A hybrid representational proposal for narrative concepts: A case study on character roles

A Hybrid Representational Proposal for Narrative Concepts: A Case Study on Character Roles*

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Abstract

In this paper we propose the adoption of a hybrid approach to the computational representation of narrative concepts, combining prototype-based and ontology-based representations. In particular we focus on the notion of narrative roles. Inspired by the characterization provided by the TvTropes wiki, where narrative devices are discussed across old and new media, we provide a representation of roles based on the integration of a set of typicality-based semantic dimensions (represented by using the Conceptual Spaces framework) with their corresponding classical characterization in terms of necessary and sufficient conditions (represented in terms of Formal Ontologies).

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1 Introduction

In the area of computational models of narrative, and more in general in the field of Knowledge Representation, different approaches to the computational representation of concepts have been proposed. Nowadays, one of the most successfully used formalisms is that one of formal ontologies based on standard Description Logics [2]. Previous work in computational models of narrative has exploited Formal ontologies to model narrative concepts (for a more detailed account see [5] and characters' roles in particular (see Section 2 for a short overview).

One of the main problems for narrative technologies is the need to deal with the representation of the common sense concepts as part of the description of narrative contents. In storytelling, commonsense knowledge includes not only the description of domain knowledge, such as how the incidents characters are involved into in a story, but also the characterization of narrative notions, such as genres, roles, languages, etc. For the representation of such concepts, however, it is not easy to establish a set of necessary and sufficient conditions. In fact, the knowledge about such concepts is usually organized and characterized in prototypical terms and is based on an intuitive, cognitively grounded, characterization. A major problem of the ontology based systems and formalisms, shared with the most of computational models

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of cognition, is, however, given by the fact that they do not allow nor the representation of concepts in prototypical terms nor the possibility of performing forms of approximate and common sense-based conceptual reasoning. In Cognitive Science, on the other hand, evidences exist in favor of prototypical concepts [27].

Since, in our opinion, the representation of concepts in typical terms is crucial in order to grasp the core elements used by humans for reasoning on the narrative knowledge, in this paper we follow the approach presented in [11, 12] and apply it to the case study of narrative roles. We argue that a hybrid solution is suitable for representing and reasoning on narrative roles since it provides an enhanced conceptual model able to better characterize what narrative roles are and how they can be used for concrete reasoning purposes. The solution is hybrid since it combines a typical and a classical representational component (based respectively on conceptual spaces and on ontological framework) each encoding specific reasoning mechanisms. The rest of the paper is structured as follows: in Section 2 a brief overview regarding the narrative roles is provided; Section 3 presents the general conceptual architecture considered for modelling narrative roles; Section 4 describes the Conceptual Space framework employed in our representations; Section 5 shows some simple examples of role modelling according to the hybrid approach and, finally, Section 6 discusses about the advantages of our proposal and about its future extensions and applications.

2 Related Work

The notion of narrative roles dates back to the beginning of 20th century, when the Russian formalist Vladimir Propp proposed a formal account of narrative structures [26]. Propp relied on a corpus of Russian fairy tales to elaborate a model of the structure of fairy tales. Situated at the junction between folkoric studies and semiotics, Propp's account is based on a set of 'character functions', that can be arranged in certain legal sequences according to the rules encoded in a story grammar. Some decades later, Greimas [18] expanded the notion of role into the more general model of actant roles. According to this theory, narratives are defined by a fixed schema of relations among roles, such as the hero opposing to a villain, the helper assisting the hero, the object being pursued by the hero in her/his quest, etc. Thanks to their descriptive potential, structuralist models have been adopted as narrative models in interactive storytelling systems, including [16, 15] and [7]. The system described by [16] employs an ontology, called OntoPropp, to describe plot types in the domain of fairy tales. The system uses the ontology to perform case-based reasoning: given a story plan, searches the ontology for a similar plot, measuring the semantic similarity of the given plot with the plots encoded in the ontology. Inspired by the paradigm of role playing games, the Opiate system [7] creates story plots given user generated story worlds, then casts the available characters into the roles that appear in the plot based on their relevance to the roles. However, Proppian inspired models have been criticized for their inability to face the challenges of interactive applications [3, 15]. Designed for specific genres, they work well for grasping the regularities expressed by the manifestations of those genres, but they are difficulty extended to other genres, failing short to account for the variability expressed by storytelling in new media. In scriptwriting tradition, the systematization of dramatic situation proposed by Polti [25] established the practice of classifying the configurations of characters' oppositions according to fixed schemata, intended to inspire and support the work of authors and practitioners. The 36 situations listed by Polti, each accompanied by a choice of literary works of all kinds that exemplify them, are described with reference to the character roles appearing in them. For example, the situation described as "The

