

TOPIC: KNOWLEDGE REPRESENTATION

- CONCEPTUAL DEPENDENCIES
- SCRIPTS



CONCEPTUAL DEPENDENCIES

Conceptual Dependency theory is based on the use of limited number of primitive concepts and rules of formation to represent any natural language statement.

Sentences are represented as a series of diagrams depicting actions using both abstract and real physical situations.

- The agent and the objects are represented.
- The actions are built up from a set of primitive acts which can be modified by tense.
- Building blocks – entities, actions, conceptual cases, conceptual dependencies and conceptual tenses.



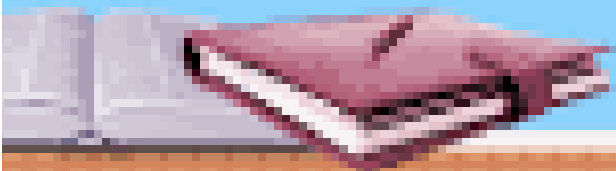
do example given on page 141 of reference book

Entities

- Picture producers (PP) – actors/physical objects including human memory that perform different acts.
- Picture aiders (PA) – supporting properties/attributes of producers.

Actions

- Primitive actions (ACTs) – actions.
- Action aiders (PA) – supporting properties/attributes of primitive actions.



Primitive actions	Intended meaning
ATRANS	Transfer of an abstract entity
ATTEND	Focusing attention on an object
CONC	To think about something
EXPEL	Expulsion of anything from the body
GRASP	Grasping or holding an object tightly
INGEST	Ingesting something
MBUILD	Building on information
MOVE	Moving a part of the body
MTRANS	Transfer of mental information
PROPEL	Application of force
PTRANS	Physical transfer from one location to another
SPEAK	Emitting a sound

Figure 7.10 Conceptual dependency primitive actions.



Conceptual cases

- All actions involve one or more of these
 - Objective case
 - Directive case
 - Instrumental case
 - Recipient case

Conceptual dependencies

- Semantic rules to form dependency structure
- Relationship between an actor and an event
- Relationship between primitive action and an instrument



