Towards Data-Driven Drama Management: Issues in Data Collection and Annotation

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ABSTRACT
One of the key questions in the design and development of interactive drama is structuring an experience for participants such that an engaging, coherent narrative is presented while enabling a high degree of perceived meaningful interactivity. This paper proposes a new approach to the design of intelligent drama managers (DMs) where DM strategies are learned from a corpus of data collected from pen-and-paper RPG game sessions with expert human game masters. In particular, this paper focuses on the issues relating to the collection and annotation of relevant data from recorded gameplay sessions.

Author Keywords
Interactive Storytelling, Data-driven Drama Management

1.0 INTRODUCTION

One of the central challenges of AI-based drama managers (DMs) in interactive narrative systems is to maintain an engaging storyline while affording a high degree of perceived freedom to players. Most approaches to the design of intelligent drama managers [4,15,18,26] have built analytical models that are based on well-known theories of traditional narratives. While these approaches have been quite successful in developing DM algorithms that provide a high degree of interactivity and coherent narratives, they merely shift the authorial effort from technology development to knowledge representation and knowledge engineering. In most current systems, much effort is still needed from the author in developing a parameterized library of DM and player actions, and a library of strategies that the DM can adopt to accommodate player actions.

With the increased focus in the games industry on reaching casual and current nongaming segments of the market, and the interest in interactive storytelling [5] and agent-based systems [2], the ability to provide personalized experiences to users is becoming increasingly important. However, technological and resource limitations mean that e.g. game designers are forced to create the stories in virtual worlds with technologically and financially imposed limits on player freedom [24], for example by relying on pre-authored plots [12]. Table-top Role-Playing Games (RPGs) (also called Pen-and-Paper RPGs - PnPs) are therefore subjects of increasing interest in academia and industry as a source of inspiration in the development of interactive storytelling systems, for use in computer games, education and interactive entertainment [12]. A line of thinking has emerged in the past few years that may eventually lead to models of the RPG gaming process which can be utilized in the construction of digital systems [17]. Kim [10], inspired by discussions on online discussion forums, developed an early model of the RPG gaming process that outlined communication channels between the game participants and integrated the concept of a shared game space where the players communicated the actions of their characters within the shared, imagined, fictional world. Henry [9] advanced this idea by modeling the basic information flow of RPGs, with the game components and participants forming a network of data sources and entities. Mäkelä et al. [13] further addressed this line of thinking by deconstructing RPGs into a series of processes. Tychsen [22] noted that RPGs could be modeled as information systems, combining the previous ideas into a coherent framework.

In this paper, a novel approach to data-driven drama management is presented, where the focus is shifted from

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constructing interactive storytelling systems top-down, to a bottom-up data-driven approach, based on data collected from multi-player pen-and-paper RPG games with human players. Data collected from expert Game Masters (GMs) can be used to automatically learn strategies for intelligent DM reactions to player actions while maintaining a coherent narrative. In the current article, the knowledge representation and engineering task is limited to identifying an annotation scheme for data collected from play sessions of different players with expert game masters, which forms the second crucial step following data acquisition. This data enables automatic identification of patterns at various levels of granularity from moment-to-moment player interactions and GM reactions to abstract narrative patterns that emerge from these interactions.

There are several challenges in collecting data from humans playing PnP RPG games, including choice of recording medium (video, audio, text), frequency and granularity of recording, etc. In the following sections, we first justify our choice of using PnP RPG games for collecting data; we then describe the procedure and format of data that we collected. Next, we describe an annotation scheme that is influenced by the analytical DM models and is mapped on the data collected from our experiments. We conclude with a preliminary discussion of the learning techniques that we are currently using to analyze the data and some challenges in mapping data collected from PnP RPG games to a computational representation.

