Knowing and/or believing a think: deriving knowledge using RDF CFL

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Abstract: From the web discussion on a difference between knowing and believing, we have chosen in this paper the statements fulfilling enough our seeing the topic, corresponding to our knowledge level of cognitive science. The aim of paper shows one of the capabilities of our Resource Description Framework Clausal Form Logic (RDF CFL) graph language using as an example a well- known Castaněda's puzzle.
RDF CFL is an appropriate tool that contains a package of inference methods working especially in closed-worlds that have been developed in the clausal form of first order predicate logics.

Key-Words: Resource Desription Framework, RDF, logic puzzle, first order logic, CFL, knowing, believing, deriving.

1 Introduction

In the frame of seeking an optimal formal language means for semantic web inferences a model and language RDF CFL has been developed. Using an intensional approach to the language semantics in its graph based style of representation a demand of open world has been fulfilled. On the other side the RDF CFL [5] system contains a package of inference methods working especially in closed-worlds, that have been developed in the clausal form of first order predicate logics, useful for solving a lot of tasks over corresponding knowledge bases. The article shows one of the capabilities of our RDF CFL graph language using as an example a well-known Castaněda´s puzzle that has been before used by some authors of new formal approaches, like for example Shapiro´s SNaPS for testing their possibilities. The believing versus knowing problem accompanying the puzzle brings into a discussion a further dimension.

1.1 RDF CFL briefly

Main basics of RDF CFL become from two well-known resources:

1. Richards´ clausal form logic CFL [8], the graph version inclusive using only binary predicates for representing roles, properties or relationships, slightly modified by application of concept-relationship modelling paradigm;
2. RDF model with our own methodology of using variable quantifying, the graph version inclusive.

The Clausal Form Logic (CFL) built on the base of the FOPL and well corresponding with common using of the conditional „if – then "statement. Generally, a conditional statement (clause) says that the consequent composed as a disjunction of some predicate atoms follows from the antecedent composed as a conjunction of some predicate atoms.[7, 8]

The approach allows us to formulate clauses in the form

<antecedent> < implies> <consequent>

Selecting a formal language for a knowledge representation is crucial. The formal basis should become here the first order predicate logic (FOPL) base for its high expressivity and a wide range of already developed formal deduction tools. [7,8]

Knowledge Representation (originally those contained in Web resources), which are based on a domain ontology usually has been created in the framework of RDF (Resource Description Framework) model [9, 10, 13]. An RDF model manipulates the semantic aspect of terms specified through URI references to resources in which their meanings are always elucidated by means of a certain position in a relevant ontology. The graphic RDF model in its form is easy and simple to understand even for the users who do not have experience with formal modelling. The idea is based on a simple statement concerning relations between items (resources) in the form of basic vector.[7,8]

Our system RDF CFL represents and reasons about entities whose meaning can have extensional but also intensional characters.

Graph version of the RDF CFL [8] brings into the modelling a possibility to see the semantics in a pure intensional style, so it fulfills the open-world demand of semantic web systems.

Moreover RDF CFL uses inference apparat of the CFL with extensionally based semantics that is able only to catch open world by means of sequences of individual moment snaps of modelled reality.

Our RDF CFL language of representation is able as well as the language of the SNePS to be a natural communication language for using not only for people but also for human-robot interaction. In the frame of formal representation of the NLC it means besides others to distinguish if an agent (man or robot) told us a real knowledge about a part of the domain of our interest or if it only expressed its own belief about any think within a part of the domain. As the NLC theory speaks about mental objects like persons or acts, we can also construct them by means of our RDF CFL formal apparat in the form of networks shearing intensional bindings between concepts of the real world.

1.2 Deductive and/or inductive reasoning in human minds

Our minds make acts of logical reasoning in everyday life. But do we use the logic in its deductive or inductive form? Deduction leads to specific conclusions based on weighing up general principles that ought to be true. Induction is the opposite, and produces a general conclusion from specific cases. We use logical induction more often than formal principles of deduction in everyday life. We make generalizations on previous experiences and now we only believe them. Those previous experiences are often just based on seeing or feeling a thing before. Generalization on one or two experiences can be very dangerous and often leads towards fallacious reasoning.

Our intention is to present here by means of a known puzzle a possibility of fulfilling some of the requirements on the investigating of belief′s legitimacy only with a simple first order predicate logic version like RDF CFL, all without such a very sophisticated but rather complicated formal apparat like a fully intensional SNePS (natural language competence system NLC) [1] uses.

