Terminal Time: An Ideologically-biased History Machine

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Abstract

Terminal Time is a machine that constructs ideologically-biased documentary histories in response to audience feedback. The audience answers multiple-choice questions via an applause meter. The answers to these questions influence which historical events are chosen from a knowledge base, how these events will be slanted to embody the bias implied in the audience's answers, and how the events will be connected together to form a historical narrative. Once the narrative has been generated, video and sound clips are selected from a term-indexed multimedia database. The resulting documentary, consisting of the newly generated narrative spoken by a speech synthesizer, and the video and sound clips, is then presented to the audience.

1 Introduction

Terminal Time is a machine that constructs ideologically-biased documentary histories in response to audience feedback. It is a cinematic experience, designed for projection on a large screen in a movie theater setting. At the beginning of the show, and at several points during the show, the audience responds to multiple choice questions reminiscent of marketing polls. The audience interaction in relationship to the viewing experience is depicted in Figure 1. In the first question period, an initial ideological theme (from the set of gender, race, technology, class, religion) and a narrative arc (e.g. is this a progress or decline narrative) are established.

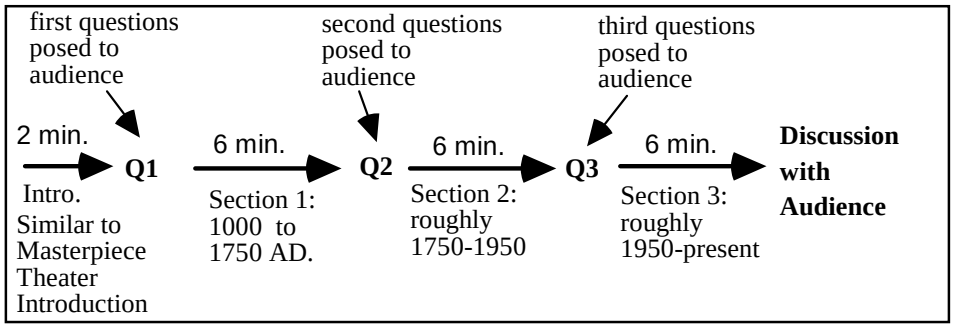

Figure 1: Audience interaction

The second set of questions refines the ideological theme chosen in the first set, and possibly introduces a sub-theme (e.g. combining race and class, or technology and religion). The third set of questions further refines the theme(s) and introduces the possibility for a reversal (e.g. a decline narrative becoming a progress narrative). An example question (from the first question period) is shown in Figure 2.

> Which of these phrases do you feel best represents you:
>
> A. Life was better in the time of my grandparents.
> B. Life is good and keeps getting better every day.

Figure 2: Example question

The audience selects answers to these questions via an applause meter – the answer generating the most applause wins. The answers to these questions allow the system to create historical narratives that attempt to mirror and often exaggerate the audience's biases and desires. By exaggerating the ideological position implied in the audience's answers, *Terminal Time* produces an uncomfortable history that encourages the audience to reflect on the influence of ideology on historical narratives.

Terminal Time, a collaboration between a computer scientist specializing in AI-based art and enter-

tainment, an interactive media artist, and a documentary filmmaker, benefits from understandings of narrative drawn from AI, the arts, and documentary film.

Terminal Time's architecture consists of the following major components: knowledge base, ideological goal tree (Carbonell 1979), template-based natural language generator, a blackboard for event ordering and story-arc maintenance (Englemore and Morgan, 1988), rhetorical devices, and a database of indexed audio/visual elements primarily consisting of short digital movies and sound files containing music. See Figure 3 at the end of the paper for a diagram of the architecture. The knowledge base contains representations of historical events. This is the raw material out of which the ideologically-biased histories are constructed. Examples of historical events are the First Crusades, the invention of Bakelite, and the rise of enlightenment philosophy. Ideological-goal trees represent the current ideological-bias being pursued by the computational narrator. The goal-trees consist of rhetorical goals ordered by subgoal and importance (to the ideologue) relationships. These goals are used both to select historical events to include in the story and to "spin" the event in an ideologically-consistent manner. The template-based generator generates the narrative text once specific facts have been selected and connected to make a story. The blackboard serves as a working memory for processes that impose a narrative order on event spins created by the goal-tree. Constraints can also be passed back down to the goal tree from this level. Rhetorical devices are connecting pieces of text with accompanying constraints on story structure. These devices are used to create narrative connections between historical events. An example rhetorical device is "Yet progress doesn't always yield satisfaction." Finally, the multimedia database contains the audio/visual elements for the assembled documentary. First the system builds the narrative track using the structures and process briefly described above. Once a narrative track has been constructed, information retrieval techniques are used to match the "best" indexed multimedia elements to the appropriate pieces of text. Once the multimedia elements have been selected, the resulting documentary is displayed, layering text-to-speech synthesis of the narrative track, and the video and audio elements.

