The Visualization of Drama Hierarchies

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Keywords: Hierarchy Visualization, Drama, Sequence.

Abstract: Drama, the art that displays characters performing live actions in telling a story, is pervasive in cultures and media. The study of drama often resorts to hierarchical structures to explain the sequences of incidents that occur. Hierarchies provide an explanation of why incidents are in the sequence or cluster elements into subsequences that form a meaningful structure. This paper addresses the visualization of drama hierarchies. The paper inspects the peculiar features of drama hierarchies and proposes a visualization built upon the metaphors of tree mapping and timeline, respectively. The visualizations are preliminarily applied in tasks of analysis and interpretation in supporting teaching and research of drama scholars.

1 INTRODUCTION

It often happens, in science and humanities, that phenomena occur as sequences that are spanned by some hierarchical structure. This means that the sequence is the left–to–right collection of the leaves of the hierarchical structure, although the sequence exists on its own. In this paper, we address the hierarchic structure of drama linear incidents, as formulated with different goals by (Freytag, 2004), (Lavandier, 1994), and (Lombardo and Pizzo, 2013). As we will see, drama consists of units, that are mini dramas, and these in turn consist of more and more reduced dramas until the elementary advancement of the plot through some specific incident.

Sequences (often timelines) and hierarchies have received much attention in the visualization literature. Timeline has been one of the most addressed visual metaphors (see the book (Aigner et al., 2011) for a survey (http://survey.timeviz.net, visited December 2014); trees have been the object of several approaches of information visualization (Schulz, 2011). Node-link, nested squares or circles, horizontal and vertical adjacency, indented–list, and matrix representations are well known in the literature, each with specific advantages and disadvantages, depending on the task at hand. For example, containment (or nested) approaches have the advantage of a bounded space but leave no room for node content visualization.

However, the theme of introducing in the same visualization space both hierarchies and sequences, as it is the case for drama, has been neglected. This type of visualization poses a number of challenges that need a customization of the approaches above: both the (unique) sequence and the (multiple) hierarchies have an existence of their own, respectively, with elements in the sequence and elements in the hierarchy aligned along some dimension; also, for purposes of theory incompleteness, it can happen that some elements of the sequence are not spanned by any element in the hierarchy and that some element predicted by the hierarchy is not mapped onto any element in the sequence; finally, we have that multiple hierarchies can span the same sequence, providing alternative explanations. All these issues are of interest for the scholar and the teacher of drama.

In this paper, we address the issue of visualizing both the sequence and the hierarchies that span it in the same visual space, applied to the specific case of drama hierarchies. We introduce the generic challenges of such a combined visualization. We take as input a formal representation of dramatic media objects, that encodes the sequence of incidents of a drama as well as a number of hierarchies that provide an explanation of the dramatic facts, and we develop an algorithm for the representation of both the incident sequence and the structure hierarchies in the same visual space. Finally, we address the effectiveness of the visualization in research and teaching of drama in specific phenomena of interest.

Lombardo V. and Pizzo A..
The Visualization of Drama Hierarchies.
DOI: 10.5220/0005314801630170
In *Proceedings of the 6th International Conference on Information Visualization Theory and Applications* (IVAPP-2015), pages 163-170
ISBN: 978-989-758-088-8

2 INCIDENT SEQUENCE AND DRAMA HIERARCHIES

Storytelling is a pervasive activity across all cultures and ages, especially in its dramatic form (Mamet, 1998). In western culture, storytelling has taken many different forms, from fairytales to TV fiction, surviving the transformations occurred to media. Esslin (Esslin, 1987) defines "dramatic media" those that display characters performing live actions, such as theatre, cinema and videogames. The notion of "story" is widely acknowledged as the construction of an incident sequence that, abstracting from the theatrical or cinematographic properties, is motivated by the cause–effect chain (Rimmon-Kenan, 1983); this chain results from a complex interplay among agents, events, and environments, well known in playwriting techniques (Egri, 1946). Drama is a specific form of storytelling made prevalently by character's actions after a deliberation process. Thus, drama is normally perceived as a sequence of actions and events, and the audience have to make sense out of this sequence. In other words, we see a list of actions without the description length that is available in a novel; nevertheless, we are engaged in a complex cognitive activity to reconstruct the plot and the sense behind those actions and events. It is this sequence of incidents, that is released by a playwright, possibly organized into parts, that are called scenes, that are variable for size or importance or both. Normally drama are divided in acts and scenes: the former born out of the need of set changes, the latter born out of the need of character's entrances and exits. This organization has been kept as standard also when those needs no longer hold, and still shapes most of contemporary drama. Thus, a scene is considered a part of an act, and the sequence of scenes also contributes to define the rhythm of the play. In order to account for this sequence and to visualize the length of the drama, in our running example we measure the single elements in our timeline by counting the number of verses of the text.

