

FRAMES (SCHEMAS) for "stereotyped" packets of knowledge (Minsky 1975)

When you open the door...



What do you expect??



(Rochester, D&C, 1996)

FRAMES

"Packets" of information about a certain thing or kind of thing

- slots & values
- types of values
- default values
- type hierarchies
- frame systems --- eg, views of an object

mother ANN
 mother (a WOMAN)
 citizenship (a COUNTRY
 with default USA)
 isa PERSON

[BETTY isa PERSON with
 mother ANN
 father CARL
 citizenship CANADA
 age 29
 occupation DENTIST
 car (a HONDA)
 hobbies (a-set (one-of PAINTING, SKY-DIVING))

(a DENTIST)

with cardinality 2

]

cf db's, 1960 AI
 (Thanks, Marvin)
 But the idea of default values (later)
 is important

Logically:

PERSON (BETTY) \wedge
 mother (BETTY) = ANN \wedge
 father (BETTY) = CARL \wedge
 citizenship (BETTY) = CANADA \wedge
 age (BETTY) = 29 \wedge ← individual!
 occupation (BETTY) = DENTIST \wedge
 HONDA (car (BETTY)) \wedge
 hobbies (BETTY) = set-of (PAINTING, SKY-DIVING)

[ES isa EAT with
 agent JOHN1
 theme (a PIZZA) or theme PIZZA3
 Location LIVING-ROOM4?
 day 10/15/09
 time 12:00am
 manner GREEDY
 enjoyment +10]

Indefinite frame types

(a PIZZA) $\lambda x \text{ PIZZA}(x)$

(a PIZZA with topping PEPPERONI)

$\lambda x [\text{PIZZA}(x) \wedge \text{topping}(x) = \text{PEPPERONI}]$

(a PIZZA with topping (a MEAT-TOPPING))

$\lambda x [\text{PIZZA}(x) \wedge \text{MEAT-TOPPING}(\text{topping}(x))]$

(a PIZZA with topping (one-of PEPPERONI, MEATBALLS))

$\lambda x [\text{PIZZA}(x) \wedge (\text{topping}(x) = \text{PEPPERONI} \vee \text{topping}(x) = \text{MEATBALLS})]$

$\lambda x [x = \text{PEPPERONI} \vee x = \text{MEATBALLS}]$

(a PIZZA with topping (a-set (a TOPPING) with cardinality 2))

$\lambda x [\text{PIZZA}(x) \wedge \exists S. (\forall t. \text{in}(t, S) \Rightarrow \text{TOPPING}(t)) \wedge \text{topping}(x) = S \wedge \text{cardinality}(S) = 2]$

(a PIZZA with topping (a-set (one-of PEPPERONI, MEATBALLS) with cardinality 2))

DEFINITIONS - partial & full

(Define PERSON inherits-from

(a CREATURE with name (a STRING)
home-address (a ADDRESS)
age (a NUMBER))

$\forall x. \text{PERSON}(x) \Rightarrow \text{CREATURE}(x) \wedge$
 $\text{STRING}(\text{name}(x)) \wedge$
 $\text{ADDRESS}(\text{home-address}(x))$
 $\text{NUMBER}(\text{age}(x))$

(Define BACHELOR as

(a PERSON with sex MALE
marital-status SINGLE))

$\forall x. \text{BACHELOR}(x) \Leftrightarrow \text{PERSON}(x) \wedge$
 $\text{sex}(x) = \text{MALE} \wedge$
 $\text{marital-status}(x) = \text{SINGLE}$

DEFAULT VALUES

Eg., by default, the color of a canary is YELLOW;
 by default, a car has 4 wheels, 4 doors, ...
 by default, a flight booked by a customer
 in Rochester starts in Rochester

Define BOOKING-RECORD as
 (a RECORD with flight-date (a DATE)
 source (a CITY with default ROCHESTER)
 dest (a CITY)
 airline (a AIRLINE)
 fare (a NUMBER))

$\forall x. \text{BOOKING-RECORD}(x) \Leftrightarrow$
 RECORD(x) \wedge
 DATE(flight-date(x)) \wedge
 CITY(source(x)) \wedge default(source(x)) = ROCHESTER
 ... etc

In particular cases,
 use this to assume
 source(x) = ROCHESTER
 if no information to the contrary
 is received

PROCEDURAL ATTACHMENT

Suppose BOOKING-RECORD allows multiple
 travellers ...

source ...
 dest ...
 airline ...
 fare ...
 travellers (a-set PERSON) current frame instance
 total-fare $[(* (\text{cardin} (\text{travellers SELF})) (\text{fare SELF}) 1.08)]$ tax

B & L call this type of procedure "IF-NEEDED".
 They also allow "IF-ADDED" procedures that
 do some extra work when a slot value is
 supplied. E.g.,

source ...
 dest ...
 next-leg (a BOOKING-RECORD)
 [IF-ADDED
 (setf (previous-leg (next-leg SELF))
 SELF)]

(i.e., make the next leg point back to this leg;
 B & L's access specification actually looks like
 SELF:next-leg:previous-leg \leftarrow SELF)