Structure, Agency, and Improvisation in Human-Led Digital Interactive Narrative Exercises

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Abstract

Supporting high-agency player experiences without compromising narrative control is one of the major challenges in digital interactive narrative design. Humans, on the other hand, frequently meet this challenge when cooperating to improvise a narrative. We present a study examining how humans improvise narratives when paired together as the player and game master of a digital interactive narrative. We collected gameplay logs from these experiences, as well as participants' reported perceptions of narrative structure, personal agency, and the reasons for both their choices and their partners'. We found a strong link between perceptions of structure and of agency. We also found a tendency for participants to better identify the goals of their partner's actions following sessions where game masters expressed higher agency. Finally, we characterize the experiences using principles of improv theatre, drawing from the data to analyze negative experiences of agency as failures in the improv partnership.

Introduction

Digital interactive narrative design commonly confronts a tension between the goal of presenting an intentional narrative and the goal of supporting players' influence on it (Bates 1992; Adams 2005). For a narrative to align with authorial intent, its events should be purposeful and interconnected rather than arbitrary and meandering—it should have a coherent *structure*. For it to feel responsive to player influence, it should enable them to establish desires for the story and contribute events accordingly, promoting *agency* (Wardrip-Fruin et al. 2009). Together, these ideals suggest that designers must account for the many directions a player could desire to take the story, and integrate them all coherently.

Unfortunately, it is intractable (for humans or computers) to fully anticipate the breadth of stories that might play out when a player has significant influence. To balance structure and agency, interactive narrative researchers have proposed experience management (Roberts and Isbell 2008; Riedl and Bulitko 2013). An *experience manager* (EM) is an integrated AI agent which controls non-player elements of the story world and directs them in service of a particular narrative experience (Riedl et al. 2008). When a player does something disruptive, the EM can alter its plans to recover,

or alter the outcome of the action. With the EM adaptively protecting structure, the designer can presumably increase agency by offering the player a wider range of options.

However, Wardrip-Fruin et al. (2009) hold that agency depends on aligning player expectations with the possibilities supported by the system, and they warn of the potential for incongruence between established expectations and supported possibilities to cause critical breakdowns of agency. From this perspective, the experience management approach sets up a precarious balance. While a player may initially experience high agency, a player that observes an alteration that contradicts established expectations about a system may question if *any* of their expectations can be relied on.

In contrast to digital interactive narrative, human-led interactive narrative often results in structured stories that *also* give participants satisfying experiences of agency. In tabletop role-playing games, narrative construction is often centralized by a game master (GM) role, analogous to an EM. In improvisational theater games, narrative construction is decentralized, implicitly coordinated by the actors as they perform (Magerko et al. 2009). In either case, the ability to collectively construct a coherent story while retaining personal agency draws on the human capacity to improvise and adapt outside strict computational bounds. Improv actors, GMs, and players report cooperative negotiation between participants as a critical component of success, even when all coordination is implicit (Johnstone 1999; Fine 2002; Acharya, Mateas, and Wardrip-Fruin 2021).

We seek to better understand how humans coordinate to create high-agency, high-structure stories—even when restricted to a limited set of actions and implicit communication. To investigate this, we conducted a study in which pairs of human participants played a digital interactive narrative, with one acting as the Adventurer player character, and the other as the GM. The capabilities of the GM role mirror the capabilities of an EM. Partners were anonymous to each other, and communication was limited to in-game actions, conveyed through a text-based web interface (see Figure 1). Thus, coordination between GM and player depended on the implicit communication. We collected the gameplay logs from these experiences, and additionally solicited participants' explanations to explain why *they* took the actions they did, and why *their partner* took the actions they did. We also collected users' reported perceptions of the structured-

ness of the narrative and their experience of agency.

We used this data to evaluate two families of hypotheses relating to participants' experiences of structure and agency. First, we hypothesize that a participant's experience of structure and agency are not in tension with each other, and that their experience of either quality is not in tension with their partner's experience of either quality. Second, we hypothesize that participants' higher reports of structure or agency are connected to improved understand of their partners' intentions (suggesting that communication was successful). In this paper, we discuss the design of the interactive game, we present quantitative results regarding our hypotheses, and we also present an analysis of the role interactions we observed, drawing from the gameplay logs as anecdotes.

Related Work

Kelso, Weyhrauch, and Bates (1993) introduce *drama management* as a means for enabling "highly interactive" dramatic narratives. In this introduction, a drama manager is the anchor that tethers a player with extensive freedom to the experience of a dramatic narrative. *Experience management* generalizes this approach to establish a framework for manipulating a narrative world to ensure a player's experience conforms (strongly or weakly) to arbitrary constraints established by the author (Riedl et al. 2008). We focus on plan-based systems, where these constraints can be specified in a strong way and strictly maintained.

