Chap-10 (of Rich & Knight)

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Date __/__/__ Strong slot & filler structures

Conceptual dependency

→ In generalization-specialization scenario of property inheritance, the arrows on the lines from object to its value is the attribute line. So, the arrow is known as "slot" and value of attr. is called as "filler."

→ Conceptual Dependency (CD) is a theory of how to represent the kind of knowledge about events that is usually contained in natural language sentences.

→ The goal is to represent knowledge in a way that,
- Facilitates drawing inferences from sentences.
- Is independent of lang. in which sentences were originally stated.

→ CD repre^{n} of a sentence is ~~not only~~ not built out of primitives corresponding to words, but rather than this conceptual primitives can be combined to form meaning of words in any natural language.

→ It has been implemented in a variety of programs that read & understand natural lang. text.

→ Semantic nets provided only a structure into which nodes representing any info. at any level can be placed, but C.D. provides both structure

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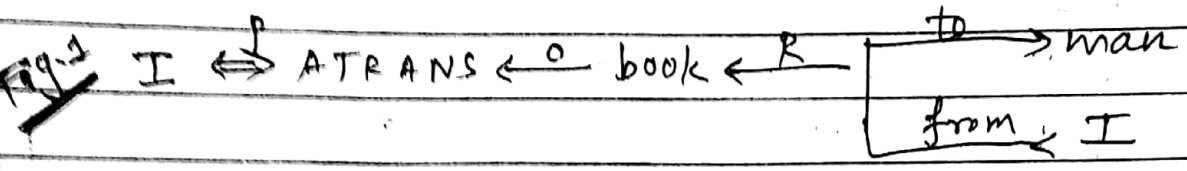
& a specific set of primitives at a particular level of granularity (abstraction); out of which repre^n of particular info. can be constructed.

fig-1 

- Arrow indicates direction of dependency
- Double arrow indicates two way link actor & action.
- p indicates past tense.
- ATRANS is one of the primitive acts used by theory. It indicates transfer of possession.
- o indicates the object case relation.
- R " receipient case relation.

→ For ex. A simple example of the way knowledge is represented in CD, the event represented by the sentence is,

"I gave the man a book."

→ This is represented as shown in fig. (1).

→ In CD, repre^n of actions are built from a set of primitive acts.

ATRANS = Transfer of an abstract relationship. (Give)
PTRANS = " " physical loca^n of an obj. (Go)
PROPEL = Hpp^n of physical force to an obj. (Push)
MOVE = Movement of body part by its owner (Kick)
SPEAK = Production of sounds (e.g. say)
ATTEND = Focusing of a sense organ (e.g. listen)

p = Past
f = future
nil = Present
t = transition
ts = Start transition
tf = finished transition
tfp = finished transition (past tense)
q : Interrogative
/ = negative
c = Conditional

⟺ two way relationship (between ob. and action or ~~between ob/actors and~~

⟹ between two objects (two PPs)

→ between object and object modifier (PP and PA).

1) Physical Act:
PROPEL, MOVE, INGEST, EXPEL, GRASP

2) Acts Characterized by resulting State Changes:
PTRANS, ATRANS

3) Acts used mainly as Instruments for other Acts:
SPEAK, ATTEND.

4) Mental Acts:
MTRANS, MBUILD.

Set of primitive acts:

1) ATRANS : ex:(give, take)
Transfer of an abstract relationship

2) PTRANS : ex:(go, come)
Transfer of the physical ~~force~~ location of an object

3) PROPEL : ex:(push, pull)
Application of physical force to an object.

4) MOVE : ex:(kick)
Movement of body parts by its owner

5) GTRASP : ex:(clutch)
grasping of an object by an actor

6) INGEST : ex:(eat, drink)
Ingestion of an object by animal

7) EXPEL : ex:(cry, excrete, sweat)
Expulsion of something from the body of an animal

8) MTRANS : Transfer of mental information
ex: (tell)

9) MBUILD : Building new information out of old
ex:(decide)

10) SPEAK : ex:(say)
production of sound

11) ATTEND : focusing a sense organ toward.
ex: (listen, see).