2 Knowing and/or Believing a Think

From the web discussion on a difference between knowing and believing [2] we have chosen the following statements fulfilling enough our seeing the topic, corresponding to our knowledge level of cognitive science.

3. ‘Believing’ means that you have chosen a truth, but ‘knowing’ means that you are certain about that truth.
4. ‘Believing’ always leaves room for doubt, but ‘knowing’ leads to confidence.
5. ‘Believing’ is blind trust, while ‘knowing’ is trusting with awareness.

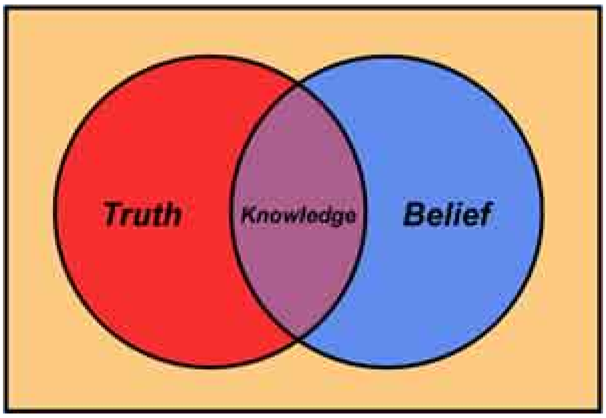


Fig. 1. Knowledge.

When you say ‘I believe’, you indicate that you don’t know about this thing, because, in your personal experience, it has not yet occurred. Beliefs are based on your words, or a particular train of thought. You apply these beliefs to your life because they are appealing. As a result, you feel and begin to believe that they are true.

To have got any assurance that what we just believe in, is true or not we should delve deeper into the meaning instead of follow blindly our belief, without letting know whether it is a truth or not, and try to have known what it is speaking about.

An element of doubt should be put in between ‘believing’ and ‘knowing’, but doubt with shrewdness or intelligence. Even if we know useful information, it should be tested with respect to the believed think, so that it turns into knowledge, and is then converted from a belief into knowledge. It is extremely important that we feed our mind with the right information. We create the world with our knowledge and beliefs. So better be careful in what we believe.

We take into account the real knowledge about a think as an end member of a step-by-step more precise chain of coming out from a rather vague stage of knowledge like beliefs to an expected goal – the real facts about the think.

3 Castaněda's puzzle with both believing and knowing input information

Following the test of capabilities of SNePS system (Stuart C. Shapiro and Wiliam J. Rapaport [1]) we decided to use in the following paragraphs the known Castaněda´s puzzle of Hector Neri Castaněda [4] with the data background coming out from the Sophocles´ tragedy as an example how to reconcile belief and knowledge about a concrete think.

A short explanation of the Sophocles´ tragedy:

Oedipus has become the king of Thebes while unwittingly fulfilling a prophecy that he would kill his father, Laius (the previous king), and marry his mother, Jocasta (whom Oedipus took as his queen after solving the riddle of the Sphinx). The action of Sophocles' play concerns Oedipus' search for the murderer of Laius in order to end a plague ravaging Thebes, unaware that the killer he is looking for is none other than himself. At the end of the play, after the truth finally comes to light, Jocasta hangs herself while Oedipus, horrified at his patricide and incest, proceeds to gouge out his own eyes in despair.

Imput data for a solving of the Castaněda´s puzzle consists of three sentences, two of them (1), (3) we use as beliefs and one (2) as a description of a real fact:

1. At the time of the pestilence, Oidipus believed that: Oedipus´s father was the same as his own father but the previous King of Thebes was not the same as his own father.
2. Oedipus´s father was the same as the previous King of Thebes.
3. It was not the case that at the time of pestilence Oidipus believed that: the previous King of Thebes was the same as his own father but the previous King of Thebes was not the same as his own father.

Input sentences (1) and (3) express two beliefs of Oidipus, the first at the positive approach, the second from the negative point of view.

Authors of the paper [1] completed input information by four theorems:

(T1) For any individuals x and y: if x is (genuinely or strictly) identical with y, than whatever is true of x is true of y and vice versa.

(T2) The sentential matrix occurring in (1) and (3), namely:" at the time of pestilence, Oidipus believed that:__ was the same as his own father but the previous King of Thebes was not the same as his own father", expresses something true of (a property of) the individual denoted by the singular term that by filling the blank in the matrix produces a sentence expressing a truth.

(T3) The expression „was the same as" in (2) expresses genuine or strict identity.