The *Terminal Time* project has been on-going since the summer of 1997. During this time, several prototypes have been built in order to experiment with different representation schemes. The most recent prototype, finished in April of 1998, has been performed in front of theater audiences at several venues. This prototype has only one question period (at the beginning) and constructs a "mini-history" of the period 1900-1929. Since the construction of this last prototype, we have been working on the implementation and knowledge encoding for the architecture outlined above, performing historical research, and creating media elements. This final version will take advantage of the upcoming end of the millennium to tell the history of the last 1000 years. The project will be completed in June of 1999.

In the rest of this paper, we will describe the artistic aims of the project, discuss the relationship of this project to computer creativity, and describe in more detail the knowledge base and ideological goal trees.

2 Artistic goals

2.1 Documentary form

Ever since the first moving images were recorded, filmmakers were aware of the power of this medium to effect historical meaning. The historical documentary became one of the first identifiable film genres. The popular model of this form in America today, most clearly exemplified by Ken Burns' "The Civil War," has the familiar structure of Western narrative: each program has a distinct dramatic arc, a beginning, middle and an end. The rhetorical structure -- also familiar and now almost universally expected -- invariably involves a crisis situation, a climax, and a clear resolution. Generally there is one prevailing narrative, one interpretation of the historical facts presented. Most usually, the narrative is delivered to the audience by an unseen, yet obviously white, male narrator. So popular is this model that networks and cable channels, including the public television networks, rarely show programs that diverge from it; thus the form has become even more codified.

With *Terminal Time* we intend to imitate the model of this "cookie-cutter documentary" with a machine that produces and reproduces it, until the model itself is revealed for the tool of ideological replication that it has become. Although dominant in popular media today, the cookie-cutter documentary is just one form of historical documentary. *Terminal Time* derives its impetus from the dominance of this archetype, as well as from independent attempts to challenge the authority implied in the historical documentary and to posit alternative forms.

2.2 Utopian navigation

There is a great deal of industry hype surrounding interactive media and computing. Typically such experiences are promoted through a rhetoric of utopian navigation. According to such rhetoric, the computer provides unlimited access to information and experience, a pure source of empowerment that imposes no interpretation on the data that is processed. Other familiar tropes in this rhetoric include: Real-time, Immersion and Virtuality -- promising the thrill of reality or hyperreality, without the effort, right from one's own PC. Microsoft's ads softly beguile us with the question "Where do you want to go today?"

With *Terminal Time*, we play with these notions by building a program that engages in active interpreta-

tion and construction of the interactive experience. While the resulting constructed histories clearly respond to audience input, the system has a mind of its own, pushing the story into extremes that the audience did not intend. Thus value-free navigation gives way to a value-laden interpretation. *Terminal Time* is a program that bites back.

2.3 Audience experience

Utilizing indirect questionnaires as a user interface, the system essentially target markets each audience with an appropriate history. Rather than asking audiences what type of history they would like, or how they would like to navigate through history, they are asked questions about their own demographics and psychographics: what type of home they live in, what cultural trends they find most disturbing, how well they get along with others, etc. The resulting history is like holding a funhouse mirror to the audience; it reflects an exaggerated and distorted view of the audience's biases.

