

Narrative Development in Improvisational Theatre

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Abstract. We have investigated the experience of improvisers as they perform to better understand how narrative is constructed by group performance in improvisational theatre. Our study was conducted with improvisers who would perform improv “games” with each iteration video recorded. Each individual participant was shown the video in a retrospective protocol collection, before reviewing it again in a group interview. This process is meant to elicit information about how the cognition involved develops narrative during an improvisation performance. This paper presents our initial findings related to narrative development in improvisational theatre with an ambition to use these and future analyses in creating improvisational intelligent agents. These findings have demonstrated that the construction of narrative is crafted through the making and accepting of scene-advancing offers, which expert improvisers are more readily capable of performing.

Keywords: Improvisation, Cognition, Performance, Narrative.

1 Introduction

Improvisational theatre has its roots in the *commedia dell’arte*, a 15th century Italian theatre form that involved stock characters, where actors were required to fill in the holes of a basic plot outline for each new performance [1]. Modern Western improvisational theatre has been influenced heavily by the seminal teachings of contemporary directors such as Del Close and Keith Johnstone who have developed forms and methods for improvisation that cater just as much to storytelling as comedy [1], [2].

This connection to storytelling is a particularly compelling one when considering the creation of digital interactive stories. Improvisational actors have the daunting task of constructing a story for an audience in real-time without the benefit of explicit coordination or pre-planning [3], [4], [5]. There is a high degree of agency for all of the actors on stage and, within some game forms, the audience as well (e.g. certain improv “games” involve the audience being prompted for content suggestions in the middle of a scene). Improv theatre, therefore, is a real world example of what some interactive story researchers attempt to accomplish – an adaptive, story-rich experience that has high agency for all members involved [6].

There have been attempts to model improvisation from a theoretical point of view, studying improvisational texts or techniques to elicit computational behaviors for intelligent agents [7], [8]. The results of these projects have been fairly specific

Narrative Development in Improvisational Theatre

examples of a single facet of modern improvisation (e.g. status) without a broader model encompassing more of improvisation. These works also tend to focus on *what improvisers are taught* and not necessarily *what they actually do* in terms of mental processes. Therefore, we have conducted a series of experiments designed to study the underlying cognition of theatrical improvisation with the end goal of creating intelligent agents that have behaviors modeled after our findings.

Our research target is to reach a better understanding of a subset of cognitive mechanisms underlying improvisation that we hypothesize is the most useful for building improvisational intelligent agents: basic cognition (e.g. how improvisers reason about their own knowledge and goals as well as that of others (i.e. theory of mind, reasoning about their own skill levels, or metacognition), narrative development (i.e. how improvisers reason about story development, character, and the environment), model convergence (i.e. how improvisers deal with having initially different models about the platform, the characters, the setting, the current state of the story, etc.), referent use (i.e. how improvisers use improvisation domain knowledge and the constraints of the game, an improv scene with rules that constrains the performance either in terms of rules of performance and / or scene content, they are playing to guide their decisions), and cognitive workload (i.e. how the real-time constraints of improvisation affect cognition). This paper presents our initial findings on a specific set of our data that is likely the most relevant to creating improvisational intelligent agents: narrative development. Section 2 discusses the related work in improvisation research and believable agents. Section 3 presents our experimental design for studying human improvisers. Section 4 introduces our synthesis of existing narratology concepts and our findings in improvisation. Section 5 describes our current findings. Finally, Section 6 discusses the limitations of our findings, as well as future work.

2 Related Work

2.1 Improvisation Research

The current body of research on improvisation, which most notably comes from the improvisational music domain, points to the following generalities:

1. Improvisation is a constant process of receiving new inputs and producing new outputs [9], [10]. Improvisational dance, theatre, music, etc. all depend on performers observing their own and other performers' actions, performing some quick deliberative process, and then selecting new actions to perform. Strategies for visual and auditory attention, deliberation on inputs, and the heuristics used for selecting actions are unclear in any domain. An improvisational model must be able to process and interpret these inputs as knowledge involved in the decision-making process.
2. Improvisation is a “continuous and serial process” [4], [5] as opposed to one that is “discontinuous and involving iteration,” such as music composition [3]. This suggests that there are specific cognitive processes that are employed during

Narrative Development in Improvisational Theatre

improvisation that are either (a) different from those used during non-improvisational acts, or (b) employed with different constraints than those used during non-improvisational acts.

