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Metrics for desired structural features for narrative renderings of game logs ☆,☆☆

Pablo Gervás

Universidad Complutense de Madrid, Madrid, Spain

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ABSTRACT

User performance in games is rarely recorded in formats amenable for easy revision. Game logs could be exploited as a source for reflection on user performance, with a view to improvement. Yet in their raw form they are difficult to interpret, and sometimes only specific parts of the game are worth reviewing. The ability to produce textual narratives that rework these logs (or the interesting parts of them) as stories could open up this wealth of data for further use. Existing work on narrative composition could be instrumental in achieving this end. This paper presents a model of the task of narrative composition as a set of operations that need to be carried out to obtain a linear sequence of event descriptions from a set of events that inspire the narration. An initial implementation of the model is applied to a chess game understood as a formalised set of events susceptible of story-like interpretations. Operating on simple representations of a chess game in algebraic notation, a number of candidate metrics are explored in relation to their variability over a number of games and their impact on the resulting tellings of a game.

1. Introduction

The increasing popularity of serious games and gamification as aids for learning raises the question of how we might, with the help of existing technologies, improve the efficiency of learning processes over games. An important process in learning is reflection over past performance, with a view to improving future achievement. This requires going over a game that has been played, reviewing decisions and outcomes at various points. The data needed for this generally exist in the form of game logs. Yet in their raw form these logs are difficult to interpret, and reliving them in their original form would be too time consuming and not homogenously fruitful, as sometimes only specific parts of the game are worth replaying. The ability to produce textual narratives that rework these logs (or the interesting parts of them) as stories could open up this wealth of data for further use.

The task of putting together a narrative that conveys events that have already happened is the kind of basic storytelling that people carry out in their everyday lives to communicate with one another, to convince, to inform, to remember the past, to interpret the present and to plan for the future. Automated composition of narratives from data is a budding line of research within computational narratology, but elementary techniques are already available that can provide an initial approximation to this task [1–6]. Of these, Gervás [5], Gervás [6] attempt to address this challenge from an engineering point of view: given an exhaustive record of all moves made in a given game, find a way of telling what happened as a linear sequence that may be later converted into text, trying to maximize coverage, minimize redundancy, and achieve a certain natural fluency. Chess is chosen as an initial case study because it provides a finite set of characters (pieces), a schematical representation of space (the board) and time (progressive turns), and a very restricted set of possible actions. Yet it also allows very elementary interpretations of game situations in terms of human concepts such as danger, conflict, death, survival, victory or defeat, which can be seen as interesting building blocks for story construction. Gervás [6] in particular focused on processes of content and focalization selection (what to say and which character to follow for telling it) by means of an evolutionary solution. In such a solution, the responsibility for the quality of the final result lies heavily on the metrics employed to define the fitness functions that drive the process of evolution.

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E-mail address: pgervas@sip.ucm.es

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The present paper expands upon the procedure outlined in [6], focusing on the set of metrics used to define the fitness function. The paper reviews existing models related to the narrative composition task, describes the proposed computational model and the case study for narration of chess games, defines an improved set of metrics, discusses the effect of these metrics on a number of possible input games and the resulting selections, and finishes with conclusions and future work.

2. Previous work

A number of models of related tasks and elements arising from different fields of research are reviewed in this section to provide background material for the discussion.

According to many theorists, narrative can be considered in two different ways: in terms of the content that it considers (events, actions, time and location), and in terms of the way this is presented when told (which elements are mentioned explicitly and which are left implicit, which are emphasized and which glossed over, in what order these elements are presented, ...). These two visions have been named different ways by different researchers, story and discourse, *histoire* and *discours*, *fabula* and *sujzet*. In order to avoid ambiguity, we will restrict our analysis here to three levels of conceptual representation of a story, and refer to these as the *fabula* (the complete set of what could be told, organised in chronological order of occurrence), the *discourse* (what has been chosen to tell, organised in the order in which it is to be told) and the *narrative* (the actual way of telling it).

Narratologists, who specialize in the study of narrative, consider the concept of *focalization* [7] as the way in which a narrator restricts what he is telling about a particular scene to what might have been perceived by someone present in that scene. This may be one of the characters if the scene is told in the first person, or the narrator himself as if he had been present (if the story is told in the third person). This has an interesting implication in the fact that, through focalization, narrative discourse (and thereby the structure of stories) is influenced by the perception of space: events that take place simultaneously in different locations that cannot be perceived at the same time (this may be different cities but also different neighbouring rooms separated by a wall) usually require different narrative threads.