Drama can be summarized as a group of specific features, that can be defined more or less precisely. These features refer to the identifiable elements in Shakespeare's *Romeo and Juliet* as well as in Tom Stoppard's *Rosencrantz and Guildenstern Are Dead*, in HBO's *Sopranos* and even in some reality show, such as CBS's *Survivors*, and, finally, in some famous videogame such as Rockstar Games' *L.A. Noir* or Ubisoft's *Assassin Creeds*' series. Drama scholars have developed a number of approaches to dramatic texts and theatrical plays (Carlson, 1984). The "technical point of view" relies on the so–called constructivist approach, which departs from the linguistic and literary forms to focus on the constitutive elements of drama. So, focussing on how the plot develops and is structurally organized, how characters are involved in the actions, what conflicts take place, drama studies acknowledge the existence of hierarchies that span the sequence of incidents. Within this framework, in particular, the analyses of Lavandier (Lavandier, 1994), Ryngaert (Ryngaert and Bergez, 2008), Hatcher (Hatcher, 1996), and Spencer (Spencer, 2002) contribute by distilling the dramatic elements that the author has to handle in order to produce a well formed play.

As a running example we refer to Shakespeare's drama *Hamlet*. This well known drama tells the story of the Prince of Denmark, who is contemplative and thoughtful by nature, facing the murder of his father (the former King) by the usurper (the King's brother Claudius). Hamlet devotes himself to avenging his father's death, and decides to fool Elsinor's Court by acting mad. This madness makes him able to reveal the corruption of the court and the guilt of his uncle, who he kills in the final scene of the drama. Going in depth in the plot, for the plan hierarchy case we address the so–called "nunnery" scene in the Third Act. In this scene, Ophelia is sent to Hamlet by Polonius (her father, Lord Chamberlain) and Claudius (the King) to confirm the assumption that Hamlet's madness is caused by his rejected love. According to the two conspirers, 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 she should go to a nunnery. In the middle of the scene Hamlet puts Ophelia on a test to verify her honesty. Because he guesses (correctly) that the two conspirers are hidden behind the curtain, he asks the girl to reveal where her father Polonius is. She decides to lie and replies that he is at home. As a consequence, Hamlet becomes very angry in realizing that even Ophelia is corrupted and there is no hope to redeem the court.

The case of incident sequence spanned by drama hierarchies poses a number of issues to be accounted for in visualization. Now we review such issues.

2.1 Representation and Processing Issues of Drama Hierarchies

The representation issues to be accounted for when we need to visualize drama hierarchies that span an incident sequence in drama are the following.

The first issue is that the sequence and the hierarchies have both an existence on their own; they should be both visualized in the same space with their own

features. Sequence features a total linear order of elements; so, the visualization system should represent such an order of the incidents in a story plot. Hierarchical structures do not necessarily pose an order on the leaves; so the several approaches to tree layout can, but not necessarily, include such an order in the visualization; the relevant relation is dominance over the hierarchy nodes. In our cases of interest (hierarchies that span a sequence), such trees are also projective and the leaves of the tree are left–to–right ordered.

The second issue is the spanning relation between the hierarchical structure and the sequence. The hierarchy, being the result of a top–down derivation process (as, e.g., in the case of a generative grammar) or a clustering (e.g., email stream structuring), consists of internal nodes, that we call non terminal symbols (NT, as it happens in grammars), and leaves, that we call terminal symbols (t). The hierarchy spans the sequence, or portions of it: this means that the leaves or terminals of the hierarchy, map the elements of the sequence to some extent. The elements of the sequence that are spanned by the leaves of the hierarchy should be aligned in the visual representation; so, the hierarchy sheds some light on the formation or motivation of the sequence portions that are mapped. For example, in the case of drama we can see in what step of the story we are in a certain sequence (later, we see that it happens that multiple type of hierarchies span a sequence of incidents, with multiple meanings).

