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The canonical processes of a dramatized approach to information presentation

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Abstract This paper describes the application "Carletto the spider" in terms of the mapping with the canonical processes of media production. "Carletto the spider" is a character-based guide to a historical site and implements the Dramatour approach for the design of drama-based interactive presentations. Dramatization makes presentations more engaging, thus improving the reception of the content by the user. The major technical issue of the approach is the segmentation of the presentation into audiovisual units that are edited on-the-fly in a way that guarantees dramatic continuity while adapting to the user response. We describe the workflow of the application and its mapping to the canonical processes of media production, envisaging possible standardizations for the application portability.

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1 Introduction

This paper describes the implemented application "Carletto the spider" in terms of the canonical processes of media production [7]. "Carletto the spider" presents information about a historical site in a dramatized form. The presentation is delivered by a virtual character, adapting the content to the user's location on-the-fly. "Carletto the spider" is an example of the Dramatour approach for building drama-based information presentations [2].

The Dramatour approach merges production methods for *dramatic media* [3], such as television or cinema, and formal annotation techniques to build information presentations. The assumption underlying the methodology is that the dramatization of the exposition enhances the effectiveness of the communication through the user's engagement in the emotions displayed by the characters [11]. The emotions of a character result from the conflicts she/he engages in with her/himself or with other external entities during the drama performance. In a plot designed by a drama author, such conflicts increase in number and intensity until they find some resolution [9]; so, the drama features a rising then falling emotional course (often called *dramatic arc* [4]).

Differently from linear (non-interactive) drama, the author of an interactive dramatic plot must accommodate the reactions of the user, and manage the conflicts arising from the interaction between the user's reactions and the emotional course of the plot. The solution is to employ some form of flexible drama scripting [8].

In the simpler case of single-character interactive presentations for visit guidance to a historical location, such as the case of "Carletto the spider", the users' (in our case, visitors) reactions are limited to the implicit or explicit manifestation of different degrees of interest for the topic addressed by the presentation at some point. Her/his input influences

the subsequent selection of topics operated by the character and the way they are presented. The presentation is segmented into atomic audiovisual units, annotated according to the topic they deal with, and assembled on-the-fly in response to the user's input to form a presentation that is compliant with the drama tenets sketched above. The character's presentation must address both the task of providing information to the visitor and the task of building a bond with the visitor for emotional engagement.

In the next section we describe how we have developed the application "Carletto the spider"; then, we describe the mapping with the canonical processes; finally, we provide some conclusions.

2 The Making of "Carletto the spider"

The application "Carletto the spider" is a virtual guide for the historical location of Palazzo Chiablese in Turin, Italy. This baroque palace hosts the former royal apartments of the Savoy family. Carletto, an anthropomorphic spider (Fig. 1), lives hidden on the walls and the ceilings of the apartment. His image is captured by a webcam and delivered to the visitor's mobile device (a PDA) via a wireless network. As it emerges along the presentation, he is the last descendant of a noble family of spiders, inhabiting the palace for centuries; his ancestors have been annotating the relevant facts about the palace in a web, where he himself files his memories. When he needs to find out some forgotten detail, he consults the web. A visitor is free to stroll inside the apartments. Carletto uses the network to localize the visitor and adapts his presentation to the visitor's behavior: the informative content he provides depends on the room where the visitor is located at some point and on how long the visitor has remained inside that room (and on the overall duration of the visit). The installation of "Carletto the spider" was open to the general public for one week in April 2006. We carried out an evaluation of the system performance by surveying about 300 anonymous

Fig. 1 "Carletto the spider" on the device screen

questionnaires that demonstrated people liked Carletto, were emotionally engaged with him, and preferred him to the standard plain audioguide [1].

The presentation given by Carletto has been written by a drama author with the support of an expert in the historical and artistic aspects of the location. Carletto experiences a personal conflict between the role of a "guide", who exposes facts orderly and plainly according to the topology of the location (like a human guide usually does), and the desire to be a "landlord" of the palace, who recounts all the trivia and the anecdotes he knows—most of which involve him or his family personally. This approach meets the requirement of centering the presentation on an internal conflict of the character to gain the emotional engagement of the visitors [9]. Moreover, Carletto engages in an external conflict with the cleaners, who would like to get rid of him to clear the palace from his webs. After some time in a room, Carletto becomes uneasy, and tries to induce the visitor to move to another room, in order to "prevent the cleaners from trapping him" (the real constraint is that the total duration of the visit ought to be under 30 min). Carletto keeps the control of the interaction with the visitor, politely directing her/his attention to the significant items in the rooms and reporting the historical facts, always in a dramatized style. However, the visitor can take control at any time, either implicitly, by moving to another room, or explicitly, by pausing or stopping the presentation.