Suppliants" (exemplifies by Aeschylus' tragedy "The Suppliants") encompasses a Persecutor, a Suppliant, a Power in authority, whose decision in favor of the Persecutor or of the Suppliant is doubtful. However, the catalogue of roles that emerges from this classification, despite its claim for generality, is situation specific and open to the authorial creativity. As effectively demonstrated by TvTropes[1], character tropes in today's media can be described along with different dimension, ranging from media specific (such as "Cartoon Character Tropes") to genre specific classifications ("Cops and Detective"). Each character trope is declined into several subtypes each exemplified by a number of individual characters, which possess most of the features of the trope; the same character can be related to more than one trope. While some basic tropes, such as the Villain or the Hero are reasonably similar to structuralist accounts, most of the features mentioned in the typical character trope description do not concern their functional role, but, rather, concern minor, yet relevant features such as appearance, values, etc.

3 Levels of Representations

During the 70's and 80's of the last century, in the context of theoretical debates on connectionism, a classical distinction was in auge between symbolic and sub-symbolic models. While sub-symbolic, or connectionist models, were used for embodying knowledge structures and processes more closely to human-like organizations and processes, many logic-based systems, from which ontological formalisms descend, were developed which were mostly oriented on providing a clear formal semantics, enabling forms of logically-valid automatic reasoning [Brachman and Schmoltze, 1985].

In the AI tradition, the term "ontology" is, referred to "an engineering artifact, constituted by a specific vocabulary used to describe a certain reality, plus a set of explicit assumptions regarding the intended meaning of the vocabulary itself" [19].

The main reasoning tasks performed on such systems are therefore: categorization (the process regarding the class membership assignment to specific instances) and classification (the process through which new subclass relations are inferred). As sketched above, a major problem of such systems consists in the fact that, differently from the connectionist networks whose knowledge structure was organized to deal with prototype-style representations [4], they leave open the problems of representing and reasoning on typicality, which is a crucial aspect of our cognitive abilities. In more recent years, Peter Gärdenfors [14] proposed a famous tripartition of representational levels where, instead of a symbolic/sub-symbolic dichotomy, a further level is considered: namely the conceptual level. This level of representation is intermediate between the other two, and is characterized by a representation in terms of conceptual spaces, i.e. geometrical representations of knowledge that consist of a number of quality dimensions. In such geometrical framework it is possible to represent the concept in prototypical terms and it is possible to perform some forms of simple prototype-based conceptual reasoning without requiring a completely unstructured representation as in the case of classical neural networks (a brief description of the conceptual spaces is provided in section 4).

In this article, by following the approach presented in [11, 12] [2] and firstly applied in [17] we propose to combine, for the computational representation of the "narrative role",

[1] http://www.tvtropes.org

[2] Such approach is also inspired by the so called heterogeneous hypothesis about concepts in Cognitive Science, according to which concepts do not constitute a unitary element and are constituted by different, complementary, bodies of knowledge (for a detailed account on this point see [23]