CD:

John ran

John ⟺ PTRANS

2) A nice boy.

3) John ate icecream

John ⟺ (P) PTRANS ⟵ (O) icecream

4) John pushed the cart

John ⟺ (P) PROPEL ⟵ (O) Cart

5) I heard a frog in woods.

I ⟺ MTRANS ⟵ (O) frog ⟵ (CP) ears.

I ⟺ woods.

6) Since Smoking can kill ya, I stopped.

one ⟺ INGEST ⟵ (O) Smoke ⟵ (R) one, cigeratte.

I ⟺ INGEST ⟵ (O) smoke ⟵ (R) I, cigarette

one ⟵ (P) dead, alive

7) I saw a dog.

I ⟺ MTRANS ⟵ (O) dog ⟵ (R) CP, eyes.

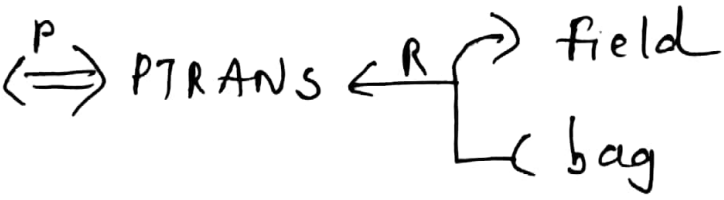
8 John ran yesterday.

→ John 

9 The plants grew.

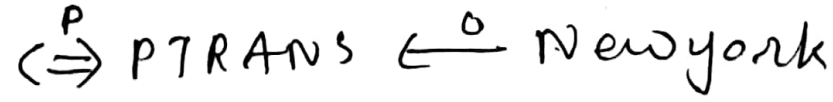
→ Plants ← Size > x.
Size = x

10 John fertilized the field.

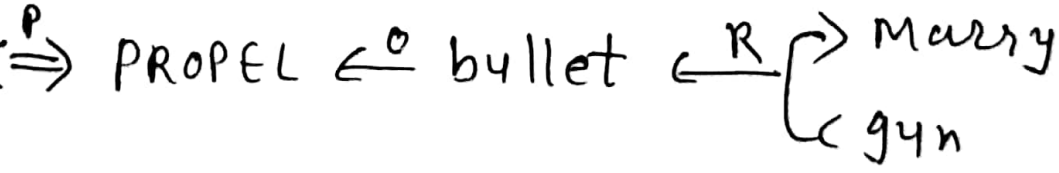
→ John 

Q-B-3

1) John flew to New york

→ John 

2) John ~~[illegible]~~ shot Marry.

→ John 

3) John ate eggs.

→ John 

10.2 ☆ Scripts

→ CD is a mechanism for representing & reasoning about events. But, rarely events occur in isolation. So, here, we shall present a mechanism for representing knowledge about common sequences about events.

→ A "script" is a structure, which describes a sequence of events in a particular context. A script consists of a set of "slots".

→ Each slot is associated with some info. about what kinds of values it may contain as well as a default value to be used if no other info. is available.

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→ Scripts are useful bcoz, in the real world, there are patterns to the occurrence of events. These patterns arise bcoz of causal rela'nship bet'n events.

→ The events described in a script form a giant "causal chain". The beginning of the chain is the set of entry conditions which enable the first events of script to occur.

→ The end of the chain is the set of results which may enable later events or event sequences to occur.

→ Within the chain, events are connected to both the earlier events that make current event possible & later events that current event make enable.

→ If a particular script is known to be appropriate in a given situation, then it can be very useful in predicting the occurrence of events, which is not mentioned. Scripts can also be useful by indicating how events that were mentioned relate to each other.

→ For ex., what is connection bet'n someone's ordering steak (cafe, hotel) & someone's eating steak? But, before a particular script can be applied, it must be activated, i.e it must be selected as appropriate to current situation.

→ There are two ways in which it may be useful

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to activate a script.

