

Words, Emotions and Plot-Generation in MEXICA

Rafael Pérez y Pérez

Laboratorio de Interacción Humano-Máquina y Multimedia.
Centro de Ciencias Aplicadas y Desarrollo Tecnológico
Universidad Nacional Autónoma de México
Circuito Exterior s/n-Ciudad Universitaria, México D. F. 04510
Tel: (52-55) 5622-8602x1174.
Fax: (52-55) 5622-8653
E-mail: rpyp@servidor.unam.mx

Abstract

MEXICA is a computer program for plot-generation. As a distinctive characteristic, the system employs emotional links between characters and the dramatic tension of the story in progress as cue to probe memory and retrieve sequences of actions. All valid actions in MEXICA are defined in a text file known as the dictionary of Linguistic Representations of Actions. This dictionary, together with a set of previous stories, constitute the material employed to construct the knowledge structures that drive the generation of frameworks for short-stories. This paper focuses on explaining the relationship between Linguistic Representation of Actions and emotions, and their role during plot generation.

1. Introduction.

MEXICA (Pérez y Pérez, 1999; Pérez y Pérez & Sharples, 2001) is a program that generates frameworks for short stories about the Mexicas (the old inhabitants of what today is México city) based on the engagement-reflection cognitive account of writing (Sharples, 1999). During engagement the system focuses on generating sequences of actions driven by content and rhetorical constraints and avoids the use of explicit goals or predefined story-structures. During reflection MEXICA evaluates the novelty and interestingness of the material produced so far and verifies the coherence of the story. Figure 2 shows an example of a story developed by MEXICA. The design of the system is based on structures known as Linguistic Representations of Actions (LIRAs), which are a set of actions that any character can perform in the story and whose consequences produce some change in the story-world context. These representations (also known as Primitive Actions) are defined as single words (usually verbs) like *A found B*, strings of words like *A followed and found B*, or whole phrases like *A followed the trace through the forest and finally found B swimming in a beautiful waterfall*, where A and B represent characters in the story. MEXICA requires a dictionary of LIRAs to work. In such a dictionary one must specify the word or phrase that identifies the action, the number of characters that participate in it (maximum three actors), and a set of preconditions and postconditions associated with the action (see figure 1).

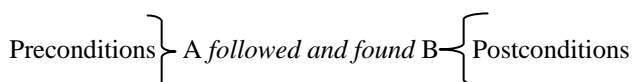


Figure 1. Elements that constitute a Linguistic Representation of an Action.

In this way, in MEXICA a story is defined as a sequence of LIRAs. There are two types of possible preconditions and postconditions in MEXICA: 1) emotional links between characters and 2) dramatic tensions in the story.

Tlatoani was an inhabitant of the Great Tenochtitlan. Priest was an ambitious person and wanted to be rich and powerful. So, priest kidnapped tlatoani and went to Chapultepec Forest. Priest's plan was to ask for an important amount of cacauatl (cacao beans) and quetzalli (quetzal) feathers to liberate tlatoani. With a hidden knife tlatoani was able to cut all the ropes and escape. Tlatoani was really angry for what had happened and affronted priest. Priest thoroughly observed tlatoani. Then, took a dagger and attacked tlatoani. Suddenly, tlatoani and priest were involved in a violent fight. In a fast movement, priest wounded tlatoani. An intense haemorrhage arose which weakened tlatoani. Priest felt panic and ran away. Prince was an inhabitant of the Great Tenochtitlan. Early in the morning prince went to Chapultepec Forest. Suddenly, prince realized that priest wounded tlatoani. Tlatoani always felt a special affection for prince. Even when prince knew about the sympathy that tlatoani felt, prince saw a unique opportunity to become rich and attempted to take advantage of the situation by asking tlatoani for an important amount of cacauatl (cacao beans). Tlatoani was really angry for what had happened and affronted prince. Prince, knowing that tlatoani's life was at risk, resolved not to cure tlatoani. Prince decided to go back to the Great Tenochtitlan City. The injuries that tlatoani received were very serious. However, tlatoani knew that when a Mexica dies fighting, the Gods protect that soul in order it arrives safely to the other world. So, tlatoani died in peace.

Figure 2. The Kidnapped Tlatoani (a story developed by MEXICA).