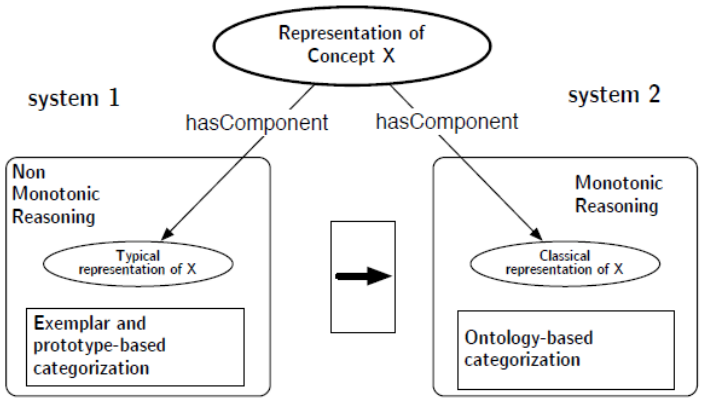

Figure 1 The general architecture for the representation of concepts).

a double level of integrated representations where, for the same concept (e.g. HERO), a characterization in prototypical terms in offered by adopting the Conceptual Spaces framework and the corresponding representation in terms of necessary and sufficient is provided by using the standard ontological formalisms. Such representational distinction also allows dealing with both typical and classical reasoning processes performed on the different bodies of knowledge characterizing the same conceptual entity. The way in which those different reasoning mechanisms, potentially contrasting, are conciliated is based on the dual process theory of reasoning and rationality [6, 20]. This framework postulates the existence of two different types of cognitive systems. The systems of the first type (type 1) are phylogenetically older, unconscious, automatic, associative, parallel and fast. The systems of the second type (type 2) are more recent, conscious, sequential and slow, and featured by explicit rule following. Therefore, given this state of affairs, we propose that the conceptual representation of narrative roles should be then equipped with two major sorts of components, based on:

- type 1 processes, to perform fast and approximate categorization of exemplars (or instances) by taking advantage from prototypical information associated to concepts;
- type 2 processes, involved in complex inference tasks and that do not take into account the representation of prototypical knowledge.

A general picture of the architecture that we want to exploit in this case study is presented in the figure 1. For a detailed description of the cognitive assumptions inspiring this proposal we remind to [21]

4 Conceptual Spaces

As above mentioned, according to Gärdenfors, conceptual spaces (CS) represent an intermediate, geometric–based, level of representation between the sub-symbolic and the symbolic one. It is based on the definition of a number of quality dimensions describing a given concept: examples of this kind are temperature, weight, brightness, pitch for describing the concept of color. To each quality dimension is associated a geometrical (topological or metrical) structure. The central idea behind this approach is that the representation of knowledge can take advantage from the geometrical structure of the conceptual spaces. For example, instances (or exemplars) are represented as points in a space, and their similarity can be calculated in a natural way in the terms of their distance according to some suitable distance measure (e.g. Euclidean Distance or Manhattan Distance). Furthermore, concepts

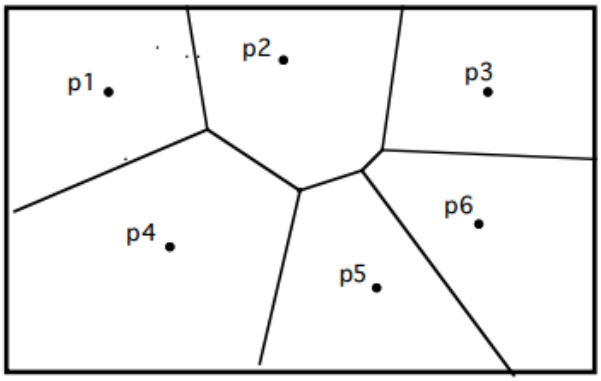

Figure 2 Example of a Voronoi tessellation (from Gärdenfors, 2000).

correspond to regions and regions with different geometrical properties correspond to different kinds of concepts. In particular, concepts correspond exactly to convex regions. In such scenario, therefore, prototypes and typicality effects taking place at the conceptual level have a natural geometrical interpretation: prototypes correspond to the geometrical center of the region itself (the centroid). Thus, given a certain concept, a degree of centrality can be associated to each point that falls within the corresponding region. This degree of centrality can be interpreted as a measure of its typicality. Conversely, given a set of n prototypes represented as points in a CS, a tessellation of the space in n convex regions can be determined in the terms of the so-called Voronoi diagrams (the figure 2 below shows a Voronoi tessellation where p1, p2, pn represent prototypical categorical centers). In sum, one of the main feature of the conceptual space level is represented by the fact that, differently from the models situated at the sub-symbolic and symbolic level, it provides a natural way of interpreting typicality effects on concepts since its geometrical structure allows a direct way of calculating the semantic similarity among concepts and exemplars by using classical metrical distances.