The character "Carletto" was designed and realized by a 3D graphics production team, following the specifications given by the author. The author wrote the units that contribute to the presentation together with indications for the audiovisual production. Each unit, lasting between 15 and 50 s, either accounts for some topics concerning the location or achieves some communicative function from Carletto to the visitor. Content topics and communication functions constitute the metadata for annotating the units. The example unit in Fig. 2 is split between the dramatic content (a) and the annotation (b). The dramatic content is expressed in textual form and is subdivided into tripartite sections (five in this example): (i) Carletto's acting is encoded into an identifier that the animator interprets (e.g., C4 means that Carletto speaks with the right hand leaning on his chin); (ii) camera control and scene content (indications for direction) are encoded with a 5-tuple (refer to Fig. 1 for a frame of the third section): type of shot (LS = Long Shot, MS = Medium Shot, CU = Close Up), character orientation (0 = Front, -90 = Left side), position of the character in the frame (RIGHT_POS and CENTRE_POS are self-explanatory), camera motion (FIXED_CAMERA = camera in a fixed position, CENTRED_CAMERA = camera keeping the character in the center), presence of the spiderweb in the background (NO_WEB, WEB); (iii) the words uttered by Carletto. The annotation metadata in Fig. 2b are subdivided into three sets: the communicative function

PRESENTATION_UNIT   INF_004
ACTING: A2
CAMERA: <LS, -90, RIGHT_POS, FIXED_CAMERA, NO_WEB>
WORDS: The first owner of the Palace was the marchioness Beatrice Langosco di Stroppiana. The beautiful lady, widow of an earl, was very … intimate … with the duke Carlo Emanuele I …
ACTING: C2
CAMERA: <LS, -90, CENTRE_POS, CENTRED_CAMERA, WEB>
WORDS: So, she was his mistress … and gave him three children … illegitimate children of course, … but this was normal at the time … in fact, in 1583, the lady married the noble man from Brescia
ACTING: C4
CAMERA: <LS, 0, RIGHT_POS, FIXED_CAMERA, WEB>
WORDS: Francesco Martinengo di Malpaga, and bore other five children, and was then beloved by the later duke Emanuele Filiberto for her services …
ACTING: E1
CAMERA: <MS, 0, CENTRE_POS, FIXED_CAMERA, WEB>
WORDS: For her services? (*red face*) … well, it was a prize for this … ehm … love story … or morganatic marriage … well … (*Carletto trips over a web wire; then stands up again and says*)
ACTING: F1
CAMERA: <CU, 0, CENTRE_POS, FIXED _CAMERA, WEB>
WORDS: … I'd like not to introduce an equivocal …

(a)

ANNOTATION TAGS for INF_004		
COMMUNICATIVE FUNCTION	**INFORMATIVE**	
TOPIC ONTOLOGY	**topological**	**historical**
	Palazzo Chiablese	Beatrice Langosco Carlo Emanuele I
GIVEN/ NEW	**given**	**new**
	===	Beatrice Langosco

(b)

Fig. 2 **a** A textual presentation unit (English translation from the original Italian). **b** Annotation metadata for the unit in **a**

accomplished by the unit, the content topic conveyed by the unit, the given/new distinction over the discourse referents mentioned in the unit. There are two major categories of communicative functions: informative, i.e. the act of providing information about a certain topic, and interactional, i.e. one of the acts that contributes to the interaction with the visitor. The latter functions encompass the social function (basic social behaviors, like greeting or introducing oneself), the directive function (attempting to influence the user's behavior, like inviting her/him to another room), and the phatic function (displaying the character's presence without conveying any information). The unit in Fig. 2 is an informative unit. The topics delivered through the informative function are arranged into a taxonomic ontological representation of the facts about Palazzo Chiablese and the royal apartments. This representation is split into two subontologies. The topological ontology organizes the knowledge about the structure of the location: palace, rooms, walls and ceilings of each room, objects contained in a room (e.g., the unit in Fig. 2 is about the whole palace); the historical ontology contains the historical facts and the characters related to the location (e.g., the unit in Fig. 2 mentions two major characters, Beatrice Langosco

and Carlo Emanuele I). Given the user's current location, topics are selected with reference to one of the two ontologies, by alternating them along the presentation in order to realize Carletto's inner conflict between his institutional role of a guide (the topological ontology) and his personal desire to be the landlord of the palace (the historical ontology).

