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Annotation of metadata for dramatic texts: the POP-ODE initiative

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Abstract. This paper addresses the problem of the metadata annotation for the dramatic texts. Metadata for drama describe the dramatic qualities of a text, connecting them with the linguistic expressions. Relying on an ontological representation of the dramatic qualities, the paper presents an annotation environment for the creation of a corpus of annotated texts.

1 Introduction

Drama annotation is the process of annotating the metadata of a drama. Given a drama expressed in some medium (text, video, audio, etc.), the process of metadata annotation identifies what are the elements that characterize the drama and annotates such elements in some metadata format. For example, in the sentence “Laertes and Polonius warn Ophelia to stay away from Hamlet.”, the word “Laertes”, which refers to a drama element, namely a character, will be annotated as “Character”, taken from some set of metadata. Drama annotation projects, with the sets of metadata and annotations proposed in the scientific literature, rely upon markup languages and semantic encoding. This paper presents an initiative for the crowdsourcing annotation of metadata for dramatic texts: the gathering of such corpus is relevant for teaching drama through schematic charts [13], informing models of automatic storytelling [10], preserving drama as an intangible form of cultural heritage [12]. The initiative, called POP-ODE (POPulating Ontology Drama Encodings), relies on a web-based system, that provides a friendly interface to the dramatic qualities of a text. The metadata are defined through an annotation schema that descends from a formal theory of drama, Drammar, expressed through a computational ontology.

2 Drama and annotation

A drama is a story conveyed through characters who perform live actions: for example, theatrical plays (Shakespeare’s *Hamlet*), TV series (HBO’s *Sopranos*⁴),

⁴ <http://www.hbo.com/the-sopranos>, visited on 21 July 2017

but even reality shows (CBS’s *Survivor*⁵), and games (Ubisoft’s *Assassin’s Creed*⁶). Drama has been pivotal for storytelling across all cultures and ages [14], growing through different media and being most pervasive, from theater and cinema to TV and videogames [4]. Along these media, a single drama can assume several forms, fulfilling a number of its core conditions. For example, the abstraction of the oral tale *Cinderella* has, e.g., Perrault’s [19] and Disney’s [1] versions. Metadata annotation for dramatic texts must encode the major concepts and relations of the drama domain, which have been shared by a majority of scholars in the drama literature. Here, we refer to the so-called *dramatic qualities*, that is those elements that are necessary for the existence of a drama, which can be found in several drama analyses, e.g. [9, 22, 7, 23]. All the initiatives on this topic have shared similar sets of elements, namely story units, characters or agents, actions, intentions or plans, goals, conflicts, values at stake, emotions. These elements are annotated in connection with media chunks (e.g., text paragraphs), often with the goal of constructing corpora of annotated narratives and the study of the relationships between the linguistic expression of the story in the narrative and its content.

In order to clarify the dramatic elements, we anticipate an informal annotation of a scene taken from Shakespeare’s *Hamlet*: the so called “nunnery” scene. In this scene, situated in the Third Act, Ophelia is sent to Hamlet by Polonius (her father) and Claudius (Hamlet’s uncle, the king) to confirm the assumption that Hamlet’s madness is caused by his rejected love. According to the two conspirators, Ophelia should induce him to talk about his inner feelings. At the same time, Hamlet tries to convince Ophelia that the court is corrupted and that she should go to a nunnery. In the middle of the scene, Hamlet puts Ophelia to a test to prove her honesty: guessing (correctly) that the two conspirators are hidden behind the curtain, he asks the girl to reveal where her father Polonius is. She decides to lie, by replying that he is at home. Hamlet realizes from the answer that also Ophelia is corrupted and consequently becomes very angry, realizing that there is no hope to redeem the court. The climax incident in the scene consists of a question-answer pair:

- Hamlet: “Where is your father?”
- Ophelia: “At home, my Lord!”