In plan-based narratives, the author establishes which stories are acceptable by setting the goal of the planning problem (Young 1999). During play, the EM identifies a plan for reaching that goal and directs non-player characters (NPCs) to follow it. When the player chooses an action, the EM performs *narrative mediation*, evaluating the action's effect to determine if it would disrupt the plan (Riedl, Saretto, and Young 2003). If the action would be disruptive, the EM ideally *accommodates* it by incorporating it into a new plan that reaches the goal. Otherwise, the EM must resort to *intervention*: altering the action's effect to become non-disruptive. For example, an EM might accommodate an NPC's unplanned death by using another NPC to fulfill the same role, or it might intervene by causing the player's attack to miss.

Narrative mediation has been extended with plan recognition to anticipate player actions and enable proactive mediation (Harris and Young 2009). Anticipating disruptive actions lets the EM prevent the opportunity to take an action, rather than altering its effect. Another extension incorporates a model of player knowledge, enabling mediation that preserves the *perceived* story world and events, but which may revise anything the player has not observed (Robertson and Young 2018). These approaches expand the ability to intervene less overtly, but not necessarily less obtrusively.

Our characterization of agency in this paper follows the perspective presented by Wardrip-Fruin et al. (2009). They describe agency as a phenomenon that arises from the interaction between system and player, experienced when "the actions players desire are among those they can take as supported by an underlying computational model." Under this definition, agency in a narrative depends on the actions that the player can imagine as continuing and completing the story they have experienced, what Young and Cardona-Rivera (2011) call narrative affordances. Affordances *perceived* by the player are not necessarily *real*, and not all real afforances are necessarily perceived. This establishes narrative agency as a communication problem, where the system must align the player's perceived and desired affordances with the system's real ones. In our exercise, the GM shares in this task of communicating what actions and story developments they will allow or encourage.

We found it useful to focus on the improvisational character of the exercise when examining how communication influenced agency. We structure our analysis through analogy to improv theatre, another form of cooperative, interactive, improvised storytelling dependent on implicit communication. At the heart of this analogy is the idea that, regardless of role, participants' contributions are *offers* in the language of improv—an expansive term encompassing any on-stage action or utterance (Johnstone 1999). The term "offer" emphasizes the cooperative nature of narrative development in improv theatre, where the impact of every contribution depends on how the improvisers build upon it (or do not).

The importance of making and accepting offers is emphasized in the widely-known "yes, and" rule. Observational data supports this, demonstrating that the progression of a scene depends on participants making scene-altering offers that are accepted, and that improv actors make acceptance a core aspect of their performance (Magerko 2007). This might appear to suggest that an improv theatre perspective would mark *any* GM intervention as bad practice, but it can also be constructive to reject offers (Fine 2002). We also stress that the asymmetric improv exercises we study may have a unique relationship to improv theatre principles.

The experimental game *Bad News* (Samuel et al. 2016) is also an asymmetric improv storytelling experience where a computationally-assisted GM collaborates with a player to improvise a story. It differs in being a live role playing game assisted by computational tools, in contrast to our game which is a digital role playing game that strictly enforces a limited vocabulary of objects and actions.

The study described in this paper is an iteration on the study design in a previously published paper (Siler and Ware 2024). The previous study was limited by its story domain, which offered a singular goal for the player to pursue. We designed an expanded domain for this iteration, *The Crown*, which we describe in the following section.

Methods

The data[1] was collected as part of a classroom exercise in an undergraduate game development class at the University of Kentucky. Participating students accessed a web browser interface, connecting to the server with a unique, anonymously-assigned ID. Participants were paired together anonymously, each assigned to the role of GM or player of an interactive narrative hypertext game (see Figure 1). Pairs and initial roles were determined randomly, but subsequent

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[1]This (2024 dataset) and other iterations of the project are available at: https://cs.uky.edu/%7Esgware/projects/pairedstories/

pairings avoided pairing the same participants twice in a row, or assigning a participant to the same role twice in a row.

The instructor gave participants a brief description of the story world and its characters, and introduced the central conflict, which was described in the interface: "It is time for the kingdom to crown a new ruler. But just before the Heir's coronation ceremony, a Bandit ran off with the Crown. The Heir has promised the Adventurer a bounty of Royal Treasure to bring back the Crown. But the magical Crown has the power to turn anyone who activates its magic inside the Palace into the all-powerful monarch, and many covet the position. Who will claim the throne?"

The game was described as an interactive storytelling exercise. Participants were advised to consider challenges for collaboration with limited communication, including making and accepting offers, reasoning about intention, and managing uncertainty and unexpected developments. Lastly before proceeding with the logged exercises, students were guided through a short tutorial session (see Figure 2).

At the end of the period, the instructor connected the exercise with the course by discussing how a GM or game designer can implicitly communicate about intentions with the player. Finally, students were given the option to volunteer their game data for research by signing a consent form. The data collection was approved by the institution's IRB.

Rating Prompts   During each session, participants were periodically prompted to rate their agreement with two statements about the story so far, each on a five-point Likert scale from "completely disagree" to "completely agree".