(T4) The singular terms „the previous King of Thebes" and "Oidipus´s father" have exactly the same meaning and denotation in both direct and indirect speach.

Our method needs for an analyzing the puzzle the theorem (T5) more. It is one of the known deMorgan rules:

(T5) Negation of a conjunction of statements implies a disjunction of the negated statesments.

3.1 Representing sentences (1) – (3) in RDF CFL language

Representing the belief (1)

4. *At the time of the pestilence, Oidipus believed that: Oedipus´s father was the same as his own father but the previous King of Thebes was not the same as his own father.* Fig. 2 shows an antecedent of the clause without a consequent.

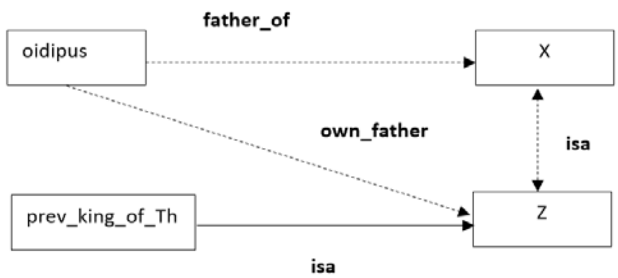


Fig. 2. An antecedent of the clause without a consequent.

After an application of the substitution rule (laius/X, @anybody/Y) the network (1) becomes (1´). "Substitution rule" is one of the two inference rules within the system RDF CFL. The substitution rule is usable in both of the clauses (1) and (3) because both of them are here representing networks of inference prerequisites of processes with variables of universal quantified elements in representative clauses.

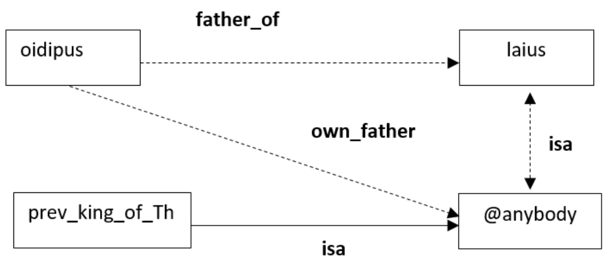


Fig. 3. Next step of deduction.

Representing the belief (3)

It was not the case that at the time of pestilence Oidipus believed that: the previous King of Thebes was the same as his own father but the previous King of Thebes was not the same as his own father.

The fig. 4 represents the Oidipus´s belief in its positive variant, having the conjunction of vectors isa(prev_king_of_Th, Y) & father_of(Oidipus, Y) in the antecedent of a clause without a consequent.

After the using of (T5) the fig. 4a represents the original negative Oidipus´s belief as the consequent (disjunction) of a clause without an antecedent.

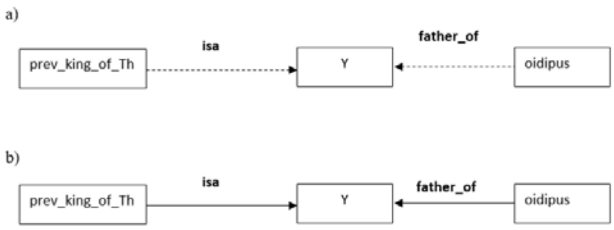


Fig. 4. The Oidipus´s belief in its positive variant.

Representing the knowledge (2) of the Sophocles´s mythological tragedy

2. *Oidipus´s father was the same as the previous King of Thebes*.

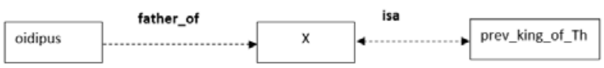


Fig. 5. The form of clause of RDF CFL.

3.2 Adding relevant rules or facts to make a knowledge from the belief as it has been given

Authors of [1] as well as [4] use four relevant teorems (T1) – (T4) to investigate believes (1) and (3) to become a knowledge.

The same four theorems (T1) – (T3) we use now for solving the question from the point of view of our RDF CFL graph language.

(T1) expresses a law holding in predicate logics and of course must hold in RDF CFL as its modified system (see at the fig. 5 in the form of clause of RDF CFL).