3. Improvisation is a process of severely constrained human information processing and action [10], [11], [12]. As Pressing [9] points out, an improviser must, in real-time, optimally allocate attention, interpret events, make decisions about current and future actions, predict the actions of others, store and recall memory elements, correct errors, control physical movements, and integrate these processes seamlessly into a performance. How this view of cognitive constraints maps on to the theatre improv domain has yet to be shown.

2.2 Improvisation in Interactive Narrative

There have been a few attempts to create virtual improvisational theatre systems. The Computer-Animated Improvisational Theater (CAIT) is an interactive theatre system that allows children to control avatars in a virtual world in which intelligent animated agents improvise playtime activities [7], [13]. The intelligent animated agents reactively follow the *broad but shallow* reasoning philosophy, which aims to produce agents that appear intelligent in the short term without delving deeply into theories of cognition [14]. Without such a formal theory or cognitive model of creativity and improvisation, the CAIT agents are limited to only executing task sequences that were pre-authored by the system developers. That is, any variability in agent performances is due to responses to the human interactor.

The Improv system [8] is a system in which virtual animated avatars can be scripted to enact a scenario. The Improv system emphasizes variability at the surface level of the presentation – the exact positioning, movements, and gestures of avatars in a virtual graphical environment – by introducing noise to produce natural-looking variability. Hayes-Roth and van Gent [13] combined the Improv system and CAIT to produce a non-interactive scenario about a master and servant that can play out three different ways depending on the setting of personality traits for the master and servant roles.

A field of work that is similar in many ways to computational theatre systems is the domain of interactive story research [15], [16], [17]. Interactive story systems attempt to tell a story in which the user is an interactive participant and is able to perform actions or make choices that impact the direction and/or outcome of the story. Swartjes' investigation into improvisation noted several improvisation techniques for developing narrative (such as making, interpreting, and accepting offers) [6]. His work surveyed the possibility of implementing improvisation theory, as opposed to studying real life improvisers, into emergent narrative systems. In Swartjes' conclusion, he observes that future work will focus on developing and implementing an architecture that uses improvisation techniques [6].

Many, but not all, interactive story systems create experiences procedurally by simulating a virtual environment populated by autonomous agents that enact the roles of characters. Most researchers in the area of interactive story have not attempted to reproduce improvisational theatre. These systems employ, to varying degrees,

attempts to create the appearance of intelligent activity without modeling improvisation or creativity. Interactive story systems, for both entertainment and training, have taken steps towards giving the appearance of believable improvisational performances without the benefit of a deep understanding as to how expert humans perform the same tasks.

3 Experimental Method

We conducted a series of experimental sessions from 2008 to 2009 in order to extract cognitive data from human improvisers in a theatrical setting. Our purpose was to better understand how improvisers construct narrative as an improvisational task, the decision-making process they employ, and information about group dynamics in this domain. The research participants were recruited from a pool of four local improv troupes ranging in experience from novice to expert.

Retrospective protocol collection involves having the participants perform a given improv task (e.g. being given an improv “game” and a pre-determined set of suggestions for the scene) while we videotape the performance, and then immediately showing the video recording to each of the participants in different interview rooms. Interviewers have the role of prompting participants to continuously comment on what they recall about their thought process during what is transpiring on screen. The purpose of this is to try to elicit procedural and semantic knowledge that was being employed while they were on stage. While retrospective data has several limitations, an extensive and rigorous process of experimentation and prototyping led to this decision. Since data is impossible to get *during* the performance, a retrospective technique is the most appropriate (though noisy) means of collecting cognitive data.

The *group interview* is conducted after all of the individual protocol collections are completed. The participants as a group review the performance again with a group interviewer present. They are prompted to discuss any possible states of confusion that they had as individuals, what each was thinking that the other was trying to accomplish, etc. The goal of the group interview is to uncover issues in group dynamics, consensus building techniques, and any surprises that may have not been obvious from the individual interviews alone.