1. "Every action in this story is important and well-integrated into narrative [sic]"
2. "I feel free to make meaningful choices that will influence this story"

We recorded responses to (1) as a rating of story structure, and responses to (2) as a rating of the participant's experience of agency. Participants were prompted for these ratings at most once per minute when control of the game switched away from them, and a final time at the end of the game.

Explanation Prompts   After the conclusion of a session, participants were prompted to provide explanations for each event in the story, excluding travel events and events which never have an effect in the computational model of the game. Each prompt included a review of all story actions occurring before the one being explained. Participants were asked to explain their own action choices, as well as their beliefs about the intentions behind their partner's choices (see Figure 3). Responses were required to identify at least one explanation from a selection including crowning one of the five characters, the addition of conflict or suspense to the story, establishing the realism of the character that took the action, or another explanation supplied by the participant.

Game Description

We describe the digital interactive narrative game in two parts: the interface, which we describe in brief, and the computational model, which we refer to as *The Crown*.

Interface   The hypertext interface presents each participant with narration, the current state of the game (as observable by their role), a menu for selecting actions, and a reference briefly describing every character, location, item, and action in the game. The player role was presented with the observations and actions available to the Adventurer character, narrated in second person.[2] The Adventurer observes visible characters they share a location with, any items they have, and any actions they are involved in. Invisible characters are described as an "unseen force" when acting upon visible characters. The GM role was given an omniscient perspective of the narrative and state, and control over NPC actions and story events. The GM was also presented with controls for letting the player act, for letting the player *continue* to act after each action (otherwise resuming control), and for deciding the outcome of actions which can fail. Finally, each role supplied their characters' responses (accept or deny) to requests for consent to joint actions.

Computational Model   *The Crown* provides a plan-based model that describes the underlying behavior of the narrative. In each state of the story world it determines what each character observes, which actions are possible, and how an action will alter the state. For the purpose of the exercise, no character goals are enforced—all choices about actions are left to the participants. The narrative ends when a character takes the action to become the monarch, or when the GM concludes the story after the Adventurer's demise.

Many of the actions in *The Crown* require key items:

- *attack*: Cutlass or Longsword
- *become monarch*: Crown
- *buy* and *sell*: Coin or Royal Treasure
- *consume* and *apply poison*: Food, Poison, Invis. Potion
- *detain*: Key to the Stocks
- *release*: Key to the Stocks or Lockpick

Items are always held by characters, moving between them according to the outcomes of the *give*, *take* (with or without consent), *loot* (from someone immobilized), *buy*, and *sell* actions. Characters can also *travel* between locations.

The remaining actions are available depending on role. The GM controls the story events for the effect of the Invisibility Potion wearing off (*end invisibility*), and for ending the story after the Adventurer's death (*player died ending*). The GM also controls two actions which have no effect on the state of the story, but which invoke narrations: *time passes* ("Some time passes...") and *hunger* ("The [character]'s stomach growls."). Finally, the player has a *wait* action which reports "The Adventurer waits idly for a while."

The *buy*, *sell*, and *take* actions are joint actions which prompt the target of the interaction for consent. If the target refuses, the *buy* and *sell* actions fail. Instead of automatically failing, a refused *take* succeeds or fails at the GM's discretion. The GM also determines the outcome of *attack*s.

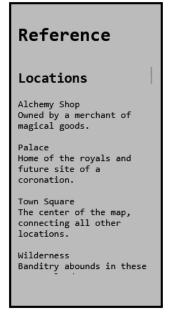[2]All examples are in third person, with text modified for space.

Figure 1: The game interface (GM view). It provides the running narration of the game in a central pane, as well as choices for proceeding; state and reference information are presented on the left and right.

The Bandit goes to the Town Square.
The Guard slashes at the Bandit... lethally!
The Adventurer loots the Crown from the Bandit.
The Adventurer goes to the Palace.
The Adventurer gives the Heir the Crown.
The Heir has ascended to the throne!

Figure 2: The story corresponding to the tutorial session.

Design Choices *The Crown*'s central conflict provides a non-trivial set of goals for both participants to reason about. The narration only explicitly states the Heir's intentions (the Bandit's motivations are described ambiguously), and the titular macguffin can draw any character into the conflict.

The items and the interactions they enable also support a variety of approaches to resolving the conflict (or achieving subgoals). We included the potential for subterfuge as well as confrontational options. There are lethal options (*apply poison* and *attack*) as well as non-lethal options (using the Invisibility Potion and *detain*) for either approach, alongside a variety of methods for negotiating item ownership.

The Invisibility Potion provides a means to manipulate observability. Being invisible prevents a character from being seen (and therefore prevents being targeted), but does not change the outcome of actions the invisible character performs—except by influencing participants' expectations. Rather than limiting the flexibility of invisibility by defining a mechanic by which it ends in response to the character's actions, it ends at the GM's discretion.

