Scripts

- Modified form of frames
- Help in representing stereo type of events that take place in day-to-day activities
- Specific properties of restricted domain can be exploited with special purpose structures
- Example
  - Going to hotel
  - Going to theatre
  - Going to supermarket
  - Leaving for workplace
  - Going to bank for withdrawal of money

Scripts

- It is special case of frame structure
- Captures situation in which information is stylized
- They also have slots , in each slot we have information about slot
- It tells
  - What happens in a situation
  - What event follows
  - What role every actor play

Scripts

- Are useful because in real world there are patterns to occurrence of events
- These patterns arise because of casual relationship between events
- These events form casual chain starting from entry condition and ending in result
- If particular script is applicable in a situation then it is useful in predicting the occurrence of event not given explicitly.
- Tells the relation between events like ordering and payment are different in restaurant script.
- Before applying a script it must be activated

Activation of scripts

- Depending upon how important the script is , it can be activated in two ways
  - For fleeing script
    - One which are not central to situation
    - Are mentioned briefly
    - May be referred frequently
    - Activation – store a pointer to script so that it can be accessed later if necessary
    - Eg Susan passed her favourite restaurant on her way to museum . She enjoyed new Picasso exhibit.
  - For non fleeting script
    - Activation is full
    - Attempt to fill slots with particular objects and people involved in current situation
    - Headers can serve as an indicator that script should be activated

Activation of scripts

- Once the scripts have been activated there are variety of ways in which it can be useful for interpreting a situation like
  - Interpreting an event that has not been explicitly observed
    - Eg " John went to 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."
    - Question " did john eat dinner last night?"
    - Ans- yes although not told explicitly

Activation of scripts

- Another use of script is to provide a way of building a single coherent interpretation from collection of observation.
  - Provides information as to how the events are related to each other
  - Casual chain of events
  - Eg " Susan went out to lunch. She sat down on a table and called the waitress . The waitress brought her a menu and she ordered a hamburger."
  - Question " why did waitress bring Susan a menu?"
  - Ans1: Because Susan asked for it. By moving backward in casual chain
  - Ans2: So that Susan can decide what she wanted to eat. By moving forward in casual chain.

Activation of scripts

– Third way in which script is useful is that it focuses attention of unusual events

- Eg" John went to a restaurant. He was shown his table. He ordered a large steak.He sat there and waited for a long time. He got mad and left.
- Important : place of departure
- Typical sequence of events is interrupted
- Hence other events which were following it cannot be interpreted . Infer :John did not made payment .
- Question " John got mad why?"
- Ans not because he was shown his table but because he waited for long time.

Components of script

- **Entry condition**: basic condition that must be fulfilled
- **Result**: what happens after script has occurred
- **Props**: Objects that are existing in script
- **Roles**: what various characters play is brought under slot (implicit or explicit)
- **Track:** represents a specific instance of generic pattern
- **Scenes**: sequence of activities are described in detail

Script : going to restaurant

Props: food

      tables

      menu

      money

Roles: owner

      customer

      waiter

      cashier

Entry condition

Customer is hungry

Customer has money

Owner has food

Results

Customer is not hungry

Customer has less money

Owner has more money

Owner has less food

Scene 1 entering the restaurant

Customer enter restaurant

scans the table

chooses the best table

decides to sit

goes there

occupies seat

Scene2 Ordering the food

customer ask for menu

waiter brings it

customer glances it

chooses what to eat

orders the item

Scene 3: eating food

waiter brings the food

customer eats it

Scene 4 paying the bill

ask for bill

waiter brings it

customer pays it

waiter hands over the cash to cashier

waiter brings the balance amount

customer tips him

Customer movers out of restaurant

Advantages and disadvantages

- Advantages
  - Permits one to identify what scene must have preceded, what event has taken place
  - Each action or event is described to minute detail
  - Gives single interpretation from variety of observation
- Disadvantages
  - It is difficult to share information across scripts
  - One script is true for one type of situation
  - Not generalized as they represent stereo – type of information

Conceptual Dependency Theory

- Schank's (1975) Conceptual Dependency Theory was developed as part of a natural language comprehension project.

- Schank's claim was that sentences can be translated into basic concepts expressed as a small set of **semantic primitives**.

- Conceptual dependency allows these primitives, which signify meanings, to be combined to represent more complex meanings.

- Schank calls the meaning propositions underlying language "**conceptualisations**".