The third issue concerns the fact that the hierarchy projects new elements onto the sequence. In the domain of drama, these new elements are null elements, e.g., unimplemented characters' intentions in drama, that reveal what element, predicted from the hierarchy, is actually omitted in the sequence (which is perfectly legal as a naturally occurring phenomenon, anyway).

The fourth, final representation issue concerns the possibility that multiple hierarchical structures span the same sequence. This can happen for different reasons. In drama studies, as we will see below, the sequence of the incidents develops from the projections of the intentions of the characters; since each character develops her/his intentions hierarchically, we have again a forest of trees that span the same sequence; however, in this case, the visualization does not address several theories, but the contribution of each character to the plot. In all these cases, the visualization system must be able to distinguish the several sources.

In addition to these four representation issues, there exists one processing issue: the visualization system should also work with incomplete information; partial sequences and hierarchies allow the users (researchers, scholars, enthusiasts) to work with rough and partial interpretations that can be refined and fixed as the theory improves. So, for example, the scholar

In the remainder of this section, now we introduce one specific type of drama hierarchy that spans the incident sequence.

2.2 The Hierarchies of Characters' Intentions

The character–centered representation of drama facts (see (Lombardo and Pizzo, 2013)) introduces the interpretation of incidents motivated by characters' intentions, i.e. plans that aim at realizing characters' goals. Some incidents, usually a minority, can be unintentional events, so event that are not directly motivated by some character's deliberation. Following the BDI model of agent (Rao and Georgeff, 1995), the formation of goals depends upon the beliefs of the characters about the state of the world and about the other characters' mental states. Goals and beliefs are mental states of a character.

The library of plans, organized in one or more hierarchies associated with individual characters, link goals and actions. Plans feature a tripartite structure: Preconditions, which are the states that enable the application of the plan; Action or list of Subplans, which are the actions to be performed to achieve some goal; Effects, which are the states that hold after the plan has been carried out successfully. There are base plans, which consist of a single basic action, and recursive plans, which consist of an ordered list of subplans. Preconditions and effects can be mental states, and state of affairs that hold in the story world for the actions and plans to be executed. Higher plans are recursively defined as sequences of (sub)plans (again bordered by states). In our running example of the "nunnery" scene, Hamlet and Ophelia feature conflicting goals: Hamlet, who initially believes that Ophelia is honest (a belief, i.e. a mental state), intends to convince her to go to a nunnery to escape the court corruption; Ophelia, who respects her father's authority (a value, again a mental state), intends to induce Hamlet to talk about his love feelings (which should be the cause of his madness). Recursively, these plans consist of subplans: according to the analysis in (Lombardo and Pizzo, 2013), Ophelia's plan to induce Hamlet to talk consists of starting by waiting to meet him in some room, then greeting him as he enters the room, then returning him the gifts he gave her in the past (in order to stimulate in him the reflection about his love for her), and then "presum-

ably" keeping the topic of conversation around love until he overtly states that his madness is caused by her rejected love. We say "presumably" because this plan fails, because Hamlet refuses the returned gifts (and we do not know how it could have continued); so, Ophelia re–plans to explicitly introduce the topic of the conversation (Hamlet's madness). On the other hand, Hamlet's plan is convince Ophelia that the court is corrupted and then advise her to go to a nunnery. Also Hamlet's plan fails because Hamlet realizes that someone, probably Polonius, is hidden behind some curtain in the room and, so, he re-plans to put at test Ophelia's honesty before going back to his previous plan of advising her a nunnery. As we know, this does not happen, and Hamlet gives up his plan definitely.

Each high–level plan roots a plan hierarchy. The larger the hierarchy, the longer the span of the hierarchy onto the sequence; the higher and longer the number of hierarchies, the more present the character in the drama. In case two plan hierarchies, of two different characters, hinge on the same sequence portion (sometimes even spanning the same incidents) we have a dramatic conflict, usually solved with the success of one character and the failure of the other. For example, the climax of the "nunnery" scene is when Hamlet, who wants to ascertain Ophelia's honesty, asks her a rhetorical question ("Where is your father?"), knowing the right answer (that he is in the room), hoping that she replies honestly, and Ophelia lies ("At home, my Lord."), trading honesty for loyalty to her father. This conflict should be visualized, to help the drama analysis.