2.0 INTERACTIVE NARRATIVES IN ROLE-PLAYING GAMES

Role-playing games (RPGs) form one of the core game genres, and has been ported between a variety of formats, media and technology platforms. Role-Playing Games took their early beginning in wargaming among the hobbyist communities [11], but rapidly evolved into group-based collaborative games focusing on allowing the players to take control of character operating within fictional worlds, operating under a framework of rules. The game form was rapidly adopted by historic recreation societies as a platform for live action RPGs (LARPs). Role-Playing Games were also among the early tabletop games to get transferred to the computer platform, first in single-player forms (*Akalabeth, Ultima*), and later as multiplayer games (*Neverwinter Nights, DungeonSiege*). To this day, tabletop RPGs continue to exert an influence on digital games. With the launch of *Meridian 59, Ultima Online*, *World of Warcraft*, and other massively multiplayer online RPGs (MMORPGs), which parallels the physically-embodied LARPs, RPGs have taken on a new aspect: That of living, virtual worlds [4]. Despite their great variety across media platforms, RPGs share a number of key features, such as the focus on character development and narrative themes, incentive systems and lack of clearly defined victory conditions). However, the different incarnations of RPGs provide very different gaming experiences [21]. This difference is linked to the variations in the number of players involved, how the game is controlled, and importantly to the media of expression – physical for LARPs, virtual for CRPGs and MMORPGs, and imagined/visualized for PnPs. Role-Playing Games are generally focused on telling some kind of a story – from the classical epic hero´s journey of *Neverwinter Nights* and *Fable*, to more direct social experiences in MMORPGs. Multi-player RPGs, irrespective of media format, are based on collaborative storytelling - The players communicate the actions of their characters within the fictional game world, but the way this communication takes place varies (e.g. from directing an avatar to perform an action in the virtual world of a CRPG, versus declaring the action in the shared imagined world of a PnP), and the different media impose different limits on the collaborative storytelling.

2.1 Introduction to table-top RPGs (PNPs)

Of interest to the current study is tabletop multi-player RPGs, which form one of the purest models of interactive collaborative storytelling in existence [6]. In relation to the development of interactive storytelling systems, PnPs (Figure 1) form a more relevant source than improvisational theatre, because they contain actual drama management and is author-centric; whereas improvisational theater does not feature overall (macro level) story structures or -management. PnPs vary substantially in form and format, and there are literally hundreds of rules systems and ways of playing these games that take place partly in the imagination of the participants. However, even though the way PnPs are played differs enormously, they normally have structure – they are games in the definition of Salen & Zimmerman [18]: "*A game is a system in which players engage in artificial conflict, defined by rules that result in a quantifiable outcome"*. RPGs fulfill the requirements of this definition, although the quantifiability of the outcomes of some forms of RPGs can be difficult to establish – this is notably the case for games that are focused on the personal/mental development of the player characters, rather than statistical features such as abilities, skills and powers. Of key interest here, RPGs generally contain a function often referred to as Game Masters (GMs) [5,20]. The GM is associated with a range of functions in all forms of RPGs, with however substantial variance in the specific responsibilities. In PnP RPGs, the GM normally plays a central role as story facilitator [2]. Game Masters are normally responsible for managing the overall plot of the game story, and controlling the behavior of any game world entities and objects not controlled by the player characters [20]. In short, the GM acts as a drama manager.

Fig. 1: Players engaged in a PnP Role-Playing Game session.

Pen and Paper RPGs are complex games that involve multiple participants engaging in an activity that takes place partly in the real-life gaming situation, partly in the minds of the participants in far-off imaginary environments. The basic nature of PnPs and the fact that there are countless variants makes it hard to pin down the underlying principles of these games. Several researchers and hobbyists, over the past decade, have developed a basic understanding of how the gaming process shapes collaborative narratives in PnPs [e.g. 7,8,13,20].

2.2 Game process

The gaming process of RPGs can be described as an information system. The participants form users who input, extract and store information via a variety of channels. As a result of the processes operating in the system, the state of the fictional game world changes in an iterative fashion.

The cyclic nature of the RPG system originates because there exists a communication between the real world of the players, and the fictional game world of the characters (Figure 2). In the classical PnP situation, the players take decisions in the real world leading to their fictional character (agents) to perform specific actions within the fictional world.

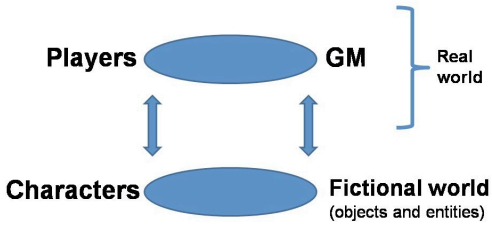

Figure 2: Communication between the players and GM in the real world, leading to actions taken by the player characters (agents) and state changes of objects and entities in the fictional world.