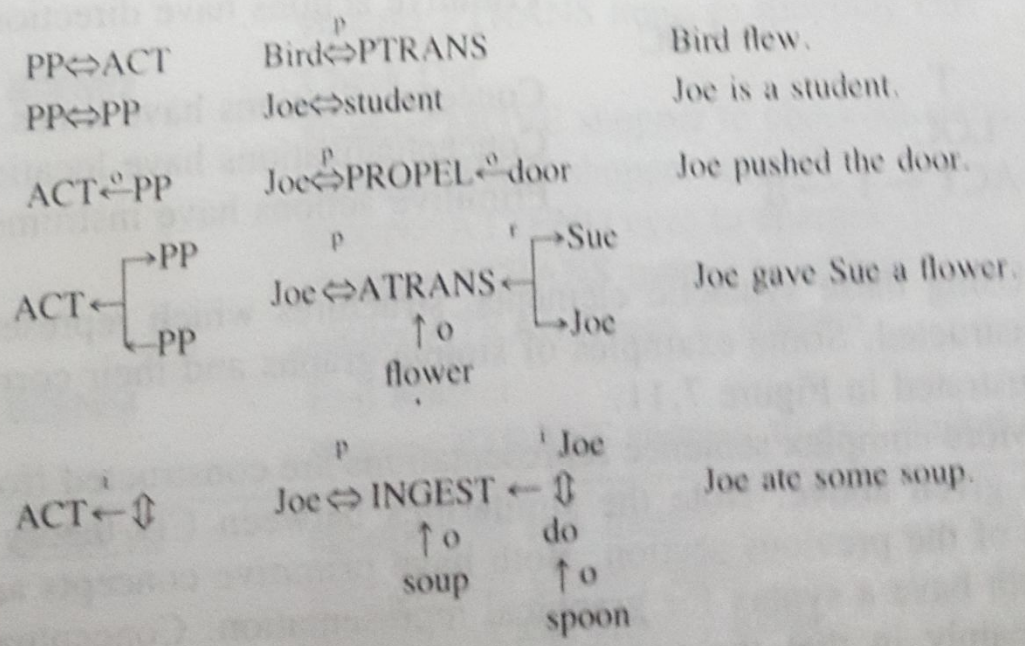
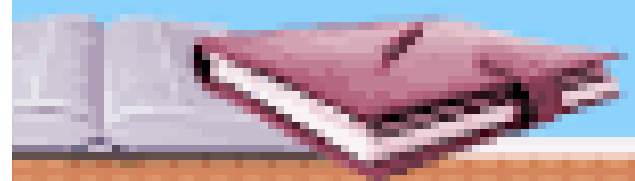
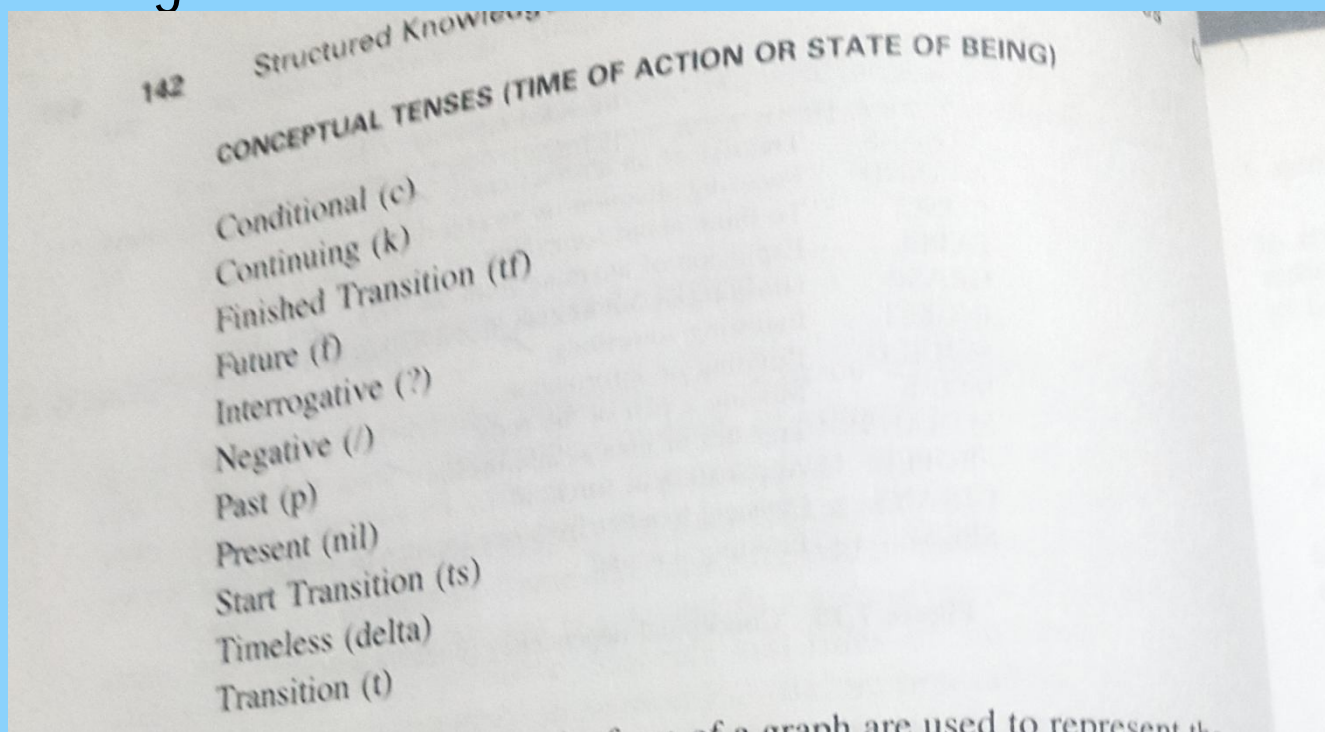


Figure 7.11 Some typical conceptual dependency structures.



Conceptual tenses

- Time of action
- State of being



Conceptual Tenses

Conceptual structures in the form of a graph are used to represent the meaning of different English (or other language) sentences. The graphs are constructed from elementary structures in accordance with basic syntax rules. Some of the basic concept rules are as follows.

PP ACT

Some picture producers perform primitive actions.

PP PA

Picture producers have attributes.

