Shoelace: A Storytelling Assistant for GUMSHOE One-2-One

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ABSTRACT

In creative roleplaying games, game masters take on many roles, including keeping track of the game's story, remembering past actions, and improvising new content based on player choices and desires. This dynamic storytelling can be quite difficult, particularly in real-time play, and this paper explores how digital tools might be able to assist GMs with elements of this process. In particular, we explore issues that game masters experience in running the *GUMSHOE One-2-One* system by analyzing posts from the online role playing game community, and discuss the design of a digital tool that helps to address common problems. The resulting tool, *Shoelace*, helps game masters keep track of story events with a graph-based game world visualization, while also providing creative suggestions using Prolog queries over a database of game information.

CCS CONCEPTS

• **Software and its engineering** → **Interactive games**; • **Human-centered computing** → *User interface design.*

KEYWORDS

roleplaying, storytelling, tabletop games, game masters, co-creativity

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1 INTRODUCTION

Recent years have seen a rapid rise in the popularity of creative roleplaying, a diverse practice of play where humans co-create interactive story experiences with a system of rules and computation. These experiences take many forms, from classic tabletop roleplaying games (TTRPGs) like *Dungeons & Dragons* (D&D) to novel immersive experiences like Tender Claw's *The Under Presents* [20], a virtual reality theater production. As a new generation of players have discovered and championed the joys of creative roleplaying, the practice has become increasingly culturally and economically significant. Netflix's mega-hit *Stranger Things* centers D&D prominently, while *Critical Role*, a D&D "actual play" show, is Twitch's largest affiliate [23]. D&D itself is more popular than ever [39], while independently-published "indie" TTRPGs have also exploded in popularity, re-imagining creative roleplay for new audiences [21]. Large media companies have begun to invest in the space, evidenced by Disney's recent creation of a live-action roleplaying hotel, *Star Wars: Galactic Starcruiser* [9].

This surge in popularity comes at a time where the benefits of creative roleplaying are increasingly understood for a variety of applications. During the COVID-19 pandemic, people used TTRPGs to create meaningful social experiences online amidst lockdowns and social distancing [33]. Researchers have explored the ways that role playing games are used to build identity and community [15], a phenomenon reflected in the increasing popularity of TTRPGs to create positive spaces for queer people and people of color [22]. Investigations into the use of live action roleplaying games for educational purposes have suggested the potential for building intrinsic motivation [16], with case studies showing success across a variety of subjects, including science [17], engineering [30], medicine [19], and computational thinking [24]. Researchers have also investigated the ways in which roleplaying can serve as a therapeutic tool, with studies suggesting benefits for mental health [12].

But despite high demand for creative roleplaying and increased awareness of its social value, there are still major barriers to entry that limit its accessibility. While TTRPGs are a popular entrypoint with a low material cost, they require someone to serve as "game master" (GM), a role many players find to be difficult. A GM facilitates gameplay by mediating the relationship between the players and the TTRPG's game world; they respond to players' intents and desires while still providing a structured play experience afforded by the TTRPG's predefined rules and content. This process entails a careful balancing act between the needs of players and the existing commitments of the game world; doing it well can be difficult even for experienced GMs, often requiring deep knowledge of the specific campaign and extensive preparation between gameplay sessions. While veteran GMs often find the challenges involved fulfilling, new GMs often find it stressful and intimidating, enough so that many players never attempt the GM role at all. The difficulty of GMing and the time commitment involved has led to an imbalance

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between player demand and GM supply, with players often unable to find a game to join [34]. This dynamic is evidenced by the rise of professional GM marketplaces like *StartPlaying* [6], where players can hire GMs to run games for them at substantial hourly rates.

In this paper, we introduce a tool to help beginner GMs better manage the storytelling aspect of creative roleplaying. We build off our previous qualitative research into the difficulties faced by GMs, which suggested live storytelling support was underserved by existing tools [10]. Our tool focuses on addressing two major storytelling challenges: keeping track of the game world and improvising in response to player behavior. We do so in the context of *GUMSHOE One-2-One*, a two-player detective TTRPG where a GM guides a single player through a mystery investigation [32]. Our tool, *Shoelace*, enables a GM to easily access information from the game manual while dynamically visualizing and tracking the state of the game world. Further, *Shoelace* queries a model of the game world to provide suggestions in response to common player requests. *GUMSHOE One-2-One* (G121) has short but complex story-driven campaigns, providing an ideal test-bed for evaluating a GM storytelling assistant; while our tool is specific to G121, we believe our findings inform the design for storytelling tools for creative roleplaying more broadly.

2 RELATED WORK

2.1 Storytelling in roleplaying games

This work builds on existing research related to storytelling in roleplaying games. In previous studies, researchers have conducted interviews with GMs to better understand how the process of storytelling works in creative roleplaying and how it may be replicated or enhanced with computational tools.

