`. This allowed her to create a story which dynamically explored the Percy Jackson universe. While the contributions of GAI were not explicitly marked, the story is written to show off their capability for dynamic content.

For example, in one knot the character boards a ship named the *Princess Andromeda* and then the player is prompted to decide what she wants to do, which is stored in a variable called `what_to_do`. This input is injected into a prompt to `generate`: "You are the narrator of what happens once Luke has told you that you are on the Princess Andromeda ship from Percy Jackson Sea of Monsters. The player wants to do this: " + what_to_do + ". Narrate the next step in a story where they succeed. Without speaking of an explosian." Here,

the GAI is instructed to be the narrator driving the plot forward, freeing the authorial voice to be positioned as a guide or commentator.

The third rhetorical mode, **counter-voice**, explicitly marks the GAI voice in the story as synthetic; the authorial voice confronts the GAI voice and challenges its presence. Counter-voicing emerged as *quaezae* developed her story. *quaezae* expressed moral opposition to using GAI as well as fear of its possible effects on her, telling the workshop facilitator (the first author) that she felt GAI was ruining her friends' minds. She admitted to occasionally using GAI, but only on her friends' phones so that it would not be connected with her. At first, she was opposed to participating in the workshop at all, but after discussing how the technology worked with the facilitator, and being invited to experiment with GAI to become better-informed in her opposition, she decided to write a dystopian story in which implanted AI chips are required to participate in society, and are accepted as normal without complaint. An excerpt is shown in Figure 3.

```
32 === Yes ===
33 Then lets begin...
34 {generate("A 2 sentance destription of waking up after the
35 cyberpunk-implant surgery with the team surrounding you as you wake
36 up, greeting you by name which is " + name + ".")}
37 Its been a while...you are now about $2000 poorer...very expensive....
38 -> GEnd
39 === GEnd ===
40 As you go on with your life, you notice how . . . simple it is to have
41 the new implant in your arm, your banking, checking and savings is all
42 at your fingertips (or an arms reach- haha!)
43 The Good Ending.
44 -> END
```

Figure 3. Excerpt from *quaezae*'s story.

In this story, GAI is assigned to voice the repulsive inhabitants of the cyberpunk world, and to narrate the story's disturbing episodes. This is similar to the narrator mode in that the GAI voice is distinct from the authorial voice (which in this case creates ironic distance from the cyberpunk world through sarcasm), but here the GAI is consistently assigned roles which are unpleasant within the story world, potentially causing the real-life reader to be repulsed by the GAI system itself. This is an example of interactional positioning (Wortham, 2000), a phenomenon in which positioning of a text's in-story identities becomes reified in analogous positioning amongst the readers. The sarcastic tone feels appropriate to a story which only includes the GAI voice in order to reject it.

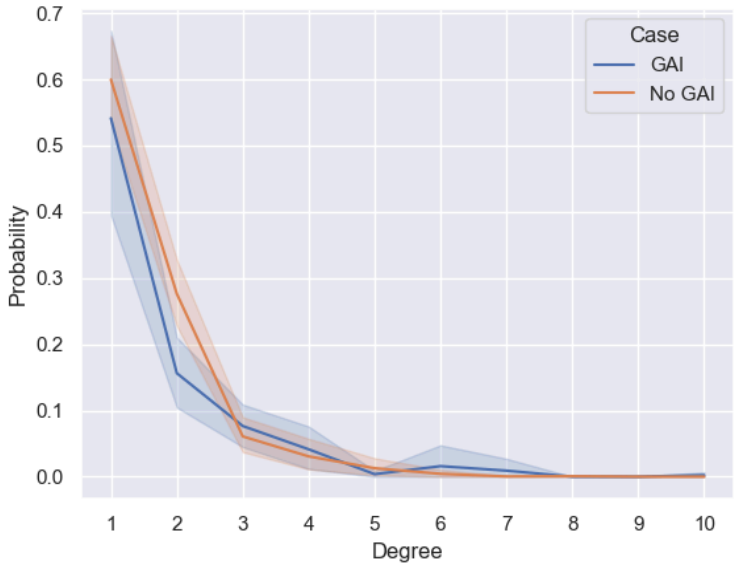

Figure 4. Degree distributions of GAI and non-GAI stories.

RQ2: How is the structure of GAI stories different?

Figure 4 plots degree distributions for the GAI and for the non-GAI stories, showing the mean and 95% confidence interval for each. As expected, both distributions drop off as node degree increases. Slightly more than half of nodes in story graphs have an out-degree of one, meaning that they are part of a linear narrative with only one path. Nodes with higher out-degrees are much more rare. There is no significant difference between the distributions.

RQ3: How is the writing process of GAI stories different?

Figure 5 shows transition diagrams for the GAI and for the non-GAI stories, showing the likelihood of moving from one type of story edit to another over a story's development. (For readability, only transitions above a cutoff are shown, so the transition probabilities in Figure X will not add up to 1.)