We intentionally limited the number of narration-only actions we included, prioritizing opportunities for implicit communication instead. However, each role has an action

Figure 3: An example of the prompting used during the post-game explanation interview.

for conveying idleness (*wait* and *time passes*), which we intended for participants to use when they want to encourage their partner to take action, or when no other actions are available. The *hunger* action provides a means to encourage the use of the Food item without enforcing it mechanically.

Finally, the GM role was designed to reflect the capabilities of an EM. The GM controls NPC actions and story events, has intervention options for the *attack* and *take* actions, and can assume or cede control at any time.

Results

25 students participated in the narrative exercise and signed a consent form to release their data. These students played through 34 sessions collectively. In 3 of these sessions, fewer

than 5 events occurred and no responses were recorded. In another session, no ratings were reported. In 6 of the remaining 30 sessions, one or both players did not provide explanations for any actions, but did report ratings.

We analyzed the 30 sessions with rating information for evidence of support for our hypotheses concerning the tension between structure and agency. Only the 24 sessions which had explanations from both participants were analyzed for support for our hypotheses relating structure and agency to understanding partners' intentions.

Hypotheses

We investigated two families of hypotheses.

1. On the relationship between structure and agency:

   (a) An individual participant's experience of structure and agency are not in tension with each other.

   (b) A participant's experience of structure (or agency) is not in tension with their partner's experience of structure (or agency).

2. On the relationship of structure (or agency) to understanding partners' intentions:

   (a) When a participant's perception of structure (or agency) is higher, the accuracy of both participants' explanations of their partners' intentions will be higher on average. (e.g., the GM's rating of agency is higher if participants often understood each other's intentions.)

   (b) When a participant's perception of structure (or agency) is higher, their intentions will be explained more accurately by their partner. (e.g., the player's rating of agency is higher when the GM understood why the player chose the actions they did.)

   (c) When a participant's perception of structure (or agency) is higher, the accuracy of their explanations of their partner's actions will be higher. (e.g., the GM's rating of structure is higher when the GM understood why the player chose the actions they did.)

We tested our hypotheses using Spearman's rank correlation coefficient (Schober, Boer, and Schwarte 2018), since perceptions of agency and structure were recorded as ordinal ratings. Due to the small sample size, we used permutation tests (Ernst 2004) to determine p-values. Since we evaluated many related statistics, we reduced the risk of falsely rejecting null hypotheses using the Benjamini-Hochberg (1995) method for family-wise false discovery control (corrected p-values are indicated as FDC in tables).

Since participants provided explanations using multiple-choice selections accepting multiple answers (see Figure 3), each response regarding one action represents a set of explanations. Participants were required to choose at least one explanation, but we ignore the "other" explanations for our evaluation, so the set of motivations we consider may be empty. We compared the sets of explanations participants provided using two methods of computing accuracy:

- The "Any" statistic is 1 if there is any intersection between the explanations, and 0 otherwise.

- The "Jaccard" statistic is the size of the intersection between the explanations divided by the size of the union, and 0 if both sets were empty.

Hypotheses were evaluated at two levels of resolution. For entire sessions, we considered relationships to the last structure and agency ratings participants provided in a session, and measures of explanation accuracy are averaged across the session. Within sessions we considered a resolution defined in terms of "rating windows," which associate each time a participant provided ratings with the set of actions occurring between that rating and the previous one (if any).

Conceptually, these actions represent the set of actions that are most relevant to each rating instance, and any changes in rating between instances. However, since the GM and the player did not report ratings at the same moments, these windows are not aligned between the roles, and so cannot be used for comparisons between participant ratings.

Session-Level

item 1	item 2	corr	p	FDC
GM Agency	**GM Struct.**	**0.858**	**0.001**	**0.001**
GM Agency	Pl. Agency	0.136	0.241	0.385
GM Agency	Pl. Struct.	0.056	0.397	0.457
GM Struct.	Pl. Agency	0.055	0.400	0.457
GM Struct.	Pl. Struct.	-0.039	0.602	0.602
Pl. Agency	**Pl. Struct.**	**0.846**	**0.001**	**0.001**

Table 1: Correlation results for the last ratings given by the GM and player (Pl.) in sessions with sufficient data.

We saw a strong positive correlation between a participant's final agency and structure rating in a session, suggesting that these qualities were related. This correlation strength was similar for both roles (GM: 0.858, $p \cong 0.0$; player: 0.846, $p \cong 0.0$). We found no strong signal in evaluating the correlation between any combination of the GM's reported scores and the player's.

We also evaluated the relationship between participants' last ratings for a session and the average accuracy of:

- All explanations of partners' actions in a session (for hypothesis 2a).

- All explanations given for that participant's actions by their partner (for 2b).

- All explanations given by that participant for their partner's actions (for 2c).

Across these relationships we found a notable signal in one case, but it did not pass false discovery control. This was a trend between players' ratings of structure and the accuracy of their explanations for GM actions (0.384, $p \cong 0.162$).