Using interviews with GMs, Bergström [13] categorizes different "frames" of storytelling in role playing games, such as diegetic and non-diegetic communication. With this storytelling model, Bergström et al. [14] investigates how to design tools for role playing communication, leading to development of *Undercurrents*, a tool for secret communication between role playing factions.

Flowers et al. [25] interviewed GMs and observed their game sessions to analyze various GMing techniques. They categorized GM behaviors into "attractors" and "detractors", different techniques used by GMs to guide players towards and away from different actions. Within this framework, they speculate how a computerized system could implement similar methods to guide players through an interactive story.

Tychsen et al. [36] models how GMs guide players through a story, describing how GMs build dynamic stories by flexibly navigating through "waypoints", anchor moments in an overarching narrative. These waypoints are often predefined in an TTRPG game module, but can be customized and re-ordered as necessary by the GM. GMs have flexibility to integrate these waypoints fluidly into the moment-to-moment game story, and can pick and choose the aspects that reflect their player's interests. Waypoints are functionally equivalent to the "scenes" that make up a G121 session, and *Shoelace* aims to assist with this on-the-fly planning.

Our work is further informed by our own research into storytelling in TTRPGs. In our previous work, we performed qualitative interviews with GMs in order to better understand how they prepare for and run their games, with a specific focus on their methods and needs around improvisational storytelling [10, 11]. From these interviews, we identified two primary struggles with storytelling: keeping track of events and relationships in the game world and improvising in response to unanticipated player behavior [11]. With *Shoelace*, we aim to address these issues by providing GMs with a comprehensive game state visualization and tools for creative support.

2.2 Role playing support tools

Over the past couple decades, a variety of consumer products and research projects have demonstrated the ability for computational tools to assist in creative role playing. As a result of the COVID-19 pandemic, a large portion of TTRPG sessions are now played remotely over video streaming platforms. To facilitate remote play, virtual platforms have attempted to replicate the affordances offered by in-person play while exploring the new possibilities enabled by computational systems. One of the most widely adopted tools for running TTRPGs online is *Roll20* [1], a virtual tabletop simulator. It provides a virtual dice roller, the ability to stream voice and video to all players, and virtual maps with layers and objects. These tools allow GMs to track the game state and provide each player with different amounts of visual information based on their character's abilities and location. Ultimately, these visualization tools and information tracking features surpass what's possible with analog play.

Similar tools like *D&D Beyond* [2] aim to bring the benefits of computational systems to in-person play. With an emphasis on accessibility, *D&D Beyond* aims to reduce the information overload experienced by new players. At the start of play, the tool assists players with creating character sheets and understanding available options and abilities. During the game session, the tool allows quick reference to the game rules while displaying relevant information to the player, including abilities, spells, items, and resources.

Another set of computational tools focus on assisting GMs with the creative preparation work needed for a TTRPG campaign. *World Anvil* [3], for example, provides a platform that enables GMs to build out the lore of their fictional world, with tools to create artifacts like maps, timelines, and wiki-style reference guides. Some popular tools focus on a single aspect of creative planning; *Inkarnate* [5] enables GMs to design richly detailed overworld maps, while *Dungeon Fog* [4] is a popular tool for creating dungeon environments for combat and exploration. These tools give GMs more ownership over their game worlds, enabling them to craft their own narratives rather than rely on prewritten ones from game modules.

While creative planning tools have existed for some time, a recent development has been the spread of in-session creative support tools. One area of focus has been in-game combat; tools like *Kobold Fight Club* [35] and *D&D Beyond*'s Encounter Builder [2] enable GMs to quickly create unscripted combat encounters on-the-fly. A GM can quickly search through possible creatures for players to fight while receiving assessments of how the enemies would impact combat difficulty, letting them set an appropriate challenge for a given group. Recent research efforts have focused on supporting procedural and AI-driven content generation. One tool in this vein

