A Superstructure for Organizing Family History Information

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Often a computer is little more than an electronic filing clerk.
To make computers do more (especially for family history), they must:

• Automatically process
  – Certainty information
  – Conflicting information

• Support
  – Evidence-based family history research
  – Automated collaboration

• Provide automated research guidance
Our solution is inspired by how people think.

gather information

conceptualize
A Proposed Superstructure

• Seven Layers*
  – Symbol
  – Class
  – Information
  – Knowledge
  – Evidence
  – Communication
  – Action
• Wisdom

* Charles T. Meadow and others
Our Story
Our Story
Symbol

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Class

BloodType

**external representation:**
\[\text{b}(A+|A-|B+|B-|AB+|AB-|O+|O-)\text{b}\]

**context keywords:** \text{b[Bb]lood\$[Tt]ype}\text{b}

**input method:** BloodTypeToString

**output method:** StringToBloodType

**operator methods:**
- CanDonateTo(x: BloodType, y: BloodType)
  - returns Boolean

end
Class

BloodType

**external representation:**
\[b(A+ \mid A- \mid B+ \mid B- \mid AB+ \mid AB- \mid O+ \mid O-)\]

**context keywords:** \(b\{Bb\}lood\{sTt\}ype\)

**input method:** BloodTypeToString

**output method:** StringToBloodType

**operator methods:**
CanDonateTo(x:BloodType, y:BloodType)
returns Boolean

end

regular-expression recognizer for reading text
read & store
write to text
operate/compute
Information
Information

Generalization/specialization, "isa" constraint

functional constraint

relationship set
Knowledge

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Knowledge

meta-information connection

constraint violation

soft constraint
Evidence

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Evidence

Formal
- BirthDate
- BirthPlace
- DeathDate
- DeathPlace
- Name
- Gender
- MarriageDate
- MarriagePlace
- Spouse
- BloodType
- Child
- Certainty

Informal
- Probability of ChildBloodType for MotherBloodType and FatherBloodType
- MotherBloodType
- FatherBloodType
- ChildBloodType
- Probability

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Evidence

Reasoning with the evidence:

- Person(x₁)-BloodType(x₂),
- Person(x₃)-BloodType(x₄), Person(x₅)-BloodType(x₆),
- Child(x₁)-Person(x₂), Person(x₃)-Gender('F'),
- Child(x₁)-Person(x₄), Person(x₅)-Gender('M'),
- Probability(x₇)-of-ChildBloodType(x₂)-and-
  MotherBloodType(x₄)-FatherBloodType(x₆),
- Certainty(x₇)-Person(x₅)-BloodType(x₂)
Communication

The probability of a child's blood type being B- when both the mother's and father's is A- is 0.0.

Probability of ChildBloodType for MotherBloodType and FatherBloodType

Dr.Q -> GenGuide
Communication

The probability of a child's blood type being B- when both the mother's and father's is A- is 0.0.

Dr.Q -> GenGuide

write & send
receive & read

Probability of ChildBloodType for MotherBloodType and FatherBloodType

MotherBloodType
FatherBloodType
ChildBloodType
Probability
Communication

model structure:
Probability[1:*] of ChildBloodType[1:*] for MotherBloodType[1:*] and FatherBloodType[1:*]
end;
model instance:
Probability(93.75%) of ChildBloodType(A-) for MotherBloodType(A-) and FatherBloodType(A-);
Probability(6.25%) of ChildBloodType(O-) for MotherBloodType(A-) and FatherBloodType(A-);
... end;
Action

The probability of a child's blood type being B- when both the mother's and father's is A- is 0.0.

Get BloodTypeTable and documentation for Person-BloodType.

Parents Wrong ?

Blood Type Wrong ?

Applicable information gathered
Get documentation for Person-Child, Person-Gender, and Person-Spouse-MarriageDate-MarriagePlace; Gather known evidence.

Mother Wrong ?

Father Wrong ?

Alternate Set of Parents ?

Applicable information gathered
Display information; Suggest: ...

Initiate search
Specify search criteria; Gather known data and evidence; Evaluate probabilities; ...

Applicable information gathered
Display information; Suggest: - Double-check documentation - Find additional documentation
The probability of a child's blood type being B- when both the mother's and father's is A- is 0.0.

Automatic information gathering triggered on arrival of information.
Wisdom

• The proper application of
  – Knowledge
  – Evidence (Truth)
  – Communication
  – Action

• When Properly Applied
  – Record and process richer information
  – Perform evidence-based reasoning
  – Collaborate effectively
  – Semi-automate family history research