The whole approach works by matching the actions reported in the plans with the incidents in the sequence; in this way, each plan spans some portion of the sequence through the alignment of actions in the plan with actions in the sequence. However, we can notice that each plan also introduces precondition and effect states, to border the actions or the subplans (which recursively are implemented through actions) on the left and the right, respectively. The incidents of the sequence are viewed as operators that carry on the story development from one state to the next one; states are projected from the plan structure onto the sequence, augmenting the representation connecting the motivations (goals and plans intended by the characters) to the actions actually carried out. So, if we want to visualize the story advancements through the states that hold during the drama development, we augment the sequence with states, as extra elements in the sequence. Finally, it happens that some incidents in the timeline are not the result of a planned deliberation of some character or the hierarchies of plans are incomplete with respect to the sequence: in both these cases, the visualization should mark such misalignments between the hierarchies and the sequence.

3 RELATED WORK

Sequences and hierarchies have been receiving many solutions in the visualization literature (Heer et al., 2010) (Liu et al., 2014), with specific metaphors for time (Aigner et al., 2011) and trees (Schulz, 2011). The case of multiple trees spanning the same set of basic elements (usually the leaves of a tree) has been the object of several approaches of information visualization (see the survey in (Graham and Kennedy, 2010) on single and multiple trees). Some work (Card et al., 2006) has also addressed the problem of stitching together hierarchical structure and time into one visualization space, in order to help an analyst understand how very large hierarchies change through time; the goal is to enable the analyst to detect patterns of relationships. However, this approach addresses the evolution of a hierarchy in time rather than what hierarchies span within some timeline.

The visualization of story relations has attracted the attention of visual artists and amateurs to provide unique maps for orientation. This is particularly useful for stories with intricate plots that are not immediate to grasp (see, e.g., the visualization of two Nolan's films *Memento*, 2000, http://visual.ly/memento-scene-timeline, visited December 2014, and *Inception*, 2010, http://visual.ly/inception-timeline-visualisation, visited December 2014), but also to trace the overall involvement of characters, visualized as horizontal chronological lines that converge and diverge, illustrating their mutual interactions as well as their relationship in time with places and/or collective events (see, e.g., the movie narrative charts at http://store.xkcd.com/collections/posters/products/movie-narrative-charts-poster, visited December 2014). The latter visual design was then automatized through some algorithmic approaches in (Tanahashi and Ma, 2012) and (Liu et al., 2013), with issues of symmetry and compactness, and consequent impact on readability of features with respect to the manual version. Liu et al.'s work has also introduced the issue of hierarchic information on places, which has some loose connection with the hierarchic structures visualized in our approach. Again, a multi-level storyline visualization method is undertaken by (Chen et al., 2012), which organizes and synthesizes some representative information, that includes locations, objects, and characters, to produce a bi–dimensional layout for movie summaries. The automatic op-

erations of clusterization and classification in the video sequence remind of the sequence elements in our representation, while the bi–dimensional video–based layout could be a suitable presentation method for the hierarchies addressed here.

On a more productive side, a number of visual interfaces are provided with software tools that have been developed to assist the creation and production of dramas. For example, the writing assistant Dramatica Pro (http://www.writersstore.com/dramatica-pro-story-development-software/, visited December 2014) visualizes the building blocks of a plot structure, with diagrams for plot progression and story points, that helps the writer in controlling and balancing the tension within the story development. The connections fleshed out are useful to connect the several professionals of the production, while leaving unexplored the possibilities of addressing the more motivational features of the drama.