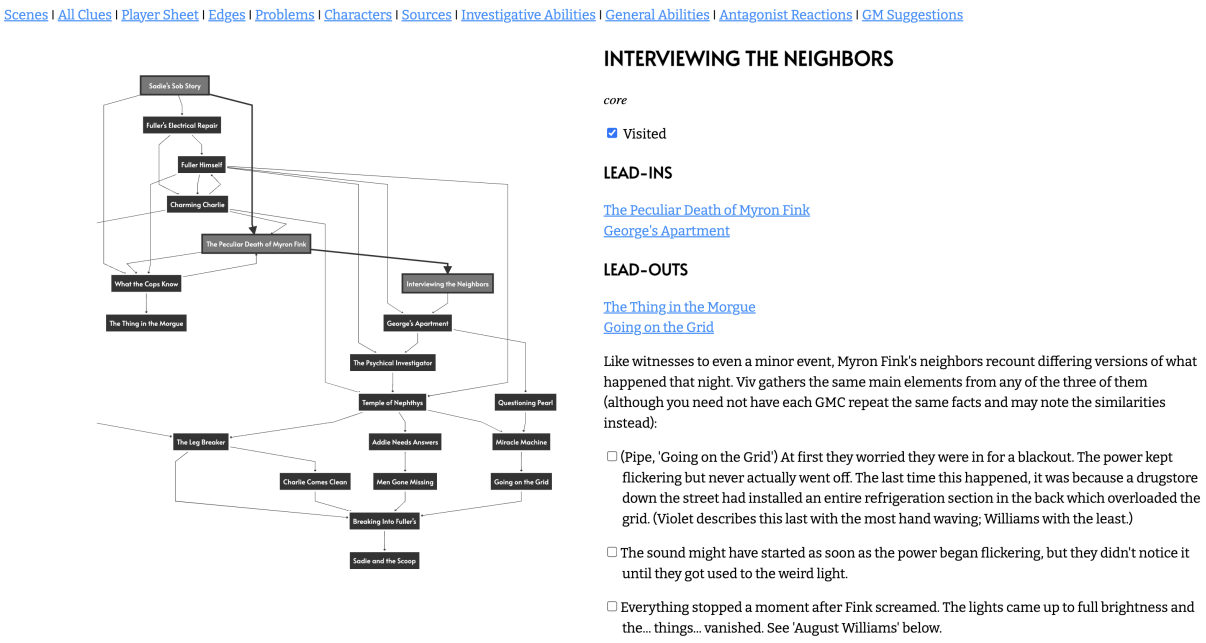

Figure 1: The *Shoelace* interface. On the left, the graph shows the flow of scenes through *Fatal Frequencies*. On the right, there is the Scene view, a breakdown of the active scene adapted from the module [32]. The *Scene* view contains all of the information needed for the GM to run the scene, along with checkboxes to record the player's activity. Clicking on a scene in the graph will updates the material in the *Scene* view to the new scene.

is *Imaginarium* [26], which uses a templating system to enable GMs to quickly generate new characters and locations. With *Shoelace*, we aim to perform a similar task, using Prolog to generate suggestions for the GM when facing certain scenarios.

Shoelace is informed by these existing tools but focuses instead on in-session storytelling, an area we believe has been undersupported in previous work. In TTRPGs, story content is generally found in an unwieldy campaign module, often requiring substantial preparation time for a GM to master. It can be hard to see how scenes relate to one another, as connected scenes may be separated by dozens of pages of text. In general, it can be difficult for a GM to navigate the tension between moment-to-moment gameplay and long term narrative commitments. By dynamically visualizing a module's story graphically, we enable the GM to reference the story content they need while situating it in a broader narrative context. *Shoelace*'s state tracking enables GMs to see how choices they and the player have made impact future narrative options, while game state queries provide suggestions for when the player has deviated from a scripted path. Taken together, these affordances make the task of storytelling much more accessible for a new GM, requiring less preparation before the session and fewer moments of in-game pause.

3 DESIGNING A STORYTELLING SUPPORT TOOL

3.1 Design Goals

Our work developed out of GM interviews concerning how computational tools could be used to assist with storytelling during their TTRPG campaigns [10, 11]. Through these interviews, we identified two primary issues that we wanted to address with a prospective storytelling tool.

First, a recurring issue we found was that GMs had trouble keeping track of narrative information. When GMs are running games, they are managing many different elements of play: they execute the mechanics of each player's turn, perform as non-player characters, plan future events, etc. While these are difficult tasks on their own, many GMs stated that they found it difficult to take notes during play to keep track of what had happened. We wanted our tool to facilitate narrative note taking without further burdening the player with complex tasks that could slow them down. We decided our tool should be sufficiently expressive to log relevant information while lightweight enough to be unobtrusive.

Further, another issue GMs expressed was the need to dynamically update their story in response to player behavior. While TTRPG modules will often include flexibility in their narrative logic, including branching paths and optional events, it's common for players to behave in ways unanticipated by a module's reference material. Rather than restrict a player to a fixed set of actions, a GM will prefer to engage with a player's creativity by creating new narrative paths. While these unexpected narrative turns can