This is a (very relevant) story unit: boundaries are decided through the detection of a specific goal pursuit, distinct from the goals pursued in the previous unit. Here Hamlet, one of the two characters in the unit, is pursuing the goal of proving Ophelia’s honesty. Honesty is a value for Hamlet, and Ophelia’s behavior is putting at stake such a value. So, he decides to pursue the goal of proving Ophelia honesty through a plan in which he asks a question he knows the answer of, i.e. the current location of her father Polonius (Hamlet is sure that Polonius is in the same room, behind a curtain). and Ophelia lies, by answering with a false

⁵ <http://www.cbs.com/shows/survivor/>, visited on 21 July 2017

⁶ <https://www.ubisoft.com/en-US/game/assassins-creed/>, visited on 21 July 2017

location, i.e. Polonius' home. So, we can annotate this unit with the following metadata:

- Unit: Hamlet tests Ophelia for honesty
- Characters: Hamlet, Ophelia
- Hamlet values at stake: Honesty
- Hamlet goal: Prove Ophelia honesty
- Hamlet plan: Asking Ophelia a rhetorical question
- Hamlet plan accomplishment: FALSE
- Ophelia values at stake: father's authority, honesty
- Ophelia goal: Respect father's authority
- Ophelia plan: Lying about presence of Polonius in the room
- Ophelia plan accomplishment: TRUE
- Conflict: Hamlet plan VS. Ophelia plan
- Hamlet emotions: Distress, Reproach, Anger
- Ophelia emotions: Disappointment, Joy, Shame

In particular, notice that emotions arise from the accomplishment of the characters with respect to their values, an adaptation of OCC emotional theory [17] [10]. So, Hamlet feels Distress because his plan fails, feels Reproach because Ophelia is putting at stake honesty (an important value for him), and Anger as a consequence of Distress and Reproach. Ophelia, though feels Joy because she achieved her goal to respect father's authority (the value with maximum priority here), she is disappointed because her hope to convince Hamlet to talk about his feelings failed and is ashamed because she put at stake another value of hers, namely honesty (with a lower priority here, but always present). There also are long spanning values at stake, goals, and plans of the characters as well as conflicts.

These elements have been taken into account by several annotation projects, with several non-empty intersections. Project DramaBank, which has proposed a template based language for describing the intentional content of textual narratives, is a standalone downloadable application relying on an internal, non-standardized representation format [3]. A media-independent model of story is provided by the OntoMedia ontology [21], exploited across different projects (such as the Contextus Project⁷) to annotate the narrative units of different media objects, ranging from written literature to comics and TV fiction. In the field of cultural heritage dissemination, the StorySpace ontology supports museum curators in linking the content of artworks through stories [25], with the ultimate goal of enabling the generation of user tailored content retrieval. Some initiatives also rely on automatic annotation approaches, which can overcome the difficulties of recruiting annotators, especially when minimal schemata targeted at grasping the regularities of written and oral narratives at the discourse level can be worked out [20]. Finally, Drammar⁸ is an ontology of drama, specifically conceived to annotate dramatic media [11], that makes the knowledge about

⁷ <http://www.contextus.net>, visited on 21 July 2017

⁸ <https://www.di.unito.it/wikidrammar>, visited on 21 July 2017

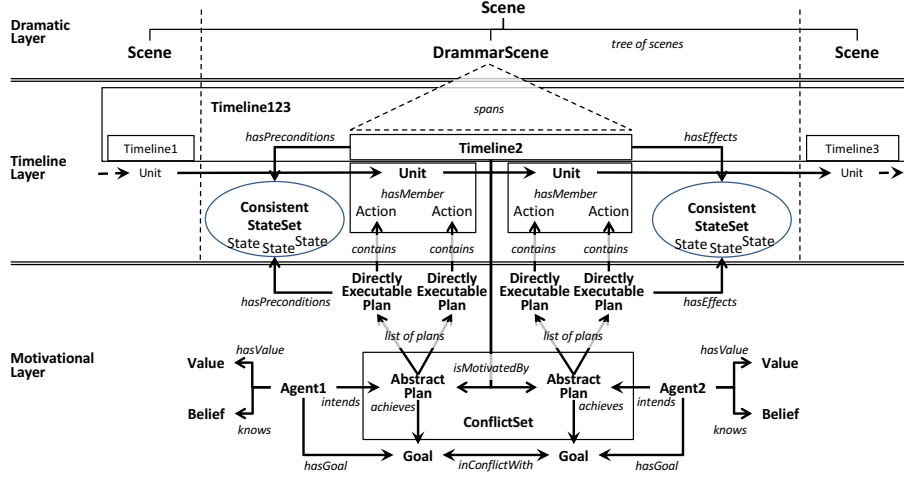


Fig. 1. Layers of ontology Drammar

drama available as a vocabulary for the linked interchange of annotations and readily usable by automatic reasoners, such as, e.g., the calculation of characters' emotions [10]. The usage of Drammar introduces two advantages: first, it is complete with respect to dramatic elements and non-dependent with respect to different media, considered as a mapping object from the metadata representation; second, as we have seen above, being a formal ontological model we can exploit the automatic reasoning capabilities for the discovery of new metadata.