Window-Level

As with final ratings in a session, there was a strong positive correlation between a participant's agency and structure ratings at each moment they provided a rating. Once again, the correlation strength was similar for both roles (GM: 0.825, $p \cong 0.0$; player: 0.835, $p \cong 0.0$). This provides further support

item 1	item 2	corr	p	FDC
GM Agency	Pair Any	0.104	0.313	0.537
GM Agency	Pair Jaccard	-0.009	0.518	0.691
GM Agency	Pl Any	0.003	0.496	0.680
GM Agency	Pl Jaccard	-0.312	0.932	0.949
GM Agency	GM Any	0.142	0.264	0.507
GM Agency	GM Jaccard	0.204	0.181	0.414
GM Struct.	Pair Any	-0.048	0.591	0.691
GM Struct.	Pair Jaccard	-0.145	0.753	0.821
GM Struct.	Pl Any	-0.030	0.556	0.691
GM Struct.	Pl Jaccard	-0.341	0.949	0.949
GM Struct.	GM Any	-0.073	0.630	0.703
GM Struct.	GM Jaccard	-0.042	0.574	0.691
Pl. Agency	Pair Any	0.180	0.200	0.437
Pl. Agency	Pair Jaccard	0.074	0.365	0.595
Pl. Agency	Pl Any	0.238	0.131	0.330
Pl. Agency	Pl Jaccard	0.053	0.403	0.605
Pl. Agency	GM Any	-0.020	0.535	0.691
Pl. Agency	GM Jaccard	-0.060	0.605	0.691
Pl. Struct.	Pair Any	0.264	0.106	0.329
Pl. Struct.	Pair Jaccard	0.240	0.130	0.330
Pl. Struct.	Pl Any	0.384	**0.032**	0.162
Pl. Struct.	Pl Jaccard	0.260	0.110	0.329
Pl. Struct.	GM Any	0.046	0.420	0.611
Pl. Struct.	GM Jaccard	0.061	0.394	0.605

Table 2: Correlation results for the final ratings given by either the GM or player (Pl.), with respect to the accuracy of the explanations given for partners' actions, in sessions which had sufficient explanation data.

item 1	item 2	corr	p	FDC
GM Agency	**GM Struct.**	**0.825**	**0.001**	**0.001**
Pl. Agency	**Pl. Struct.**	**0.835**	**0.001**	**0.001**
GM Agency	**Pair Any**	**0.281**	**0.001**	**0.031**
GM Agency	Pair Jaccard	0.205	**0.014**	0.116
GM Agency	Pl Any	0.184	**0.048**	0.211
GM Agency	Pl Jaccard	0.077	0.245	0.489
GM Agency	**GM Any**	**0.330**	**<0.001**	**0.014**
GM Agency	GM Jaccard	0.246	**0.005**	0.063
GM Struct.	Pair Any	0.216	**0.011**	0.103
GM Struct.	Pair Jaccard	0.131	0.083	0.329
GM Struct.	Pl Any	0.201	**0.034**	0.162
GM Struct.	Pl Jaccard	0.112	0.156	0.376
GM Struct.	**GM Any**	**0.272**	**0.002**	**0.037**
GM Struct.	GM Jaccard	0.184	0.029	0.162
Pl. Agency	Pair Any	0.051	0.301	0.535
Pl. Agency	Pair Jaccard	-0.077	0.783	0.825
Pl. Agency	Pl Any	0.074	0.231	0.483
Pl. Agency	Pl Jaccard	-0.082	0.791	0.825
Pl. Agency	GM Any	0.062	0.285	0.527
Pl. Agency	GM Jaccard	-0.027	0.595	0.691
Pl. Struct.	Pair Any	0.123	0.104	0.329
Pl. Struct.	Pair Jaccard	0.032	0.372	0.595
Pl. Struct.	Pl Any	0.117	0.124	0.330
Pl. Struct.	Pl Jaccard	0.012	0.451	0.637
Pl. Struct.	GM Any	0.207	**0.029**	0.162
Pl. Struct.	GM Jaccard	0.140	0.101	0.329

Table 3: The overall correlation between one participant's structure and agency ratings, and the correlation between either of a participant's ratings and the accuracy of a set of explanations occurring since that participant's last rating.

for a connection between perceptions of personal agency and narrative structure, a connection that is apparent even as these perceptions fluctuate throughout an experience.

We also identified a few mild correlations between ratings given by the GM and average explanation accuracy in the associated window (as determined by the "Any" statistic). GM agency reports were correlated with the joint average accuracy for participants' explanations in the associated window (0.281, $p \cong 0.031$), and correlated at slightly greater strength (0.330, $p \cong 0.014$) with the average accuracy of GM's explanations of the player's actions. GM structure ratings also showed correlation (0.272, $p \cong 0.037$) with the average accuracy of GM's explanations of the player's actions.