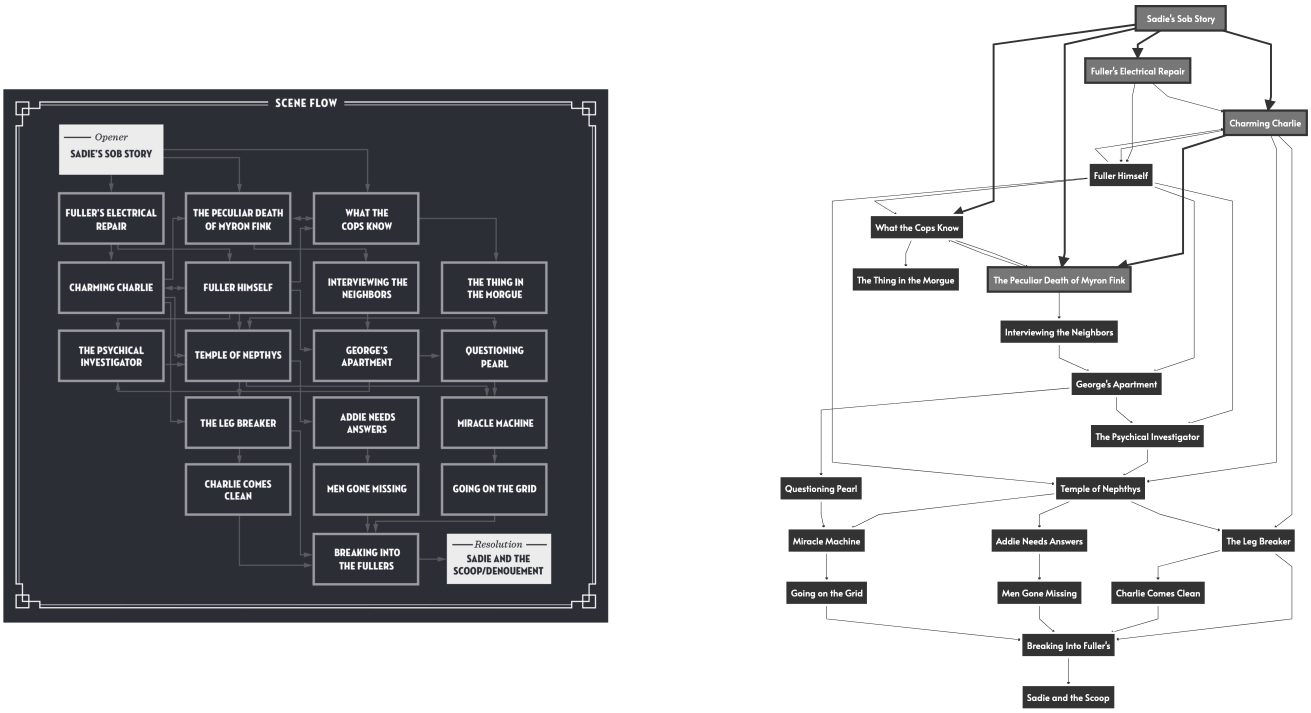

Figure 2: Left: The original scene diagram from the *Fatal Frequencies* module [32], © Pelgrane Press. Right: The scene flow graph in *Shoelace*. The links between scenes in the original graph are hard to parse, making it unsuited for live reference. The *Shoelace* graph makes the connections easier to see while clearly distinguishing the available and visited scenes. It also serves as a dynamic reference interface, enabling the GM to find scene information faster and more intuitively than with the manual.

be fulfilling creative roleplay experiences, they entail substantial improvisation on the part of the GM. We decided our tool should be able to provide creative support to GMs when players behaved in unexpected ways.

3.2 GUMSHOE One-2-One

In previous work, we examined how we might model the events in a *Dungeons & Dragons* module, using the *Lost Mine of Phandelver* as a case study. We constructed a prototype narrative visualization that was well-received by the GMs we interviewed [11] as a possible storytelling aid. However, we decided after more experimenting that D&D wasn't a great fit for prototyping a storytelling tool. While story-rich, the format has a heavy focus on combat and movement, issues we felt had already been addressed well by existing tools. Further, the game has a wide possibility space for story events at each step of play; between the planned actions from the game module and the spontaneous actions of players, it created a large amount of data for the GM to log and an unwieldy number of relationships to encode in our world model. While we hope to scale our efforts to D&D in the future, we decided its breadth made it less ideal as an initial research domain.

As our priority was validating our hypotheses concerning how a computational tool could assist in storytelling, we decided to target a role playing game system more suited to storytelling research. After some searching, we chose *GUMSHOE One-2-One* [32], a noir-inspired detective game where a single player must solve a mystery. A G121 campaign is composed of scenes, discrete chunks of story involving characters and a location. These scenes contain clues, valuable information the player needs to solve the mystery. Finding some clues will unlock new scenes immediately, while others are only valuable later in the story when the player has found more information.

The player character interacts with these scenes through two sets of abilities: investigative abilities and general abilities. Investigative abilities, such as "research" or "photography", will always succeed, and enable the player to find clues in the game world when invoked. General abilities, such as "stealth" or "fighting", require a dice roll and allow the player to respond dynamically to events in the scene as they unfold. Failing a dice roll can cause the player to miss out on potential clues, but they have a limited number of "pushes" they can use to guarantee their dice roll succeeds. Adding further depth are "edges" and "problems", buffs and debuffs the player can receive by triggering certain events in the story.