During our data analysis, we found that the decision-making process involved in improvisation mapped well onto the decision cycle posited in Newell’s. This has lead us to both a bottom up (data-driven) and top down (applying Newell’s Unified Theory of Cognition) analysis of our data, using language and structure from the UTC to provide a framework for organizing and explaining our findings [22]. Improvisers receive new *inputs*, elaborate new knowledge based on what they have observed and already know, propose actions to take, select one of those actions, and then execute the selected action. We have compacted this cycle for presentation in this paper into *input*, *creation*, *selection*, and *execution*. Presenting our data within this framework allows us to organically situate our data within the constraints of a long-standing cognitive architecture. This bodes well for both a verification of the data we have collected (i.e. if it did *not* match onto this decision cycle – or the workings of other

high level cognitive theories – then our data may be faulty or too noisy) as well as for the future implementation of our theory in a synthetic character in the SOAR architecture.

4 Narrative Theory and Improvisation

We have surveyed various narrative sources to arrive at an appropriate vocabulary for describing narrative development in improvisational theatre. It is important to ground our analysis both in terms of what has been observed of narrative structures in related domains (typically literary and film narrative theory) and in what we observe improvisers doing in our collected data. The following is a synthesis of narrative theories as they relate to our findings, providing a useful and empirically based vocabulary to describe our findings.

A simple and concise definition of narrative is as a *story*, which is what is in a narrative (the content), plus its *discourse* (how that story is related to an audience) [18]. Chatman's definition was selected because it synthesizes Anglo-American, Russian, and French theories of narrative and his own definitions that have been widely influential on narrative theory. A narrative's story consists of *existents* and *events*, while its discourse consists of the narrative's *manifestation* and the story *structure*. Figure 1 visually represents the information we examine further below.

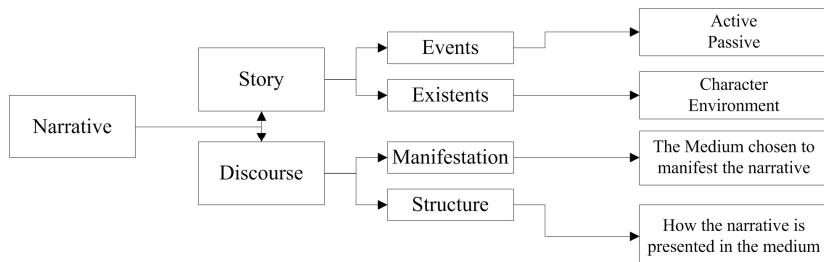


Fig. 1. Narrative and its Constituents

4.1 Story

Story can be broken down into its *existents* and *events*. Existents are characters, settings, and everything that exists within the world of the story. *Character* can be described as the sum of a character's traits, and is verisimilar in nature. *Setting* is a physical place and the objects within it [18]. For example, "Heathcliff" is a character in the book *Wuthering Heights*, and "Wuthering Heights" is a location in that book. Therefore, both Heathcliff and Wuthering Heights are existents within the narrative *Wuthering Heights*. Existents in improvisational theatre are generated within a scene, and their use and construction is a focus of our research. Events, the second story element, are what occur within a narrative. Ryan proposes terminology that matches our data: *active* and *passive events* [19]. Active events are occurrences that

Narrative Development in Improvisational Theatre

significantly alter the state of the scene. Alternatively, passive events do not significantly alter the state of the scene.

As both our research and Ryan point out, the goal in performing an event does not always affect the state of the scene (defined as “the condition of a system (or part thereof) at a given point of operation; a set of elements characterized by a number of properties and relations at a given time; a situation” [20]) as desired. In other words, an action that could be intended to affect the scene could wind up having no effect and vice versa. Therefore, we recorded both the performers’ reported intentions to affect the scene and the actual result of their actions based on our observations.

4.2 Discourse

Narrative's other main element, discourse, is derived from its *manifestation* and *structure*. The manifestation is the medium used (e.g. books, ballet, cinema, etc.), and its elements vary from art to art. A narrative’s structure is a connected set of narrative statements that relate the story, the order of situations and events, the speed of narration, etc. [18]. The cinematic media is structured by shots. In the film *Citizen Kane*, for example, the flashback to Kane’s childhood uses a long depth of field structure to allow focus on Kane, his parents, and Walter Thatcher. The shot is a long take that maintains focus on all of the characters. This scene could have been broken into shots focusing on the individual actors, while still having the same dialogue. The substance of the discourse would have been the same, but the structure would have been different. Therefore, it is the discourse that determines how the states and events are portrayed and ordered.

