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# Laying the Foundations for a Formal Theory of Drama

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**Abstract.** The goal of this research is to lay the foundations for a formal theory of drama, that abstracts from the procedural and interactive aspects involved in the generation of dramatic content. The theory characterizes dramatic qualities by reconciling the structural accounts provided by traditional drama analysis with an agent-based perspective on characters.

## 1 Motivations and Formalization

In the design of AI systems for communication and entertainment, much attention has been devoted to the dramatic qualities exhibited by interactive applications. Typical applications span from artificial characters for entertainment and instruction, to interactive systems for storytelling and drama [1,2,3]. The aim of this paper is to lay the foundations of a formal theory that systematizes the basic aspects of drama in a direct and explicit model, with an immediate integration with agent-based theories. The theory, called *Drammar*, abstracts from the interactive and procedural aspects of drama generation, and is intended as the starting point for specifying, implementing and evaluating practical storytelling systems in a principled way.

The notions of direction, character and plot, pervasive throughout the literature on drama analysis since Aristotle, are the three main components of the drama ontology incorporated in *Drammar*. The goal of a drama is to make audience perceive what is intuitively called a “story” by displaying the actions of some *characters* in conflict; actions are organized in a *plot*; the plot moves toward a *direction*. Concerning the structure of drama, it has been a well known convention to segment the list of actions that form a drama into a number of units or sections [6]. Such units, despite terminological disparities, are of the same nature, so that some authors define drama as a recursive or “fractal” structure [7].

*Drammar* is structured in two levels: the *actional* level models the intentional behaviour of the characters in a plot as intelligent, goal-directed agents. The *directional* level accounts for dramatic meaning, abstracting from the intentionality of the characters through the use of attributes that model the effect of plot incidents onto the characters’ rational and emotional state. The *drama direction* is a change function that transforms the rational and emotional state of a character into a different state [4]. Such states are defined through values assigned to a number of *attributes* of the characters (or *dramatis personae*), defined as a set of attributes. The set of attributes defining a character combines a rational, BDI perspective with an emotional component.

A *Dramatis\_persona CHAR* is a pair  $\langle ATT, POLARITY \rangle$ , where *ATT* is a subset of a *POOL* of attributes; *POLARITY* is a set of pairs  $\langle x, v_x \rangle$ , where  $x \in ATT$  e  $v_x \in \{+, -\}$ . All the attributes in *ATT* are assigned a value in *POLARITY* and for each attribute only one assignment is permitted.

The *Direction* is a function *D* that specifies the value changes of the characters' attributes after the execution of the plot. So, the domain of the direction function is a *State* (where a *State* is a set of Polarities of attributes), and the co-domain is another *State*. So, let a *State* be  $\bigcup_i CHAR_i.POLARITY$ :

$$\mathcal{D} : State_i \rightarrow State_f$$

The relationship between the value changes of the rational/emotional states of the characters and the actual actions and events listed in a drama is stated at the actional level through the notion of *drama goal*. The drama goal is the world state that realizes the *Direction*, and it is operatively specified as the achievement or the negation of the goal of a certain character, namely the drama protagonist.

The *Plot* is the component that carries out the polarity inversions described by the *Direction* function. The *Plot* is a sequence of elementary units called called *Beats*, pure actional units formed by a action-reaction pair [6]. Notice that some *Beat* may not change any attribute value, but every change does occur in some *Beat*.

The three components described above form a *Drama-unit*, that represents by itself all the basic aspects of drama. Formally, a *Drama-unit* is a triple:

- *Dramatis\_personae* is a finite set of *Dramatis\_persona*;
- *Direction* is a function  $\mathcal{D}$  defined as above;
- *Plot* is a list of *Beats*  $\langle B_1, B_2, \dots, B_m \rangle$ ,

and the condition holds that at least one attribute inverts its polarity.

In *Drammar*, drama-units are subdivided into smaller drama-units, resulting in a tree of drama-units. The leaves of this tree are directly connected to beats, and its root is the properly called drama, the highest-level unit that subsumes the entire sequence of beats, and is not subsumed by other drama-units. The units of the drama and their directions are combined in a drama-specific progression related with the emotional engagement of the audience via the protagonist's fate. Dramatic actions in the plot trace a curve related to the fulfilment of the direction. Each drama-unit, with its goal, has both a temporal position and a *dramatic value* within the plot. This value is given by the number of value changes that occur within the unit, either in a beat directly included by the unit or in a beat included in one of its sub-units.

## 2 An Example

We apply the formal system *Drammar* to the definition of a linear drama, the well-known Hitchcock's *North by Northwest* [8] (see the table in Figure 1). *North by Northwest* is about a middle-aged advertising executive Roger Thornhill who is mistaken for the (non-existent) government agent George Kaplan by a gang of spies lead by Mr Vandamm. He gets involved in a series of misadventures and is pursued across the States