We find that this roleplaying system is an ideal fit for a computational story assistant. The game is simple mechanically; there is only a single player, and they act within a restricted set of possible decisions. The heavily structured narrative makes modeling the

game world and tracking information simple. Player actions can only impact the narrative in specifically afforded ways: finding a clue, talking to suspects, and following leads to new scenes. While player creativity will often take the story outside of its pre-scripted content, the ways it does so are easily modeled. For example, a player's creative actions could lead them to find a clue in a unique, unanticipated way, but once this clue is found, the state of the game world is functionally no different than if they had found it more conventionally. And while the narrative is heavily structured, it's also extremely dynamic moment-to-moment, putting substantial improvisational demand on the GM to reconcile impromptu events with the broader narrative. A computational assistant could make it easier to navigate these narrative tensions by providing creative support.

3.3 User Research

Since our previous GM interviews centered around *Dungeons & Dragons*, we wanted to verify that the insights we found still made sense for *GUMSHOE One-2-One*. We decided to research the problems faced by G121 GMs to validate our approach to storytelling support while identifying any additional functionality that could be helpful. To do this, we analyzed online posts from GMs talking about running the G121 system. We looked at comments from ten websites including forum threads, blogs, and dedicated online communities for RPGs including r/rpg [7] and rpg.stackexchange.com [8]. We also examined the official GM advice material provided by Pelgrane Press, the G121 publisher, in order to get a better understanding of how it might be codified in a digital system. While this investigation was not exhaustive by any means, we believe it was sufficiently representative to validate and inform the design of our prototype. Ultimately, we saw that the issues we identified in our previous interviews were still present in G121, perhaps even exacerbated by the story-driven nature of the system.

First, we saw a variety of comments expressing issues with remembering and tracking game information. Several commenters found that the heavily-detailed narrative system made for difficult prep work; one commenter writes, the "[games] take far too long to prep, because there's a very high density of information and it isn't presented in a convenient fashion" [29]. Another discusses the issue with popular module *Fatal Frequencies*, noting that "[Fatal Frequencies] is very structured and detailed, with dozens and dozens of facts to keep in your head" [18]. They go on to ask for help preparing for the game, wondering how to remember the details of scenes, problems, and edges, and how they should take notes during the game.

Additionally, GMs also expressed issues with the heavy improvisational burden imposed by the game. One commenter highlights the intensity brought by having a single player character, noting, "There's also less breather time in [One-2-One], since you don't get situations where the players take time to discuss amongst themselves what they're going to do while you race ahead to plan the next unexpected thing" [27]. GMs have to come up with new material quickly, without the downtime that might be found in games with more players. Further, others found it difficult to make up or change material while still staying internally consistent with the rest of the game's story. One commenter writes, "the adventures are written in a very linear fashion and don't really accommodate a player who doesn't do exactly what the author expected" [29], reflecting how the long term narrative commitments in G121 create tension with the freedom afforded to the player in each scene. Another commenter echoes this sentiment, noting "I do still have problems with the player(s) elegantly bypassing parts of the scenario through clever play, so that important bits of the story are 'stranded' with no obvious links leading in their direction" [29].

From these comments, we can see that G121 GMs struggle with information management and improvisation, creating opportunities for computational support. These comments also suggest potential ways we might assist with these problems. For example, since the GMs struggle to manage all of the information in the game module, we should make it easy to reference all of the content in the game module, not just what has happened so far. Similarly, we should help GMs improvise around "stranded" clues by presenting them with alternate paths to give the clues to the player.

4 SHOELACE

Based on our design research, we created *Shoelace*, a prototype storytelling assistant for *GUMSHOE One-2-One*. For our first iteration, we targeted *Fatal Frequencies*, a module for the *Cthulu Confidential* version of G121.

4.1 Modeling the game world

The foundation of *Shoelace* is a Prolog database that models details about the game world that the GM may want to reference or track. To make the integration with our front-end simple, we use Tau Prolog [37], a Javascript-based Prolog interpreter designed to easily integrate with a web application.

We represent many different elements of the G121 system, including scenes, clues, sources, edges, problems, challenges, characters, investigative abilities, general abilities, pushes, and antagonist reactions.

Most of the game world information is derived directly from the game module. For example, the *Fatal Frequencies* module expresses that in the first scene, "Sadie's Sob Story," we can find the clue that "Someone in George's apartment building was murdered the day before he disappeared" [32]. In Prolog, we record information about the clue, including where it can be found, if the player has found it, and what scene(s) it unlocks (or helps unlock).

Some information, however, is only implicit, but still something we encode in the database because it is important for a GM to reference on the fly. For example, we represent the relationships between all of the characters with a label and a valence (positive, neutral, or negative) to describe their relationships to one another. While the label is given in the module's character graph (e.g. "works for"), the valences were chosen by us based on our best judgments of the relationships between characters.

Taken together, the information in the database enables the GM to track the game state as well as perform queries that can be used for creative support.

