Knowledge Representation

Chapter 4

What is KR?

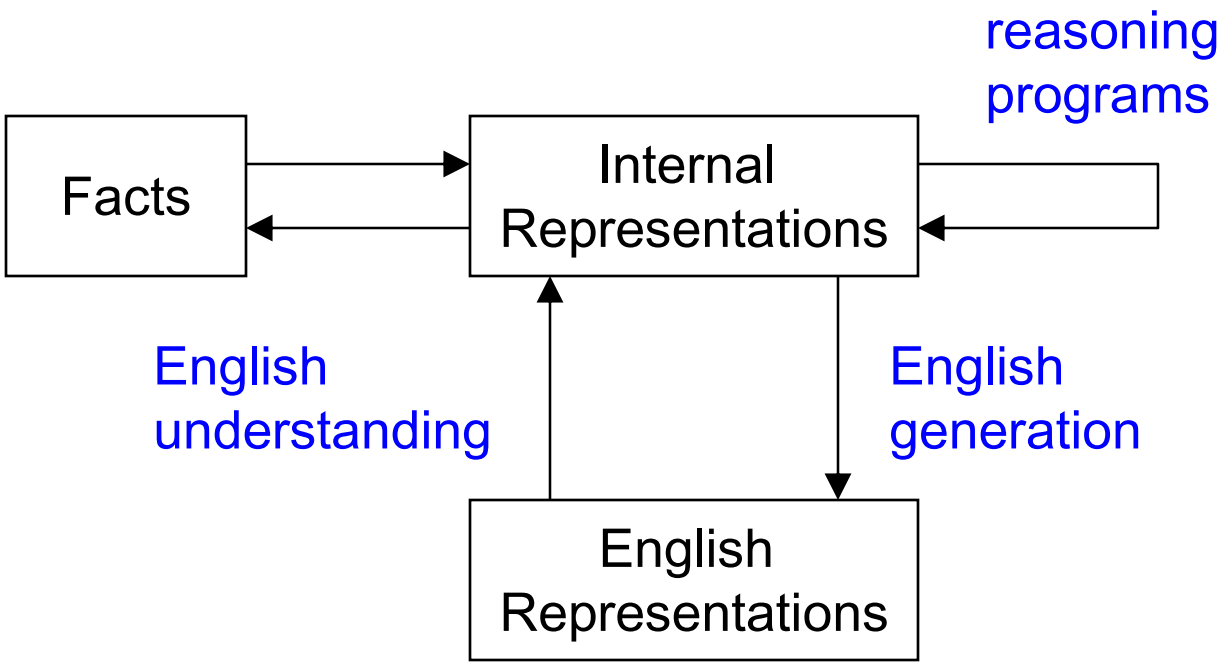
R. Davis, H. Schrobe, P. Szolovits (1993):

1. A surrogate
2. A set of ontological commitments
3. A fragmentary theory of intelligent reasoning
4. A medium for efficient computation
5. A medium of human expressions