In dramatic theatre, the discourse is derived from the dramatic text. This indicates who should speak in turn, who should move where, etc. Improvisational theatre lacks a dramatic text, so its equivalent must be created and developed ad hoc by the improvisers on stage. This involves a rapid intake and processing of data [21]. During an improvisational performance, the narrative is being created while simultaneously being executed by its discourse. This is further explained in section 5.1.

5 Current Empirical Findings

This section explains how the narrative terminology described in section 4 is adapted to encoding the improvisation performances. Then it discusses how that information is mapped onto the Newell Decision Cycle.

5.1 Narrative on Stage

As described in Section 4.1, the first narrative theory to be mapped is story’s concept of existents. Existents are broken into their major components of character and environment [18]. *Character* is broken down into a character’s *traits* and *consistency*. Traits are the character’s relationships (i.e. how that character relates to other characters), goals (i.e. what they wish to accomplish in both the long and short-term),

Narrative Development in Improvisational Theatre

history (i.e. past events that are revealed), and attributes (i.e. physical and mental qualities). In other words, traits are the aspects of that character that make them a unique person. Consistency is a matter of whether or not the character remains verisimilar within the narrative [18]. In one game, improviser D7 realizes that his character is an “I’m gonna play by the rules” person. When his character’s friends begin speaking poorly of his wife he decides to defend her. D5 then says D7’s wife is handsome. D7 later explained in the interview that,

“D5 isn’t necessarily trashing the woman, which I’ve already formed an opinion about that I love her and I think she’s the most beautiful person in the world... He’s kind of calling her ugly which I then say, are you calling her mannish?”

D7’s attitude remains consistent, establishing verisimilitude for the character.

“Environment” is one of a few terms that improvisers use when describing the virtual space on stage. They describe environment in terms of the location (i.e. where the scene is supposed to take place, such as a museum), the objects (i.e. the nonliving objects within the location, such as a statue), attributes (i.e. the qualities of the location, such as cold), and consistency. Consistency is derived from what in the environment remains the same from moment to moment. For example, D7 pantomimes holding a bag of popcorn during one experimental run. The bag’s apparent weight and size remain the same for the duration of the scene. This action maintains the consistency of the environment as a realistic/plausible location, as opposed to the audience’s expectations perpetually being violated (e.g. the popcorn bag changing size for no reason or disappearing altogether – both of which are the types of errors that are more likely to occur in novice performances).

The other major narrative theory concept to address is discourse (see Section 4.2), which focuses on the structure and manifestation of the narrative. The manifestation, medium [20] used is improv theatre, but the structure of the narrative’s events is simultaneously being generated as it is performed. The discourse of the narrative (and therefore how the content is communicated) is generated through *offers* [6]. An offer made by an improviser introduces an idea or possible progression to the scene (i.e. one improviser turns to another and says, “Check out that lion”; the first improviser is offering the idea of a lion being in the scene). In order to advance the state of the scene, improvisation is constructed through making, accepting, and rejecting offers. We have analyzed the data for active (i.e. intending an event to significantly alter the state of the scene) and passive intent (i.e. intending an event to not significantly alter the state of the scene) in the offers made, and whether they are accepted or rejected as events that alter the state of the scene. Our research has so far consistently displayed that for a scene to progress, the events that alter its state are active intent offers that are accepted. However, there are some incidents of intentions being misconstrued in their intent, or simply not observed. This data defaults to passive input and/or execution, because it does not attempt to actively develop the state of the scene.

5.2 An Improviser's Decision Cycle

The following is a deconstruction of an improviser's decision process based on our initial empirical findings. Character, environment, and intention are coded for each stage in the cycle (i.e. when the performers develop the scene in the ways explained in the previous section, that data is encoded).