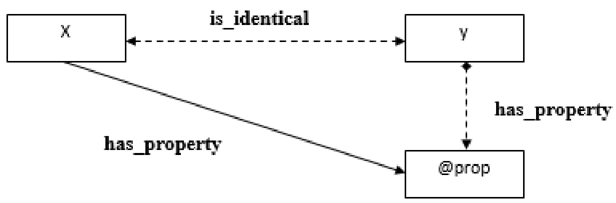
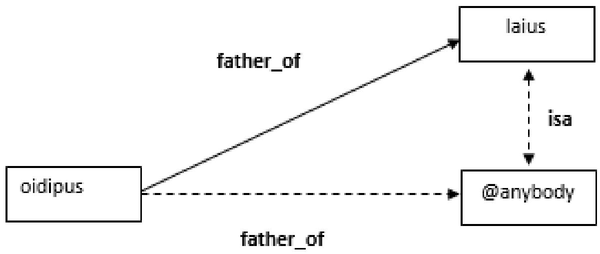


Fig. 6.

Theorem (T2) represents the corresponding RDF CFL "substitution rule" [1].

(T2) rule applying in the (1´) graph returns the statesment father_of(oudipus, laius).



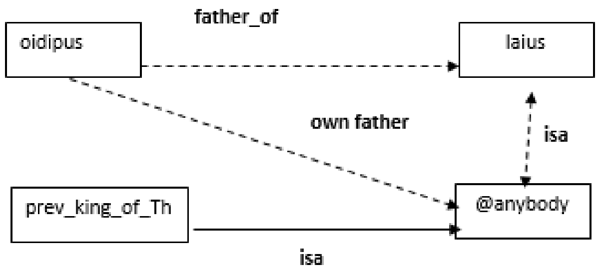


Fig. 7.

After an using resolution rule on clauses of the fig 7:

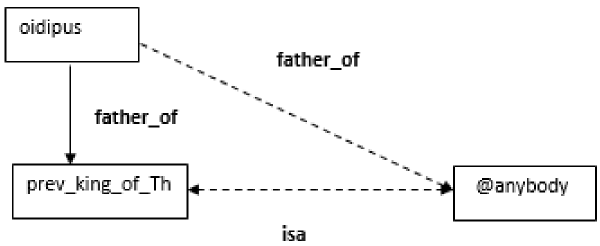


Fig. 8.

After a further using of (T1) rule: father_of(oidipus, prev_king_of_Th)

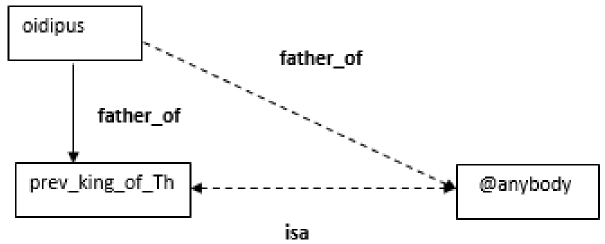


Fig. 9.

(1´) after previous instance of (T2) rule and after a using resolution rule the network says at the consequent of the corresponding clause the same as the statement (2): *Oidipus´s father was the same as the previous King of Thebes.*

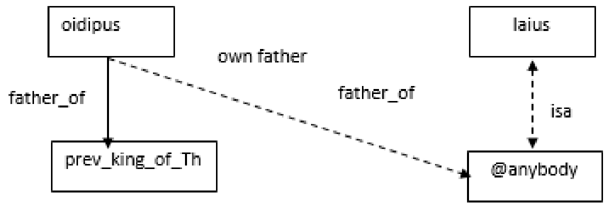


Fig. 10. The result.

Tab. 1. For illustrative purposes URI references

Oidipus	https://www.wikidata.org/wiki/Q130890
Laius	http://dbpedia.org/page/Laius
King	https://www.wikidata.org/wiki/Q535214
anybody	http://dbpedia.org/page/Indefinite_pronoun
father	http://dbpedia.org/ontology/father
isa	https://cs.wikipedia.org/wiki/ISA
identical	http://dbpedia.org/page/Identical

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4 Conclusion
Our system RDF CFL [5,6,12,13] can represent and reason about entities whose meaning can have an extensional character but also it can use means to express as well as systems like SNePS the meaning pure intensionally S o, our language of representation is able to be in an environment of semantic web a u seful natural communication language not only for people but also for human-robot interaction.

By means of the RDF CFL graph representation apparat is there a possibility to construct relevant intensional bindings between concepts of the real domain in the form of networks shearing all their original properties.

We can take into account a real knowledge about a think as an end member of a st ep by step more precise chains that are coming out from a r ather vague stage of knowledge like beliefs to an expected goal – knowledge as real facts about the think.

Moreover our approach leads also to seeing all the process of the children education in a similar manner. It means at the beginning we cannot speak about a real knowledge of an educated subject. The process of step by step education we can take as a cleaning a rather uncertain concept believed in child´s mind towards a conceptual term with a clear meaning.

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