Since "Carletto the spider" is an adaptive application, the exact presentation order of the units cannot be predicted in advance. So, each presentation unit is further tagged according to a *given/new* distinction of the discourse referents mentioned therein. A referent introduced by the unit as it was the first time in the presentation is marked "new" ("The first owner of the Palace was Beatrice Langosco di Stroppiana"); a referent assumed as already introduced in another, previously delivered unit is marked "given" ("Lady Beatrice was involved in a few love affairs"). The application maintains a history of referents introduced. A unit can be delivered only if its "given" referents are already present in the referents' history; conversely, a unit cannot be delivered if it contains a "new" referent that has already been introduced.

The system architecture has a client-server structure. The implementation of the architecture was based on hardware available on the consumer market and mostly on open-source software. The client, written in Java, ran on the PDA ASUS A636 (PocketPC series). Also the server was implemented in Java, while the database system that hosts the units is MySQL. The video player was based on a Flash player. The overall bitrate of a video (PDA screen resolution), including sound, was about 400 Kbit/s, enough to accommodate the 20 people that could be inside the apartments at the same time. The localization of the visitor was limited to the room level (so, object proximity was not taken into account) and was based on a method that measures the signal strength of pre-installed 802.11 Wireless Access Points [6], an approach suitable to locate devices in macro-areas of indoor locations.

In the next section we describe the workflow of the application and the mapping to the canonical processes.

3 Mapping "Carletto the spider" to the canonical processes

The workflow of the application "Carletto the spider" is illustrated in Fig. 3. We identify two major phases: the first (upper part of the figure) is the off-line editing phase, where the audiovisual units are produced and tagged with the metadata; the second (lower part of the figure) is the real-time execution phase, when the units are retrieved from storage and displayed to the user. The following description is centered upon the real application processes; then we map the most relevant of these processes to the canonical processes.
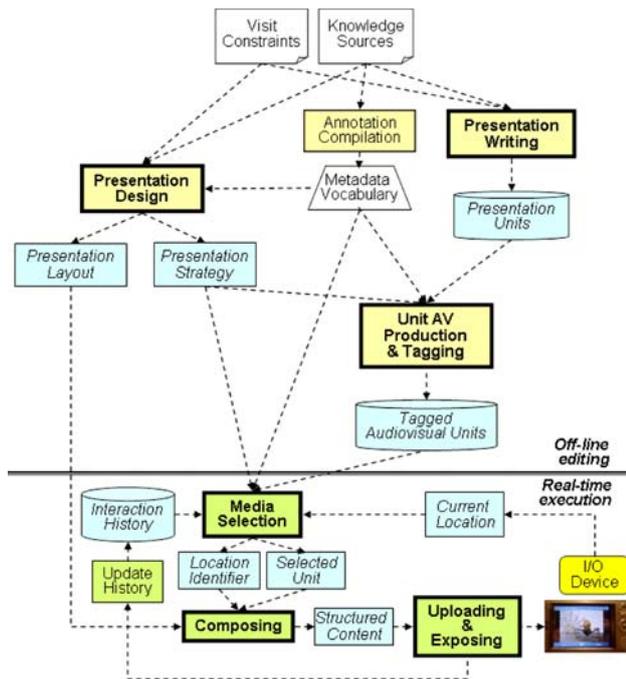
Fig. 3 Overview of the processes and assets in the application "Carletto the spider". The application processes that participate in the mapping to the canonical processes are outlined in *bold*; assets are in *italics*