The GM is responsible for providing the reactions of the game world (specifically game world objects, entities and environments) to the reaction of the player characters, while keeping track of the unfolding game narrative. The state of the game world is thus changed. The reaction of the game world is fed back into the system to the players, who subsequently process the feedback, before making a decision about what to do next (individually or as a group) (Figure 3). This top-down view of PnPs encompasses the interactive nature of the game playing activity itself [22].

This model is accurate in explaining the basic nature of the RPG process at the very detailed level (looking at the verbal utterances of the players, however, it is important to realize that the feedback cycle is often broken into systems of sub-cycles, which can occur at any stage of the regular feedback cycle (decision – action – reaction – processing). For example, during the processing stage, a game world state update from the GM can result in the players internally discussing what their next action should be and submitting queries to the GM for detailed information about a specific section, object or entity of the game world. These queries and negotiations form examples of sub-cycles [6]. Players do not react uniformly to a given game world state change, and can even react at different times to the same input from the game. Furthermore, players rarely have their characters react uniformly to a given game world state change. For example, one player may choose to direct his/her character to engage an opponent, while another decided to talk to an NPC. These are differing behaviors, and split the process into several sub-cycles that need to be resolved before the main feedback cycle is resolved. Sub-processes like these can last until a point in the playing of the game where the player characters are again acting in a coherent fashion (operating within the same chronological, geographical and contextual point within the game world and narrative.

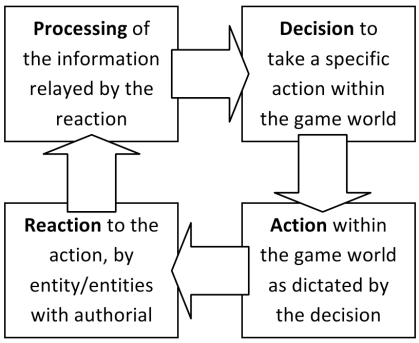

Figure 3: The action-reaction-processing-decision cycle of table-top RPG gameplay. Source: [22].

2.3 Story development

The formation of the game story is based on the iterative nature of the game world state; however, the GM operates at multiple levels of story management, not just the detailed level described above [2,6,20]. Because the story is shaped collaboratively, there is a wide possibility space for story development. However, normally the story is not completely improvised. The GM will guide for formation of the story based on a game module, which contains the information the GM needs to manage the game narrative, usually in the form of a story framework. Game modules can include a list and description of major plot points and

events that could take place in the game, descriptions of non-player characters, places and objects. The level of detail in the scenario, and the flexibility of the story framework described can vary.

The story of a PnP can be divided into a conceived and a perceived part. The latter is formed by the already complete sections of the game story, and is locked down into one path (although in some cases PnP groups can actually backtrack and rewrite the game story). The part of the story that has not been formed (or played) yet is the conceived story, and rests in the game module and the mind of the GM. As the game progresses, the conceived story is gradually transformed to a specific perceived story. Because RPGs are story-based games, the conceived story will always be composed of a potentially infinite number of possible narrative paths. However, the GM will normally exert control on the storyline, with or without the players realizing this. As such, the players have the highest degree of freedom to act at the moment-to-moment level, i.e. within the confines of a specific event or scene. During game play a path is formed through the space of possible conceived stories. This gives rise to the formation of the shared perceived story, which is the verbal communication that can be recorded; and the individual mental models of the game story, as perceived by each participant [20].