However, the use of ontology editors and reasoning tools is challenging for drama experts [24]. For the accomplishment of the annotation task, it is crucial to provide a friendly environment with metaphors and interfaces that directly descend from the drama scholarship, which abstracts the annotator from the details of the ontology representation. Here we describe a pipeline and system for the metadata annotation of dramatic texts.

3 The Drammar ontology

In order to build a formal encoding of the dramatic elements, Drammar (see [10] and [12] for thorough descriptions) resorts to a set of theories and models that are well established in Artificial Intelligence and Computer Science. The ratio of this design strategy is twofold: on the one side, it relies on widespread, sound models, with formal properties that have been investigated in depth; on the other side, it augments the interoperability of the representation with other encodings, which can be contributed by several disciplines, such as, e.g., interactive storytelling and procedural animation.

The design of Drammar ontology relies on three representation layers (see Figure 1 for a synoptic overview). The first, the closest to the drama docu-

ment to be annotated, is the observable *timeline* (middle of Figure 1), appraised through a literary text or an audiovisual medium, a succession of the incidents (or *actions*) that happen in the drama. Incidents are assembled into discrete structures, called *units*. Each succession of incidents forms a sub-timeline of the whole timeline of the drama. This level is formalized through the Situation Calculus paradigm ([15]): with sub-timelines that function as operators advancing the story world from one state to another (states aggregated in consistent state sets, ellipses in the figure), that work as preconditions and effects of some sub-timeline of incidents. The actions result from the deliberation process of the characters, named *agents* here.

The deliberation process is represented by the motivational layer (bottom of Figure 1), which centers upon the notion of the character’s intention in achieving (or trying to achieve) a *goal*. The intention, or the commitment of the character, is represented by a *plan*, which consists of the actions that are to be carried out in order to achieve some goal; plans are organized hierarchically, with high-level behaviors (abstract plans) formulated as lists of lower-level plans, or *subplans*, until the directly executable plans, which directly contain actions. Goals originate from the *values* of the characters that are put at stake and need to be restored, given the *beliefs* (i.e. the knowledge) of the agents. This level is formalized through the rational agent paradigm, or BDI (Belief, Desire, Intention) paradigm ([2]) (which is also applied in the computational storytelling community ([16]; [18])). This is why characters are encoded as *agents* in Drammar (bottom of Figure 1). The agent is characterized by goals, beliefs, values engaged, and plans; values can be at stake or in balance; plans can be in conflict with other plans, possibly of other agents; a conflict set aggregates all the plans, agents and goals that determine a dramatic scene (DrammarScene), through the game of alternate accomplishments. The plan is the major structure of the Motivational Layer, where all the other entities participate ([5]); plan hierarchies are trees of plans, with abstract plans that recursively dominate children subplans, until directly executable plans with actions that are actually performed by the agents in the drama; each plan hierarchy pertains to a single agent; several hierarchies (pertaining to several agents) project onto the same portion of the timeline, often with goals in conflict (actually, conflicts motivate a dramatic scene). The success/failure in achieving goals as well as in supporting own values is responsible for agents’ appraisal of the drama incidents. Plans have preconditions and effects, which are consistent sets of states (where consistent means that there no two states in contradiction within the set); when some plan motivates a timeline, its preconditions and effects (the consistent state sets mentioned above) are included in the preconditions and effect of a timeline.

The dramatic layer (top of Figure 1), which is directly inspired by the literature on drama theory, accounts for the hierarchical structure of the scenes: scenes are recursively composed of daughter scenes. Scenes span timelines, that is sequences of units. Some scenes are called DrammarScenes, meaning that they are motivated by some conflict over the characters’ intentions, which is the characterization of scenes according to the Drammar ontology.