5 Examples: Hero – Anti Hero and Villain in the Hybrid Architecture

In this section we consider some examples showing in which sense the considered hybrid modelling proposal can be beneficial for the representation of narrative roles. We will take into account the concepts of HERO, ANTI-HERO and VILLAIN extracted by the common sense descriptions coming from the TvTropes repository. As above mentioned, in such online repository, typical descriptions of roles are provided that can be useful for practitioners of the narrative field in order to design their own character according to the main assets presented in such schemas. In particular, Tropes can be seen as devices and conventions that a writer can reasonably rely on as being present in the audience members' minds and expectations. Regarding the HERO, TvTropes identifies the following relevant representative features: e.g. the fact that it is characterized by his/her fights against the VILLAIN of a story, the fact that his/her actions are necessarily guided by general goals to be achieved in the interest of the collectivity, the fact that they fight against the VILLAIN in a fair way and so on. Examples of such Trope are: Superman, Flash Gordon etc.. The ANTI-HERO, on the other hand, is described as characterized by the fact of sharing most of its typical traits with the HERO (e.g. the fact that it is the protagonist of a plot fighting against the VILLAIN of the story); however, his/her moves are not guided by a general spirit of sacrifice

for the collectivity but, rather, they are usually based on some personal motivations that, incidentally and/or indirectly, coincide with the needs of the collectivity. Furthermore the ANTI-HERO may also act in a not fair way in order to achieve the desired goal. A classical example of such trope is Batman, whose moves are guided by his desire of revenge. Finally the VILLAIN is represented as a classic negative role in a plot and, in line with the actant model by Greimas [18], is characterized as the main opponent of the protagonist/HERO. In addition to this classical contraposition, TvTropes also reports some physical elements characterizing such role from a visual point of view. For example: the characters of this Trope are usually physically endowed with some demoniac cues (e.g. they have the "eyes of fire"). Finally, they are guided by negative moral values. Examples of such role can be easily taken from the classical literature to the modern comics. Some representative exemplars are Cruella de Vil in Disney's filmic saga or Voldemort in Harry Potter.

As a starting point for motivating our proposal let us consider how such roles would be modelled by using standard ontological formalisms and, therefore, by using only necessary and/or sufficient conditions. A possible solution, also taking into account the motivational component of characters structure (in line with the Belief Desire Intention model acknowledged by the literature in computational drama [1, 8, 22] is reported below (classes are in upper cases):

- HERO = PROTAGONIST AND hasOpponent some VILLAIN AND Fight_for only COLLECTIVE_GOALS AND Fight_fairly AND has_Positive_Moral_Values.
- ANTI-HERO = PROTAGONIST AND hasOpponent some VILLAIN AND Fight_for some PERSONAL_GOALS AND Fight_for some COLLECTIVE_GOALS Fight_fairly AND has_Negative_Moral_Values.
- VILLAIN = PROTAGONIST AND hasOpponent some HERO or ANTI-HERO AND has some EVIL_PLANS AND has_Negative_Moral_Values