2.4 Authorial control

Considering PnPs as information processing systems does not inform how authorial control operates in shaping the game story. As en entity in a game system, the traditional role of the GM is to facilitate game flow and –story, provide the environmental content of the fictional world, and possibly arbitrate conflicts. The players in utilize the input from the GM to formulate a response in the form of character actions. Authorial control deals with the rights to give credibility to the behavior of objects, agents and environment [24]. In the classical PnP model, the players have the credibility to direct their characters according to their won motivations, and any action their characters can logically perform within the game world has credibility. Some PnPs however permit the players to affect the game world outside the ability of the character, thus taking parts of the authorial control traditionally allocated to the GM. The degree of authorial control the GM has depends on the level of credibility of the players (there does not even need to be a GM present - authorial control can be completely distributed among the players). Storytelling in PnPs can thus vary from situations where the participants establish an initial state of the game world and the characters, and proceeds without any overall plot structure (improvising), to situations where the GM manages a very tight story framework with very little or inconsequential freedom on behalf of the players to affect the linear experience of the game story. In terms of facilitating the collaborative story, the more authorial control the players have, the more adaptable and flexible the GM has to be. An extreme case is represented by digital RPGs, where the players are limited even in the types of actions they can direct their characters to perform. The division of authorial control can be described and defined for any PnP game session; however the distribution of authorial control can vary during a game session. Game play can therefore be compared to a continuing negotiation process where different participants discuss, debate and propose statements about events occurring in a fictional game world.

By varying the distribution of authorial control, different methods for conflict resolution, story management etc. are adopted, and this provides a wide solution space for PnP groups to handle collaborative storytelling. It also means that participants can tailor the game process to suit their specific interests.

2.5 GM operation models

The specific details of how GMs operate and function in PnPs are far from well-understood, at neither the higher level of operations, nor in the details of managing action-reaction cycles. The general principles of GM functionality have been discussed within the hobbyist community for decades and some models of key aspects such as division of authorial control and maintenance of dramatic tension during play [e.g. 7,10,25]. The hobbyist communities have focused to a lesser degree on the actual evolution of the collaborative storyline. In comparison, within the games research community, an increased amount of attention have been given to this subject over the past few years, in terms of mapping GM functionality and how to transfer GM story facilitation to digital storytelling systems [e.g. 2,6,17]. Despite this recent work, the cognitive processes and detailed mechanics of how GMs operate have not been modeled, although Drachen et al. [6] provide a top-down first step towards this: The model considers story facilitation in a PnP context. While the process is highly varied, there are some commonalities that operate at different levels of detail: First of all, GMs utilize a form of waypoints [27] as a key tool for anchoring the unfolding game narrative. Waypoints have pre-conditions that trigger them, and although these can change during play, they are central to story management. In pre-planning, GMs typically conceptualize the story in terms of sets of discrete events, each with a specific purpose for the overall story, and have a plan for the game session which changes to greater or lesser degrees during play. The plan may call for the PCs to rescue the princess, but they may end up rescuing the dragon instead – in RPGs, story is always in a stage of fluctuation at low- and high levels of resolution. The inherent flexibility of events (waypoints), which can be created and eliminated on the fly (e.g. as a result of the actions of the PCs), mean that there is a near-infinite variability space which the players navigate through, however, depending on the GM, this variability space can become more constricted at the high levels of abstraction, i.e. the players may be able to rescue the dragon rather than the princess, but the presence of the princess and the dragon they may not be able to change. If GMs do permit these changes, the abstract nature of the princess and dragon as story elements could be realized in a different way. If a

story element is judged by the GM as important enough to maintain, it can be realized in the unfolding narrative in different ways – it can even be brought back if its function went unfulfilled. Story elements can change over time. Levels of abstraction are a key aspect of GM operation, as they consider both the overall flow of the story and the nature and effects of interaction between entities and objects of the fictional world and the PCs at multiple levels.

3.0 EXPERIMENT PROCEDURE AND DATA COLLECTION

The data for the current study were collected through a series of experiments involving multi-player RPGs across different media (tabletop and digital), run at the IT University of Copenhagen in 2005-2007; and at the Macquarie University in 2004-2005. For this article, focus is on the data collected from the PnP sessions.

