Chapter III
Using Rules in the Narrative Knowledge Representation Language (NKRL) Environment

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ABSTRACT

NKRL is a semantic language expressly designed to deal with all sort of 'narratives', in particular with those ('non-fictional narratives') of an economic interest. From a knowledge representation point of view, its main characteristics consists in the use of two different sorts of ontologies, a standard, binary ontology of concepts, and an ontology of n-ary templates, where each template corresponds to the formal representation of a class of elementary events. Rules in NKRL correspond to high-level reasoning paradigms like the search for causal relationships or the use of analogical reasoning. Given i) the conceptual complexity of these paradigms, and ii) the sophistication of the underlying representation language, rules in NKRL cannot be implemented in a (weak) 'inference by inheritance' style but must follow a powerful 'inference by resolution' approach. After a short reminder about these two inference styles, and a quick introduction of the NKRL language, the chapter describes in some depth the main characteristics of the NKRL inference rules.

INTRODUCTION AND MOTIVATION

'Narrative' information concerns the account of some *real-life or fictional story* (a 'narrative') involving concrete or imaginary 'personages'. In this paper, we will deal mainly with those *(multimedia) non-fictional narratives* that are typically embodied into corporate memory documents (memos, policy statements, reports, minutes, documentation archives for product development…), news stories, normative and legal texts, medical (or financial, cadastral, administrative…)

records, many intelligence messages, surveillance videos or visitor logs, actuality photos and video fragments for newspapers and magazines, eLearning and Cultural Heritage material (text, image, video, sound…), plotting and narrative course of actions for videogames etc. From a 'content' point of view, these narrative concern in practice the description of *spatially and temporally characterized 'events'* that relate, at some level of abstraction, *the behavior or the state of some real-life 'actors'* (characters, personages, etc.): these try to attain a specific result, experience particular situations, manipulate some (concrete or abstract) materials, send or receive messages, buy, sell, deliver etc. Note that:

- The term 'event' is taken here in its *most general meaning*, covering also strictly related notions like fact, action, state, situation, episode, activity etc., see (Zarri, 1998) in this context.
- The 'actors' or 'personages' involved in the events *are not necessarily human beings*: we can have narratives concerning, e.g., the vicissitudes in the journey of a nuclear submarine (the 'actor', 'subject' or 'personage') or the various avatars in the life of a commercial product.
- Even if a large amount of (non-fictional) narratives are embodied within natural language (NL) texts, this is *not necessarily true*: narrative information is really '*multimedia*'. A photo representing a situation that, verbalized, could be expressed as "The US President is addressing the Congress" is not of course an NL document, yet it surely represents a narrative.

In this paper, we will describe succinctly an Artificial Intelligence tool, NKRL, "Narrative Knowledge Representation Language", see (Zarri, 1998; 2003; 2005) that is, at the same time:

- A *knowledge representation system* for describing in some detail the essential content (the 'meaning') of complex (non-fictional) narratives;
- A system of *reasoning (inference) procedures* that, thanks to the richness of the representation system, is able to automatically retrieve at least part of the *implicit information* buried in the original data;
- An implemented *software environment*.

From a *knowledge representation* point of view, as it will appear clearly later, the *complexity* of the information to deal with implies the use of an *advanced sort of representation*, able to describe this information with a minimum loss of the original 'meaning'. NKRL concerns then, fundamentally, an *n*-ary type of knowledge representation – see, e.g., (Zarri, 2007) – in contrast with, e.g., the simpler W3C languages (RDF(S), OWL) that are essentially 'binary' languages.

From a *reasoning* point of view, reasoning ranges in NKRL from the *direct questioning* (using specific data structures called *search patterns*) of a knowledge base of narratives represented according to the NKRL format to *high-level inference procedures*. These make use of the richness of the representation system to automatically establish 'interesting' relationships among the narrative items stored in an NKRL knowledge base and/or the 'personages' mentioned within them. For example, the 'transformation rules' employ a sort of *analogical reasoning* to try to automatically replace some queries that failed with one or more different queries that are not strictly 'equivalent' but only 'semantically close' to the original ones, disclosing then semantic affinities between what was originally requested and what is really present in the base. The 'hypothesis rules' allow us to build up *causal-like explications* of given events according to pre-defined reasoning schemata formed of several 'reasoning steps'; during the execution, these last are automatically converted