ACT ← O — PP

Primitive actions have objects.

ACT ← R — $\begin{cases} \rightarrow PP \\ \leftarrow pp \end{cases}$

Primitive actions have recipients.

ACT ← D — $\begin{cases} \rightarrow LOC \\ \leftarrow LOC \end{cases}$

Primitive actions have directions.

T
LOC

Conceptualizations have times.

ACT ← I — \updownarrow

Conceptualizations have locations.

Primitive actions have instruments.

Using these syntactic elements, structures which represent any sentence can be constructed. Some examples of simple graphs and their corresponding sentences are illustrated in Figure 7.11.



SCRIPTS

- Frame like structures used to represent commonly occurring experiences.
- Example –
 - Going to movie
 - Shopping in a supermarket
 - Eating in a restaurant
 - Visiting a dentist
- Components –
 - Actors
 - Roles
 - Props
 - Scenes



SCRIPT-NAME:	food market
TRACK	: supermarket
ROLES	: shopper deli attendant seafood attendant checkout clerk sacking clerk other shoppers
ENTRY	
CONDITIONS	: shopper needs groceries food market open
PROPS	: shopping cart display aisles market items checkout stands cashier money
SCENE1	: Enter Market shopper PTRANS shopper into market shopper PTRANS shopping-cart to shopper
SCENE2	: Shop For Items shopper MOVE shopper through aisles shopper ATTEND eyes to display items shopper PTRANS items to shopping cart
SCENE3	: Check Out shopper MOVE shopper to checkout stand shopper WAIT shopper turn shopper ATTEND eyes to charges shopper ATRANS money to cashier sacker ATRANS bags to shopper
SCENE4	: Exit Market shopper PTRANS shopper to exit market
RESULTS	: shopper has less money shopper has grocery items market has less grocery items market has more money

Figure 7.12 A supermarket script structure.

References/Resources

Dan. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall, 2004

Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed., 2009

NOTE: Please go through the reference book for details on the above topic and feel free to mail your doubts or discuss anything.



Assignment

7.1 Express the following concepts as an associative network structure with interconnected nodes and labeled arcs.

Company ABC is a software development company. Three departments within the company are Sales, Administration, and Programming. Joe is the manager of Programming. Bill and Sue are programmers. Sue is married to Sam. Sam is an editor for Prentice Hall. They have three children, and they live on Elm street. Sue wears glasses and is five feet four inches tall.

2 Write LISP expressions which represent the associative network of Problem 7.1.

- a. using property lists, and
- b. using a-lists.

3 Write PROLOG expressions which represent the associative network of Problem 7.1.

4 Transform the FOPL statements given below into equivalent conceptual graphs.

- a. $\forall x \text{ NORMAL}(x) \ \& \ \text{GROWN}(x) \rightarrow \text{WALK}(x).$
- b. $\forall x, y \text{ MARRIED}(x, y) \rightarrow \text{MARRIED}(y, x).$
- c. $\forall x \text{ HASWINGS}(x) \ \& \ \text{LAYSEGGS}(x) \rightarrow \text{ISBIRD}(x).$



Assignment

7.5 Transform the following conceptual graphs into equivalent FOPL statements.

a. [PERSON:sue] \leftarrow (AGENT) \leftarrow [DRINK]-

(OBJECT) \rightarrow [FOOD:milk]

(INSTRUMENT) \rightarrow [GLASS]

b. (PAST) \rightarrow [[CAMEL:clyde] \leftarrow (AGENT) \leftarrow [DRINK] \rightarrow (OBJECT)-

[WATER] \rightarrow (ATTRIBUTE) \rightarrow [50-GALLONS]]

6 The original primitives of conceptual dependency theory developed by Schank fail to represent some important concepts directly. What additional primitives can you discover that would be useful?

7 Create a movie script similar to the supermarket script of Figure 7.11.

8 What are the main differences between scripts and frame structures?

9 Express the following sentences as conceptual dependency structures.

a. Bill is a programmer.

b. Sam gave Mary a box of candy.

c. Charlie drove the pickup fast.

10 Create a frame network for terrestrial motor vehicles (cars, trucks, motorcycles) and give one complete frame in detail for cars which includes the slots for the main component