3.1 Assumptions

Given the empirical nature of the current work, the key assumptions are: 1) Conditions within correspond to conditions without: The conditions of the experiments were kept similar and aimed at representing natural playing conditions, using the same rooms, camera setup, and so forth between groups. For all experimental setups, the players were situated around the same table (at the two universities respectively) with full visual and verbal access. 2) The sample is representative of the population: This assumption is potentially problematic as PnPs vary immensely in form and format, and this forms a restriction on the results – strictly speaking these are only valid for the specific type of RPG utilized in the experiments. However, care was taken to ensure that the PnP utilized in the experiments were as generic as possible, e.g. in using the rules system from the world most popular RPG system, *Dungeons & Dragons* (D20 System). The conclusions arrived at in this study should be viewed not as representative of story facilitation process in all forms of PnPs, but representative of the classical form, where one GM is present, and retains primary authorial control of the game world objects and entities, with each player controlling a single character and the actions/behavior of this character in the game world.

3.2 Experimental setup

The experimental setup consisted of a table in the Center for Flexible Learning at the Macquarie University or at the Game Labs at the IT University of Copenhagen. Care was taken to make the lab space feel inviting and similar to the homes where these games often take place (the other typical location is gaming conventions). Participants were provided with comfortable chairs, minimal intrusion from observers/researchers, and plenty of snacks/food and drinks. Participants were prior to each session given a thorough introduction to the goals of the research project, the placement of cameras, microphones, etc. Players were following each session interviewed about whether they felt the location of the game session had any impact on how they played the game, and all reported that they had not felt any pressure or similar impact.

The players for both game sessions were recruited in, and among the Danish and Australian gaming communities. A variety of cultural backgrounds and religions were included in the sample, with all but three of the player groups being comprised of multi-national participants. The age of the players varied between 18 to 54 years (only one was under 20). A total of 51 participants were involved in the experiments. The experience with RPG play of the participants varied, whereas all the GMs involved were very experienced. Both sexes were represented: about two-thirds were male and one-third female.

3.3 Procedure and data collection

Ten PnP sessions were run with the chosen scenario. The participants were divided into groups of five players, depending on their experience level (groups of experienced, in-experienced and mixed experience). In the in-experienced groups there were participants with no prior experience with PnPs. The game sessions were run by seven highly experienced GMs, in two cases the primary author of the game module being utilized. The same game module (the "story blueprint" that the GM uses to facilitate the interactive narrative/game) was used in 7 sessions, a different in 3 for cross comparison purposes. The game modules contain around 5-10 general plot points or scenes, with loosely defined conditions for progressing between one scene and the next. Substantial variation was observed between the sessions as to how the players progressed through the narrative (e.g., in jumping between, revisiting, altering, eliminating or even creating new scenes in runtime).

The GMs generally performed in an exemplary manner in keeping the players within the overall framework of the pre-planned storyline, without at any time forcefully limiting the players' freedom. An observer was present during the sessions, but did not interfere with the gaming activity, and he/she was constrained to answering questions.

The completion time of the game sessions varied from 4-7 hours, which is normal for a PnP game session and thus mimics the natural situation of playing these games fairly well. Roughly 60 hours of game session was recorded. Breaks in game playing were taken at the discretion of the players. Most of the groups chose not to have breaks but to keep playing, including eating lunch/dinner at the gaming table, although there were interspersed short periods with lighter social conversation where players appeared to take a mental rest from being immersed in the game playing activity. None of the groups of players/GMs experienced any apparent problems with interacting/playing, e.g. heated arguments, fights or similar.

Each game session was videotaped using hidden cameras and desktop microphones. The tapes were copied to DVD-format. For each of the PnP game sessions, three 20-minute segments of playtime were transcribed (all verbal communication and encoding of body language).

Transcription was carried out by a professional transcription company, and random tests were double-transcribed by the researchers to confirm accuracy. The transcribed segments were selected from the beginning, midway and end of each game session, in order to locate variation as a function of playtime. The transcribed segments and shared the general narrative content across the game sessions (one featuring a peaceful/social scene, one light action, one heavy action/story climax).

4.0 D3M ARCHITECTURE DISCUSSION

We propose the D3M architecture for drama management that utilizes case-based reasoning algorithms on annotated cases collected from expert game-masters in PnP RPGs (Figure 4). This approach has been successfully used in other domains like Real-Time Strategy (RTS) games [19]. The data collection process, described in the previous sections, results in a library of annotated traces of games with expert GMs and players.