An applause meter is used to measure audience response to the questions. The applause meter was chosen as the input device for two reasons: ease of setup in different venues and the audience dynamic created by public applause. The applause meter requires no special setup in a theater. All that is required is a good quality directional microphone and a small mixing board. Alternative input devices, such as buttons or knobs placed at every seat, would be difficult to install. Such devices would effectively prevent *Terminal Time* from traveling to many venues. More importantly, applause metering enables interesting and entertaining audience dynamics. With applause, the audience members can gauge how the audience as a whole is responding to questions. At performances of the prototype, the audience laughed when choices met with silence. Sometimes the applause would grow into a groundswell of whistling and clapping as it became clear that certain choices were nearly unanimous. In other words, applause metering allows the audience to watch and respond to its own behavior. In addition, there is a nice incongruity when questions of "serious import" (such as "What is the worst problem facing the world today?") are answered by a popularity vote using a social mechanism (applause) often associated with entertainment and sporting events.

The audience should be kept just on the edge of incredulity. As the history begins 1000 years ago, the audience should experience a comfortable sense of historical authority engendered by the familiar documentary form and the remoteness of the historical events. As the history unfolds, the effect of the periodic audience polls becomes more and more apparent. The system will sometimes have to make wild causal leaps in order to maintain the ideological story. In addition, the system may foreground obscure historical episodes while leaving out well known ones. These occasional lapses, combined with the reflection of the audience polls in the content, begin creating a tension with regard to the veridicality of the history (a sense of "wait a minute, this doesn't seem quite right..."). Ideally, this tension should reach a maximum as the piece moves into modern history.

In order to fully appreciate the piece, an audience should see it more than once. In a typical hour-long performance, an audience will be able to see two performances. In the second viewing, *even if the audience answers the polls in exactly the same way*, they will experience a different history.[1] Seeing two different histories back-to-back should make fully apparent the effect of ideological bias in historical construction.

3 *Terminal Time* and computer creativity

Terminal Time is informed by a conception of AI as an expressive medium (Mateas 1999; Sengers 1998). Expressive AI conceives of AI systems as cultural artifacts. The concern is not with building something that *is* intelligent independent of any observer and cultural context. Rather, the concern is with building an artifact that *seems* intelligent, that participates in a specific cultural context in a manner that is perceived as intelligent. Expressive AI views a system as a performance. Within a performative space, the system expresses the author's ideas. The system is both a messenger for and a message from the author. Expressive AI thus changes the focus from the system as a thing in itself (presumably demonstrating some essential feature of intelligence), to the system as a communication between author and audience. At the technical level of building the artifact, the technical practice becomes one of exploring which architectures and techniques best serve as an inscription device within which the authors can express their message.

As authors, we have specific artistic goals and audience experiences we are pursing with *Terminal Time*. The project would lose meaning if we could not exert authorial control over the histories generated by the system. Of course, maximum authorial control would consist of writing a fixed set of canned histories; audience interaction would select one of these canned histories. But this extreme of control is inappropriate for this project on several grounds. Conceptually, the project depends on the machine "really constructing" the histories. The critique of the computer as a passive conduit of information requires that the computer actually take on an active role as a semi-cooperative genie, obviously responding to the choices voted on by the audience, but taking these choices to extremes. And on practical grounds, the number of possible histories resulting from all possible answers to all the questions is too large to build by hand. So, even if the conceptual

[1] In the event that the polls are answered in the same way, the differences will appear in the specific events chosen and the text generated for these events, not in the ideological bias.

purity of the piece did not demand it, practical necessity would require that the computer play an active role in story construction. As we reject the extreme of pure hand-authoring, we also reject the extreme of strongly emergent architectures, that is, architectures in which as little high-level knowledge as possible is given to the system, with all high-level behavior resulting from large numbers of statistical combinations of low-level elements. Such architectures by definition make authorship highly problematic. In a sense, they provide no authorial "hooks," no places within the architectural in which an author can exert specific control. Much of the architectural work that went into the iterative prototyping of *Terminal Time* was a search for an architecture providing authorial "hooks" on the right level of abstraction: low-level enough to allow significant combinatorial possibilities and the capability for surprise, yet high-level enough to allow the exertion of authorial control over multiple levels of the story construction process.