In other words, GMs demonstrated a better post-session understanding of player intentions for groups of actions when those groups of actions preceded stronger GM perceptions of agency and structure. This was also true with respect to the joint average accuracy of post-session explanations for actions preceding stronger GM perceptions of agency only, though this was weaker than GM accuracy alone.

Several window-level results did not pass false discovery control, but may encourage further exploration into links between explanation accuracy and GM agency and structure.

Discussion

The clearest relationship in our quantitative analysis is the strong correlation within individual participants' ratings of narrative structure and agency. This correlation is equally strong for both roles despite their distinct relationships to control of the narrative. Our data did not indicate a relationship *between* partners' ratings of the qualities, but there is an apparent harmony within participants' perceptions.

We were able to identify some links between GM reports of structure and agency and the accuracy of their explanations for player actions in the period before the report. This correlation could only be established for the looser sense of accuracy that we used. Participants' explanations for their partner's actions were accurate only half the time overall by this looser sense. By the Jaccard metric the average accuracy of partners' explanations is 0.36, though the average accuracy of some sessions is as high as 0.93.

While our quantitative analysis identified some interesting relationships and trends, the data is noisy and complex. For example, structure and agency ratings may vary greatly by the chance preferences of GM or player, as demonstrated by one session where the player reported a positive feeling of agency in spite of only being allowed to take one *travel* action. As such, it is difficult to capture any broad impression of how the interactions between the roles influenced perceptions of agency, structure, or intent. In the remainder of this section we discuss the communication practices that were observed in more detail, using concepts from improv

theatre to guide our analysis. We begin by elaborating on the framing of interactive narrative as an improv game.

Interactive Narrative as Improvisation

Improv theatre performances typically involve actors playing an *improv game* which sets constraints for the performance (Magerko et al. 2009). As an improv game, interactive narrative specifies unusually strong constraints over the performance—fully prescribing the characters, items, locations, *and* possible events in the story world.

The game is performed by two improvisers in asymmetric roles: the player and the GM. The player is embodied by a character in story world and—much like an improv actor—participates by determining how their character thinks, feels, and acts. In contrast, the GM's role in the performance is more like a puppeteer and playwright, with their contributions being conveyed through the NPCs, story events, and selecting the outcome of actions.

This asymmetry favors the GM in terms of absolute control over the story world, but it favors the player with control of the narrative focus. From this perspective the GM is obliged to take an authorial role, but can only truly succeed in their role by steering (or pushing) the player character through a narrative experience. In turn, the player must participate sincerely in their role for the pair to succeed. We note these obligations as useful for understanding the roles' interactions; we do not argue that the participants always understand, accept, or fulfill these obligations.

Offers   Every action in a performance is an offer, and the actions in this performance are specified by the underlying computational model of the game. This defines the offers that can be made, when they can be performed, and whether they can be directly refused. Either participant can refuse offers to take a joint action by denying character consent, and the GM can also refuse offers made with actions that can fail. All others are automatically accepted as described in the computational model.

Refusing an offer nullifies its effect in the computational model, but does not necessarily nullify its effect on the performance. Instead, refusing an offer directly establishes an alternative offer in its place. For example, if a player offers "the Adventurer steals the Guard's Longsword" and the GM refuses it, this instead accepts an offer of "the Adventurer *tries to steal* the Guard's Longsword *and fails*." The GM's intervention negates the outcome sought by the player's offer, but the new offer that results may still be built upon with further events like "the Guard detains the Adventurer."

Endowments   This demonstrates an important aspect of the relationship between the computational model and the offers it supports. Some offers are established by actions which have no computationally-defined effect but still *endow* the story world with ephemera like relationships (Garrett 2006). Participants are free to ignore these ephemera, but they nonetheless establish them intentionally and react to them as well. For example, GMs in 19 sessions elected to have NPCs carry out failed attacks, appearing to demonstrate conflict between NPCs or establish a threat towards the Adventurer (see Figure 4).

> ...
> The Adventurer steals the Key from the Guard.
> The Adventurer fails to take the Guard's Longsword.
> The Guard slashes at the Adventurer... a miss!
> The Adventurer detains the Heir.
> The Guard slashes at the Adventurer... lethally!
> The Guard goes to the Palace.
> Today's tragic events have sealed the Adventurer's fate.

Figure 4: A snippet from session 22, where a threat is established and then carried through on once it is ignored.

The GM's *hunger* action similarly endows a target character with an ephemeral quality that has no representation in the computational model. In 8 of the 10 sessions where GMs signaled the Adventurer's hunger while the Food item was still available, the player built upon this with the Adventurer consuming the Food, often immediately afterwards. We originally envisioned this action being used in communicating an NPC's vulnerability to poisoned Food, but it was also often used when the Food was no longer available.

