A Simple Conceptual Dependency Representation

- “I gave the man a book.”

where the symbols have the following meanings:

- **Arrows indicate direction of dependency.**
- **Double arrow indicates two way link between actor and action.**
- **p indicates past tense.**
- **ATRANS is one of the primitive acts used by the theory. It indicates transfer of possession.**
- **o indicates the object case relation.**
- **R indicates the recipient case relation.**

CD Primitive Actions

ATRANS Transfer of an abstract relationship (e.g., give)

PTRANS Transfer of the physical location of an object (e.g., go)

PROPEL Application of physical force to an object (e.g., push)

MOVE Movement of a body part by its owner (e.g., kick)

GRASP Grasping of an object by an actor (e.g., clutch)

INGEST Ingestion of an object by an animal (e.g., eat)

EXPEL Expulsion of something from the body of an animal (e.g., cry)

MTRANS Transfer of mental information (e.g., tell)

MBUILD Building new information out of old (e.g., decide)

SPEAK Production of sounds (e.g., say)

ATTEND Focusing of a sense organ toward a. stimulus (e.g., listen)

CD Primitive Conceptual Categories

ACTs Actions

PPs Objects (picture producers)

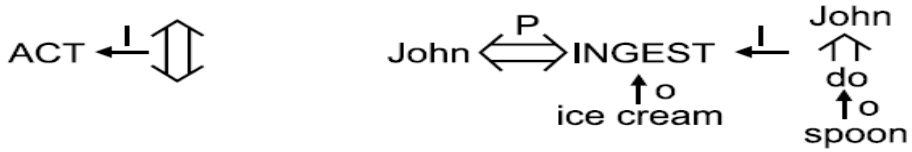
AAs Modifiers of actions (action aiders)

PAs Modifiers of PPs (picture aiders)

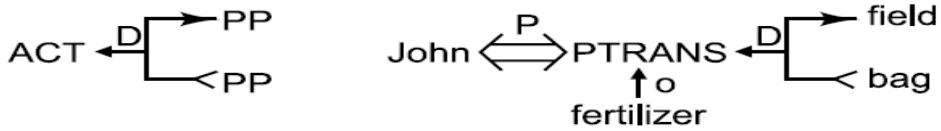
The Dependencies of CD

1. PP ⟺ ACT — John ⟺ (p) PTRANS — John ran.
2. PP ⟺ PA — John ⟺ height (> average) — John is tall.
3. PP ⟺ PA — John ⟺ doctor — John is a doctor.
4. PP ↑ PA — boy ↑ nice — A nice boy.
5. PP ↑↑ PP — dog ↑↑ Poss-by ↑ John — John's dog.
6. ACT ←(o) PP — John ⟺ (p) PROPEL ←(o) cart — John pushed the cart.
7. ACT ←(o) PP, PP — John ⟺ (P) ATRANS ←(o) John, Mary; ATRANS →(o) book — John took the book from Mary.
8. ACT ←(I) ⇕ — John ⟺ (P) INGEST ←(I) John; INGEST →(o) ice cream; John →(do) →(o) spoon — John ate ice cream with a spoon.

The Dependencies of CD (Cont'd)

8. 

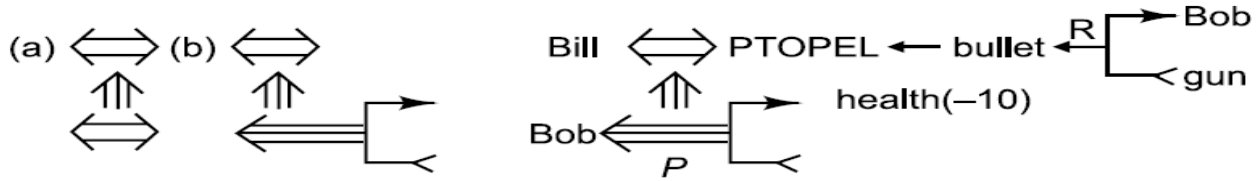
John ate ice cream with a spoon.

9. 

John fertilized the field.

10. 

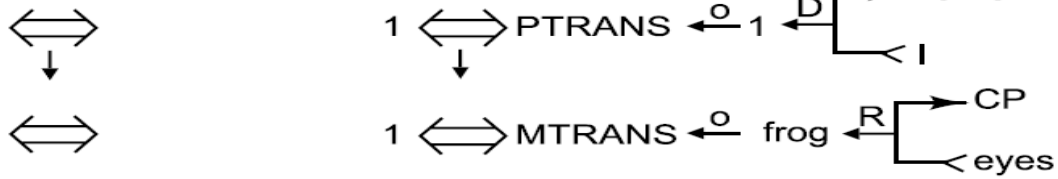
The plants grew.

11. 

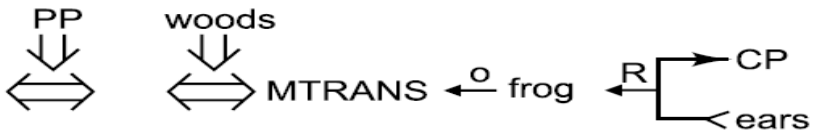
Bill shot Bob.