In the off-line editing phase, we started from a document worked out by the ministry officers that contained an informal description of the Visit Constraints: the physical location of the tour (five rooms of the royal apartments of Palazzo Chiablese in Torino), its duration (less than 30 min), the profiles of the target users (senior citizens, medium education level, low acquaintance with technology). Also, the domain experts of the ministry provided the Knowledge Sources for the presentation contents. Given these informal documents, three processes elaborate the formal components of the dramatized presentation. A process of *Presentation Writing* translates the contents from the Knowledge Sources, given the Visit Constraints, into units that will be then acted by Carletto (*Presentation Units*); these units contain annotations for the subsequent media generation process. A process of Annotation Compilation produces the Metadata Vocabulary, that includes the communicative and topic metadata described above; they provide the semantic annotation for the audiovisual units that form the presentation. Finally, a process of *Presentation Design* defines the message to be conveyed by the application; it is expressed through a set of rules—encoded in a scripting language—that constrain the linear structure of the presentation that will emerge in real-time (*Presentation Strategy*). The Presentation Design also determines the type and position of the material to be delivered and its visual organization (*Presentation Layout*), encoded in a content template (a mark-up file) in which variable elements are

inserted in a fixed structure, accompanied by presentation directives (a style sheet file). In particular, an area for playing the audiovisual unit occupies 90% of the screen, and a text area showing the current location of the visitor occupies 10%. The creation of the audiovisual units occurs through a complex process of *Unit Audiovisual Production & Tagging*, composed of two processes, the Audiovisual (AV) Production and Tagging. The textual *Presentation Units* (such as the one in Fig. 2) are the input to the AV Production process, operated by multiple human professionals (sound technicians, actors, visual artists, director), that yields the Audiovisual Presentation Units; the latter are then tagged with the Communication Metadata and the Topic Metadata (Tagging) to yield the *Tagged Audiovisual Units*, that are stored in a repository queried during the real-time execution phase.

The real-time execution phase selects and displays the units that form Carletto's presentation. Here, all the actors are software-based. The *Interaction History* is a dynamically updated data structure that contains the past interaction between the application and the visitor (parsed by the Update History process). It is a chronologically ordered list of quadruples consisting of: the room visited, the unit delivered, the topic addressed, the communicative function addressed. Moreover, the mobile device continuously samples the location of the visitor to get the *Current Location* and provides it to the process that selects the unit to be shown next, the *Media Selection* process. It takes as input the *Interaction History*, the *Current Location*, the *Presentation Strategy,* and selects, in the repository of units, the unit to be displayed next (*Selected Unit*); moreover, after a preliminary test, we decided to deliver the visitor an indication of her/his recognized current room (*Location Identifier*). The *Composing* process takes as input the *Selected Unit* and the *Location Identifier* and binds them to the variable elements in the *Presentation Layout* to yield the *Structured Content,* in which the *Selected Unit* is mapped to the video playing area and the *Location Identifier* is mapped to the text area. The bindings in the *Structured Content* still contain options for the two components: the unit video can come in multiple resolutions, or it can be replaced by a text message to be displayed in case the video is temporarily unavailable; the option for the missing location situation is the default message "Location Unknown". The *Uploading* process decides the appropriate options given the network infrastructure, the mobile device, and the availability of video and location. Finally, an *Exposing* process displays everything on the output device.

In the following subsections, we show how the relevant application processes map to the canonical processes, together with the corresponding UML schemata where necessary for comprehension. The mapping between the processes involved in the application "Carletto the spider" and the canonical processes defined in [7] reveals a wide coverage of the whole system (see Table 1).

Table 1 Relationship between the processes of "Carletto the spider" and the canonical processes