The general process of text generation takes place in several stages, during which the conceptual input is progressively refined by adding information that will shape the final text [8]. During the initial stages the concepts and messages that will appear in the final content are decided (*content determination*) and these messages are organised into a specific order and structure (*discourse planning*).

A number of related efforts exist to automatically derive narratives from sport games [2–4]. These efforts operate on input data in the form of statistics on a given game, and produce texts in the manner of newspaper articles covering similar games. These efforts, for instance, are heavily mediated by the set of data they start from, which do not constitute raw perceptions of reality but purpose-specific abstractions such as statistics on percentage of successful attempts, relative number of fouls between opposing teams, or total time that a team had control of the ball. In such cases, a large portion of the effort of converting the real life data into story material has already been achieved by the stage of drawing statistics from the game.

The task of narrative composition has also been explicitly addressed by Hassan et al. [1], Gervás [5], Gervás [6]. Hassan et al. [1] addressed the task of generating stories from the logs of a social simulation system. Gervás [5] focused on the task of generating a natural language rendering of a story extracted from a chess game for a given set of pieces and with focalization set at a prefixed range of perception (squares of size 3 were used). Gervás [6] was also based on chess but proposed an evolutionary approach to determine which set of pieces and what range of perception to use for each of them when telling the story.

The task of composing a narrative text from a recorded set of events can be decomposed into the following subtasks: (1) selection of the subset of events to be told, (2) imposition of a certain order on the events to be told (this generates a narration sequence), and (3) production of an appropriate form of text for this sequence. Step 1 was only addressed explicitly by [6]. Step 2 (imposing a particular order on events to be told) is addressed by both Hassan et al. [1,5], with Gervás [5] being the one that devotes most effort to it. The present system relies on the solution for step 2 developed in Gervás [5]. Step 3 (rendering the resulting conceptual discourse as natural language) was addressed by Hassan et al. [1] in terms of template-based NLG and by Gervás [5] with a more refined NLG system that included referring expression generation, lexical and syntactic choice, and grammar-based surface realization. The system described in the present paper refines the model of step 1 presented in Gervás [6], and it does not address step 3.

3. A computational model

In real life, events to be reported may have happened simultaneously in physically separated locations, and constitute more of a cloud than a linear sequence, a volume characterised by 4 dimensional space time coordinates. Composing a narrative for such an input involves drawing a number of linear pathways through that volume, and then combining these linear pathways (or a selection thereof) together into a single linear discourse. This type of linear pathway is sometimes referred to as a *narrative thread*. In games of enough complexity to merit a special effort of revisiting them, the same issue may arise. In either case, the type of narrative that we want to obtain involves a linear sequential discourse where only a single event can be told at any given point. From a narratological point of view, this task corresponds to the identification of appropriate focalization decisions for conveying a given material. Focalization, understood as the decision of which character the narration should follow, and how much of the environment around him at each point should be conveyed to the reader of the narrative, divides the perception of reality into individual fibres (one for each possible focalizer character) that are linear and sequential in nature. For each character involved in the set of events to be conveyed, a possible focalization fibre can be drawn.

The present paper follows [5,6] in using chess as a case study over which to consider basic intuitions of the narrative composition process. For a discussion on the advantages and shortcomings of this approach the interested reader is referred to the original papers, though some observations on the convenience of considering more complex domains are covered in Section 4.

The chess pieces are considered as characters of a story. To model the way humans tell stories in terms of narrative threads, based on subsets of the events that can be said to be experienced by a particular character, each piece is assigned a field of perception corresponding to a $M \times M$ square around the position of the board in which it is standing. This area around a piece is defined by a value N known as the *range of perception* of that particular piece, such that $M = 2 \times N + 1$. The set of events that we would be considering is the set of all moves involved in a given game.

A basic software implementation has been written that reads a description of a chess game in algebraic notation (see Table 1) and builds for it a representation in terms of threads focalized on a given character assuming a certain range of perception around him.

Events are triggered by pieces moves. Whenever a piece moves, this constitutes an event for the piece itself, for any other piece