The abstract ontology, expressed as a set of logical specifications of classes and properties, is expressed through a formal language to become a digital, textual artifact that can be fed to a software program (for manipulation, querying, comparison, etc.). In particular, Drammar is expressed through the ontology language, which has been designed as part of the Semantic Web project and allows conceptual models to be described in an unambiguous way, open to understanding and manipulation by both human users and software programs. The concepts and relations introduced above are encoded in the ontology Drammar, written in the Semantic Web language known as OWL (Ontology Web Language). In particular, Drammar is written in a specific sub-language, OWL2 RL (Rule Language), a syntactic and semantic restriction of OWL 2 ([10]), which provides the adequate tradeoff between expressivity and complexity with respect to the requirements of the drama domain (see ([6]) for an introduction to computational ontologies). Also, Drammar includes classes that are intended as an interface between the drama domain concepts and the linguistic and common sense types of knowledge that express the content of the drama when instantiated in media, according to the paradigm of linked data ([8]).

4 The POP-ODE initiative

The POP-ODE initiative consists of several aspects: the pipeline, the web interface, the visualization tool, the corpus.

4.1 The POP-ODE pipeline

POP-ODE consists of a pipeline and a number of tools for the accomplishment of the annotation task of metadata for dramatic texts (see Figure 2). The Figure 2 shows the pipeline vertically, on the left, from top to bottom. A drama encoding annotator (at the top, left) works through a web-based interface to fill the tables of a data base built according to the tenets of ontology Drammar, which encodes the elements mentioned above, namely story units, characters, actions, intentions or plans, goals, conflicts, values at stake (emotions are calculated automatically from these data). At the same time, the annotator can select the text chunks that correspond to some annotation (from the .txt file). The ontology axioms have already been encoded by the drama scholar (possibly supported by the ontology engineers), through the well-known Protégè editor⁹. Exploiting these axioms (contained in a conceptual model, OWL file), the mapper module DB2OWL converts the data base tables into an OWL file, actually a Drammar Instantiated Ontology file (OWL DIO file). A further software module, OWL2CHART, extracts the individuals and properties in a XML Drammar Chart file, which is then visualized by the interactive chart module, the user can interact with [13]. The interactive chart module, developed for visualization purposes and as a teaching device, here supports the validation of the produced

⁹ <http://protege.stanford.edu>, visited on 21 July 2017.

ontology, allowing for a fast checking of the encoded axioms. On right column, the figure shows examples from each step. The top of the column shows a thumbnail of the web interface (see detail below). As example for the data base, there are two example tables, Agent and Value, connected through the Agent identifier (Hamlet has honesty as a value). The assertion example from the DIO OWL file concerns the agent Marcellus who intends the plan of reaching the guard post. The example from the XML chart representation shows the attributes of the plan above, which determine its visualization color and shape in the interactive chart.

4.2 The POP-ODE web interface

Figure 3 shows the web interface for the annotation. The top of the figure shows the text selector: on the left, the Hamlet text from an authoritative source (Shakespeare’s navigators), on the right, the text chunk that pertains to the unit selected below. The middle of the figure shows the unit annotation, that is the actions that have been identified by the annotator in the selected segment of the text, recognized as a bounded unit. On the left and the right of the unit annotation are the previous and the following unit in the story timeline, with the values that are at stake or at balance before and after the current unit. So, in this example, the unit concerns Polonius that asks Ophelia about her feelings; it occurs after Polonius blesses Laertes on his departure and before Ophelia promises to avoid Hamlet. The bottom of the figure concerns the plans that motivate such a unit. In particular, going from left to right, we see that, Ophelia (the agent or character shown at the left), who has the goal of meeting Hamlet, has the plan of convincing her father Polonius that Hamlet is reliable, and this plan is in conflict with Polonius’ plan who wants to convince Ophelia that she is too candid for Hamlet. As we know from the following unit, Polonius will succeed in convincing Ophelia, and actually Ophelia’s plan fail (see “accomplished? NO” at the far right).

4.3 The POP-ODE visualization tool

Figure 4 shows a detailed visualization of the “nunnery” scene. The timeline of the story units (middle of figure) is the pivotal element onto which the upper and lower part of the interface hinge. The header on the left contains the description of each row (from top to bottom: play, acts, scenes, timeline and characters, represented by their initials). The upper part of the interface contains the incident structure, organized as a recursive hierarchy of acts, scenes and units that acknowledges both the tradition of theatrical writing and the most recent theories of scriptwriting. At each level of hierarchy, an arc marks the presence of some segment of text: the grey box situated on each arc can be clicked to display information about the segment (the use of boxes to signal text content is consistently repeated through all the components). Each arc is marked by a number of segments of different colors, which are intended as visual cues of the participation of the characters to the segment. The lower part of

