The MKR Language

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Abstract

MKR is a user-friendly RI ("Real Intelligence") language which combines the best features of English, UNIX shell, Unicon and CycL. MKR propositions have a terse English-like format which helps a human user focus on essential characteristics and avoid floating abstractions. MKR is a very-high-level knowledge representation language with a rigorous epistemological foundation including context, genus-differentia definitions, ECP hierarchies (knits) and a unique characterization of the changes associated with actions. The MKE program includes an intelligent knowledge assistant (ke) which interacts with the knowledge base, checks for errors, executes user commands, and possesses self knowledge. This paper gives an overview of the MKR language, and describes several MKE/MKR applications: a Genealogy knowledge base; MKR interfaces to Semantic Web knowledge bases; axiomatic concepts in epistemology.

0. introduction

The MKR language and McCullough Knowledge Explorer (MKE) were "born" in 1996. MKR semantics are the same as English semantics. There is no proof theory for MKR.

1. MKR requirements

Correct epistemology:
- context
- genus-differentia definition
- ECP hierarchy (knit)
- action

User friendly (English-like):
- phrase list
- statement
- question
- command
- logic

User-friendly (UNIX-shell-like):
- variable
- method
- control structure

Discovering the proper characterization of the changes associated with actions turned out to be the most difficult part of the MKR design. The current characterization using prepositional phrase lists (pplist) was "born" in 1999. It is one of the most significant new features of MKR.

2. English “problems”

In my opinion, English is "too complicated" to be a good KR language. I eliminated these English "problems" when I designed the MKR language.

- ambiguity -- use context/view
- redundancy -- use characteristic name = value
- nominalization -- use action
- verb tenses -- use context/time (past,present,future)
- inverted word order -- use statement format
  for questions with embedded "?

Examples of the undesirable redundancy in English are subject-verb agreement and plurals. In MKR, the infinitive form of an English verb is used, regardless of the subject.

English: I walk. MKR: I do walk done;
he walks. he do walk done;

3. MKR propositions

Basic format

The simplest form of MKR proposition is at context { sentence }; where context is space=s,time=t,view=v and sentence has the form subject verb object pplist;
s, t specify where, when actions occur, and v names the contextual knowledge unit (knit) -- an entity-characteristic-proposition hierarchy. This ECP hierarchy includes all the propositions which determine the meaning of the sentence.

Characteristic types
The object describes some characteristics of the subject. The verb indicates what type of characteristic. The basic characteristic types and corresponding verbs are

<table>
<thead>
<tr>
<th>Definition</th>
<th>is, isa, iss, isu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alias</td>
<td>is</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>isa, iss, isu</td>
</tr>
<tr>
<td>Group</td>
<td>ismem, isalt</td>
</tr>
<tr>
<td>Relation</td>
<td>rel</td>
</tr>
<tr>
<td>Part</td>
<td>haspart</td>
</tr>
<tr>
<td>Attribute</td>
<td>has</td>
</tr>
<tr>
<td>Action</td>
<td>do</td>
</tr>
<tr>
<td>Interaction</td>
<td>causes</td>
</tr>
</tbody>
</table>

Many MKR verbs have inverses and iterative forms, not shown here.

The two forms which use pplist are definitions
subject is genus of domain with differentia; and actions
subject do action = event
out action products
of action domains
with action characteristics
od action direct objects
from action initial characteristics
to action final characteristics
done;
Actions may also be written as productions
product := subject do ... done;

Sentence types
MKR has the classical sentence types found in natural languages, plus some "programming" types.

Statement
Question
Command
Conditional
Iteration
Assignment
Production
Group definition (begin ... end)
Group definitions are used for defining hierarchies, relations, and other groups.

Hierarchy definition
This example is a high-level ECP hierarchy.

begin hierarchy overview;
existent;
/  entity;
/  man;
/  knowledge;
/  list;
/  characteristic;
/  definition;
/  part;
/  attribute;
/  conscious;
/  space;
/  time;
/  view;
/  relation;
/  action;
/  exist;
/  identify;
/  interaction;
/  proposition;
/  context;
/  sentence;
/  statement;
/  question;
/  command;
/  conditional;
/  iteration;
/  assignment;
/  production;
/  group definition;
/  Existence;  # entity DO exist done;
/  Identity;    # entity HAS characteristic;
/  Consciousness;  # man has conscious;
/  Identification;  # man do identify od entity done;
end hierarchy overview;
# propositions
Existence IS Identity;
Consciousness IS Identification;
existent is existent;
existent HAS characteristic;
existent DO exist done;
man isa entity;
knowledge := man do identify od existent done;
knowledge haspart proposition list;
proposition isc context, sentence;

Relation definition
This example is the birth-death relation used in the MKE Genealogy application.

r_birth is relation with
  arraymode=gdbm, arraykey="$1",
  label=[pid, sex, birthdate, birthplace, deathdate, deathplace, deathcause],
format=[person:1, sex:2, time:3, space:4, time:5, space:6, cause:7],
   automatic="isu",
   meaning=
   $1 is person with pid=$1;
   #at space=$4,time=$3 {$1 do exist done;};
   #at space=$6,time=$5 {$1 do die with $7 done;};
   $1 has sex=$2,birthdate=$3,birthplace=$4,
       deathdate=$5,deathplace=$6,deathcause=$7;
};

begin relation r_birth;
Dick McCullough 1936,male,1936,GA/Ft. Benning,NA, NA, NA;
Bob McCullough 1938,male, 1938, GA/Ft. Benning,NA, NA, NA;
...
end relation r_birth;
do check od person done; # number of persons in KB

4. some MKE/MKR applications

Genealogy
MKE includes all the relations needed for a Genealogy knowledge base.
   aka          address
   birth-death  phone (and email)
   marriage-divorce school
   child         work
   note

To reduce processing time (which had become a factor in my 1000 person KB), I replaced some of the MKR meaning scripts with Unicon procedures.

MKE generates a GEDCOM file, which is a standard format used by many Genealogy programs. GEDCOM files are organized by
   person
   family (marriage)
   note

Semantic Web
MKE currently interfaces directly with
   Stanford TAP KB (RDF/OWL language)
   OpenCyc KB (CycL language)
   Google
   Amazon

MKE translates between MKR and RDF,OWL,CycL. The variables
   kbmode isany mke,tap,cyc;
   kblanguage isany mkr,rdf,owl,cycl;
specify which knowledge base MKE accesses and which language it uses. The variable
   kformat isany mkr,rdf,owl,cycl,ho,rel,...;
specifies what input language MKE uses.

Epistemology
By using the MKR language, I have developed some significant new insights into Ayn Rand's axiomatic concepts -- Existence, Identity, Consciousness. I have discovered that Rand's concepts can be identified as the names of the propositions which express the facts of reality.

   Existence :: entity DO exist done;
   Identity :: entity HAS characteristic;
   Consciousness :: man has conscious;

Further, I can see that there is a "missing" fourth axiomatic concept -- Identification.
   Identification :: characteristic := man do identify od entity done;

Now it becomes quite obvious what Rand's equivalence statements mean. The propositions
   Existence IS Identity;
   Consciousness IS Identification;
are statements of metaphysical equivalence among the four axiomatic propositions.

5. availability
McCullough Knowledge Explorer (MKE) is a free, open source program, available for Windows, Linux and Mac. It can be downloaded from http://rhm.cdepot.net/.

References