4.2 Information visualization and tracking

Shoelace dynamically represents the game world visually, with information split into multiple views that the GM can swap between:

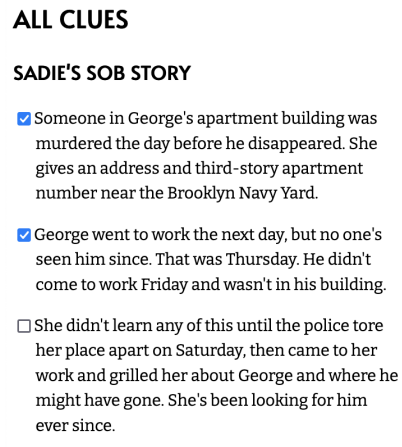

Figure 3: In the *All Clues* view, the GM can see the clues the player has gathered in each scene. Here, the player has gathered two clues from the scene "Sadie's Sob Story."

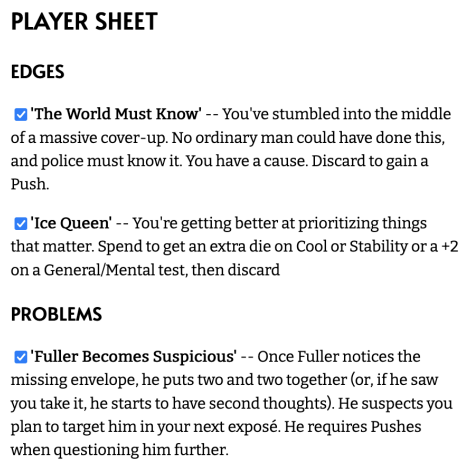

Figure 4: In the *Player Sheet* view, the GM can see the player's abilities, pushes, edges, and problems. Here, the player has edges "The World Must Know" and "Ice Queen" and problem "Fuller Becomes Suspicious."

- The *Scenes* view, depicted in Figure 1, displays a flowchart describing the relationships between all of the scenes in the module. In G121, scenes are connected to one another through "lead-ins" and "lead-outs". A scene has a lead out to another scene when it has a clue that unlocks that second scene, while a scene has a lead-in from another scene when that second scene can unlock it. In *Shoelace*, we display lead-outs and lead-ins using directional arrows, enabling a GM to visualize the potential paths through the story. While the base module also contains a scene flowchart, we update the scene graph as the narrative progresses, graying out scenes that have been visited while highlighting the lead-outs that have been unlocked.
  The scenes graph (Figure 2) is interactive, and clicking on a given scene node will display a panel containing all of the information needed by the GM to run the scene, including the scene's name, whether it has been visited, its lead-ins and lead-outs, the scene's reference text, the scene's clues, the scene's challenges, and the scene's antagonist reactions. The informational panel enables the GM to track all of the events that occur when running a scene. The GM can toggle a checkbox to indicate if a scene has been visited or not, while they can also do the same for each clue the player can find. Toggling a clue will update it in the Prolog database, and the state change will be propagated across the application; if a lead-in clue has been marked as found, the scene graph will update to show that the associated scene is now available.
- The *All Clues* page, seen in Figure 3, displays a list of all of the clues in the game, listed under the headings of the scene they are from. Each clue has a checkbox that the GM can use to see if the clue has been found as well as toggle its status in the Prolog database.
- The *Player Sheet*, seen in Figure 4, contains all of the information concerning the player character. First, it displays all of the player's active problems and edges, which can be toggled by the GM. It also shows the player's remaining pushes, which the GM can increment or decrement. Further, displays the players stats — their general and investigative abilities alongside their associated dice values.
- The *Characters* view, seen in Figure 5, displays a graph of the characters in the module and the relationships between them, similar to how it is presented in the module material. However, *Shoelace* allows this graph to be modifiable. If the player has visited a scene with a given character, that character's node will be marked gray to indicate the player and the character have met. The *Characters* view also displays information about each character, including their name, description, and their current relationship with the player. The GM can change the valence of the relationship to reflect successful or failed social interactions.
- The *Edges* and *Problems* views display a list of the respective edges and problems that the player can receive. Like clues, each entry in the list has a checkbox that the GM can use to indicate if a player has received the given problem or edge. When changes are made, they are reflected in the *Player Sheet*.
- The *Sources* view contains a list of the sources the player character can contact for more information when they are stuck. The page displays each source, their name, their bio, and their investigative abilities.
- The *Investigative Abilities* and *General Abilities* page lists out all of the investigative and general abilities and their descriptions.
- The *Antagonist Reactions* page lists all of the "antagonist reactions" in the game, which are special pre-written events the GM can trigger when certain conditions have been met. The *Antagonist Reactions* view describes the event and how to run it, along with whether it is currently eligible for use. When an antagonist reaction becomes available, it also appears on the scene graph.