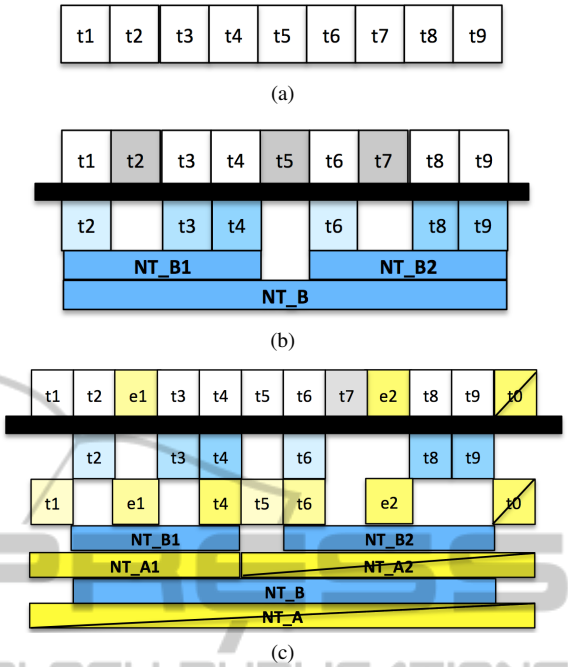

Figure 1: What to visualize: (a) sequence of elements; (b) hierarchy spanning a sequence (c) multiple hierarchies spanning a sequence.

4 THE VISUALIZATION OF DRAMATIC FACTS

The features of the problem that the visualization system takes as input, are:

- a sequence of elements, called terminal symbols, with the precedence relation over the elements (see Figure 1(a));
- a number of hierarchies, based on some dominance relation, such that some leaves span elements of the sequence, as exemplified by Figure 1(b), with only one hierarchy, and Figure 1(c), with two hierarchies;
- a dimension of the possible role differences for the hierarchy elements.

These individuals and relations are annotated manually by the scholar, the enthusiast, or the student through a graphic interface (Lombardo and Pizzo, 2014). The internal encoding is a computational ontology, that is also able to perform automatic reasoning about the classification of elements and the appraisal of emotions by the characters.

Figure 1 provides a generic layout, with different meanings that can be assigned to the visual elements, depending on the type of hierarchy visualized. Since multiple hierarchies can span the same portion of the sequence and that the hierarchies operate concurrently, the visualization will address single dominance relationships, that can be represented interspersed. So, NT_B dominates NT_B1 followed by NT_B2; NT_B1, in turn, dominates $t2$, $t3$ and $t4$, in this order; NT_B2 dominates $t6$, $t8$, $t9$, in this order. NT_A dominates NT_A1 (which dominates $t1$, $e1$, and $t4$, in this order) and NT_A2 (which dominates $t5$, $t6$, $e2$, and $t0$, in this order). Notice that $e1$ and $e2$ are extra elements predicted by the NT_A1 and NT_A2, respectively), that are not present in the original sequence. For example, states of the plans are projected onto the sequence. $t7$ is a sequence element with no hierarchy item that spans it (so, it is grey in the visual design). $t0$, predicted by NT_A2, does not occur in the sequence, but, differently from the extra elements should be present on its own; the lack of this sequence element causes the NT_A2 hierarchy item to be not completely derived, and this is propagated onto NT_A too. For example, this happens with a subplan failing or an action missing, which causes the failure of all the ancestor plans.

The visualization algorithmic schema proceeds bottom–up from the sequence up to the high levels of the hierarchies: after the extraction of the precedence (sequence) and dominance (hierarchy) relations from the data sets, we compute the original sequence positions on a line; this horizontal line accounts for the elements of the sequence. Then, we extract the spanning relations of hierarchy nodes onto sequence elements and, for the leaves, the exact matches; for each match, we compute the possible augmentations of the sequence with null elements (that are predicted

in the hierarchy but are not present in the sequence, for various reasons, see above). Finally, we compute the positions of the elements in the hierarchies, realizing the correct alignments, given span and matches, and assign a different color to items in the hierarchy, given some distinctive role in visualization. The elements of the hierarchies are inserted onto horizontal layers that are superimposed one on top of another.

The characters' intentions motivate the incidents occurring in the sequence. These are represented by hierarchical plans arranged on trees; plans that commit to short–term goals are components (i.e., children in tree terminology) of plans that commit to longer–term goals. The visualization of the characters' intentions in a drama is of great importance for scholars and professionals, and is one of the most important differences between drama analysis and literary criticism. The visualization module addresses the representation of multiple trees of characters' intentions (or plans). Figure 2 shows the visualization of the nunnery scene of Hamlet. In this case, the colors identify the character who intend the plans visualized in the schema. As we can see, though four agents are involved in the nunnery scene (Hamlet, Ophelia, Polonius, Claudius), only Hamlet and Ophelia intend plans, that is are engines of the drama.