4 Knowledge base

4.1 Upper Cyc ontology

The knowledge base consists of second order predicate statements about historical events, definitions of ontological entities used in the historical event descriptions (individuals and collections), and inference rules. *Terminal Time*'s ontology is based on the Upper Cyc Ontology, the top 3000 most general terms in the Cyc ontology (Lenat 1995). The Upper Cyc Ontology is available free of charge from Cycorp[2]. It does not include any other components of Cyc (theorem prover, natural language engine, database, etc.); it only provides definitions of the top 3000 most general terms. However, the upper ontology provides a useful set of distinctions in terms of which the more specific ontology needed by *Terminal Time* can be defined.

4.2 Example historical event

Figure 4 shows part of the representation of The First Crusades. Those terms preceded by a "$" are defined in the Upper Cyc Ontology. Those terms not preceded by "$" are defined within the TT ontology in terms of the Upper Cyc Ontology. The intent of the representational syntax in Figure 4, translated into English, is:

> The First Crusades, a historical event occurring in the 11th century, involved a war and a transfer of possession of something. The First Crusades can be divided into three sub-events: the call for the First Crusades, the march to Jerusalem, and the taking of Jerusalem (in that temporal order). The call for the First Crusades is a communication act in which Emperor Alexander and Pope Urban I, acting in concert, asked the community of European Christians to take Jerusalem by force.

```
; TheFirstCrusades
($isa TheFirstCrusades HistoricalEvent)
($isa TheFirstCrusades $WagingWar)
($isa TheFirstCrusades $TransferringPossession)
(circa TheFirstCrusades (CenturyFn 11))
($comment TheFirstCrusades "The First Crusades is
the first attempt of European Christians to
take back Jerusalem from the Muslims - 11th century")

($firstSubEvents TheFirstCrusades
    CallForFirstCrusades)
($subEvents TheFirstCrusades
    FirstCrusadesMarchToJersalem)
($lastSubEvents TheFirstCrusades
    FirstCrusadesTakeJerusalem)

($isa CallForFirstCrusades
    $Requesting-CommunicationAct)
($senderOfInfo CallForFirstCrusades
    (CompositeInteligentAgentFn PopeUrbanI
     EmperorAlexander))
($recipientOfInfo CallForFirstCrusades
    (CompositeIACollectionFn EuropeanChristians))
($infoTransfered CallForFirstCrusades
    (RequestFn
     (takeByForce
       (CompositeIACollectionFn
         EuropeanChristians)
       (CompositeIACollectionFn
         MiddleEasternMuslims)
```

Figure 4: Example knowledge base representation

The syntax gains its representational intent both from inference rules that allow new terms to be proved true given the knowledge base, and from actions taken by the rest of *Terminal Time* when terms are proved true.

Terminal Time's full representation of the First Crusades can be found in Figure 5 at the end of the paper.

4.3 Inference engine

The inference engine, implemented in Common Lisp, is based on the interpreter implementing higher-order hereditary Harrop logic described in Elliott and Pfenning (1991). Hereditary Harrop logic allows knowledge base entries (the program, thinking in logic programming terms) to consist of Horn clauses, and queries (goals) to consist of all the standard Prolog-like goals (atomic goals, conjunctions, disjunctions, existentials), plus embedded implications (assumptions). The interpreter also includes extra-logical support for operations such as unifying logic variables against a function evaluated by Lisp.

[2] http://www.cyc.com/

```
(solve '(and
    ($purposeInEvent ?Agent FirstCrusades
     ?Purpose)
    ($isa ?Purpose $WagingWar)
    ($subEvents FirstCrusades ?Sub)
    ($isa ?Sub $Requesting-CommunicationAct)
    ($senderOfInfo ?Sub ?Agent)
    ($infoTransfered ?Sub (RequestFn ?Request))
    (match ?Purpose ?Request)
    (not (and
            ($subEvents FirstCrusades ?Sub2)
            ($isa
             ?Sub2
             $Requesting-CommunicationAct)
            ($startAfterEndingOf ?Sub ?Sub2)
            ($infoTransfered ?Sub2
                  (RequestFn ?Request2))
            ($isa ?Request2 $WagingWar)))
    ($hasBeliefSystems ?Agent ?Bsystem)
    ($isa ?Bsystem $Religion)))
```

The inference engine is used to answer all queries about historical events. For example, in the discussion below of ideological goal trees, the historical event tests that are mentioned are all made using the inference engine. For example, the query "Does the instigator of a war (e.g. The First Crusades) have a religious belief?" could be represented as a query as depicted in Figure 6. An English rendition of this query is:

Figure 6: An example query

> Is it true that some agent in the First Crusades had the purpose of waging war, that this same agent requested some other agent to engage in this war, that this request to wage a war occurred before any other request by any other agent to engage in a war, and that the agent who requested the war (and whose purpose is to wage war) holds religious beliefs?