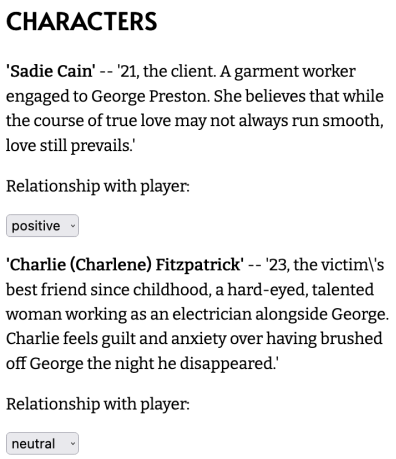

Figure 5: In the *Characters* view, the GM can update the relationship between player and non-player characters. Here, the player has a positive relationship with "Sadie Cain" and a neutral one with "Charlie Fitzpatrick." These statuses impact the results of queries in *GM Suggestions*.

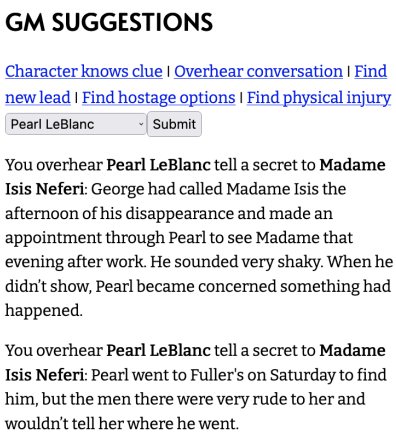

Figure 6: The *GM Suggestions* view allows the GM to query the game state for help resolving certain game scenarios. Here, the GM uses the *Overhear Conversation* query to find clues that character "Pearl LeBlanc" could plausibly share in an overheard conversation.

4.3 Improvisation support

To provide improvisational support to GMs, we use Prolog queries to search through our database. These queries can provide useful game information or make suggestions for specific scenarios the GM may encounter. In *Shoelace*'s GM suggestions page, we present the GM with several queries to choose from; we describe a few of these options in more detail below:

- *Find New Lead* – This query identifies available clues that the player hasn't found that unlock scenes the player has not visited. The GM can use this query to help get a player's investigation unstuck, highlighting what areas they should guide the player to explore.
- *Character Knows Clue* – This query returns a list of clues that a given character can share with the player. The GM can use this query to create meaningful encounters with non-player characters outside of the specific scenes those characters are scripted to appear.
- *Overhear Conversation* – This query, seen in Figure 6, generates a suggestion for a conversation between two characters that the player could overhear. The query looks for a set of characters that have a positive relationship with one another, are alive, and where one character knows a piece of information the player doesn't know. The GM can use this query to help the player discover clues they may have missed earlier in the story; the GM can script a new encounter where the player overhears the missing information.

5 DISCUSSION

With *Shoelace*, we believe we have made meaningful progress toward our two motivating goals for a storytelling assistant: helping GMs keep track of information and providing GMs with creative support for improvisation, all while reducing the barrier to entry for new GMs. In this section, we discuss how *Shoelace* contributes to each of these efforts and how we can build upon it further. We also discuss how our investigation into storytelling support might extend to other TTRPG systems and tools.

5.1 Information visualization and tracking

Shoelace functions as a near-complete substitute for a module's reference material, potentially eliminating a large part of the friction brought by running a story-driven role playing game. A conventional paper or PDF version of the game module would require a GM to flip through many pages to find relevant information, causing the flow of play to come to a halt as they search. We believe *Shoelace* will facilitate more seamless play as its hyperlinks and interactive graphs enable the GM to quickly jump to the information they need. As a result, a new GM may be able to better emulate the performance of a more experienced GM while needing less prep time than before.

Shoelace also integrates information tracking directly into the flow of play, reducing the effort needed by the GM to keep track of events. As the GM reads scene information and clues out loud to the player, they can simultaneously check boxes to note the information that the player has been given or has discovered themselves. The GM can later reference this information to see which clues are missing and determine a course of action to get the player's investigation back on track. Further, the visual representation of the story enables a GM to situate the moment-to-moment story events into a grander narrative arc.

In initial playtesting, *Shoelace*'s state tracking and visualization has been received positively, and we plan to explore the impact with the tool more rigorously with a study gathering quantitative and qualitative data about player and GM experience. Our limited testing with researchers and volunteers has suggested it reduces the in-game burden placed on GMs as well as the volume of planning

needed to run a game session. However, it's likely that the impact on the play experience is much more nuanced, and we expect that a study will give us more insight into how we can better design assistive storytelling tools.

Creative roleplaying depends on the very human relationships between people playing together, and computational mediation can potentially disrupt this dynamic. Even though our tool makes it easier to track and maintain the G121 story world, logistical benefits alone don't necessarily translate into a more enjoyable experience; limitations or frustrations with the tool could negatively impact a GM's sense of agency, while integrating a computer into play potentially disrupts the player-GM connection. While we believe *Shoelace* represents a valuable step toward TTRPG storytelling assistance, the proper design and deployment of these systems is still very much an open question, and we hope to continue to explore it in future work.