Conceptual dependency

- It is theory of how to represent kind of knowledge about events that is usually contained in a natural language sentences.
- It is theory of NLP which mainly deals with representation of semantics of a language
- Overall goal is to represent knowledge in such a way
  - It facilitates inferences from sentences
  - Is independent of language in which the sentence were originally constructed
  - It facilitates to build question answer type of system, translation system etc.

Conceptual dependencies

- Because of these objectives CD are made of **conceptual primitives** which are combined to form meaning of words in a language.
- Theory was given by Shank 1973
- Unlike semantic net , CD provide both
  - structure to provide information within a sentence
  - Specific set of primitive at particular level granularity
  - Using such primitives , representation of particular piece of information can be constructed
- CD consist of two building blocks
- Building Blocks
  - **Primitive conceptualizations (conceptual categories)**
  - Conceptual dependencies (diagrammatic conventions)
  - Conceptual cases
  - **Primitive acts**
  - Conceptual tenses

CD building blocks

- There are four conceptual categories
  - ACTs — Actions
  - PPs — Picture producers, Objects
  - AAs — Action aiders, modifiers of action
  - PAs — Picture aiders , modifiers of PPs
- Dependency structures are **conceptualizations**
- They can serve as component of large CD structures
- Dependencies among conceptualization correspond to **semantic relations** of underlying concept.
- Some of the rules of CD as given by Shank is as follows:

Concept can be

- An **abstract** or **concrete** object that invokes an image
  - "cars" are concrete objects
  - "gravity" is an abstract concept
- An object (**nominal**) produces a picture (PP)

- Something an animate object **does**.
  - "running" is an action
- A modifier that **modifies** an object or an action.
- A modifier that **specifies** an action or a nominal.
  - "blue" is a PA modifier (e.g. A blue car)
  - "quickly" is a AA modifier (e.g. He quickly ran)

CD

- Conceptual categories (PP, ACT, PA and AA) relate to each other in specified ways. These relations are called **dependencies** by Schank.

- In a dependency relation, one partner or item is **dependent** and the other **dominant** or **governing**.

- A governor ⬚ dependent is a partially ordered relationship
  - A **dependent** must have a **governor** and is understood in terms of the governor
  - A governor may or may not have dependent(s) and has an independent existence
  - A governor can be a dependent

- PP and ACT are inherently governing categories.
- PA and AA are inherently dependent.

Representation in CD

Example: *I gave the man a book.* CD structure is

I ⟷ p ⟶ ATRANS ⟵ o ⟵ book → man / I
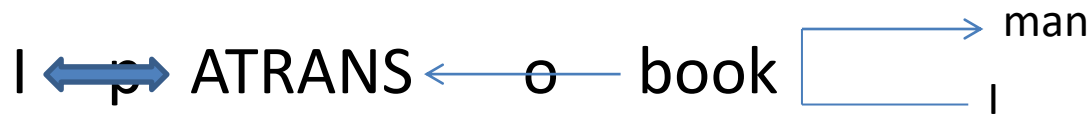
- Arrow : indicate the direction of dependency
- Double arrow indicate two way link between actor and action
- Tenses are represented as p for past, f for future etc,
- Case information like object is represented as o and R as recipient

Set of primitives acts

S.No	CD primitive	meaning and example
1	ATRANS	Transfer of abstract relationship (eg **give, take purchase**)
2	PTRANS	Transfer of physical location of an object (eg **go,walk,fly)**
3	PROPEL	Application of physical force to an object (eg **push,pull,throw)**
4	MOVE	Movement of body part by its owner (eg **kick,hit)**
5	GRASP	Grasping of an object by an actor (eg **clutch,catch)**
6	INGEST	Ingesting of an object by an animal **(eat,drink,smoke, breathe)**

6	INGEST	Ingest of an object by an animal (eg eat)
7	EXPEL	Expulsion of something from the body of an animal (eg weap,cry,sweat,spit)
8	MTRANS	Transfer of mental information between animals or within animal. Various sense organs serve as origins(eg tell, read, speak,sing,see)
9	MBUILD	Building a anew information out of old (eg decide, describe,imagine, consider, answer)
10	SPEAK	Production of sounds (eg say, tell, sing)
11	ATTEND	Focusing of a sense organ towards stimulus (eg listen, watch see,look)

Rules of CD`s

- Rule 1: relation between an actor and event he/she causes. Two way dependencies as none can be considered primary

  $$p$$

  – PP ⟷ ACT   John ⟷ PTRANS   John runs.