It may be the case that a query appears in several different places within *Terminal Time* (e.g. in several different rhetorical goals); it would be inconvenient to have to repeat such complex queries in multiple places. Much of this query can be pushed into inference rules. For example, one could define a predicate (instigator AGENT WAR) which means that AGENT is the instigator of the WAR. All of the query in Figure 6 down to the $hasBeliefSystems formula could then become an inference rule for proving that an agent is an instigator. As additional ways of proving that someone is an instigator are needed, they can be added as additional inference rules. This collection of instigator rules becomes part of the knowledge that *Terminal Time* has about the script $WagingWar. The query in Figure 6 has been partially unpacked (removing inference rule chaining) in order to provide a clearer example of the kinds of queries made of the knowledge base.

5 Ideological goal trees

Terminal Time organizes ideological bias with goal trees, adapted from Politics (Carbonell 1979). In Politics, ideology is encoded as a set of goals held by the ideologue. The goals are organized via subgoal links (not corresponding exactly to either the conjunctive or disjunctive notion of subgoal) and relative importance links. The relative importance links place an importance partial order over the subgoals. For example, in Politics, the US Conservative ideologue's most important goal is *Communist Containment.* This goal has a number of subgoals such as *Have a Strong Military*, *Aid Anti-Communist Countries*, etc. Though *Have a Strong Military* and *Aid Anti-Communist Countries* are sibling subgoals, *Have a Strong Military* has a higher relative importance. In addition to their own goal tree, an ideologue also possesses beliefs about the goal trees of others. In Carbonell's system, the goal trees were used to organize inferences made by a news story understanding system.

In *Terminal Time*, the goal tree has been modified to represent the goals of an ideological story-teller. Rather than having goals to modify the world, the story-teller has rhetorical goals to show that something is the case. For example, the Hard Core Anti-Religious Rationalist might have the goals shown in Figure 7.

Figure 7: Example rhetorical goals

G1: Show that religious thought leads to evil
G2: Show that religious thought leads to war
G3: Show that religious thought leads to oppression
G4: Show that religious thought is the same around the world

G2 and G3 are subgoals of G1. G4 has a lower relative importance than G1.

The leaf goals in the goal tree are used to organize two kinds of knowledge: a set of tests for recognizing when a historical event is potential fodder for satisfying the rhetorical goal, and a set of plans for actually constructing the description of the event to satisfy the goal (the event spin).

5.1 Tests for event applicability

An ideologue needs a way of recognizing when a historical event could be used to satisfy a goal (make an ideological point). For example, the Hard Core Rationalist must be able to recognize that the First Crusades can be used to show that religious thought leads to war. This involves recognizing that the First Crusades was a war, and that the people who started it had a religious belief. An example specification for recognizing that an event can be used to show that religious thought leads to war is shown in Figure 8.

Event contains a war (W1) The aggressor (A1) of the war (W1) has a religious belief (B1)

Figure 8: An example applicability test

The event tests are purposely simplistic. For example, many wars may involve participants with religious beliefs without the religious beliefs playing a significant causal role. But *Terminal Time* pursues its ideological goals monomaniacally - it takes whatever grain of event knowledge it can find that is relevant to its current ideological bias and treats this knowledge as the whole truth.

In the process of satisfying the test, parts of the event representation are bound to roles in the test. These roles are used for focusing attention when generating the event spin. For example, a complex event may involve several sub-events and multiple actors. Yet if this event passes the test above, the actor who is the aggressor of the war and that actor's religious belief will have been bound to the roles A1 and B1, singling them out for special attention. Other knowledge known about the event can then be ignored during construction of the event spin.

5.2 Plans for event-level story generation

Once an event as been recognized as applicable to a rhetorical goal of the ideologue, additional knowledge is necessary to spin the event in such a way as to satisfy the rhetorical goal. This knowledge is represented as rhetorical plans. Such plans coordinate the bindings generated by the applicability test, available natural language templates associated with the event, and rhetorical devices.