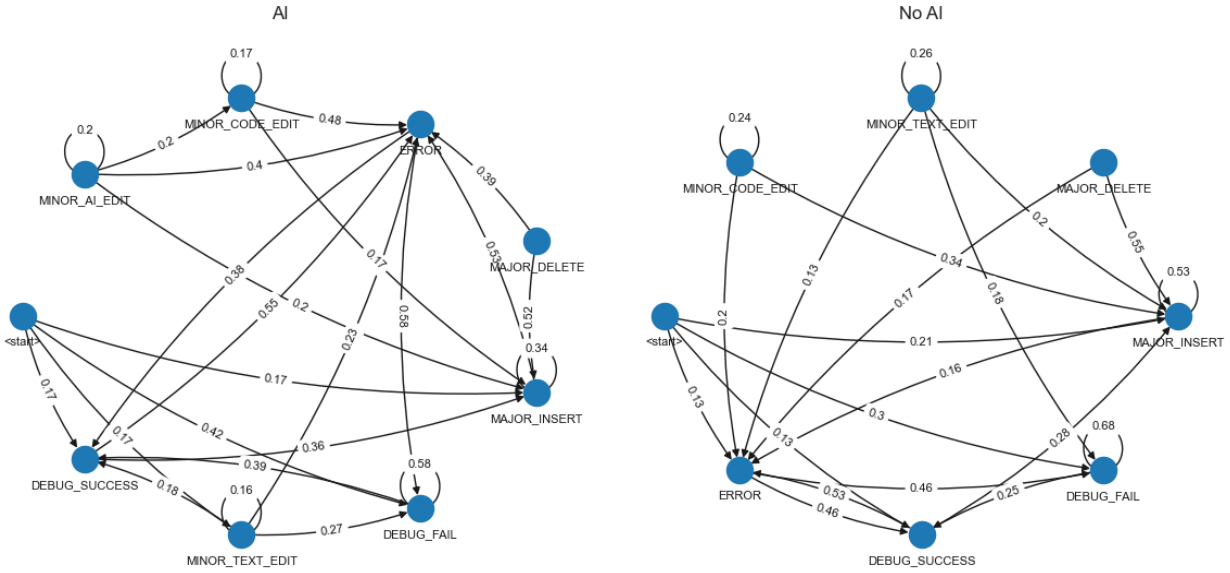

Figure 5. Transition diagrams for GAI and non-GAI stories

In most respects, the transition probabilities are similar for GAI and non-GAI stories, and are comparable to those reported in Proctor (2019). Notable features include a sink-state at DEBUG_FAIL (after failing to debug a story, roughly two-thirds of the time the next edit is another failed debug) and high transition probabilities between ERROR and DEBUG_SUCCES, indicating authors creating errors and then successfully debugging them.

For GAI stories, transitions from MINOR_AI_EDIT are similar to transitions from MINOR_CODE_EDIT, with the most likely next edits being ERROR (~0.4), MAJOR_INSERT (~0.2), and a repeat of the same minor edit (~0.2). This suggests that story authors interacted with GAI affordances

The most substantial differences between transition probabilities for GAI and non-GAI stories are much higher probabilities of transitioning to ERROR from multiple states. It is tempting to interpret this as authors paying less attention to code when they are working with GAI affordances, but this study does not provide enough evidence to justify the interpretation. GAI stories also have a stronger sink-state at MAJOR_INSERT, indicating that authors of non-GAI stories have a higher probability of entering a pattern of repeatedly adding content to their stories.

Discussion

This study presents three new affordances for integrating GAI into writing, and offers a multifaceted account of how they were taken up in a high school writing club. The results of RQ1 show authors exploring the rhetorical possibilities of GAI, developing new genres of multivocal, nonlinear writing. At the same time, the results of RQ2 and RQ3 suggest that adding GAI to the writing toolbox does not profoundly change the structure of stories or how they are written.

The possibility that working with GAI competes with attention to explicit computational structures in stories draws intriguing parallels to the debate in computer science education about the extent to which programming will still be a valued skill as GAI programming tools become more capable. Writing and programming are both highly-specialized skills; in both cases there are strong arguments that typing out characters is only the residue of the real work of modeling the problem and planning an approach to the solution.

As we have repeatedly emphasized, the results of this study are necessarily contingent on its specific technological infrastructure and how it was taken up in context. No study could show an objective effect of GAI on writing practice, for GAI itself is designed, not a natural phenomenon (Simon, 1969). The best we can do is the iterative process offered by design-based research,

Conclusion

This study reported on one iteration of an ongoing design-based research project aimed at designing AI tools for critical literacy education. Several ongoing research projects build on these results. First, we are continuing to iterate the AI affordances. On the front end, we are improving usability and exploring options for presentation of GAI text which could better support the rhetorical uses of GAI we analyzed in RQ1. On the back end, we are improving the quality of GAI content by refining how Unfold Studio interacts with its upstream GAI service. We are also analyzing the pre- and post-surveys collected during the high school writing club where this study's stories were written. Building on our claim in the introduction that GAI may reorganize our identities by shaping how we write, these surveys focus on the constructs of identity, voice, and authentic experiences with GAI, aiming to better-understand how authors experience writing with GAI as authentic or inauthentic, and how such experiences affect their writing identities.

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