In a couple of instances, the Adventurer's hunger was signaled after an NPC had taken the Food item from the Adventurer and consumed it, resulting in strong reactions from the player. In one case (see Figure 5) the player explained the consume event with "MAKE ME HATE THE ALCHEMIST," and explained their choice to later detain the Alchemist as "ALCHEMIST SUCKS SEND HIM TO JAIL."[3] The deliberate use of endowment is clearest for these actions and events without an effect modeled in *The Crown*, but all actions have the potential to endow ephemeral qualities in participants' understandings of the story.

> ...
> The Alchemist steals the Adventurer's Food.
> The Alchemist consumes the Food.
> The Adventurer's stomach growls.
> The Adventurer slashes at the Alchemist... a miss!
> The Alchemist gives the Adventurer the Poison.
> The Adventurer detains the Alchemist.
> ...

Figure 5: A snippet from session 16, where the Adventurer responded aggressively after the Food was taken and their hunger emphasized.

Tilting   Improv performances are driven by interactions like the above which "alter" characters by *tilting* the balance between them (Johnstone 1999). That balance, referred to as a *platform*, has more to do with the "typical" relationship between those characters than any absolute difference between them. For example, our game establishes an initial platform and tilt in its opening narration. The relationship between the Heir and Bandit is not *equal*, but a coronation is routine and everything is set for that routine to continue as usual—until the Bandit interferes. The theft of the Crown tilts this

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[3]The majority of this participant's responses were not all-caps.

platform, breaking routine and motivating interaction.

```
...
The Guard steals the Adventurer's Food.
The Adventurer pays a Coin for the Guard's Longsword.
The Adventurer slashes at the Guard... lethally!
The Bandit detains the Adventurer.
The Bandit goes to the Palace.
The Adventurer waits idly for a while.
An unseen force frees the Adventurer.
The Alchemist materializes back into view.
The Alchemist gives the Adventurer the Poison.
The Adventurer goes to the Palace.
The Adventurer slashes at the Bandit... lethally!
The Heir loots the Crown off of the Bandit.
The Adventurer slashes at the Heir... lethally!
The Adventurer loots the Crown off of the Heir.
The Adventurer gives the Alchemist the Crown.
The Alchemist dons the Crown.
The Alchemist has ascended to the throne!
```

Figure 6: A snippet from session 30, where tilts involving the Adventurer appeared to impact the story significantly.

Tilts introduced by participants—particularly involving the Adventurer—also appeared to have a strong effect on the story. These tilts were often built on aggressive actions like *attack* and *detain*, but not exclusively. For example, in one session (see Figure 6), helpful interactions with the Alchemist alongside harmful ones with other NPCs seemed to inspire a strong commitment to crown the Alchemist.

Interactive Narrative as Improvised Tour

Framing interactive narrative as we have, the player is a key participant in the development of the narrative. Even when the GM dominates the process of *telling* the story, instilling dramatic qualities such as suspense or uncertainty requires the player's limited point of view. In other words, the player is the primary audience, and the narrative is perceived through their character. However strictly the GM controls how the story unfolds, the player controls how it is seen like a patron constructs their experience of an art gallery.

GMs in 9 of the 29 completed sessions experienced reductions in the perception of agency, temporary or otherwise. We suggest the player's role as participatory audience is a key influence on these perceptions, which we take as indicative of difficulties with directing the player towards the GM's intentions for the story.[4] For example, one GM seemingly intended a story where the Bandit assisted the Adventurer and supported them to be monarch. They reported the maximum perception of agency after the Adventurer agreed to buy the Bandit's Crown, but neutral agency following the Adventurer attacking the Bandit (see Figure 7).

That session's outcome may indicate an inability to predict or control player behavior even when things appear to be going well. However, the session also began with the Bandit

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[4]We cannot discount other influences on GM agency, however, such as mismatched expectations about GM capabilities.