An example plan for *Show that religious thought leads to war* is shown in Figure 9.

Describe the individual who called for the war, mentioning their religious belief Describe the religious goal of the war Describe some event happening during the war Describe the outcome

Figure 9: An example rhetorical plan

Associated with this plan is an ideological tone. Given a choice a sentence templates representing the same meaning, the ideological tone will be used to select the sentence template most consistent with the ideologue. For example, several sentence templates may describe an individual calling for a war. The Hard Core Rationalist will prefer a template with a rationalist-tone, but, if such a template can't be found, will accept a template with anti-religious tone, or, if one can't be found, with generically negative tone. In the event that only a neutral description is available, then the neutral description may be combined with boiler-plate text (rhetorical devices) to set the appropriate tone. For example, the Anti-Male Feminist may match on the First Crusades as an example of men once again causing pain and suffering (in this case, by starting a war). But there may be no templates providing a gender tone. So a rhetorical device, such as "Once again, the male sex revealed their fundamentally anti-life outlook" would be combined with a neutral description such as "Pope Urban I called for the First Crusades" to set the appropriate ideological tone.

If sentence templates associated with the event can not be found to satisfy a rhetorical plan, the system backtracks, attempting other rhetorical plans if multiple plans are available for a goal, or backtracking over the bindings established by the event applicability tests.

5.3 Audience interaction influences goal trees

The primary effect of audience interaction is to change the goal tree. Audience interaction may add, delete, or change goals in the goal tree. Two different ideological positions can be mixed by combining goals from two goal trees. For example, the audience's answers to the first set of questions may select the Hard-core Rationalist goal tree. Answers to the second set of questions may determine that racial equality (perhaps exaggerated as a homogenized "Benneton commercial" multiculturalism) is a sub-theme. The goal tree will be modified to include Corporate Multiculturalist goals in addition to Hard-core Rationalist goals, thus producing a hybridized ideological narrative. Some responses to questions (particularly questions in the third and last set) will modify the tree more subtly, adding and removing individual goals in the tree.

6 Related work

Hovy's work investigating pragmatic constraints on natural language generation (1987) has some similarities to *Terminal Time*. Hovy's system, Pauline, generates event descriptions that satisfy rhetorical goals. In Pauline, rhetorical goals include goals of opinion (e.g. show that our side has good goals or takes good actions) and goals of style (level of formality, level of simplicity). This notion of rhetorical goal differs from that used in *Terminal Time*. In *Terminal Time*, rhetorical goals are goals to argue for specific ideological positions by providing historical examples. In Pauline, rhetorical goals are goals to provide a spin of a single event consistent with a specific style. The user tells Pauline which event to describe, Pauline's orientation towards the event, the hearer's orientation towards the event, and which stylistic constraints to apply. Given these inputs, Pauline produces a textual description. Though Pauline only knows about three events, it can produce 100 different texts for an event.

Pauline is concerned with rich natural language generation parameterized by pragmatic constraints. *Terminal Time* is concerned with selecting and ordering historical events so as to support an ideological position. Pauline spends much more effort crafting individual sentences; *Terminal Time* uses template-based generation. But *Terminal Time* spends much more effort selecting events consistent with an ideological goal tree and ordering these events so as to form a story; Pauline is told which single event to describe and with which specific slant. The area where the two systems most overlap is in topic selection and ordering *within* an individual event, that is, in the processing that is handled by rhetorical plans in *Terminal Time*.

Finally, a rather large difference between the two systems is in the intentionality of the design. Pauline is an AI research system intended to further the understanding of the knowledge structures and processes required for language generation under pragmatic constraints. *Terminal Time* is a performative artwork intended to function as a provocative culture artifact, a *peculiar machine* raising questions about the construction of history, the nature of ideological reasoning, and the nature of user agency afforded by computer technology.

7 Conclusion

Terminal Time constructs ideologically biased documentary histories in front of theater audiences, utilizing marketing-style polls to allow an audience to vote for the history they want. But, like technology itself, *Terminal Time* is a fickle genie, using the audiences biases and desires to display histories that become uncomfortably extreme. The conception of AI employed in this project is expressive AI: AI systems viewed as a communication between author and audience. Thus the AI architecture was designed to afford combinatorial possibilities while supporting authorial control. The ideological goal tree is one representational mechanism used to organize ideological bias in historical construction.