5.2.1 Input

The first stage of the decision cycle in improvisation is an improviser's reception of input. As stated in Section 2.1, an improviser perpetually takes in audio and visual stimuli as the scene develops from other improvisers, the audience, or the improv game host [21]. Improvisers communicate knowledge about the character traits, environment traits, and intentions of their own characters or of others. For instance, E3 was endowed in one performance with the quality of wanting purple chiffon for a house by E2 saying that E3 had always wanted it. In this way, E2 gives E3 knowledge about her character and E3 accepts that to help define her character.

Figure 2 illustrates the basic acquisition of new information by an improviser. The knowledge encoded for includes character and environment aspects (the existents), event intention (discourse structure), audience input (whether they laugh, are silent, interested, or for some games if they give a suggestion for the scene), and assignment (the origin of an assigned quality, such as the game host). For example, in a game of Party Quirks one improviser enters the scene with his arms outstretched and lurching around – as if flying out of control. This is a useful input to the party host that allows him to internally elaborate a hypothesis about the guest's quirk of flight (a character trait).

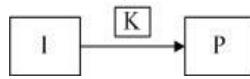


Fig. 2. Input (*I*) of Knowledge (*K*) to the Performer (*P*).

5.2.2 Creation

Creation is the term we use to encompass the processes of elaborating new knowledge and internally proposing new actions to execute. Proposed events can develop the scene. This stage and the subsequent Selection stage take place entirely within a performer's head and can only be observed by examining the collected retrospective protocol data.

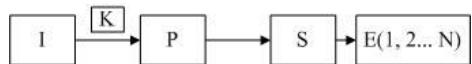


Fig. 3. The performer perceives the State of the Scene (*S*), and then mentally creates possible Events (*E(1, 2... N)*) the performer could initiate.

immediately begins to think of various possibilities for the scene, looking for inspiration in the assigned information from the game host. The knowledge elaborated is that they could see animals mating at the zoo. She decides to store that idea for later

For example, C3 is given information about the scene she will be in while playing a game named *Game* (which is defined as “perform a scene” with either no constraints, a location and relationships given, or an entire plot given by the game host). She

Narrative Development in Improvisational Theatre

(this is encoded under creation as possible states (a potential situation that may arise in the scene)). When C2 comes onto the stage, C3 thinks, "Why am I not in the scene? Okay, I must have been walking around. That made me think map. Okay, I have a map in my hand. And so through that I knew my character wasn't very good at directions." C3 takes in the knowledge of the scene from the game host and her fellow improviser. She then examines the state of the scene in a process of interpretation (why am I not in the scene?) and then proposes possible events to affect the scene (Figure 3 for visual), environment traits, and/or character traits (e.g. the mating animals, walking around previously, having a map in hand as she enters, and being poor with directions).

5.2.3 Selection

The Selection stage consists of choosing and rejecting the actions proposed in the Creation stage. Figure 4 displays that after creating possible events the performer decides on a single one and rejects the others. The order of preference in selecting events seems to be first what would heighten the emotion of the scene (by accepting/making offers), then what would keep the scene going (avoiding silence). Experts have so far exhibited the ability to accept/make offers readily, as opposed to novices who tend to default to what would keep the scene going without advancement.

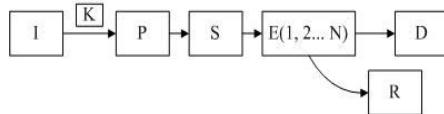


Fig. 4. One event is Decided (*D*) on and the others become Rejected (*R*).

been with the third; and the current couple would get up and leave, thus ending the scene. D6 takes in that information and decides to start the scene with a laugh. D6 later reported,

"I didn't want to start the scene with us sitting down at the table and ordering. I wanted us to have been there a while... I wanted to start with a laugh as if we had just been having a good time. And then we could change the emotion from light-hearted and then get into the story."

D6 proposes two scenarios for the starting state of the scene in creation. Either they would be starting to eat dinner, or had been eating dinner for an unknown amount of time. His assumption is that a scene of dinner starting would be heavy on gossip and small talk. This would not heighten the emotion of the scene. D6 rejects this possibility and decides to laugh as an active event. This would transition the scene from its state before the start of the scene (talking and having a good time) to the current state of the scene (where the emotions become more negative and intense).