ID	Description	Drama Goal	Attribute	Value	Attribute-type	Dramatic Value
1	R. mistaken for Kaplan and kidnapped by Vandamm's gang	Kidnapped (Roger) True	Distress	+	EMOTION.well-being	1
2	R. gets aware of mismatch and tries get out of trouble	Involved (Roger) True	Individualism	-	BELIEF.norms	20
2.1	R. meets Vandamm	Agreement (Roger,Vandamm) False	Disappointment	+	EMOTION.prospect-based	4
2.1.1	Vandamm addresses R. as Kaplan	Mentioned (Vandamm,Kaplan) True	Distress	+	EMOTION.well-being	1
2.1.2	Vandamm threatens R. of death	Threatened (Vandamm,Roger) True	Anger	+	EMOTION.well-being/attribution	1
2.1.3	Vandamm's gang tries to kill R.; R. escapes	Killed (gang, Roger) False	Relief	+	EMOTION.prospect-based	1
2.2	Nobody believes R.; R. accused of shooting Townsend	Outcast (Roger) True	Isolation	+	BELIEF.world-state	4
2.2.1	R.'s report not believed by anybody	Discredited (Roger) True	Anger	+	EMOTION.well-being/attribution	1
2.2.2	R. leaves his mother	Left (Roger.Mother) True	Submission	-	BELIEF.social	1
2.2.3	R. is believed to have killed Townsend	Falsely_accused (Roger.assassination) True	Disappointment	+	EMOTION.prospect-based	1
2.3	R. escapes police, meets Eve, seduction, fake appointment	Seduced (Eve,Roger) True	Love	+	EMOTION.attraction	6
2.3.1	R. runs away by train	Caught (Roger.Train) True	Relief	+	EMOTION.prospect-based	1
2.3.2	E. hides R. from police in the cabin	Hidden (Roger) True	Gratitude	+	EMOTION.well-being-attribution	1
2.3.3	R. and E. sleep together	Had_sex (Roger.Eve) True	Satisfaction	+	EMOTION.prospect-based	1
2.3.4	E. fixes the fake appointment with Kaplan	Deceived (Eve,Roger)True	Hope	+	EMOTION.prospect-based	1
2.3.5	Airplane tries to kill R.	Meeting (Roger,Kaplan) False	Disappointment	+	EMOTION.prospect-based	1
2.4	R. calls E.'s bluff and Professor explains	Explain (Professor,Roger) True	Anger	+	EMOTION.well-being-attribution	5
2.4.1	R. discloses E.	Deceive (Eve,Roger) False	Reproach	+	EMOTION.attribution	1
2.4.2	R. finds about Vandamm and E.	Unmasked (Roger.Vandamm) True	Anger	+	EMOTION.well-being-attribution	1
2.4.3	R. arrested and meets Prof.	Meeting (Professor,Roger) True	Truth	+	BELIEF.world-state	1
2.4.4	E.'s identity revealed	Revealed (Eve's identity,Roger) True	Pity	+	EMOTION.fortune-of-others	1
3	R. takes revenge	Married (Roger,Eve) True	Family	+	BELIEF.norms	8
3.1	E. pretends shooting R. at M. Rushmore	Collaboration (Roger,Eve) True	Relationship	+	BELIEF.social	3
3.1.1	E. fake-shoots R.	Deceived (Roger,Vandamm) True	Satisfaction	+	EMOTION.prospect-based	1
3.1.2	E. to leave with Vandamm	Coupled (Roger,Eve) True	Love	+	EMOTION.attraction	1
3.2	Chase and fight at M. Rushmore	Saved (Roger,Eve) True	Gratification	+	EMOTION.well-being/attribution	4
3.2.1	R. escapes from hospital	Rebellion (Roger,Professor) True	Independence	+	BELIEF.normative	1
3.2.2	Leonard discloses Eve's secret	Informs (Leonard,Vandamm, Eve's trick) True	Fear	+	EMOTION.prospect-based	1
3.2.3	R. kills Leonard on M. Rushmore	Killed (Roger,Leonard) True	Relief	+	EMOTION.prospect-based	1

**Fig. 1.** Analysis of North by Northwest

by both the spies and the government whilst being helped by a beautiful blonde Eve Kendall. Eventually, he will discover that Eve is an undercover CIA agent and together they will defeat the evil gang, on a thrilling sequence on the Mount Rushmore.

The first column, ID, reports the hierarchical structure of Drama-units in North by Northwest (the table rows); the levels of the hierarchy correspond to acts, sequences and scenes in the standard filmic terminology. The second column, Description, contains

an informal description of each Drama-unit. The third column, Drama goal, reports the drama goal through which the direction of a unit is accomplished. For example, Act 2 leads to a state in which the moral standards of the protagonist, Roger Thornhill, have been affected, so as to make him more inclined to help the others (the predicate “Involved (Roger)” becomes true). This goal is in turn accomplished through the drama-goals of the sub-units of that unit: Roger’s individualism is affected by the need to take himself out of the troubles he got into (Sequences 2.1 and 2.2), by Eve’s seduction (2.3) and by the awareness of a conflict between the CIA and Vandamm (2.4).

The last three columns, Attribute, Value and Attribute-type, describe the direction of each Drama-unit. For example, in Act I, Roger falls into an emotional state of distress as a consequence of being kidnapped by Vandamm’s gang, setting the “distress” attribute to +; in the second act, Roger’s “individualism” is set +. The subtype of each attribute is expressed by the dot notation: for example, “BELIEF.norms” referred to “individualism” means that this attribute belongs to the normative component of the character’s beliefs, which are part of the rational component of the character. For emotions, the notation refers to the emotional classes described in OCC model [5].

### 3 Conclusions and Future Work

The definition of drama proposed in this paper is a first step toward a comprehensive formal system for analyzing and generating drama. The current theory leaves to future research the task of identifying the instruments by which the formal model may be incorporated into practical systems.

The theory describes drama as an off-line object, and does not specifically address the interactive generation of drama. The extension of the provisional model to the non-linear case, where the list of units in the plot is not pre-determined, represents another line of research in the development of a comprehensive theory.

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