| Canonical processes	Processes of the application "Carletto the spider"
Premeditate	Presentation writing: The Author builds the Presentation Units from the informal documents stating the Visit Constraints and the Knowledge Sources.
	Input: Informal documents from the customer (Ministry of cultural heritage), namely Visit Constraints and Knowledge Sources
	Output: Presentation Units
Create media asset	Audiovisual Production: The Author, Sound Technicians, Visual Artists, Actor and Director create the Audiovisual Units.
	Input: Presentation Units, Presentation Strategy
	Output: Tagged Audiovisual Units
Annotate	Tagging: The Author tags the audiovisual units with the communicative and the topic metadata
	Input: AV Units, Communicative Metadata, Topic Metadata
	Output: Tagged AV Units
Query	*Media selection*: The server selects the audiovisual unit to be delivered to the visitor.
	Input: Current Location, Interaction History, Tagged Audiovisual Units, Metadata Vocabulary, Presentation Strategy
	Output: Selected Unit, Location Identifier.
Construct message	Presentation design: The Interaction Designer compiles the project message into formal representations of its three components: the strategy of the presentation, the selection of content to be delivered, the visual layout for publishing
	Input: Informal documents from the customer (Ministry of cultural heritage), namely Visit Constraints and Knowledge Sources
	Output: Presentation Strategy, Presentation Layout
Organise	*Composing*: The Selected Unit and the Location Identifier are organized in a document structure based on the Presentation Layout (message from the Presentation Design)
	Input: Selected Unit, Location Identifier, Presentation Layout
	Output: A Structured Document based on the Presentation Layout
Publish	Uploading: The Structured Content is associated with the actual unit and text to be displayed on the PDA.
	Input: Structured Content
	Output: Filled-in mark-up file
Distribute	*Exposing*: the complete page content is exposed on the PDA
	Input: Filled-in mark-up file
	Output: Unit playing and location identifier printed on the device screen
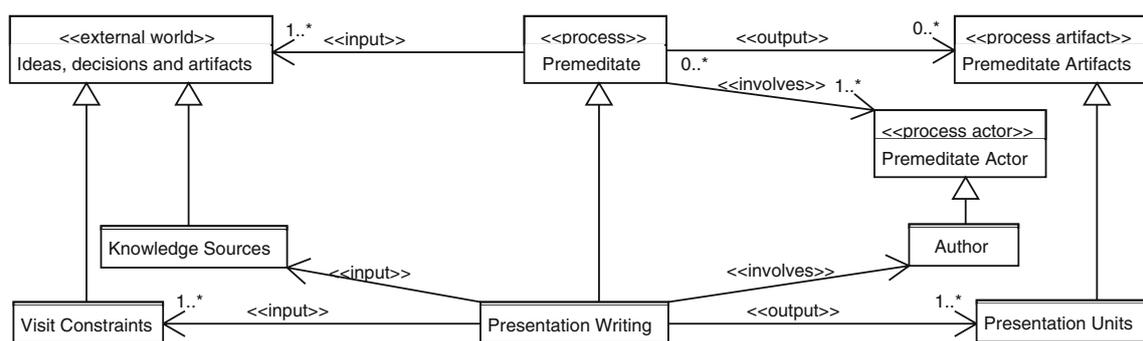
Fig. 4 The presentation writing process (a premeditate process)

3.1 Presentation writing

The *Presentation Writing* process (Fig. 4) is a *Premeditate* process, conducted by the Author (a human Premeditate Actor), that takes as input the informal documents (Visit Constraints and Knowledge Sources) and builds the Presentation Units (a sample one is shown in Fig. 2). These provide very precise indications on how to produce the media
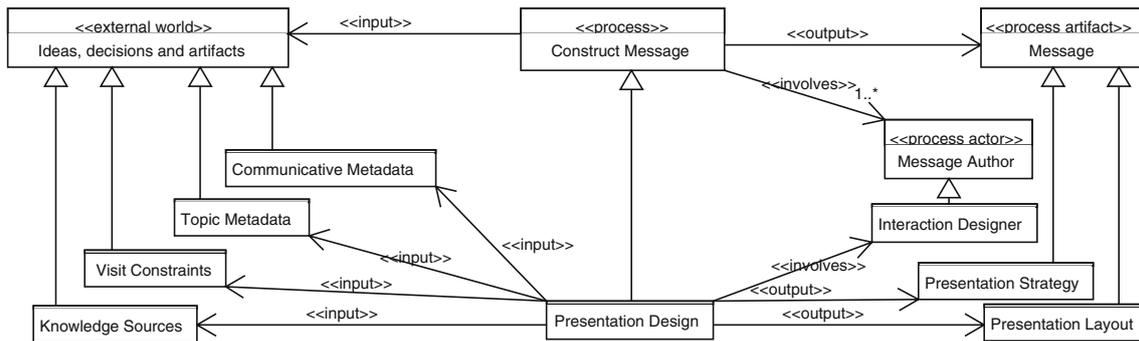
Fig. 5 The presentation design process (a construct message process)

assets (Audiovisual Clips) that form the dramatized presentation.