12. 

John ran yesterday.

13. 

While going home, I saw a frog.

14. 

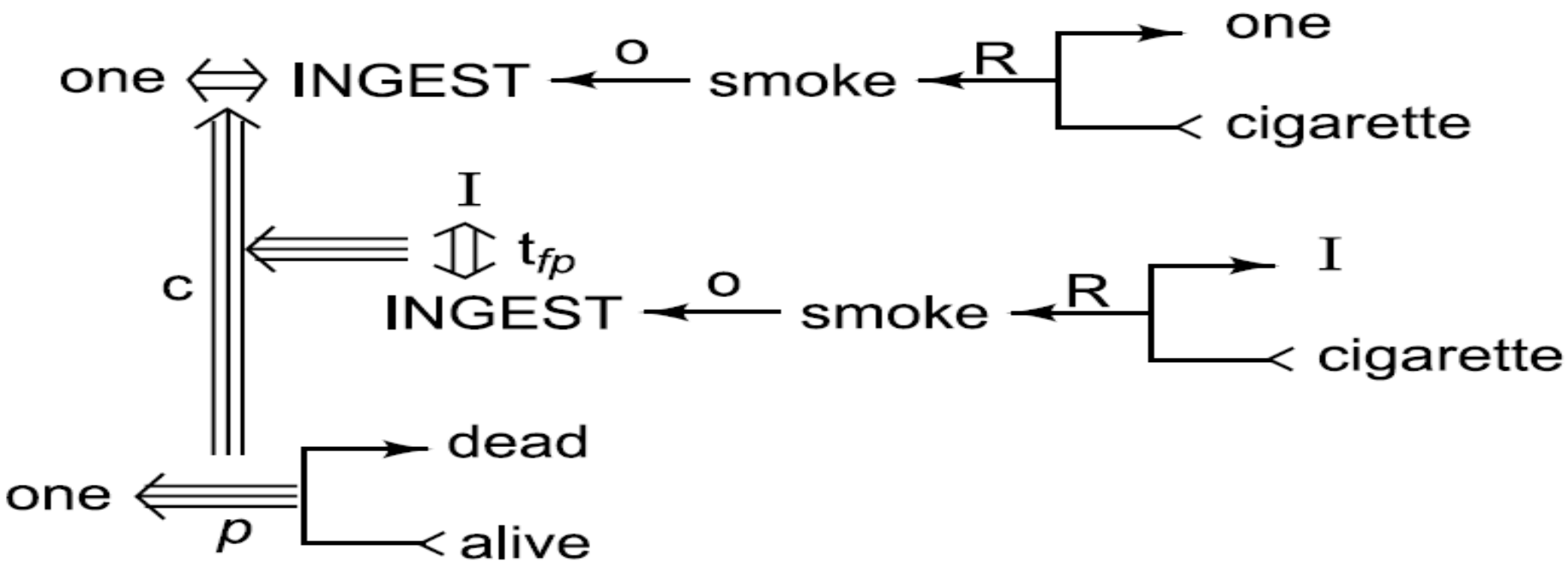
I heard a frog in the woods.

CD Conceptual Tenses

p	Past
f	Future
t	Transition
t_s	Start transition
t_f	Finished transition
k	Continuing
?	Interrogative
/	Negative
nil	Present
delta	Timeless
c	Conditional