A first problem of such axiomatic representation is given by the fact that, if we consider the ANTI-HERO roles modelled as a particular type of the general class HERO and also consider that the two classes of COLLECTIVE_GOALS and PERSONAL_GOALS are disjoint, this would lead to a logical inconsistency. Beyond the problem that the ANTI-HERO role would be inherently inconsistent, there is also another problem related to the fact that the typical information about all the Roles is not represented and, therefore, cannot be used to characterize, in terms of similarity/dissimilarity, the differences between the instances. For example: it would not be possible to let emerge the fact that an exemplar of ANTI-HERO, such as Batman, is in between, in terms of semantic distance, between Flash Gordon or Superman and, let us suppose Cruella de Vil. In short, it would be not possible to represent the similarity/dissimilarity among the characters according to a predefined set of conceptual and typical dimensions. In order to deal with these problems we propose, starting from the descriptions in TvTropes, that all the typical elements characterizing narrative roles would be represented in terms of quality dimensions of a conceptual space. The main narrative dimensions that we extracted from TvTropes are the following: Moral Values (represented on a scale of values going from negative to positive), Iconicity (going on a scale from angelic to demoniac iconicity) and Physical Capabilities (identifying, on a numerical scale, how and if a particular character playing a role has special physical capabilities such as, for example, running fast and so on). For each role, a set of famous characters, coming from different narrative genres, was considered for a preliminary modelling experimentation. Namely, we considered Superman for the role of HERO, Batman for that of ANTI-HERO and Cruella de Vil for the Villain. For each character, we assigned it a numerical value for each quality

dimension within the conceptual space (namely, *moral values*, *capabilities* and *iconicity*). By doing so, each character is mapped within the obtained space from these three dimensions as a vector of feature values. Notice that a character's position in the geometrical space is a function of the similarity of the vector representing it to the vectors representing the other characters (where the similarity is calculated with the metrics mentioned in Section 4)[3]. In particular, in our case, Superman was represented as characterized by a positive polarization regarding the moral values axis, as exhibiting a stereotypical degree of iconicity (closer to the "angelic" one) and as endowed with strong physical capabilities in virtue of his super powers. On the other hand, Cruella de Vil was characterized by a negative polarization on the moral value axis, by an iconicity based on evil traits and by limited physical capabilities. Finally, Batman was characterized as having controversial moral values (since his action are primarily guided by a revenge desire), by iconicity values closer to the demoniac polarization than to the angelic one and by average physical capabilities (since his "physical power" is exogenous w.r.t the character and is based on the artifacts that he uses). As result of this process, given the described configuration of values for each character, the obtained role space is pictorially represented in the figure 3.

Such typicality-based representational level of roles should be then, in our view, integrated with a lightweight ontological representation based only on the axiomatization of the conflicting dimension characterizing the relations among the different roles to be modeled. The characterization of roles in terms of conflicts with other roles, explicitly stated by Freitag [10] and later embedded in Greimas' actant model, is crucial for the definition of dramatic plots. Thus, the ontological module could be equipped only by the following characterization (reduce w.r.t. the previous one):

- HERO = PROTAGONIST AND hasOpponent some VILLAIN
- ANTI-HERO = PROTAGONIST AND hasOpponent some VILLAIN
- VILLAIN = PROTAGONIST AND hasOpponent some HERO

Such representation, enriched by the taxonomical information that the ANTI-HERO is subclass of HERO, would not lead to any inconsistency. On the other hand, the information regarding the difference about the Goals which are primarily pursued by the agents interpreting the different roles (Collective vs Personal Goals) can be mapped onto the Moral Value dimension within the conceptual space representation, thus avoiding to undermine the overall coherence of the hybrid conceptual representation.

6 Discussions and Future Work

The proposed representational solution for modelling narrative roles presents several advantages w.r.t. a classical ontology-based one. A first advantage, coming from the addition of the prototypical-based representation (formalized in terms of conceptual spaces) is given by the fact that it allows defining the concept of ANTI-HERO in a natural way based on the distance it has with the typical features describing HERO and VILLAIN in the role space. Furthermore, such addition also allows expressing the degree to which a given instance is similar/dissimilar w.r.t. another one based on the topological distance between them within the conceptual space, independently from the class to which it is assigned. As Figure 3

[3] Furthermore, since the results obtained by the metrics can be updated, the character position within the space can change over time based on the individual instances populating the representation.