3.2 Presentation design

The *Presentation Design* process is a *Construct Message* process (Fig. 5). It is authored by the interaction designer, who takes as input the informal visit constraints and knowledge sources, and builds the message, consisting of the Presentation Layout and the Presentation Strategy. The Presentation Layout is a visual arrangement for the presentation items on the mobile device screen, which defines the type and number of Media Assets that appear on the screen as well as their physical placement. In "Carletto the spider", the visual layout includes one audiovisual unit and one thin horizontal text area at the bottom (see Fig. 1), and is realized through a template mark-up file plus a style sheet. In the real-time execution phase, the Presentation Layout is exploited by the *Composer* (an *Organize*-class process—see above and below). The Presentation Strategy encodes the presentation strategy of the character into scripting commands, that specify how the presentation will be structured by relying on metadata. The strategy according to which the character manages the interaction with the user (how it behaves, how the visitor's input affects its behavior) is specified in terms of communicative metadata; the type and amount of information to be delivered is specified in terms of topic metadata. The Presentation Strategy guarantees that the presentation acquires a dramatic directionality by alternating topologically and historically annotated units, and prescribes the character to deliver, for each room, about 80% of the information at the first visit of the room (leaving the remaining 20% for a possible return to the room); after this threshold, the visitor is invited to move to some other room (e.g., Carletto claims that the cleaners are after him). The Presentation Strategy incorporates a general-to-particular navigation of the topic

ontology (cf. the discourse focusing strategy stated by Grosz and Sidner [5]).

3.3 Audiovisual production and tagging