The timeline of incidents, at the top of the figure, consists of actual incidents (in green), states projected from plans (in red), null incidents (in grey, green text) null states (in grey, white text). The latter two are projected from plans that failed (see the barred rectangles below in the figure).

Each plan is visualized as a horizontal rectangle, with actions, subplans and (precondition or effect) states as daughters; each subplan is aligned with the plan rewrites it, until the basic actions and states aligned with subelements in the sequence. Dominance relations are represented by different layers. Plans closer to the sequence consist of an action bordered by precondition and effect states, respectively; plans higher in the hierarchy consists of a sequence of subplans bordered again by precondition and effect states. All actions and states are mapped onto the timeline (dotted lines in the figure). Each incident or state is represented by a vertical box; boxes filled with white color and barred diagonally indicates elements that have not been realized in the timeline, thus the plan failed.

These representations have been designed of large sizes for printing and contain large text for visualization in most cases. Some space can be optimized to visualize some more global features of the drama.

5 EFFECTIVENESS OF THE VISUALIZATION

Now we address the use of the visualization in an experience of teaching drama to students. In the last decades, the focus of drama courses has switched from literary to structural and actional qualities. This means that the text is more and more intended both as an incident design (either on stage or on screen) and as a network of relations over characters' intentions. For example, McKee (McKee, 1997) guides the author through the scene splitting into beats according to the characters' goals and value changes. This leads to a larger use of visualization systems to clearly stress the structural elements in the dramatic text, and to map the connection with the performance, i.e., to show the continuity between event design and event performance.

Our visualization helps the class to understand how the text of the dramatic medium is bound to the character's deliberation, and thus how to read the *characters' behaviors*. While characters' behavior has driven some visualizations in terms of tracking the existence (the lifespan) of the agent within the flow of the story (e.g. (Tanahashi and Ma, 2012) and (Liu et al., 2013)), in our visualization this existence is formally described as a cognitive process (i.e. plans) and is therefore rooted on a formal approach to the specific elements of the drama. For example, the more successful the mappings, the more the narrative text of the dramatic medium is bound to characters' deliberation (i.e. the performance is consistent with the play). Nevertheless, a character's plan can also be used to trace the story flow of the single character in the plot. In fact, if we collapse all the plans and subplans of a single character on one line, we can map her/his evolution within the drama and his interlink with the others, in terms that are consistent with (Liu et al., 2013).

The visualization illustrated so far has proven effective in visualizing three phenomena that are frequently addressed by drama scholars in research and teaching.

In drama, it is important that the character's plans show some consistency with the incidents that occur in the sequence of events. This is the fundamental feature that gives to the audience the perception of a logical sequencing of action, thus helps to create the believability of the story in terms of consistent list of incidents within the units. In our visualization, the timeline is grounded on the perceived behaviors of the agents involved. In other words, it is graphically clear that all the states (red) and actions (green) in the timeline are connected with the

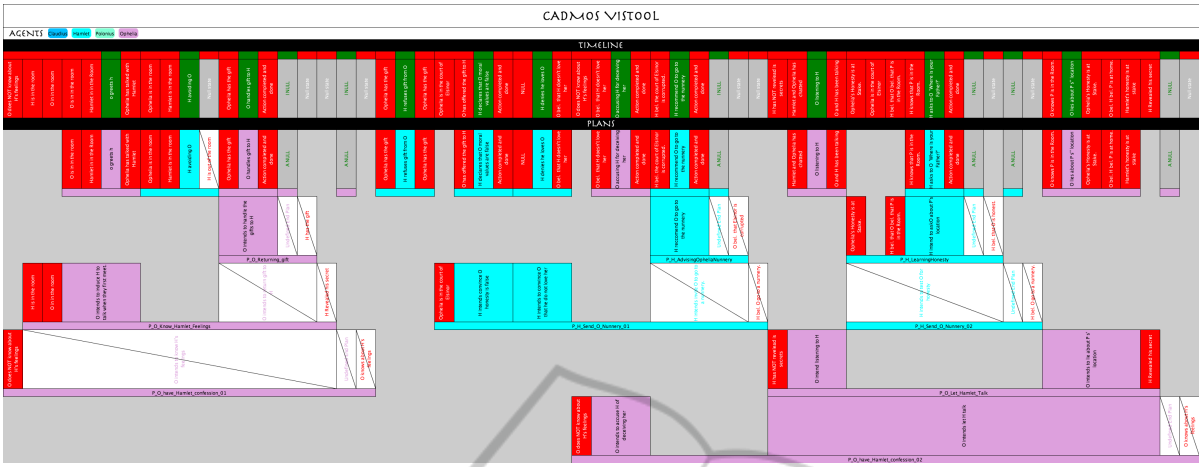

Figure 2: Screenshot of the visualization - excerpt of *Hamlet* "nunnery" scene.