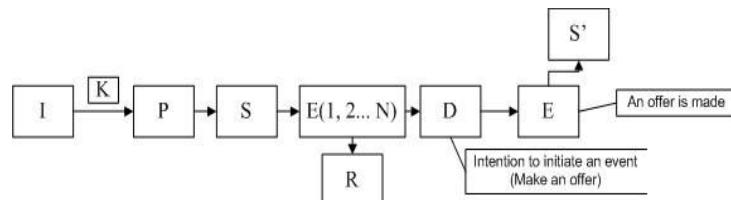


Fig. 5. Execution (*E*) of the decided event, in this case making an offer, leads to a new State of the Scene (*S'*).

5.2.4 Execution

Execution is when the improviser performs the selected decision. For example, after D1 steps to the side, he waits for D2 and D3's conversation to stall. D1 decides it is the correct time to re-enter the scene, and says, "Scott, could I have a word with you for a second?" making an offer to D2. Figure 5 illustrates this output of information. Whether or not the active intent (to significantly alter the scene) of an executed action actually affects the state of the scene is derived from the acceptance of the other improvisers. In a game of Game, D3 enters the scene saying to D1, "Mr. Coffeeman, I have more muffins for you from homeland" with a pantomimed tray of muffins and her head down. In the scene, D1 and D2 had been talking about how the muffins were fair trade muffins and how it made them feel good. D3 explained in her retrospective that their discussion had made her think of Starbucks and corporate coffee companies, so during the scene she decides to have the muffins be anything but fair trade, wanting to be a "low-status" character. D1 accepts this offer of status by rolling his eyes and sighing, "She's annoying." D1 explained in his interview, "D3 comes in with this great offer to me that we're ostensibly caring and politically aware, but actually in truth we're subjugating people still." Figure 6 displays this exchange of making and accepting offers.

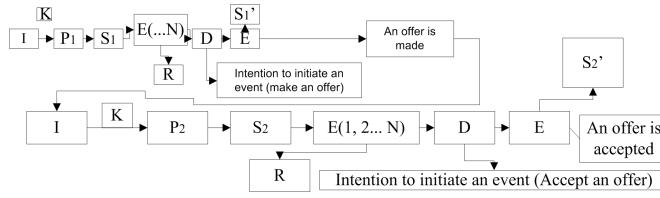


Fig. 6. The Decision Cycle of one offer being made (depicted in Figure 5), becomes input and then that offer is accepted after a decision cycle.

6 Discussion

The analysis presented in this paper is an attempt at describing how contemporary narrative theory can be used to describe how improvisers develop narratives on stage and the decision cycle used (within the scope we are considering) to improvise a story. When analyzing the collected video data, we began with an initial top-down hypothesis of categories for how to look at the data (e.g. cognition, model convergence, narrative development, etc.), built a refined coding scheme for a particular one (narrative development), and are now tasked with understanding how our single scheme can be synthesized with other data dimensions (e.g. model convergence) to construct a larger, more complete coding scheme. For instance, the decisions that improvisers make about story progression very likely has something to do with the knowledge they think the other improvisers have (cognition), whether or not everyone on stage is clear on what is happening in the story (model convergence), etc.

We have admittedly ignored certain aspects of improvisation, such as linguistic production or body language, because of the difficulty in modeling them

Narrative Development in Improvisational Theatre

computationally. Since the goal is the creation of improvisational intelligent agents, we have eschewed attempting to analyze certain aspects of performance with the hope that, once we have reached an understanding of the core areas selected, these other, more difficult, aspects of improvisation may be easier to analyze and formally encode. Understanding the appropriate level of abstraction to examine these more difficult aspects, such as linguistic production, will be an important task in itself.

Future work will focus on reaching a deeper understanding of what is reported here (e.g. doing a novice/expert comparison of how improvisers develop a narrative) and on synthesizing this work within the larger desired cognitive framework (i.e. combining these findings with analyses of improviser cognition, model convergence, etc.). The result will be a cognitive model of human improvisation that incorporates these different elements into a single, unified framework. Since the decision cycle we have observed in narrative development (and in the other categories of data analysis as well) matches closely with that in the SOAR cognitive architecture, we plan to analyze what out of our findings can be formally represented in an intelligent agent, and creative improvisational agents in SOAR that can improvise across a variety of improv games.

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Narrative Development in Improvisational Theatre

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