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COLLEGE OF ENGINEERING & TECHNOLOGY

CHAPTER – 9
STRONG SLOT-AND-FILLER STRUCTURE

CYC

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Conceptual Dependency (CD)

- Conceptual Dependency originally developed to represent knowledge acquired from natural language input.

Goals :

- To help in the drawing of inference from sentences.
- To be independent of the words used in the original input.

CD provides:

- a structure into which nodes representing information can be placed
- a specific set of primitives
- at a given level of granularity.

Examples of Primitive Acts are:

1. **ATRANS**
- Transfer of an abstract relationship. e.g. give.
2. **PTRANS**
- Transfer of the physical location of an object. e.g. go.
3. **PROPEL**
- Application of a physical force to an object. e.g. push.
4. **MTRANS**
- Transfer of mental information. e.g. tell.
5. **MBUILD**
- Construct new information from old. e.g. decide.
6. **SPEAK**
- Utter a sound. e.g. say.

7. **ATTEND**

- Focus a sense on a stimulus. e.g. listen, watch.

8. **MOVE**

- Movement of a body part by owner. e.g. punch, kick.

9. **GRASP**

- Actor grasping an object. e.g. clutch.

10. **INGEST**

- Actor ingesting an object. e.g. eat.

11. **EXPEL**

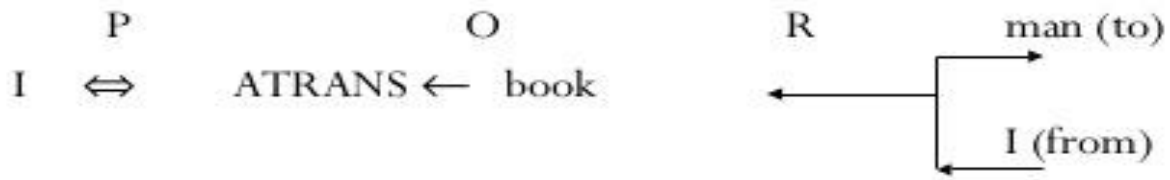
- Actor getting rid of an object from body.

- Six primitive conceptual categories provide building blocks which are the set of allowable dependencies in the concepts in a sentence:

1. **PP -** Real world objects.
2. **ACT -** Real world actions.
3. **PA -** Attributes of objects.
4. **AA -** Attributes of actions.
5. **T -** Times.
6. **LOC -** Locations.

Example

- I gave a book to the man. CD representation is as follows:



- It should be noted that this representation is same for different saying with same meaning. For example
  - I gave the man a book,
  - The man got book from me,
  - The book was given to man by me etc.

Advantages

- Using these primitives involves fewer inference rules.
- Many inference rules are already represented in CD structure.
- The holes in the initial structure help to focus on the points still to be established.

Disadvantages

- Knowledge must be decomposed into fairly low level primitives.
- Impossible or difficult to find correct set of primitives.
- A lot of inference may still be required.
- Representations can be complex even for relatively simple actions.

Scripts

- A script is a structure that prescribes a set of circumstances which could be expected to follow on from one another.
- It is similar to a thought sequence or a chain of situations which could be anticipated.
- It could be considered to consist of a number of slots or frames but with more specialized roles.

Scripts are beneficial because:

- Events tend to occur in known runs or patterns.
- Causal relationships between events exist.
- Entry conditions exist which allow an event to take place
- Prerequisites exist upon events taking place. E.g. when a student progresses through a degree scheme or when a purchaser buys a house.

The components of a script include:

1. **Entry Conditions -** These must be satisfied before events in the script can occur.
2. **Results -** Conditions that will be true after events in script occur.
3. **Props -** Slots representing objects involved in events.
4. **Roles -** Persons involved in the events.
5. **Track -** Variations on the script. Different tracks may share components of the same script.
6. **Scenes -** The sequence of *events* that occur. *Events* are represented in *conceptual dependency* form.

- Scripts are useful in describing certain situations such as robbing a bank. This might involve:
- Getting a gun.
- Hold up a bank.
- Escape with the money.

Here the *Props* might be

- Gun, *G*.
- Loot, *L*.
- Bag, *B*
- Get away car, *C*.

The *Roles* might be:

- Robber, *S*.
- Cashier, *M*.

- Bank Manager, *O*.
- Policeman, *P*.

The *Entry Conditions* might be:

- *S* is poor.
- *S* is destitute.

The *Results* might be:

- *S* has more money.
- *O* is angry.
- *M* is in a state of shock.
- *P* is shot.

- There are 3 scenes: obtaining the gun, robbing the bank and the getaway.
- The full Script could be described in Fig .

Script: ROBBERY — *Track: Successful Snatch*

Props:
G = Gun,
L = Loot,
B= Bag,
C = Get away car.

Roles:
R = Robber,
M = Cashier,
O = Bank Manager,
P = Policeman.

Entry Conditions:
R is poor.
R is destitute.

Results:
R has more money.
O is angry.
M is in a state of shock.
P is shot.

Scene 1: Getting a gun

R PTRANS R into Gun Shop
R MBUILD R choice of G
R MTRANS choice.
R ATRANS buys G

(go to scene 2)

Scene 2 Holding up the bank

R PTRANS R into bank
R ATTEND eyes M, O and P
R MOVE R to M position
R GRASP G
R MOVE G to point to M
R MTRANS "Give me the money or ELSE" to M
P MTRANS "Hold it Hands Up" to R
R PROPEL shoots G
P INGEST bullet from G
M ATRANS L to M
M ATRANS L puts in bag, B
M PTRANS exit
O ATRANS raises the alarm

(go to scene 3)

Scene 3: The getaway

M PTRANS C

- If a particular script is to be applied it must be activated and the activating depends on its significance. If the topic is important then the script should be opened.

- The danger lies in having too many active scripts much as one might have too many windows open on the screen or too many recursive calls in a program.

- Provided events follow a known trail we can use scripts to represent the actions involved and use them to answer detailed questions.

- Different trails may be allowed for different outcomes of Scripts (*e.g.* The bank robbery goes wrong).

Advantages

- Ability to predict events.
- A single coherent interpretation may be build up from a collection of observations.

Disadvantage

- Less general than frames.
- May not be suitable to represent all kinds of knowledge.

CYC

- In the absence of a learning machine that can acquire common sense facts on its own, there would seem to be only one option left.

- That is, manually programming in the millions of general knowledge items that we take entirely for granted.

- The CYC research project has actually undertaken this mammoth task.

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