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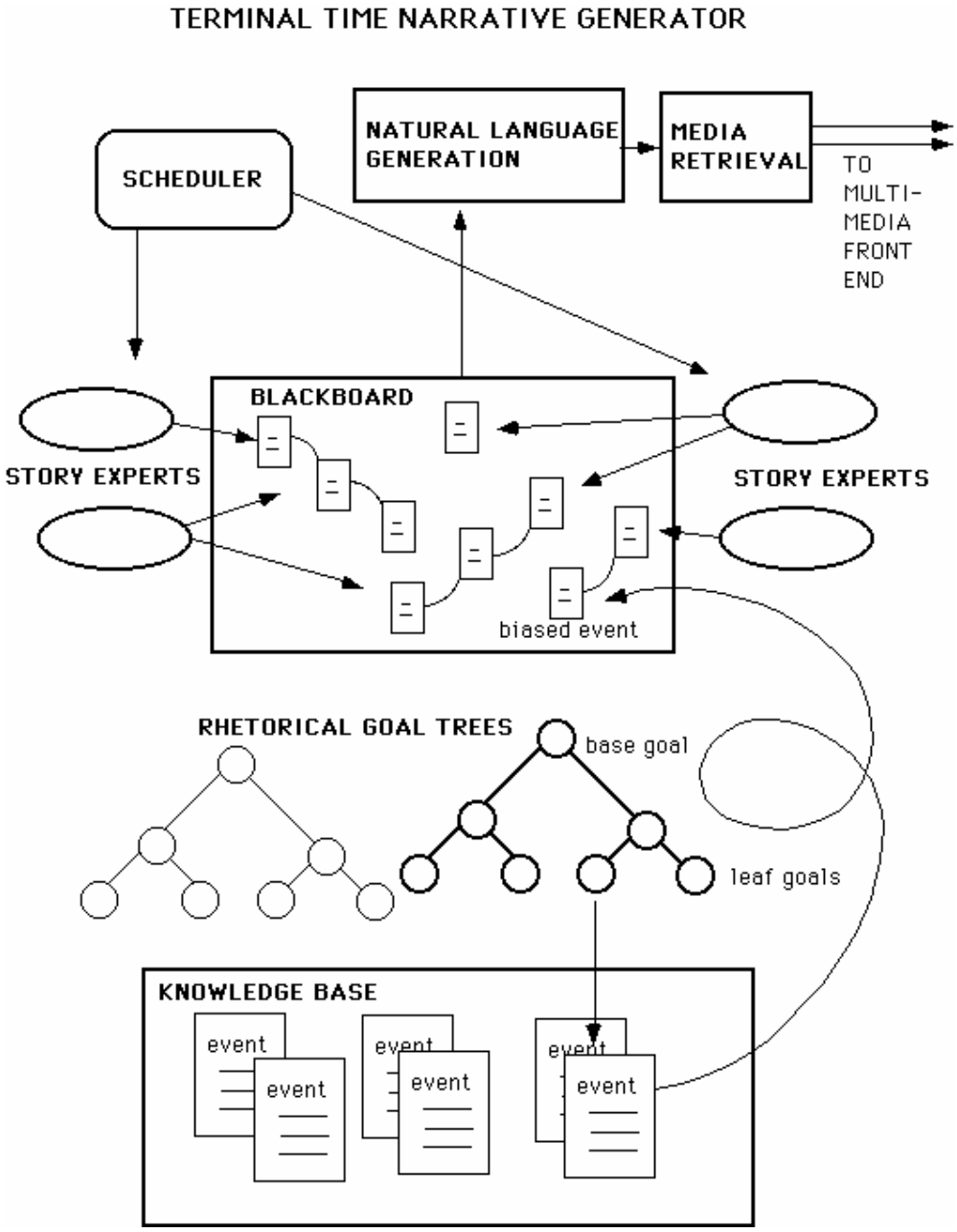