5.2 Improvisation support

The improvisational support introduced by *Shoelace* is less mature than the information visualization component of the tool, but we believe it is a powerful foundation to build upon. Each Prolog query in *Shoelace* is narrowly focused, and the set of queries we have started with is by no means exhaustive of what a GM may like to know. But even in this early stage, we believe that this framework is already useful; each query enables the GM to answer an important question about the game world that they can use to make key storytelling decisions. For example, the Find New Lead query gives the GM a quick direction to refocus the player's investigation, while the Overhear Conversation query provides the GM an easy way to surface a clue to the player in a natural way. These queries demonstrate the promise of improvisational support and the potential brought by maintaining a sophisticated model of the game world.

In future work, we intend to make *Shoelace*'s improvisation support more frictionless and sophisticated. A weakness with our current creative support is that it's useful only if the GM first identifies they are in a situation where it applies; a GM may not take advantage of the functionality if they are busy with the intense moment-to-moment demands of running the game.

Recent work in story-sifting highlights the power of using queries to identify interesting events in an emerging narrative [28]. By applying these techniques to our game world model, we could proactively surface interesting narrative choices to the GM, eliminating the need for them to explicitly choose and execute queries. We could also go beyond simple queries to create more sophisticated suggestions; narrative planners, for example, use a logical description of character goals and actions to generate potential narrative resolutions. A planning-based system could create suggestions for longer-term story goals and ideas for how the GM could guide the story there.

Advances in large language models offer an alternative path forward, potentially enabling TTRPG tools to provide creative support through the generation of high quality text. Language models have already been used to successfully generate RPG quest descriptions in an offline context [38], and using these tools to provide creative support during an active game session is a reasonable next step. With a language model, we may be able to assist the GM with more abstract creative tasks than we currently support, such as coming up with dialogue, generating new scenes, etc. Our Prolog model of the game world could assist substantially with these applications, as recent work in narrative generation has seen success guiding text generation from large language models with symbolic reasoning systems [31].

In general, we believe the possibilities for creative assistance in role playing games are still woefully underexplored. We hope that by studying GM and player experience with the tool that we can get more insight into what forms of creative support are effective, and we hope that we can use those findings to provide a more sophisticated improvisational experience in future projects.

5.3 Generalizing to other TTRPG systems

We built *Shoelace* to explore how we can use computational tools to support storytelling in the broader space of creative roleplaying. While we designed the tool with *GUMSHOE One-2-One* in mind, we believe that the general design we've used here will extend to other TTRPGs systems, and we intend to explore adapting it to other domains in future work. In particular, we believe there's rich potential in maintaining a logical representation of a TTRPG story world. In Shoelace, we've been able to use this model to track and visualize the story while providing creative support, and we believe we're only scratching the surface of how a sophisticated world model may be used in roleplaying contexts. We hope that systems in this vein will be helpful to GMs of other TTRPGs and make the GM role more accessible to newcomers.

However, one obstacle to extending this approach to other TTRPG systems is the volume of authoring work needed to represent the game world. G121 is a comparatively simple game, and it has some useful structural properties that make the world model reasonably simple to encode (e.g. non-player characters don't have their knowledge evolve as the game unfolds). But other TTRPG systems, including D&D, are more complicated, and crafting a logical model of the world sophisticated enough to provide meaningful insight to the GM is non-trivial. Ideally, the magnitude of authoring work is offset by the the potential for it to be reused; our work modeling G121 for *Fatal Frequencies*, for example, makes it much easier to create extensions for other G121 modules, and we imagine a world where this work is not continuously redone, but rather shared online and remixed by GMs for the creation of custom content. That said, in future work we intend to explore how to make this modeling process less cumbersome and investigate the design of authoring tools for TTRPG support systems.

6 CONCLUSION

In this paper, we explored how computational tools can be used to assist GMs with storytelling in creative role playing games. We noted two problems that recur for GMs and their storytelling process: keeping track of events in the game world and improvising responses to unexpected player behavior. With these problems in mind, we introduced *Shoelace*, a tool for storytelling in *Gumshoe One-2-One*. The resulting tool provides powerful assistance to a GM while serving as foundation for future research in TTRPGs and computational support. In a time where creative role playing

is increasingly popular, it's important that we eliminate the high barriers to entry. Storytelling is one of the most rewarding aspects of role playing, but also one of it's most difficult, and we should enable more people to experience the joy of this improvisational play. With *Shoelace*, we've tried to make storytelling more accessible, potentially enabling people to GM who would otherwise find it too difficult. But it only represents a first step toward what is possible in creative roleplaying with computational assistance. We are excited to see future design and development in this space as computation and artificial intelligence are integrated with role playing games.

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