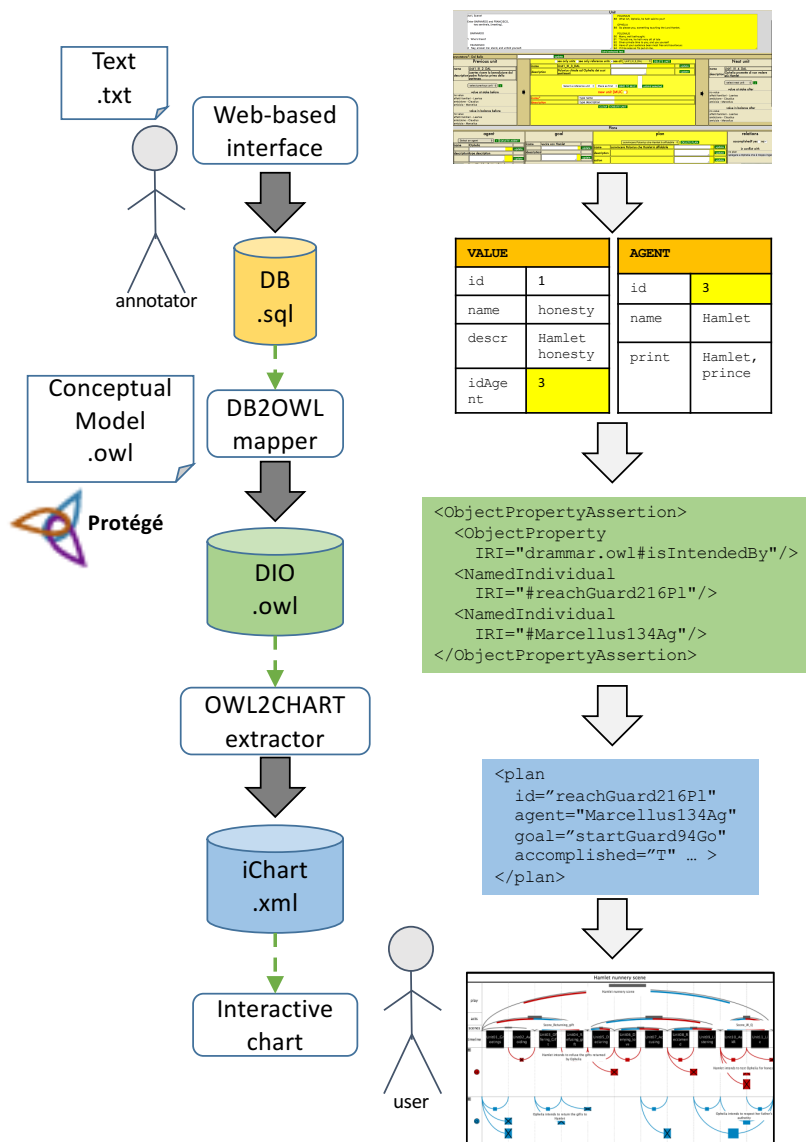


Fig. 2. The ODE-Pop annotation pipeline. The lower part shows examples of the

the interface contains the characters' individual tracks. The alignment with the storyline shows how the characters' intentions motivate each segment of the storyline. Plans that are abandoned by characters, because something went wrong during the execution, are represented by incomplete arcs marked by a crossed box. For example, Ophelia abandons the intention to return the gifts to Hamlet

The screenshot displays the POP-ODE web interface, which is divided into three main horizontal sections:

- Top Section (Text Selection):** Shows a scene with dialogue between characters. A yellow highlight is placed over a specific line of text: "POLONIUS: 88 What is't, Ophelia, he hath said to you?".
- Middle Section (Unit Annotation):** This section is used to define units of text. It includes:
 - Previous unit:** A table with fields for name, description, and value of stake before/after.
 - Current unit:** A form where a reference unit is selected (Unit 3 DAL) and a new unit (MUC) is created. It includes fields for name, type-name, description, and type-description.
 - Next unit:** A table for the subsequent unit, with similar fields to the previous unit.
- Bottom Section (Intentions-goals-conflicts Annotation):** This section is organized into four columns:
 - agent:** A table for defining agents, with a dropdown for selection and a 'DELETE AGENT' button.
 - goal:** A table for defining goals, with fields for name and description, and 'update' buttons.
 - plan:** A table for defining plans, with fields for name, description, and action, and 'DELETE PLAN', 'update', and 'update' buttons.
 - relations:** A section for defining relationships between plans, with a dropdown for 'accomplished?' and a 'DELETE PLAN' button.