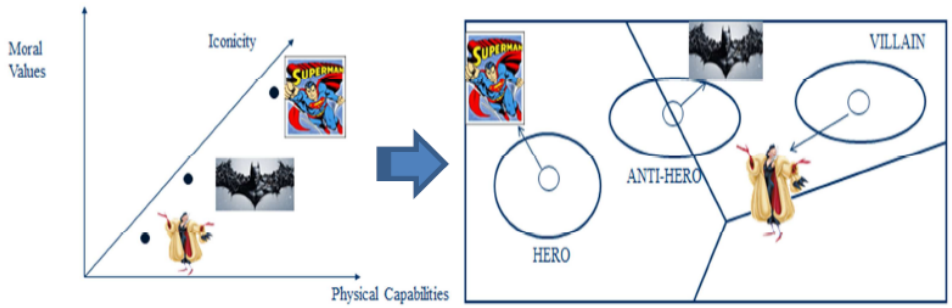

Figure 3 An evocative representation of the conceptual space considering only 3 dimensions (*moral values*, *capabilities* and *iconicity*) and the corresponding Voronoi tessellation.

shows, in fact, it is possible to determine that Batman is more or less equidistant to both the remaining characters represented in this space (Superman and Cruella de Vil[4]).

Furthermore, it is possible to calculate the distance between Superman and Cruella de Vil or, by hypothesizing the availability of a richer conceptual space, the "narrative" distance (according to the considered quality dimensions) between Superman and other exemplars belonging to the category Hero (e.g. Spider Man) or belonging to the other categories (e.g. let us suppose Voldemort or Jean Valjean). Secondly, such representation can be useful in the field of narrative based technologies in order to suggest, to the character designers, which axis (and which regions in conceptual space terms) to consider in order to create novel characters. Different declinations of such characters, and roles, can be taken into account by considering the different points falling within the conceptual regions characterizing, for example, the HERO, Anti-HERO and VILLAIN categories. A further advantage stemming from the proposed solution is given by the possibility of performing a double level of categorization processes based on the different representational levels considered. For example: it is possible to categorize the role of a given character based on both its typical traits (and this process can be performed on the system 1, conceptual space based, component) and on the classical necessary and sufficient conditions charactering its role in terms of conflicts or relations with other roles (this process can be performed on the system 2, ontology based component, by using standard Description Logics reasoners)[5] . Summing up, such representational proposal aims to go beyond the classical ontological role descriptions by taking into account the cognitive and narratological insights which are closer to the audience conceptualization of narrative roles, as exemplified by the knowledge encoded in social web resources such as TvTropes.

A major bottleneck of the proposed approach is given by the selection and characterization, in geometrical terms, of the quality dimensions describing the narrative roles and the exemplars within them. For example, according to TvTropes, a typical trait of the ANTI-HERO is self-doubt, a quality that we did not consider in our current modeling experiment,

[4] Notice that our example characters were selected for their typicality within their respective roles: as a result, the corresponding Voronoi tessellation results to be very crisp and evenly shaped. In case different, less typical character were selected, their resulting positions in terms of semantic distance would be less evenly distributed within the space. For example, Spiderman (also a Anti-HERO in TvTropes) would be much closer to the classical hero than Batman is, due to its higher altruism.

[5] In case of contrasting results, different conciliation strategies can be used in order to avoid logical inconsistencies. By following the dual process approach, the results coming from the fast, typicality-based module, should be preferred. For a more detailed account on this point we remind the interested reader to [13]

but a relevant one (and almost distinctive feature) for describing Spiderman. Abstract qualities, such as self-doubt, are difficulty mapped onto a some value scale since they do not correspond to uncontroversial perceivable features such as physical appearance. As future work, we plan to leverage automatic techniques for extracting these features from text descriptions for inducing quality dimensions of conceptual spaces from text.

An immediate future work regards the enrichment of the proposed hybrid ecosystem of roles with further dimensions, instances and categories. In addition, this approach seems to be naturally applicable to the concept of Location in a Narrative Environment (for a similar approach to the concept of "narrative echosystems" see [24]). Space and Locations, in fact, can be represented, on one hand, in terms of necessary and sufficient conditions with GIS geo-coordinates (e.g. let us consider for example, the well known Geonames ontology) and, on the other hand, by more typical and evocative features (e.g. Rome can be characterized as the "Eternal City", Paris as "the city of Love" and so on). Since such features allows to cognitively grasp the similarities and oppositions perceived by the audience, they have a crucial importance in the narrative realm.

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