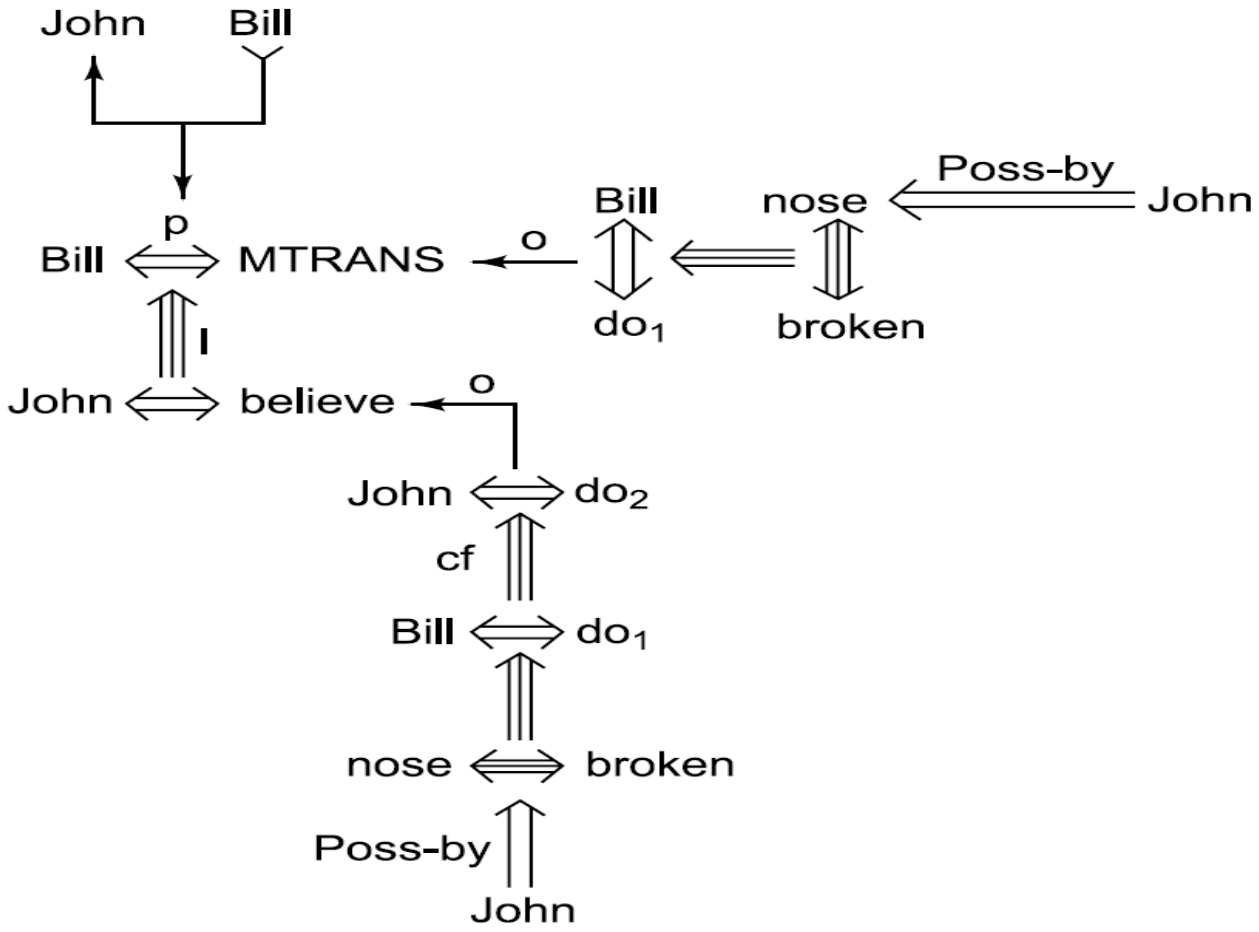
Using Conceptual Tenses

- “Since smoking can kill you, I stopped.”



The CD Representation of a Threat

- "Bill threaten John with a broken nose."



The Components of a Script

Entry conditions Conditions that must, in general, be satisfied before the events described in the script can occur.

Result Conditions that will, in general, be true after the events described in the script have occurred.

Props Slots representing objects that are involved in the events described in the script. The presence of these objects can be inferred even if they are not mentioned explicitly.

Roles Slots representing people who are involved in the events described in the script. The presence of these people, too, can be inferred even if they are not mentioned explicitly. If specific individuals are mentioned, they can be inserted into the appropriate slots.

Track The specific variation on a more general pattern that is represented by this particular script. Different tracks of the same script will share many but not all components.

Scenes The actual sequences of events that occur. The events are represented in conceptual dependency formalism.

Script: RESTAURANT
Track: Coffee Shop
Props: Tables
Menu
F = Food
Check
Money

Roles: S = Customer
W = Waiter
C = Cook
M = Cashier
O = Owner

Entry conditions:

S is hungry.
S has money.

Resulls:

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 PTRANS menu to S

(S asks for menu)
S MTRANS signal to W
W PTRANS W to table
S MTRANS 'need menu' to W
W PTRANS W to menu

W PTRANS W to table
W ATRANS menu to S

S MTRANS W to table
* S MBUILD choice of F
S MTRANS signal to W
W PTRANS W to table
S MTRANS 'I want F to W

W PTRANS W to C
W MTRANS (ATRANS F) to C

C MTRANS 'no F' to W
W PTRANS W to S
W MTRANS 'no F' to S
(go back to *) or
(go to Scene 4 at no pay path)

C DO (prepare F script)
to Scene 3

Scene 3: Eating
C ATRANS F to W
W ATRANS F to S
S INGEST F
(Option: Return to Scene 2 to order more;
otherwise, go to Scene 4)

Scene 4: Exiting

S MTRANS to W

(W ATRANS check to S)

W MOVE (write check)
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

(No pay path) S PTRANS S to out of restaurant

Triggering and Using Scripts

Susan passed her favorite restaurant on her way to the museum. She really enjoyed the new Picasso exhibit.

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.

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

John went to a restaurant. He was shown to his table. He ordered a large steak. He sat there and waited for a long time. He got mad and left.

Frames and Constraint Expressions in CYC

```
Mary
  likes:                    ???
  constraints:              (LispConstraint)
LispConstraint
  slotConstrained:          (likes)
  slotValueSubsumes:
    (TheSetOf X (Person allInstances)
        (And (programsIn X LispLanguage)
            (Not (ThereExists Y (Languages all Instances)
                (And (Not (Equal Y LispLanguage))
                    (programsIn X Y))))))
  propagationDirection:  forward
Bob
  programsIn:               (LispLanguage)
Jane
  programsIn:               (LispLanguage CLanguage)
```