Fig. 3. The web interface of the POP-ODE annotation: top) text selection; middle) unit annotation; bottom) intentions-goals-conflicts annotation.

at some point. Also, notice the hierarchical representation of the intentions of the characters, with more complex intentions encompassing shorter, simpler intentions that only span one unit of the timeline. This visualization shows clearly the conflict between Ophelia and Hamlet in this scene. Notice, for example, that her intentions span longer subsequences of the timeline, and that their beginning is always followed by the beginning of Hamlets' intentions, signaling the fact that he is mostly reactive in this scene.

The number of plan failures spanning the same segment, moreover, signal the high level of conflict that characterizes this part of the play. The vertical alignment of the characters' intentions distributed along the tracks with the story incidents along the timeline make the audience perceive the logical sequencing of actions, and represents the credibility of the story in terms of a consistent list of incidents. Long-term intentions denote a structured deliberation phase: in the visualization of the nunnery scene the intentions attributed to Ophelia are of a higher level with respect to Hamlet's ones, thus showing that she holds the overarching goal in the scene (although she fails ultimately). Opposite, Hamlet display lower hierarchies, thus showing that he is mainly reactive to a situation designed by others. The synchronous occurring of two characters' intentions (such as the ones of Hamlet and Ophelia in the "nunnery" scene) reveals the orchestration of conflicts. In this case, two arcs of two different characters' tracks happen to span the same scene or incident onto the timeline; and possibly have opposite result on accomplished, with one of the two failing (barred rectangle and interrupted arc). This means that there is a conflict between the characters and our visualization provides a clear image of the *orchestration of conflicts* and their execution. For example, on the left, in the scene "returning gift", the conflict is between the intention of Ophelia of returning Hamlet the gifts he gave her and the intention of Hamlet of refusing the gifts, by saying that they were not his, and

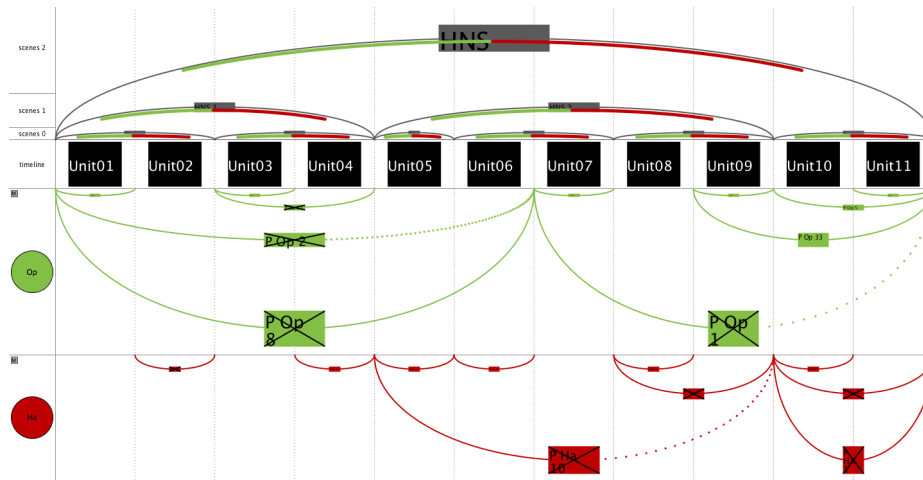


Fig. 4. Visualization of Hamlet nunnery scene. Through the tooltip facility of the interface we have magnified and highlighted the contents of the nodes (proportionally with their extension in the timeline).

Hamlet is successful in his intention; on the right, in the scene "where question", the intention of Hamlet of testing Ophelia's honesty fails, because Ophelia lies, with the intention of respecting her father Polonius' authority. The succession of intentions displayed by a character's track represents the character's changes through planning and re-planning because of the conflicts with other characters, thus stress the emotional charge of the drama. This is particular evident in the case of Ophelia (Figure 4): as we have seen, she has the highest level of intentions in this scene, composed of two main intentions (bottom of the figure) separated by a gap filled by one of Hamlet's intentions. This shows that Ophelia has to execute some sort of re-planning, given the failure of the first (bottom left), so to regain the lead of the scene with another overarching plan (bottom right). Moreover, all along the scene we see that there is a large number of failed intentions (rectangles barred with a cross); hence, the visualization reveals the inner nature of this scene with failed attempts on both sides to achieve their goals: on the one hand, Ophelia wants to discover the motivation for Hamlet's madness, on the other, Hamlet wants to send the "fair Ophelia" to the nunnery, but discovers that she is not honest at all.