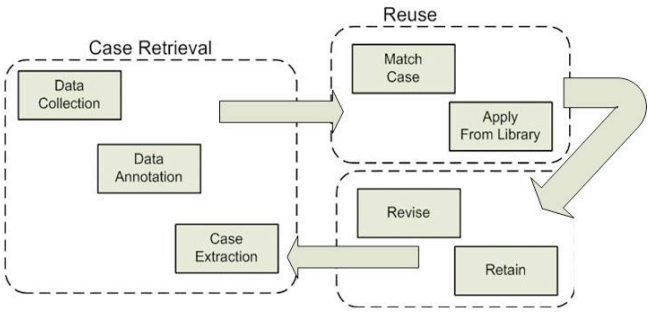

Figure 4: D3M architecture. Collected data is annotated and stored in a case library. The case library is used during execution to extract possible courses-of-action. Finally, new scenarios are then revised and retained in the case library.

Case-based planning algorithms have been popular in RTS games for strategy learning from expert players [1]. In Case-Based Reasoning (CBR), expert knowledge is annotated and stored in case-frames with a specific structure (objectives, preconditions, constituent actions, etc.). These case-frames are then matched during run-time to find similarities with the recent sequence of actions within the game. When a close match is found, the 'Reuse' algorithm applies the next DM action that is predicted by the case. For example, when a player asks for information about a particular action the DM provides the player with that information, and a hint if the request for action matches the objective that the DM has set for that round. Successful application of the state depends on DM goals, player goals, precondition satisfaction, etc. If the said action is unsuccessful, the new situation resulting from the failure is then added to the case-library as a new case.

The CBR cycle for solving problems is illustrated in Figure 4. In the first step, the system identifies key features of the problem from the problem description that serves as input to the system. This step involves determination of appropriate features of the problem for identification, and a metric for assessing similarity of input features to previous cases stored in the database. In the second step, after identifying similar cases from previous knowledge, the system proposes a solution to the new problem as the solution to one of the retrieved cases. This process involves the use of the similarity metric to narrow down the choice of solutions to a single prior case. Reuse of existing cases introduces a challenge if the problem representation and the solution representation is not similar. For example, in medical domains, where CBR is used as a diagnostic aid, often adaptation is required because patient symptoms are similar even when their histories are not usually significantly similar. Finally, on successful reuse of a previous similar case from the library the system retains the features of the new case in the case library. A detailed review of CBR techniques is outside the scope of this paper, but the interested reader is encouraged to read a review of conversational CBR systems, which are relevant to this paper, by Aha et. al. [1].

One challenge for D3M, like other CBR systems, is the development of a case-base. This involves data collection, feature selection, and data coding and annotation. Data collection from PnP RPG game sessions for our application has been described in detail in the earlier sections of the paper. Next section focuses on the annotation and feature selection tasks for D3M.

5.0 DATA CODING, FEATURE SELECTION, AND ANNOTATION

We build on the coding scheme developed by Tychsen et. al. [23] for player communication in PnP RPG games. The coding scheme has been developed first deductively from theory and models, then inductively from categories that were frequently used by players. The codes were further refined through pilot experiments. The main categories for coding were identified with utterances that were in service of one of the following:

- Content
  - Narrative Progression
  - Character action description
  - Assistance
  - Critique
- Narrative Progression
  - Scene description
  - Event description
  - Interaction
- Dramatic Language
  - Functional
  - With flourish
  - Purely expressive

- Social Hierarchy
- Receiver Hierarchy

Figure 6 shows part of a transcribed and annotated scenario from one of the games. In this sequence, the player (QM) asks the GM for more information about the world. The GM responds with a negative answer (they do not speak English), but gives more information about the world (different language Fulzan). Note that the GM states the name of the language and also elaborates with the details in a dramatic language. This prompts the players to ask for information about acquiring the skills to speak the new language. The GM provides them a hint to use an item that they are carrying for succeeding in the task.

QW: Hey, hang on, there are baddies in this place too? Do they speak English?
<Player: Request Information>
GM: They speak Fulzan, which is a horrible, evil language.
<GM: Give Information>
QW: Okay, they don't speak English.
<Player: Request Clarification>
GM: But you do have translators in your helmets that will translate it to English so you'll know what they're saying.
<GM: Give Assistance>
LF: If we're wearing our helmets.
GM: If you're wearing your helmets.