The *Audiovisual Production and Tagging* process (Fig. 6) is a *Complex Media Production* process, composed of *Audiovisual Production* (AV Production in the Figure) plus *Tagging*. They consist, respectively, of the realization of the audiovisual units and of their tagging, and the result are the Tagged Audiovisual Units. The *Audiovisual Production* process is a subclass of Generation. The Actors involved in this process are the Author (who conceived the premeditated textual Presentation units that are taken as input by this process), and the Sound Technician, Visual Artists, Actor, Director (all Creation Actors), who conjointly create the Audiovisual Units. The *Tagging* process (a *Semantic Annotate* process) annotates the Audiovisual Units with the Unit Tags provided by the Communicative and Topic Metadata (the Metadata Vocabulary, see Fig. 3). A paramount role is played by the Author, who is responsible for fitting the units with respect to the message conveyed by the presentation, possibly through a revision of the text and most importantly through tagging. Tagging occurs through a web-based editor, a PHP-based interface to a MySQL database (the audiovisual unit repository); through this interface, the Author modifies the units and inserts them into the database; the interface also constrains the Author to assign the tags contained in the Metadata Vocabulary. So, differently from traditional authoring, tagging is the means by which the "procedural author" (cf. [10]) constrains the possible outcomes of the system-user interaction within the boundaries prescribed by the drama paradigm. For space reasons, we do not go into the details of the Audiovisual Production here, but the Actor and the Sound Technicians provide a soundtrack, while the Visual Artists provide the body and facial animations of Carletto; these should be two separate creation processes then packaged together; all
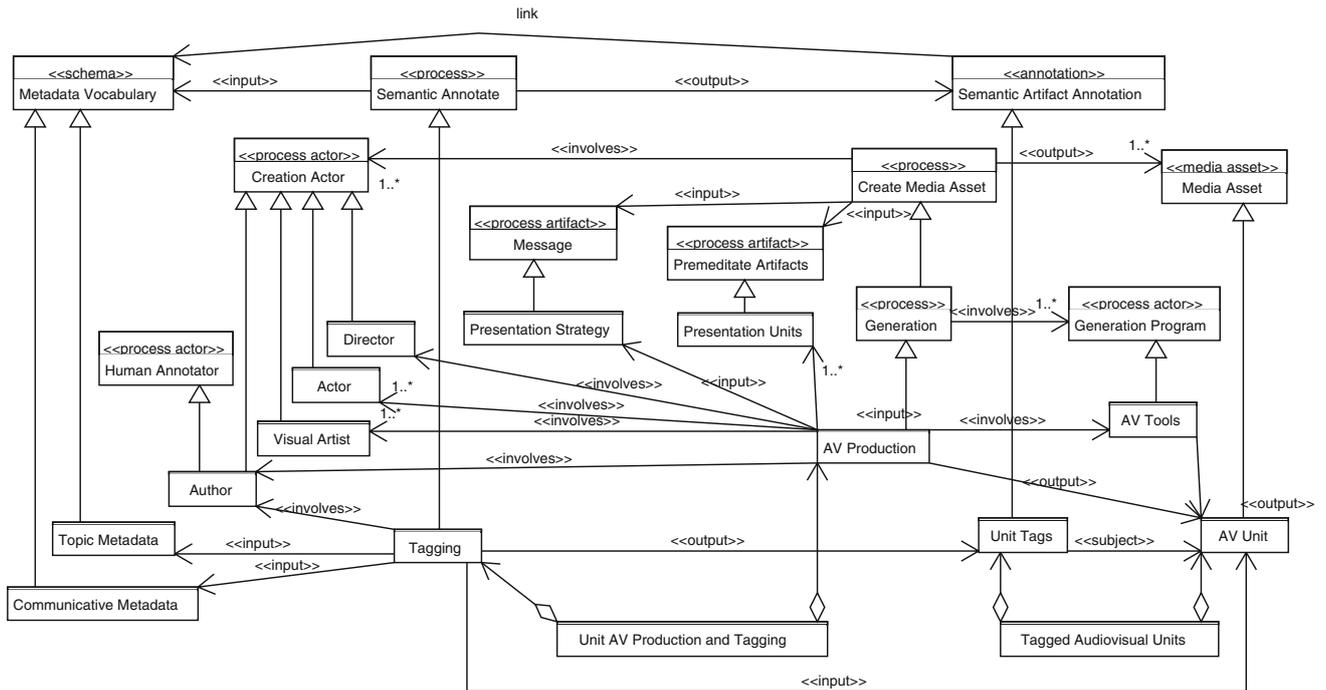
Fig. 6 Unit audiovisual production and tagging (a complex media production process)
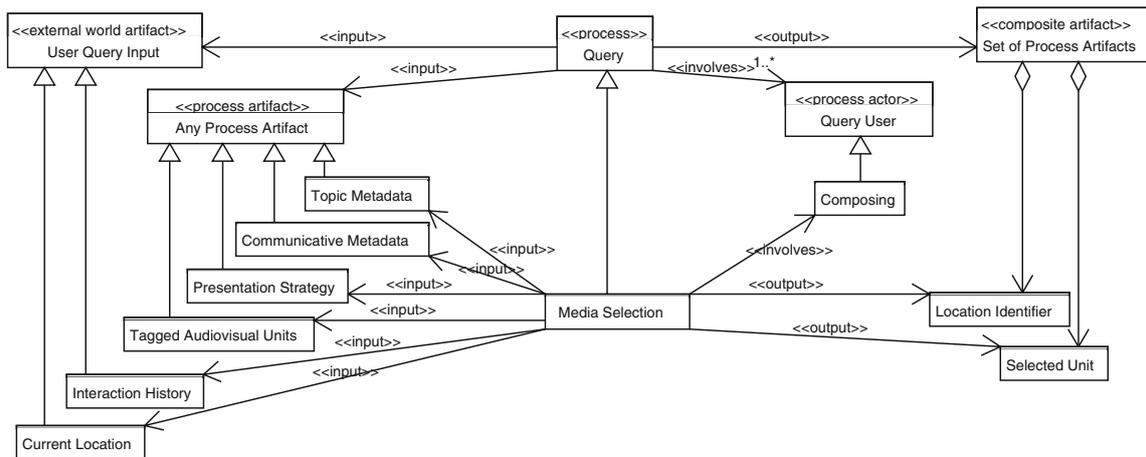