(1) For fleeting scripts, it may be sufficient to store a pointer to the script so that it can be accessed later if necessary. For ex,

"Sucan passed her favourite restaurant on her way to the museum. She really enjoyed the new Picasso exhibit."

One famous artist in france

Picasso → one exhibition.

(2) For nonfleeting scripts it is appropriate to activate the scripts fully & to attempt to fill in its slots with particular objects & people involved in current situation.

"The headers of scripts (its pre-cond^{n}s, its props, its roles) can all serve as indicators that the scripts should be activated."

→ Once a script has been activated, there are many ways in which it can be useful in interpreting a particular situation.

→ Fig. (2) shows a part of "restaurant script". It illustrates the components of a script.

(1) Entry-condition:- Cond^{n}s that must be satisfied before the events described in script can occur.

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(2) Result :- Cond^n's that will be true after events described in script have occurred.

(3) Props :- Slots representing obj.s that are involved in the events described in the script.

(4) Roles :- Slots representing the person who is involved in events described in the script.

(5) Scenes :- The actual sequence of events that occur.

The Restaurant Script:

Story:
John went out to a restaurant last night. He ordered steak. When he paid for it, he noticed that he was running out of money. He Hurried home since it had started to rain.

Script: RESTAURANT.

Track: Coffee shop

Props: Tables
Menu
Food
check
money

Roles: S: Customer
W: Waiter
C: Cook
M: Cashier
O: owner

Entry Conditions: S is hungry
S has money.

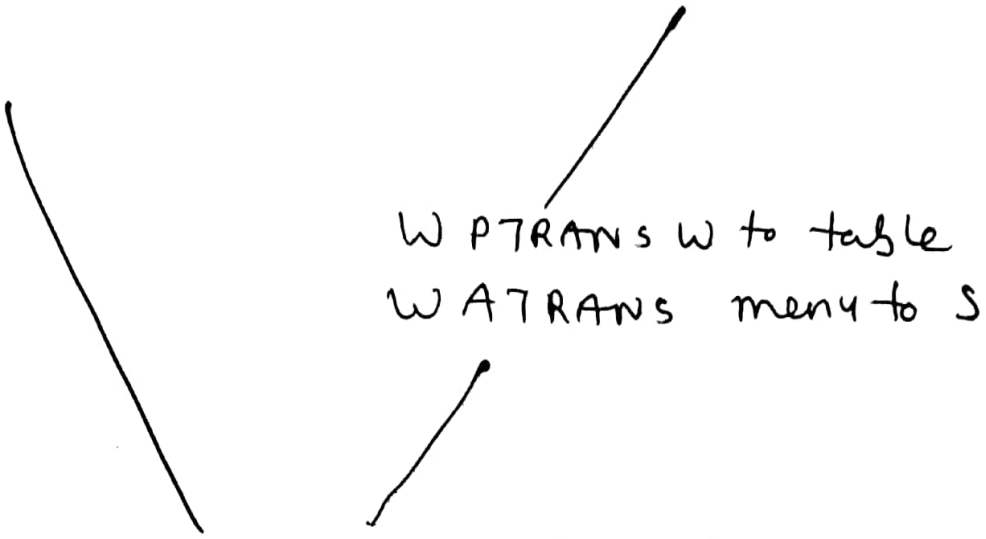
Results: S has less money
O has more money
S is not hungry
S is pleased (optional).

Scene 1: Entering

S PTRANS S into restaurant
S ATTEND eyes to tables
S MBUILD where to sit
S PTRANS S to table
S MOVE S to Sitting position.

Scene 2: Ordering:

(Menu on table) (W brings menu) (S asks for menu)
S PTRANS menu to S.
S MTRANS signal to W
W PTRANS W to table.
S MTRANS 'need menu' to W
W PTRANS W to menu.



S MTRANS W to table.
S MBUZLD choice of F.
S MTRANS signal to W.
W PTRANS W to table
S MTRANS 'I want F to W.
C Do C prepare F script)
to scene 3.