elements on the character's plan; i.e. the list of incidents in the plot are grounded onto some deliberative processes. The visualization attribute at Ophelia the higher level of plans, thus showing that she holds the overarching goal in the scene. Opposite, Hamlet hold a lower level of plans thus showing that he is mainly reactive to a situation designed by others. Characters' deliberations are complex processes and vary according the drama. In our visualization, the "nunnery" scene shows clearly that the timeline contains a relevant number of states compared to actions; in fact, the scene is described mainly by the preconditions and effects of character's plans rather then by the actions performed. Thus the scene can be considered charged with a high level of psychology because, in this case, the meaning of the actions resided mainly into the cognitive state of the characters, and therefore on the meaning that the audience can attribute to them (the process known as interpretation). More states are need to describe a drama, more the drama is based on the psychology of the characters rather that on their actions.

Normally the units listed in the timeline (in the timeline's area below the black stripe marked as "timeline") are the results of the synchronous occurrence of two agents' plans (such as the ones by Hamlet and Ophelia in the "nunnery" scene). We adopt a visualization that shows a layer of parallel plans that map onto the same chunk of the timeline. When the two plans have a similar goal, they both aim at the same effect: thus, they map the same final state onto the timeline, and are described as a shared plan. Our visualization can also pile up different plans with opposite goals. When this occurs, very often it means that only one plan will achieve its goal and thus only one state is mapped onto the timeline. In Figure 2, we see that plans (in the plan's area below the black stripe marked as "plan") of the two characters (marked with a color code on the top left) span the same chunk of timeline. Some of the states planned as effects (right side of the plans) are achieved, thus are mapped onto the timeline: this is graphically shown as two equivalent boxes in the plans area and onto timeline (the corresponding state holds). Others states are not achieved, thus are not mapped: this is graphically shown as barred box in the plan area and a "null" box onto the timeline (state does not hold). When the visualization shows this pattern, it means that there is a conflict between the characters. Hence the visualization provides a clear image of the *orchestration of conflicts* and their execution.

In drama, character's plan failure is normally evaluated through an emotional appraisal and is the reason for the character's re–deliberation. For example, in the "nunnery" scene, the failure of the Hamlet's plan is a clear indication of the emotional *characters' change*. This is normally one of the key figures into the emotional engagement of the audience. The sequence of plans in Figure 2 represents the character changes as a sequence of characters' planning and re–planning, thus stress the emotional charge of the drama. This is particular evident in the case of Ophelia: as we have seen, she has the higher level of plans but this is composed by two main plans (bottom of the visualization) separated by a gap filled by a Hamlet's plan. 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 plans (shown also as null cells into the timeline); hence, the visualization accounts for the complexity of the interchange among characters (more failed plans equals to more complex interchange).

Other significant features should be added to the visualization, namely the Dramatic Arc and a dynamic/interactive construction of the mapping. This is left for future work.

6 CONCLUSION

We have proposed a visual design and algorithmic schema for the visualization of drama hierarchies. In particular, we have addressed the visualization of multiple hierarchies spanning the incident sequence, with multiplicity expressed through different plan hierarchies that span different portions of the timeline because of failures and replanning activity, different characters' hierarchies, with individual plans in conflict that span the same portion of the timeline. Finally, we have discussed the types of phenomena that are pointed out by the visualization system. The system relies on an ontology of drama and builds upon the unrestricted manual annotation provided by media students. It was tested on the analysis and exposition of the case of a classic drama and a relevant scene from Hamlet.

Our approach is more analytic than existing ones with respect to addressing the basic constituents of a story; for example, some of the visualizations proposed elsewhere could be derived from our visualization as well as be embedded in other methods. Though tested to the research and didactics of drama structure, our system can be applied to the analysis of other types of stories that are not drama or being applied to drama production for checking the status of screenwriting.

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