Fig. 7 Media selection (a Query process)

this occurs under the supervision of a Director. The Tagged Audiovisual Units are actually a Multimedia Package.

3.4 Media selection

The *Media Selection* is a *Query* process (Fig. 7). It is invoked at runtime (by *Composing*, a Query User) in order to obtain the material to be displayed to the user. It takes as input the Current Location of the user, the Interaction History, and the Presentation Strategy, and queries the repository of Tagged Audiovisual Units for a suitable next unit (Selected Unit) and converts the Current Location input into a Location

Identifier. The figure is simplified with respect to the Interaction History, since the User Query Input is mediated by the Update History process (not described in canonical terms). By relying on the specifications provided in the Presentation Strategy, the *Media Selection* process identifies the most appropriate communicative function to be accomplished and, in the case of the informative function, it also selects the most appropriate topic given the current visitor's location (Current Location) and the current ontology (specified in the Interaction History). A special case is when the system schedules a hardwired reaction, e.g. when the localization is lost because of network malfunctioning and "Carletto invites the user to
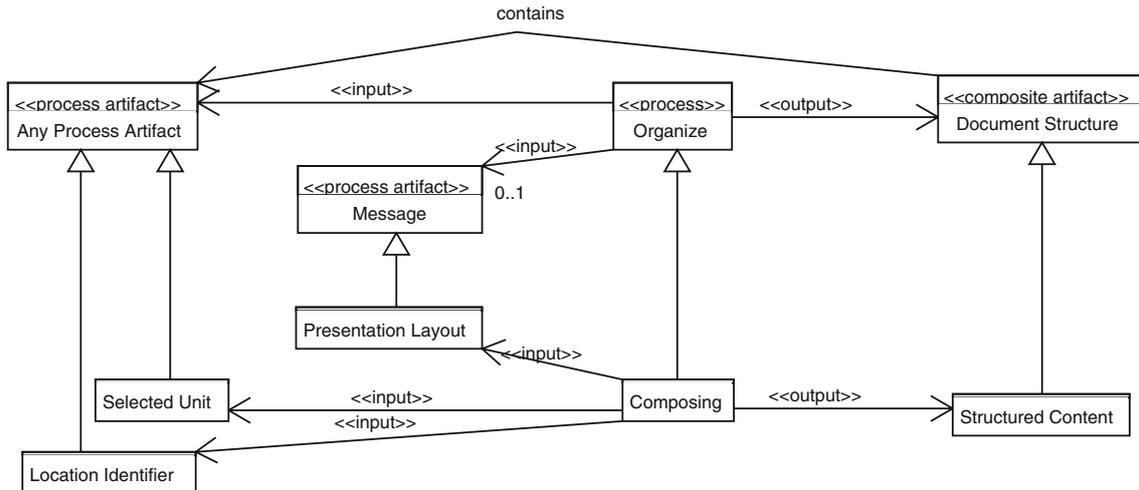
Fig. 8 The composing process of type organize

move in order to regain her/his lost position": this selection only considers the case in which Current Location is null.

3.5 Composing

Composing (Fig. 8) is a canonical *Organize* process, that yields the Structured Content by mapping the Media Assets selected by the *Media Selection* process to the variable elements in the fixed visual template specified by the Presentation Layout (a mark-up file with a style sheet associated), previously defined by the *Presentation Design* process. The Structured Content consists of a binding between the areas defined by the Presentation Layout (a video-playing area and a text area) and the actual content items (the Media Assets issued by the online Query process, respectively the Selected Unit and the Location Identifier). More specifically, the video-playing area is bound to the Selected Unit and the text area is bound to the Location Identifier. Notice that this binding is neutral with respect to the possible options for the subsequent publishing, that will be managed by the *Uploading* process.

3.6 Uploading

Uploading is a subclass of *Publish*. It takes as input the filled-in mark-up file name Structured Content (created by the *Composer*), retrieves the actual Selected Unit bound through some URI in the file and the Location Identifier (alternatively generates the message "Location Unknown"), and sends everything to the client application on the PDA through the wireless network (the whole data are called Complete Page).

3.7 Exposing

Exposing is a subclass of *Distribute*, that actually displays the Complete Page on the output device (the PDA). It is a client application on the PDA (a browser), that also inserts the information that such a unit has been delivered into the Interaction History.

4 Discussion and conclusion

The paper has presented the application "Carletto the spider", a character-based guide to a historical location inspired by the drama paradigm, and its mapping to the canonical processes. The canonical processes helped in clarifying the complex interleaving of the authorial work and the interactive application. In fact, the mapping provides a clear partition of the canonical processes over the two phases: Premeditate, Construct Message, Create Media Asset, and Annotate are involved in the off-line editing phase; Query, Organize, Publish, and Distribute are involved in the real-time execution.

The mapping helps in the portability of the application to another context. One finding is the clarification over the dependencies between off-line and real-time processes through the *Construct Message* process of *Presentation Design* and the *Organize* process of *Composing*. Also, the distinction between the annotation and the creation of the media assets (in our application a unique complex process *Unit AV Production & Tagging* operated by the Author, and the other artists) allows the identification of reusable assets across different applications. For example, the communicative metadata can be ported to a different application sharing the same communication goals of a guided tour, while the topic metadata can

be re-used in a different application for the same historical location.

As a comment to the mapping, we notice that, in an interactive application with specific semantic content, a relevant step is the creation of the metadata vocabulary, that is not included in the canonical processes. We recommend that the definition of the individual items of such annotation schema should be part of the production process as a *Premeditate* phase.

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