2. Emotions as Preconditions and Postconditions.

Emotional Links. MEXICA allows defining two types of emotional links between characters. For practical reasons all types of emotions are implemented in discrete terms with a value in the range of -3 to +3. Type 1 represents a continuum between love (brotherly love) and hate. Type 2 represents a continuum between being in love with (amorous love) and feeling hatred towards. For example, the action where character A falls in love with character B includes as a postcondition an emotional link from A towards B of type 2 and intensity +3. In the same way, the action A wounds B includes as a precondition the fact that A hates B, i.e. A has an emotional link of type 1 and intensity -3 towards B.

Dramatic Tensions. Tension is a key element in any short story. In MEXICA, it is assumed that a tension in a short story arises when a character is murdered, when the life of a character is at risk, when the health of a character is at risk (e.g. when a character has been wounded) and when a character is made a prisoner. These tensions can be defined as part of LIRA's postconditions and triggered when the action is performed in the story: e.g. the action A wounds B triggers the postcondition *the health of B is at risk*. In the same way, tensions can be deactivated through postconditions: e.g. the action C cures B deactivates the postcondition *the health of B is at risk*. Notice that C cannot cure B at least B is wounded (or ill); so, the tension *the health of B is at risk* is a precondition of the action C cures B. There is a second group of three tensions referred to as inferred tensions: 1) clashing emotions: when a character establishes two opposite emotional links towards other character; 2) love competition: when two different characters are in love with a third one; and 3) potential danger: when a character hates another character and both are located in the same place. These tensions are not defined as part of LIRAs; they are hard-coded and become active only when the emotions that trigger them are present in the story. Thus, each time an action is executed in the story in progress MEXICA verifies if inferred tensions must be triggered or deactivated. Figure 3 shows a representation of a complete definition of a LIRA.

LIRA
A saved the life of B
List of preconditions:
The life of B must be at risk [tension].
List of postconditions:
The life of B is not anymore at risk [deactivation of a tension].
B develops an emotional link of type 1 and intensity +3 towards A.
Alternative Texts
A desperately ran to forest to get some magic plants and saved the life of B

Figure 3. Definition of a Linguistic Representation of an Action.

Notice that MEXICA allows defining alternative texts to represent a LIRA. In this way, when MEXICA generates the final version of a story, it can employ any of the alternative texts to represent the action.

Each tension in MEXICA has associated a value. Thus, each time an action is executed the value of the tension accumulated in the tale is updated; this value is stored in a vector called Tensional Representation. The Tensional Representation records the different values of the tension over time. The Tensional Representation permits representing graphically a story in terms of the tension produced in the story. In MEXICA, a story is considered interesting when it includes increments and decrements of the tension (see figure 4).

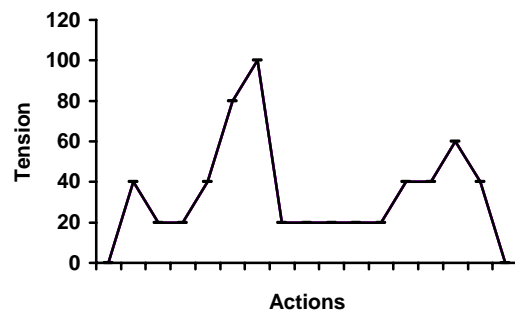


Figure 4. Tensional Representation of *The Kidnapped Tlatoani*.

3. Creating Structures in Memory.

All knowledge structures in MEXICA are built from the dictionary of LIRAs and from a set of Previous Stories. MEXICA is a tool to study the engagement-reflection cycle in plot generation. Thus, the user can define an important number of parameters that control the system. Between these parameters are included the mentioned dictionary and a set of previous stories. MEXICA includes a language to define each entry in the dictionary of LIRAs. Details of such a language can be found in (Pérez y Pérez, 1999 Appendix A). The purpose of the dictionary is to create a collection of actions with their associated preconditions and postconditions. In MEXICA, preconditions and postconditions must be as general as possible. They represent essential requirements and consequences of an action in terms of emotional links and dramatic tensions. For example, a fight between two knights irremediably has as a consequence that their life are at risk (dramatic tension) and, probably, that they develop negative emotional links towards each other. The quality of MEXICA's outputs strongly depends on the dictionary of LIRAs. Each previous story is formed by a sequence of actions. As in the case of LIRAs, MEXICA includes a language to define the previous stories. MEXICA creates in memory a group of structures known as atoms. Each atom is formed by a collection of emotional links and tensions, and by a set of possible next actions to be employed during the development of a story. The process to create atoms works as follows:

1. MEXICA reads an action from the files of Previous Stories.
2. It updates the story-world context with the action's consequences.
3. All characters in the updated story-world context are substitute by variables; then, the context is employed to build a new atom in memory.
4. MEXICA reads the next action from the files of Previous Stories.
5. The system adds this new action to the set of possible next actions of the atom created in step number 3.
6. The system goes to step 2 until the story ends.

This sequence is repeated for each previous story in the file. If MEXICA generates two identical atoms, only one is kept. The purpose of atoms is to associate groups of emotional links and tensions with a set of possible next actions to be performed. For example, if character A hates character B (an emotional link of type 1 an intensity -3) some members of the set of possible next actions might be: A insults B, A punches B, A kills B, etc. In this way, MEXICA knows that when the story-world context represents a situation where someone hates someone else, any of the elements in the set of possible next actions is a logical action to continue the story. The system can generate very complex groups of emotional links and tensions during the unfolding of a story.

4. Plot Generation.

The process of developing new stories consists of a cycle between the Engaged and Reflective States. During engagement an action is performed producing a story-world context. Such a context is used to match in memory atoms representing similar situations. These structures have associated a set of possible next actions, which are retrieved. Then, one of them is selected as the next action in the story. This action is performed in the story producing a new story-world context and the cycle starts again. As part of the engage state MEXICA employs a set of heuristics to modify the story-world context in order to retrieve novel sequences of actions. If the cycle is interrupted (e.g. by an impasse) the system switches to the reflective state. During reflection all preconditions are verified (notice that preconditions are not checked during engagement) and if necessary actions are inserted to satisfy them, impasses broken, and the material produced is evaluated for originality and interestingness. The system then returns to the engage state or finishes the story. So, plots develop in a non-linear way rather than linearly progressing from the start of the story to its end. The following lines describe how MEXICA produced *The Kidnapped Tlatoani*. For reasons of clarity, the texts employed to describe actions in this example are not exactly the same as those used in figure 2. The user selects the first action (in bold):

*** NEW STORY:

0 The tlatoani liberated himself (0)

The number on the left side (in this case zero) indicates that the action was produced at time 0; the number between parentheses on the right side indicates the value of the tension (at this moment

zero). MEXICA switches to engagement but cannot retrieve any action from memory. Thus, an impasse is declared and the system switches back to reflection to try to break the impasse.

*** NEW STORY:

1 The tlatoani lived in Tenochtitlan (0)

2 The priest kidnapped tlatoani (40)

0 The tlatoani liberated himself (20)

During reflection MEXICA checks preconditions. So, the system inserts actions at time 1 and 2 to justify why the tlatoani liberated himself (all actions generated during reflection are printed in italics). Notice that the action generated at time 0 (the action given by the user) is the last event in the story produced so far. MEXICA switches to engagement and generates three new actions (a parameter definable by the user specifies the number of actions that can be generated during engagement; in this example, this number is three).

*** NEW STORY:

1 The tlatoani lived in Tenochtitlan (0)

2 The priest kidnapped tlatoani (40)

0 The tlatoani liberated himself (20)

3 The priest attacked the tlatoani (40)

4 The tlatoani and the priest fought (80)

5 The priest wounded the tlatoani (100)

Notice that the action generated at time 5 reaches the highest value of the tension in the story (see figure 4). Now MEXICA switches back to reflection and verifies preconditions.

*** NEW STORY:

1 The tlatoani lived in Tenochtitlan (0)

2 The priest kidnapped tlatoani (40)

0 The tlatoani liberated himself (20)

6 The tlatoani affronted the priest (20)

3 The priest attacked the tlatoani (40)

4 The tlatoani and the priest fought (80)

5 The priest wounded the tlatoani (100)

In this case the system needs to justify why the priest attacked the tlatoani; so, it inserts the affronted action at time 6. All preconditions are satisfied and MEXICA goes back to engagement.