Figure 3: *Terminal Time* architecture

```
;; The terms describing the First Crusades
($isa TheFirstCrusades HistoricalEvent)
($isa TheFirstCrusades $WagingWar)
($isa TheFirstCrusades $TransferringPossession)
(circa TheFirstCrusades (CenturyFn 11))
($comment TheFirstCrusades "The First Crusades was the first at-
tempt of Eurpopean Christians to
take back Jerusalem from the Muslims in the 11th century")

($firstSubEvents TheFirstCrusades CallForFirstCrusades)
($subEvents TheFirstCrusades FirstCrusadesMarchToJersalem)
($lastSubEvents TheFirstCrusades FirstCrusadesTakeJerusalem)

($purposeInEvent
   (CompositeIntelligentAgentFn PopeUrbanI EmperorAlexander)
   TheFirstCrusades
   (takeByForce
      (CompositeIACollectionFn EuropeanChristians)
      (CompositeIACollectionFn MiddleEasternMuslims)
      Jerusalem
      TheFirstCrusades))

($isa CallForFirstCrusades $Requesting-CommunicationAct)
($senderOfInfo CallForFirstCrusades
   (CompositeInteligentAgentFn PopeUrbanI EmperorAlexander))
($recipientOfInfo CallForFirstCrusades
   (CompositeIACollectionFn EuropeanChristians))
($infoTransfered CallForFirstCrusades
   (RequestFn
      (takeByForce
         (CompositeIACollectionFn EuropeanChristians)
         (CompositeIACollectionFn MiddleEasternMuslims)
         Jerusalem
         TheFirstCrusades)))

($assistingAgent CallForFirstCrusades PeterTheHermit)

($isa FirstCrusadesArmy $Army)
($genls (MemberCollectionFn FirstCrusadesArmy)
   EuropeanChristians)
($circa FirstCrusadesArmy (CenturyFn 11))
($comment FirstCrusadesArmy "Represents the four Christian ar-
mies in the First Crusades (represent as a single entity.")

($isa FirstCrusadesMarchToJerusalem $TransportingPeople)
($fromLocation FirstCrusadesMarchToJerusalem
   $ContinentOfEurope)
($toLocation FirstCrusadesMarchToJerusalem Jerusalem)
($mainTransportees FirstCrusadesMarchToJerusalem
   FirstCrusadesArmy)

($subEvents FirstCrusadesMarchToJerusalem
   FirstCrusadesMurderJews)
($isa FirstCrusadesMurderJews $Killing-Biological)
($victim FirstCrusadesMurderJews
   (CompositeIACollectionFn EuropeanJews))

($performanceLevel
   FirstCrusadesArmy
   FirstCrusadesMarchToJerusalem
   $performedBy
   DegreeOfOrganization
   ($LowFn DegreeOfOrganization))

($isa FirstCrusadesTakeJerusalem $TransferringPossession)
($isa FirstCrusadesTakeJerusalem $WagingWar)
(takeByForce FirstCrusadesArmy
   (CompositeIACollectionFn MiddleEasternMuslims)
   Jerusalem
   FirstCrusadesTakeJerusalem))

($successfulForAgents FirstCrusades
   (CompositeIntelligentAgentFn PopeUrbanI EmperorAlexander))
($successfulForAgents FirstCrusades
   (CompositeIACollectionFn EuropeanChristians))
($failureForAgents FirstCrusades
   (CompositeIACollectionFn MiddleEasterMuslims))

;; Causal structure for FirstCrusades
($causes CallForFirstCrusades FirstCrusadesMarchToJerusalem)
($causes FirstCrusadesMarchToJerusalem
   FirstCrusadesTakeJerusalem)

;; Soon Jerusalem was lost to the Christians
($isa JerusalemRetakenByMuslims1 $TransferringPossession)
($isa JerusalemRetakenByMuslims1 $WagingWar)
(circa JerusalemRetakenByMuslims1 (CenturyFn 12))
(takeByForce
   (CompositeIACollectionFn MiddleEasternMuslims)
   (CompositeIACollectionFn EurpeanChristians)
   Jerusalem
   JerusalemRetakenByMuslims1)
   (reverses JerusalemRetakenByMuslims1 TheFirstCrusades)
```

Figure 5: Full representation of the First Crusades