- Rule 2: Describes relations between a PP and PA
  – PP ⟷ PA   John ⟷ height(>avg)   John is tall.

- Rule 3: relation between two PPs
  – PP ⟷ PP   John ⟷ doctor   John is doctor
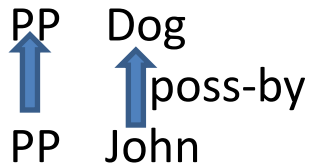
- Rule 4: relation between a PP and an attribute that has been already predicate of it

      PP   boy   A nice boy.
       ↑   ↑
      PA   nice

- **Rule 5**: describes relation between two PPs, one which provide some kind of information about other .three types of such information is
  - Possession (POSS-BY)
  - Location (LOC)
  - Physical containment (CONT)

PP   Dog

⬆️ ⬆️poss-by

PP   John

Consider the following sentences:

Possession
e.g. "This is Sally's cat":   Cat
⇑ POSS-BY
Sally

Location
e.g. "Sally is in London":   London
⇑ LOC
Sally

Containment
e.g. "The glass contains water":   Water
⇑ CONT
Glass

Rules of CD

- Rule 6: describes relation between ACT and PP that is **object** of ACT

$$ACT \overset{O}{\leftarrow} PP \qquad \text{indicates the object of an action.}$$

Example : John pushed the cart

$$John \overset{p}{\Longleftrightarrow} PROPEL \overset{o}{\longleftarrow} cart$$

- **Rule 7**: describes relation between an ACT and the **source and recipient**

ACT ← R ▶ PP / ◀ PP   indicates the recipient and the donor of an object within an action.
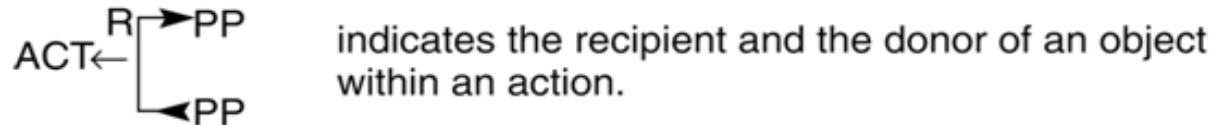
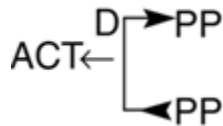Example: John took the book from Mary

Rule 8: describes relation between an ACT and the **instrument** with which it is performed

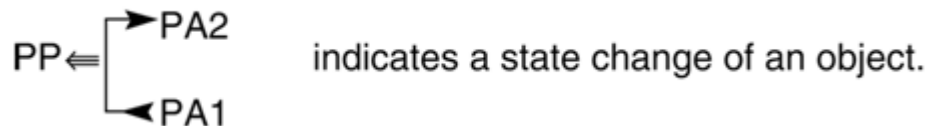ACT ← ⇕ 1   indicates the instrumental conceptualization for an action.
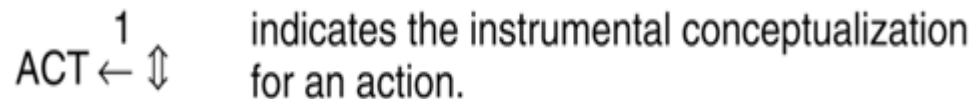
Example: John ate icecream with spoon

- Rule 9: describes relationship between an ACT and **its physical source and destination**

  Example : John fertilized the field

- Rule 10: represent relation between a PP and a state in which it **started and a state in which it ended**

 indicates a state change of an object.

   Example : Plants grew

Rules of CD

- Rule 11 describe relation between one concept and another that causes it. Arrow indicates the **dependency of one concept on another.**

X
↑
Y
   indicates that conceptualization X caused conceptualization Y.
When written with a C this form denotes that X COULD cause Y.

  Example : Bill shot Bob

- Rule 12:Describe relation between conceptualization and the **time** at which the event it describes occurs

Example John ran yesterday

- Rule 13: describes conceptualization another that is **time of first .**

  Example: While going home I saw a frog

- Rule 14 : describes the relation between a concept and **place** at which it occurred

  Example : I heard the frog in the woods

Language information

- CD can be modified to incorporate information indicated in a language tense , mood , aspect of verb form: **conceptual tenses**
    - Past   p
    - Future   f
    - Transition   t
    - Start transition   ts
    - Finish transition   tf
    - Continuing   k
    - Interrogative   ?
    - Negative   /
    - Conditional   c