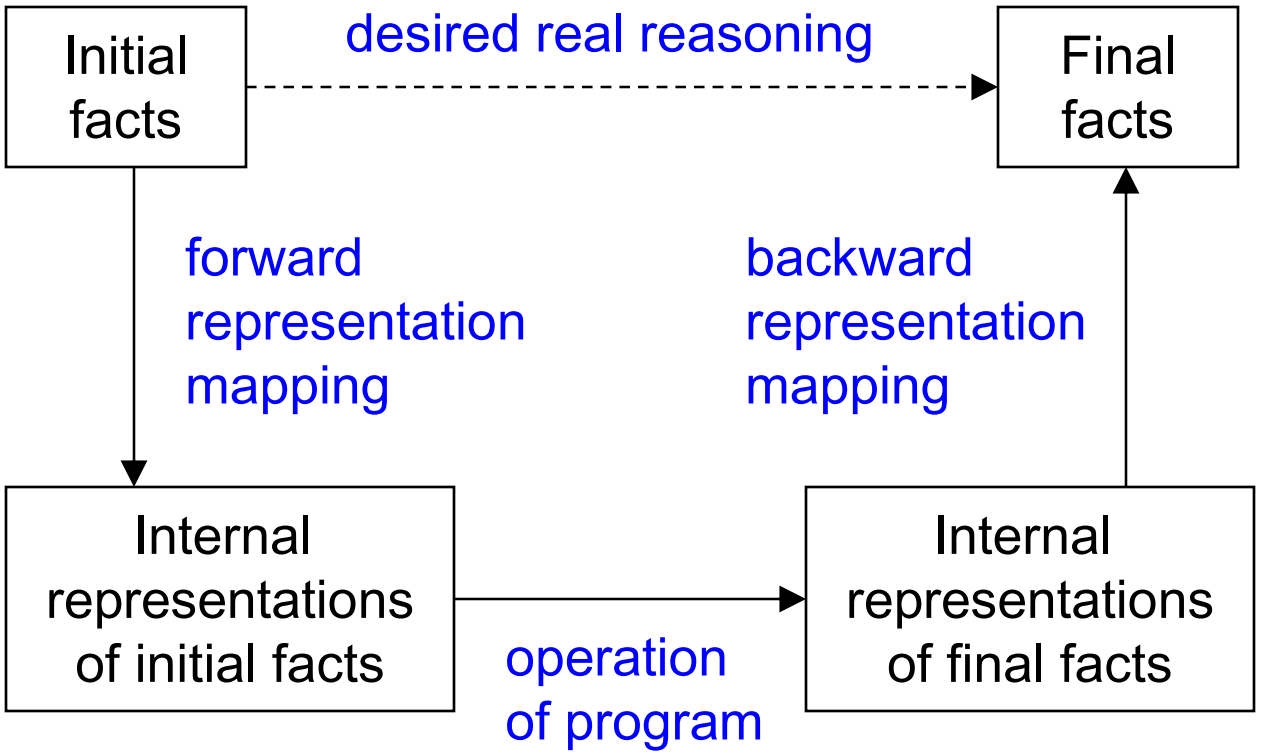
Representation and Mapping

- Facts: things we want to represent.
- Representations of facts: things we can manipulate.

Representation and Mapping



Representation and Mapping



Representation and Mapping

- Spot is a dog

- Every dog has a tail

Spot has a tail

Representation and Mapping

- Spot is a dog

  dog(Spot)

- Every dog has a tail

  $\forall x$: dog(x) $\rightarrow$ hastail(x)

  hastail(Spot)

  Spot has a tail

Representation and Mapping

- Fact-representation mapping is not one-to-one.
- Good representation can make a reasoning program trivial.

Representation and Mapping

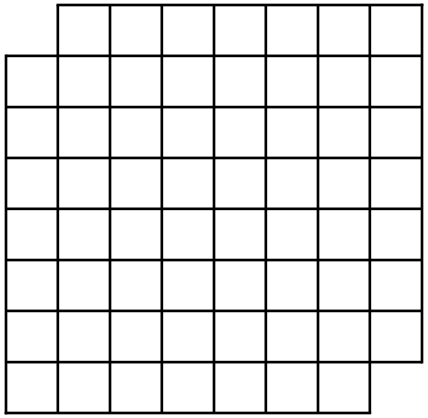
The Multilated Checkerboard Problem

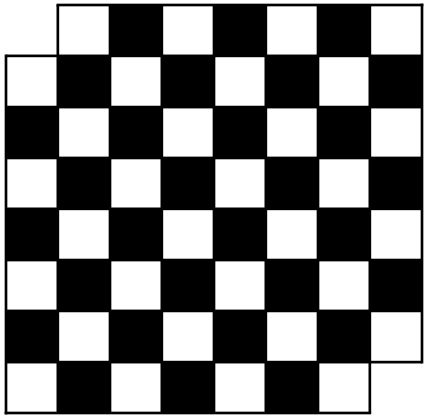
"Consider a normal checker board from which two squares, in opposite corners, have been removed.

The task is to cover all the remaining squares exactly with donimoes, each of which covers two squares. No overlapping, either of dominoes on top of each other or of dominoes over the boundary of the multilated board are allowed.

Can this task be done?"

Representation and Mapping





No. black squares
= 30

No. white square
= 32

Representation and Mapping

Good representation:

- Representational adequacy
- Inferential adequacy
- Inferential efficiency
- Acquisitional efficiency

Approaches to KR

Simple relational knowledge:

- Provides very weak inferential capabilities.
- May serve as the input to powerful inference engines.

Approaches to KR

Inheritable knowledge:

- Objects are organized into classes and classes are organized in a generalization hierarchy.
- Inheritance is a powerful form of inference, but not adequate.

Approaches to KR

Inferential knowledge:

- Facts represented in a logical form, which facilitates reasoning.
- An inference engine is required.

Approaches to KR

Procedural knowledge:

- Representation of "how to make it" rather than "what it is".
- May have inferential efficiency, but no inferential adequacy and acquisitional efficiency.

Approaches to KR

Choosing the Granularity:

- High-level facts may not be adequate for inference.
- Low-level primitives may require a lot of storage.

Homework

Reading

R. Davis, H. Schrobe, P. Szolovits (1993): “What is a knowledge representation?”