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...
The Adventurer applies the Poison to the Food.
The Adventurer gives the Heir the Food.
The Heir consumes the Food.
Suddenly, the Heir falls over dead from poison!
The Guard detains the Adventurer.
The Adventurer waits idly for a while.
An unseen force frees the Adventurer.
The Guard slashes at the Adventurer... a miss!
The Adventurer steals the Longsword from the Guard.
The Adventurer slashes at the Guard... lethally!
The Adventurer loots the Treasure off of the Heir.
The Bandit materializes back into view.
The Bandit sells the Adventurer a Crown for the Treasure.
The Adventurer slashes at the Bandit... a miss!
The Bandit goes to the Palace.
The Adventurer goes to the Palace.
The Adventurer slashes at the Bandit... lethally!
The Adventurer loots the Treasure off of the Bandit.
The Adventurer's stomach growls.
The Adventurer dons the Crown.
The Adventurer has ascended to the throne!
```

Figure 7: A snippet from session 32, where the Adventurer attacked the Bandit after being helped, reducing GM agency.

slaying and looting the Alchemist in the Adventurer's sight. Discussing improv theatre, Johnstone (1999) emphasizes the expectations audiences form based on what is shown. This suggests an alternative explanation: the GM unknowingly primed the player to view the Bandit as a threat.

Johnstone also characterizes audiences as expectant of certain satisfactions of viewership, such as expecting mysteries to be solved. Mystery can drive interest, as in session 16 (too long to show in detail) where the Bandit repeatedly undermined the Adventurer's actions when out of sight or invisible. The GM expressed a positive view of agency after the Adventurer ventured to the Wilderness in search of the Bandit. Immediately after, however, the player turned to aggressive interactions with other NPCs, saying they were "bored and trying to cause problems" after being unable to find the invisible Bandit. The GM's reported neutral agency afterwards, but influence may have been maintained if the Adventurer had not lost confidence in resolving the mystery.

Interactive Narrative as Guided Improvisation

In addition to their role as audience, the player also acts as the improv actor behind the Adventurer's performance. Players in 13 of the 29 completed sessions experienced reductions in their perception of agency. We focus on their role as an improviser to help understand these moments, especially as it interacts with the GM role as a partner.

In session 15, for example, the player expressed positive agency at two moments, but otherwise reported neutral or strongly negative perceptions. Their positive perceptions align with moments that they had the Key or Longsword, both items which would support acting on their intent to carry out the Heir's quest (as expressed in explanations).

One neutral report followed the theft of the Key, and the others followed the Guard looting the Bandit's Crown. The player explained all their following actions as adding conflict, proceeding to slay every NPC and collect every item before becoming monarch, reporting a completely negative impression of agency at the end of the story.

> The Guard sells the Adventurer a Key for the Coin.
> The Alchemist steals the Key from the Adventurer.
> The Adventurer steals the Potion from the Alchemist.
> The Adventurer consumes the Potion... and disappears!
> An unseen force steals the Guard's Longsword.
> The Bandit goes to the Palace.
> The Adventurer goes to the Palace.
> An unseen force slashes at the Bandit... a miss!
> An unseen force slashes at the Bandit... a miss!
> An unseen force slashes at the Bandit... lethally!
> The Guard loots the Bandit's Crown.
> The Adventurer waits idly.
> The Adventurer goes to the Town Square.
> The Adventurer sells the Longsword for the Heir's Treasure.
> The Adventurer goes to the Wilderness.
> The Adventurer consumes the Food.
> The Adventurer materializes back into view.
> The Guard loots the Bandit's Lockpick.
> The Adventurer waits idly.
> ...

Figure 8: A snippet from session 15, where the Adventurer disengages from the conflict rather than fight the Guard.

In this session, the collapse of agency appeared to follow a loss of motivation. The player was first motivated to respond to the initial tilt, but this faltered after being twice undermined. The GM's explanations show they intended the Guard as a challenger for the Crown, but the player's suggest rejection of this offer, selling the Heir a Longsword and going to the Wilderness. Notably, the relationship between Guard and Adventurer (or Guard and Heir) was never tilted. Contrasting this with sessions where GMs successfully drew players away from the initial tilt with more personal ones, it appears that collaboration in this session collapsed due to a lack of personal motivations facing the Adventurer.

Across other sessions, players were somewhat prone to decreases in agency after being detained or having actions rejected, but perceptions often recovered quickly once the player had another way to move forward. In sessions 17 and 41, player agency appeared to fall due to their offers being ignored or undone rather than built upon. In sessions 31 and 48, player agency fell after the Adventurer unknowingly consumed a poisoned Invisibility Potion. This stands in contrast to two sessions where the Adventurer consumed poisoned Food with no loss of agency, suggesting the influence of expectation on their agency.

Conclusions

In this paper we described a study which paired participants in a cooperative storytelling exercise using a digital interactive narrative. Participants in the player role controlled, and took the perspective of, one character. The GM role directed all other aspects of the story world. The data from this study is available online at https://cs.uky.edu/%7Esgware/projects/pairedstories/. It features participants' reports of personal agency, narrative structure, and *post hoc* explanations for their actions and their partner's actions.

Our analysis identified a strong correlation within each participants' perceptions of personal agency and narrative structure, during the experience and at the end. This supports our hypothesis that these qualities are not in tension, at least within one participant's perceptions. We found no conclusive results on the relationship between partners' ratings.

We also identified mild correlations between GM reports of structure or agency and the average accuracy of their *post hoc* explanations for the player actions that preceded those reports. There was also a similar correlation between a pairs' joint average accuracy and GM reports of agency, specifically. These results support the hypothesis that there is a connection between GMs' ratings and improved recognition of player intent, at least. Otherwise we saw support for a connection between GM agency and improved *joint* intent recognition, but all other results were inconclusive.

Finally, we described the exercise as an improv game and characterized participants' interactions using concepts from improv theatre. We used this framing to interpret interactions between the roles, and to elucidate possible reasons for negative experiences of agency observed in either role. We emphasize here that our analysis of the relationship between participants' interactions and potential internal experiences requires interpretation of the participants' actions, explanations, and reports. Anecdotally, we found this framing useful for making sense of participants' reported experiences and explanations.

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