Sentences	CD Representations

Jenny cried	p o d → ?
	Jenny ⇔ EXPEL ← tears ←──┐
	                             ← eyes
	                poss-by ⇑
	                          Jenny

Mike went to India	p d → India Mike ⇔ PTRANS ←──┐ ← ? (source is unknown)

Mary read a novel	p o d → CP(Mary)
	Mary ⇔ MTRANS ← info ←──┐
	                          ← novel
	
	        ↑ i (instrument)
	
	┌──────────────────────────┐
	│ p o d → novel │
	│ Mary ⇔ ATTEND ← eyes ←──┐ │
	│ ← ? │
	└──────────────────────────┘

Example

- Example for use of these tenses:
  - Since smoking can kill you , I stopped.
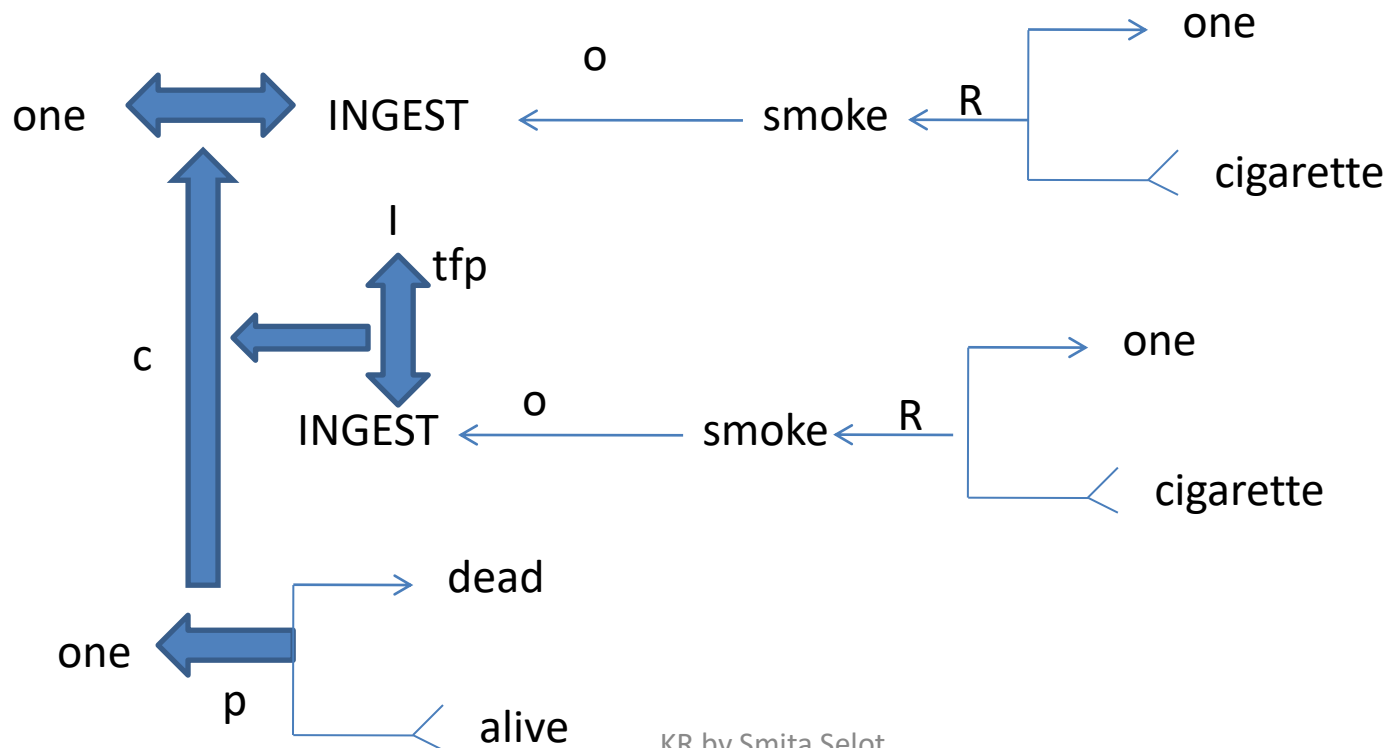
Inference

- There are 3 ways in which representing knowledge using conceptual CD facilitates reasoning with knowledge
  - Fewer inference rules are required
  - Many inference are contained in the representation itself
  - Initial structure that is built to represent the information contained in one sentence will have holes that need to be filled

Examples

- Birds flew.
- Bill is programmer.
- Susan gave box of candy to Joe.
- Charlie drove pickup fast.
- John met with an accident on road.