Available online at www.sciencedirect.com

ScienceDirect

Cognitive Systems Research 36–37 (2015) 30–48

Cognitive Systems RESEARCH

www.elsevier.com/locate/cogsys

A computer-based model for collaborative narrative generation

Action editor: Vasant Honavar

Rafael Pérez y Pérez *

División de Ciencias de la Comunicación y Diseño, Universidad Autónoma Metropolitana, Cuajimalpa, Av. Vasco de Quiroga 4871, Col. Santa Fe Cuajimalpa, México D.F. 05300, Mexico

Received 4 November 2013; received in revised form 16 June 2015; accepted 16 June 2015
Available online 26 June 2015

Abstract

This paper describes MEXICA-impro, a computational model for collective plot generation. It comprises two agents that work together in order to generate a narrative. Each contributor has its own representation of common-sense knowledge and social beliefs. I present results showing how MEXICA-impro can produce storylines that could not be produced by any of the participants alone, and how such stories generate new knowledge structures that might be employed by the collaborators to progress original plots. These results suggest that MEXICA-impro is capable of developing what I refer to as collectively-creative stories. We have established a solid framework that we hope will be the basis for extensive further research.

Keywords: Computational creativity; Narrative generation; Engagement–reflection; Knowledge generation

1. Introduction

Creativity is a fascinating, complex phenomenon that embraces, at minimum, both individual and social dimensions. In this way, features like personal knowledge, temperament, convictions, traditions, religious beliefs, historical context, political circumstances, and so on, are intertwined, influencing each other during the creative process. In past years, computer models have been employed by researchers to contribute to the understanding of this phenomenon. Many of these models, however, only characterise single agents that seem to be isolated from a social (virtual) world. Following Sun (2006), it is clear there is a need to develop systems that explicitly incorporate at least social and cognitive dimensions. That is, we need programs with cognitive skills that are capable of shaping their social environment, and also capable of being influenced by that same environment. Otherwise, our computer models always will be too limited.

We are far from reaching that goal. One possible first step is the development of creative collaborative systems where contributors work together in the development of interesting outputs. The interaction amongst collaborators with individual characteristics provides a useful social environment.

This work contributes to that goal. MEXICA-impro is a computational model for collective plot generation. It comprises two agents that work together in order to generate a narrative. Each participant is an instantiation of MEXICA (Pérez y Pérez & Sharples, 2001), a computational model for developing storylines based on the Engagement–Reflection (E–R) cognitive account of writing as creative design (Sharples, 1999). The E–R computational model was originally designed for individual plot generation. The user provides the information necessary to build the storyteller's knowledge base, which represents

* Tel.: +52 55 58146500.
E-mail address: rperez@correo.cua.uam.mx
URL: http://www.rafaelperezyperez.com.

http://dx.doi.org/10.1016/j.cogsys.2015.06.002
1389-0417/

its experience and beliefs. During Engagement, MEXICA employs its knowledge base to generate sequences of actions guided by rhetorical and content constraints. During Reflection, it breaks impasses, evaluates and, if it is necessary, modifies the material generated so far. Thus, in this work we employ a model for individual plot generation (known as MEXICA) as a base to develop a model for collective (two contributors) plot generation (known as MEXICA-impro). In MEXICA-impro I refer to one of the agents as the Leader and to the other as the Follower. The system works as follows: the Leader generates material through one complete E–R cycle and then signals the Follower to continue the narrative. Then, the Follower takes the material generated so far, advances the plot through one complete E–R cycle and then signals back to the Leader to continue the narrative, and so on. The cycle ends when the story is finished or when the participants no longer can progress the story (i.e. when an impasse is declared). Although the primary endeavour of MEXICA-impro is to generate cooperative plots, both the Leader and the Follower are capable of individual plot generation. The Collaborative-Mexica is a research tool. The user of the system can manipulate several parameters that control the behaviour of agents, and the content of the files employed to build the knowledge bases. In this way, it is possible to test the model with different scenarios.

I define computational creativity as the study of the creative process employing computers as the core tool for reflection and generation of new knowledge. In this work,

> A computer model might be considered as representing a creative process if it generates knowledge that does not explicitly exist in the original knowledge-base of the system and which is relevant to (i.e. is an important element of) the produced output... we refer to this type of creativity as computerised creativity (c-creativity).
> [Pérez y Pérez & Sharples, 2004]

I would like to complement this definition by claiming that c-creativity is only possible when such novel knowledge becomes available within the agent's knowledge base for the generation of more original storylines. Thus, in my view, an essential aim of creativity is the generation of expertise and experience that is useful for the creative process itself.

This definition, however, does not consider the cooperative aspect emphasized in this work. I believe that an important reason why one engages in a multiparty creative process is the possibility of generating a product that could not be produced by any of the participants alone. Thus, this work follows the next definition: if the narrative generated by the collaborative agents cannot be developed by any one of them alone, and such a narrative generates original structures within their knowledge base that can be employed by the contributors to produce new stories, then it is referred to as a *collectively-creative story*.

In this way, the goals of this project are:

1. Develop a model that allows at least two computer agents, with different knowledge bases, to progress a collectively-creative narrative.
2. Generate narratives that could not be produced by any of them alone.
3. Incorporate the collective stories that they produced into their knowledge base. In other words, the narratives they produced must modify their knowledge base and, therefore, the way they generate narratives.

This document is organised as follows: Section 2 describes some previous systems of story-writing; Section 3 introduces those characteristics of MEXICA that are required to understand MEXICA-impro; Section 4 shows a step by step example of a narrative generated by the system; Section 5 describes the tests preformed to evaluate the system; Section 6 discusses the results obtained; Section 7 offers a conclusion.

2. Antecedents

In the literature one can find important computer models of narrative generation. The following lines describe some representative examples. Probably the first researcher working in computer text generation was Sheldon Klein (see e.g. Klein, 1965; Klein & Simmons, 1963). Some years later TALESPIN (Meehan, 1981) was developed. TALE-SPIN follows a problem-solving approach that produces stories in an Aesop's fables style by setting goals for animal characters and then recording their attempts to reach the goal. The problem-solving approach introduced by TALE-SPIN became the model to follow for other AI researchers working within storytelling and related areas.

DEAYDREAMER (Mueller, 1990, chap. 1) is a computer program that generates narratives in the form of daydreams. The author claims that the program is an implementation of a theory of human daydreaming. The system employs emotions as part of its problem-solving approach (with the exception of MEXICA, I am not aware of another system that employs emotion in plot generation). In his book, Mueller makes an interesting observation:

> Despite the fundamental importance of creativity to human intelligence, this unique ability of humans has rarely been investigated by artificial intelligence researchers. This is understandable in light of the difficulty of the problem– creativity and the creative process are indeed quite complex. However, there are certain needles limitations of most present-day artificial intelligence programs which make creativity difficult or impossible: They are unable to consider bizarre possibilities and they are unable to exploit accidents (p. 14).

It has been 25 years since Muller pointed out these limitations and still we have not been able to get around them.