5 The corpus of annotated drama

The pipeline above has been used to build a crowdsourced corpus of annotated drama. Currently, there are a few ongoing projects in annotating drama from classic repertoire, used in theatre, cinema and media programmes. Students, about fifty per year, receive a focussed short training in formal representation

and predicate logic; then, they are assigned a scene (actually, a unit) from a classical drama to be accessed through the web interface. They fill the forms concerning units (upper part, with previous and next unit in the timeline), on one hand, and plans, goals, agents, and values (lower part, selected through plans), on the other. They also annotate conflicts over plans and values that are put at stake or in balance by the incidents in the units.

Inter-annotator agreement is managed by a supervisor, who is expert in drama studies. The intervention of the supervisor is necessary to understand whether some annotation is a paraphrase of another and whether the two annotations can be reduced to one; in case this is not possible, the two versions remain. A typical case that occur is the segmentation of a unit into incidents: some students only find a single incident within a unit (so, the unit is reduced to one incident); other students encode several incidents within a unit, and usually partial overlap boundaries of incidents. The policy of the supervisor has been to identify the minimal units, and each segmentation proposal is expressed in terms of the basic units built artificially.

Although the task looked very challenging, students with many kinds of backgrounds (psychologies, media studies, philosophy, media studies) could perform the task. The tool has proven to be effective in inferring a number of classes and relations of the ontology that are syntactically important for the coherence of the representation but are cumbersome and error-prone for the task of a manual (or semi-manual) annotator. For example, when an annotator states that some scene is spanning from this to to that unit, the tool automatically creates a timeline. We are going to make a vast and effective test of the annotation tool over several student classes, together with questionnaires and ethnographic observations, to evaluate the functioning of the tool and to create a vast corpus for studies in the digital humanities.

The current corpus of annotated drama documents consists of a small number of video and textual drama documents, respectively (see table 1). Though we have not carried a thorough evaluation of the annotation, we have employed the annotated documents in two applicative tasks: the first is the calculation of the emotions felt by the characters through automatic reasoning, on the basis of the events and the intentions manually annotated [10]; the second is the realization of printed charts of the characters' intentions, aligned with the timeline of incidents [13], currently employed in the didactics of drama writing at the University of Torino. We are going to evaluate the appropriateness of Drammar on the adequacy of description from the point of view of research on the humanities.

6 Conclusion

In this paper, we have described the POP-ODE initiative for the metadata annotation of dramatic texts. We have described the annotation pipeline for drama documents and a web-based annotation tool. The tool implements a visual interface for the representation of the intentional motivations of the characters (agents) to act within the drama. The tool has proven to be very effective in

Medium	Work	Fragment
Text	Hamlet (Shakespeare)	whole text
Text	Mother Courage (Brecht)	whole text
Text	L'Arialda (Testori's Italian neorealism)	whole text
Movie	Apocalypse now	helicopter attack scene (ride of valkyries)
Movie	Taxi driver	"Are you talkin' me?" scene
Movie	Matrix	bullet time scene
Movie	La Dolce Vita	Trevi fountain scene
Movie	The Clockwork Orange	Flat Block Marina scene
Movie	Blade Runner	"I've seen things ..." scene
Movie	The deer hunter	Russian roulette scene
Movie	The Godfather	Sollozzo omicide scene
Movie	The Snatch	dog VS. rabbit scene
Movie	Kill Bill - Vol. 2	"losing the other eye" scene
Musical video clip	Taylor Swift's "You belong with me"	3-min video
Advertisement clip	"Zippo" lighter commercial	30-sec video
Animation short	Oktapodi	2:30-min video

Table 1. Corpus of annotated drama documents, available on request.

inferring a number of classes and relations of the ontology that are syntactically important for the coherence of the representation but are cumbersome and error-prone for the task of a manual (or semi-manual) annotator. We are going to make a vast and effective test of the annotation tool over several student classes, together with questionnaires and ethnographic observations, to evaluate the functioning of the tool and to create a vast corpus for studies in the digital humanities.

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