Scene 3: Eating

C ATRANS F to W.
W ATRANS F to S.
S INGEST F.

Scene 4: Exiting

W PTRANS W to S
W ATRANS check to S.
S ATRANS tip to W.
S PTRANS S to M.
S ATRANS money to M.
S PTRANS S to out of restaurant.

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→ If you were asked the question...

"Did John eat dinner last night?"

→ According to the script represented in fig. ② you will respond that "he did". By using "Restaurant script", a computer question-answer would be able to conclude that "John ate dinner"

→ Since all of the events in the story corresponds to sequence of events predicted by the script, the program could obtain that the entire ~~script~~ sequence predicted by the script occurred normally. Thus it can conclude, that, "John ate".

→ Another use of scripts is to provide a way of building a single perfect interpretation from a collection of observations. For ex., consider foll. story.

"Susan went out to lunch. She sat down at a table & called the waitress. The waitress brought her a menu and she ordered a hamburger."

→ Now consider a question...

"Why did the waitress bring Susan a menu?"

→ The script provides two possible answers:

(1) Because Susan asked for that. (આ રીતે backward chaining થી થશે, કે, જેના કારણે waitress એ આ કર્યું)

(2) So that Susan could decide what she wanted to eat. (આ બધા forward chaining થી ગણશે, જેથી કઈ દારના તેના સરવાળાના action ના ક્રમને જાણશે. જેમ કે, તે decide કરે કે શું ખાવું છે તો એ further order કરી શકે અને ખાઈ શકે.)

10.3 ☆ CYC

→ CYC is a very large knowledge base project aimed at capturing human commonsense knowledge.

→ For ex., in chap-5, the first attempt to prove that "Marcus was not loyal to Caesar" failed, bcoz one simple fact "All men are people" was missing.

→ The goal of CYC is to encode the large body of knowledge that is so obvious that it is easy to forget to state it explicitly. (CYC થી large knowledge ગણશે. જેવી કંઈ પણ વાત mention કરવાનું ભૂલી જશો તો પણ આવે)

→ CYC provides specific ~~...~~ theory of representation for events, objects, attr.s, relations & so on.

→ Building an immense (પુષ્કળ) knowledge is a tough task, but there are some methods for acquiring this knowledge automatically. <u>Here are the ways</u>:-

(1) <u>Machine learning</u> :- Techniques for automated learning. In order for a system to learn in a great deal,

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it must already know a great deal.

(2) Natural language Understanding :- Humans extend their own knowledge by reading books & talking with other humans. For ex., when we hear the sentence

"John went to bank & withdrew $50.

We easily decide that "bank" means financial institution and not a river bank. To do this, we apply deep knowledge about what a financial institution is and what means to withdraw money. etc.

10.3] CYCL :-

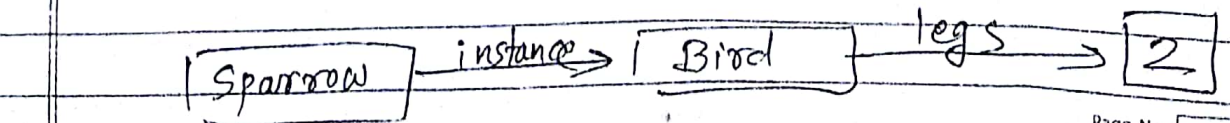
→ CYC's knowledge is encoded in a repre^n lang. called CYCL. CYCL is a frame based system to have multiple inheritance, slots as full-fledged objects.

→ CYCL generalizes the notion of inheritance ; that can be inherited along any link, not just "is-a" & "instance".

→ For ex., consider a statement,

(1) "All birds have two legs."

→ We can easily encode the first fact using standard inheritance — "Any frame with "Bird" on its instance slot inherits the value = 2 on its legs slot.



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(2) "All of Mary's friends speak Spanish."
This fact is also encoded in a similar manner, if we allow to proceed along the "friend" relation, then any frame with Mary on its friend slot inherits the value = Spanish on its "language Spoken" slot.