Figure 6: Example of annotation of transcribed verbal communication between players in a PnP RPG session.

Details of other codes are presented here [23]. We choose to select the most frequent codes that occurred during experimental sessions.

These coded sequences include various features that can be used to describe typical case frames. We model our case frames based on CBR techniques used in RTS games [19]. The basic unit of the case frames is a *behavior* that contains a *player goal*, a *GM goal,* a set of *preconditions* that are required to be satisfied for the execution of the behavior, a set of *constraints* on the participants and the execution of the behavior. Behaviors can take the form of any of the actions that are classified into one of the coding categories mentioned earlier.

The coding style and representation of frames is hierarchical and is consistent with the representation used by planning-based drama management approaches [15]. Several different approaches can be used at different levels for reactive drama management. In particular, we are exploring the use of neural networks and evolutionary algorithms to predict the next GM action based on an input history of player and GM actions. Such an algorithm can be trained from the data we have collected and coded by just looking at the code sequences at the individual action level like Sequence: *Request, Deny, AskInfo, Provide Hint…*

The hierarchy in the coding scheme can be used to learn player and GM strategies over longer game sessions using techniques discussed by [1]. This approach has the potential to contribute to pre-planning approaches as well as reactive approaches to drama management. This approach also provides a deeper insight into engaging interactive narratives with balanced authorial and player control. Whereas DM approaches inspired by improv focus on collaborative authoring among players with limited or no mutual story information, PnP RPGs allow the DM to keep and communicate the overall coherence of the story to the players. A data-driven approach enables us to exploit established CBR and Machine Learning algorithms to derive patterns of expert game masters and takes the effort of hand-crafting DM actions or planning domains away from the designers.

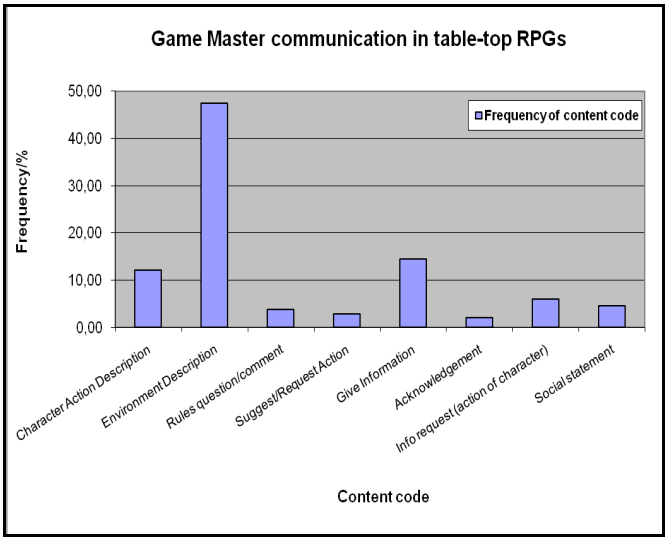

Figure 7: The most commonly utilized communication categories by GMs in the experiments (aggregated data from 3*20 minute transcriptions from five of the PnP game sessions).

6.0 CONCLUSIONS AND FUTURE DIRECTIONS

In this paper, a novel approach towards data-driven drama management is described. The focus of the paper is on the systematic collection of data and issues with annotation. This paper further describes the proposed architecture of a complete system, based on existing CBR techniques, called D3M for drama management.

The current system includes data collected in the form of transcribed verbal communication of participants in PnP game sessions. Some of the collected data has been annotated and the use of automatic annotation schemes is under investigation. Coding and annotation is done in a hierarchical fashion as game mechanics occur at different levels and it is hard to model the relationships across levels. For example, moment-to-moment action sequences can be analyzed using computational intelligence techniques for predicting the next action in the sequence. While such techniques would suit reactive DMs, its results do not convey any information about the strategic nature of the sequence of actions. Higher level analysis of the story actions needs to occur to evaluate the quality of the story,

coherence, character immersion, etc. A structured hierarchical annotation scheme and an architecture for utilizing annotated PnP game traces is the first step towards a high-quality interactive drama manager.

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