*** NEW STORY:

1 The tlatoani lived in Tenochtitlan (0)

2 The priest kidnapped tlatoani (40)

0 The tlatoani liberated himself (20)

6 The tlatoani affronted the priest (20)

3 The priest attacked the tlatoani (40)

4 The tlatoani and the priest fought (80)

5 The priest wounded the tlatoani (100)

7 The priest ran away (20)

8 The prince decided not to cure the tlatoani (60)

9 The prince went back to Tenochtitlan City (40)

MEXICA generates three actions at times 7, 8 and 9 and switches to reflection. Notice a peculiar moment at time 8 where the system introduces a new character in the story, the prince, which decides not to help the wounded

tlatoani. MEXICA needs to explain why this situation occurs.

*** NEW STORY:

1 *The tlatoani lived in Tenochtitlan (0)*

2 *The priest kidnapped tlatoani (40)*

0 The tlatoani liberated himself (20)

6 *The tlatoani affronted the priest (20)*

3 *The priest attacked the tlatoani (40)*

4 *The tlatoani and the priest fought (80)*

5 *The priest wounded the tlatoani (100)*

7 *The priest ran away (20)*

10 *The prince lived in Tenochtitlan (20)*

11 *The prince decided to go to the forest (20)*

12 *The prince realised that the priest wounded the tlatoani (20)*

15 *The tlatoani was fond of the prince (20)*

14 *The prince tried to abuse of the tlatoani (40)*

13 *The tlatoani affronted the prince (40)*

8 *The prince decided not to cure the tlatoani (60)*

9 *The prince went back to Tenochtitlan City (40)*

The first step is to introduce the prince in the story at time 10, situate the prince with the tlatoani at the forest at time 11 and make the prince aware that the tlatoani is wounded at time 12. Next, MEXICA inserts the affronted action at time 13 to justify why the prince does not want to help the tlatoani. However, now the system needs to explain why the tlatoani affronted the prince. So, it inserts the abuse or take-advantage action at time 14. Finally, to satisfy the preconditions of action 14 (the goal of this precondition is to increase the tension producing clashing emotions) the system inserts the was-fond action at time 15. MEXICA switches to engagement.

*** NEW STORY:

1 *The tlatoani lived in Tenochtitlan (0)*

2 *The priest kidnapped tlatoani (40)*

0 The tlatoani liberated himself (20)

6 *The tlatoani affronted the priest 20*

3 *The priest attacked the tlatoani 40*

4 *The tlatoani and the priest fought 80*

5 *The priest wounded the tlatoani 100*

7 *The priest ran away 20*

10 *The prince lived in Tenochtitlan*

11 *The prince decided to go to the forest*

12 *The prince realised that the priest wounded the tlatoani*

15 *The tlatoani was fond of the prince*

14 *The prince tried to abuse of the tlatoani 40*

13 *The tlatoani affronted the prince 40*

8 *The prince decided not to cure the tlatoani 60*

9 *The prince went back to Tenochtitlan City 40*

16 *The tlatoani died due to his injuries 0*

MEXICA cannot retrieve actions from memory and an impasse is declared. So, it switches to reflection and inserts the action where the tlatoani dies in order to break the impasse. The system switches back to engagement and a new impasse is declared. This time MEXICA cannot break it and the story is ended. A detailed description of how this story is generated can be found in (Pérez y Pérez, 1999).

5. Conclusions.

In MEXICA, LIRAs are the basic plot components whereas emotional links and tensions work as the joining units (c.f. Lehnert, 1983). During engagement preconditions are ignored; so, the production of material relies completely on the knowledge recorded in atoms. During reflection actions might be inserted in any part of the story to satisfy preconditions. Thus, the story does not unfold in a linear way and its structure arises as the plot develops. These characteristics allow MEXICA to generate material without the use of explicit goals or pre-defines story structures (c.f. Meehan, 1981; Pemberton, 1989; Turner, 1994). This attribute is relevant since story-predictability, i.e. "the degree to which the output of a computerized storyteller can be predicted when the content of the system's knowledge-structures are known" (Pérez y Pérez & Sharples, 2004), is closely linked to predefined structures. Gelernter (1994) claims that creativity can be reduced to the discovery of new analogies when one thought triggers another one that is related to it by shared emotions. MEXICA suggests that Gelernter's ideas can be useful to create more flexible computer programs for plot-generation.

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