Semantic Knowledge

- What is meaning? Can it be represented and processe

  How can we computationally model semantic knowledge?

  How does semantic processing articulate with syntactic processing? 4.2

© António Branco

q **Semantic knowledge is the k**

q ·.what is the meaning

of natural language expressions? 4.3

Well, the meaning sees João with th

4.4

knowledge

q

To know the meaning of a declarative sente

Semantic knowledge

i.e. the conditions in which f is

i.e. how the world is when f is true

By the way: what is the meaning of imperative and interrogative s

To describe the meaning of f is to describe (represent/determine)

the truth conditions of f

with a language 4.5

like any description, the description of the truth conditions

Semantic representation

q

Description

the description of the truth conditions of the sentences of the target la

Meta-language

. The meta-language can be another natural langua

. Exs:
.

The sentence

O Pedro é careca

is true iff Pedro is bald. ·

The sentence

is true iff Pedro is bald. ·

O Pedro é careca

:

Description, Translation a

Translation The significant part of the descr

q

in the translation of f into the meta-language L·:

Portuguese

. Meta-language L·

: English

. Sentence : O Pedro é careca

Sem. repr. : **O Pedro é careca** is true iff Pedro is bald

Translation : Pedro is bald *q*

Synonymy : f' from L' is a translation of f from L iff Pedro é careca

; **Pedro is bald** , C(p);

: 4.7

careca(pedro)

Meta language Formal representation of meaning

translation into a

. well-defined expressions (w

. support for the automation of reasoning

q Options

. FOL, First Order Logic

. GQ, Generalized Quantification Logic

. DRT, Discourse Representation Theory

. ... 4.8

q Syntax (

quick sketch

)

Language of semantic representation

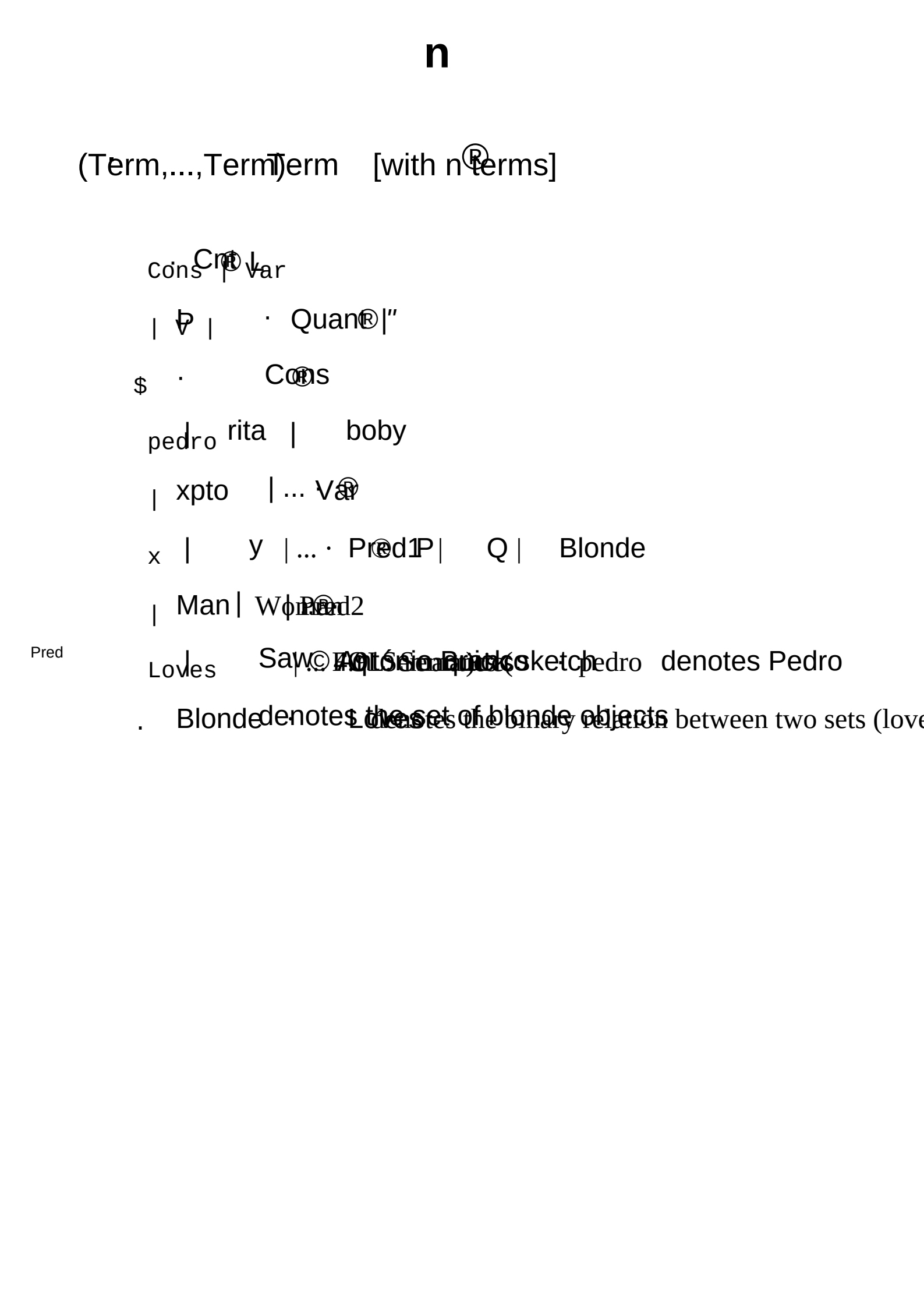
. F

® Fatom | F Cnt F | Quant Var, ...,Var F | ¬F | (F)

. Fatom

n

(Term,...,Term) Term [with n terms]



F2 is true iff F1 is true a

. F1 V F2 is true iff F1 is true or F2 is true. ¬F1 is true iff F1 is not true

. F1 Þ F2 is true iff if F1 is true then F2 is true

xPred(x) is true iff denoted by at least one object in the set

" xPred(x) denoted by

Pred is true iff all objects belong to the set

Pred

what is the semantics of

Pred(António Branco)

Some translations

Rita is blonde. Blonde(rita)

Pedro loved himself. Loves(pedro, pedro)

Rita loved Pedro. Loves(rita, pedro)

Pedro loved Rita. Loves(pedro, rita)

Rita loved Pedro and Pedro loved himself. ¬(

Loves(rita, pedro))

Ù xLoves(x, x)

Loves(pedro, pedro)

There is at least one man (in this city, in this universe,...). $

© António Branco

More translations

x(Blonde(x))

Everyone is blonde. " Everyone was a blonde man. "

x(Man(x)

All men are blonde. "

x(Man(x)

Þ

Blonde(x))

All women love a man. "

x (Woman(x)

Þ $ (Man(y)

Love(x,y)))

Blonde(x)) $y (Man(y)

Love(x,y)))

Þ

Calculation of what we already know how to do

What we still don't know how to do

how to represent the meaning of (some) lexical items

Pedro pedro

Rita

rita love(,) how to represent the meaning

x (Woman(x)

What we still don't know how to do

How to combine the meaning of (some) lexical items

· the meaning of an expression

subexpressions and the way they are combined

- Also a natural imperative imposed by the finitude of men
  - Formal tool
    - a tool that dispenses us from creating "a symbo
    - a priori
    - (in the lexicon) the semantic representation
    - of each of an infinite number of grammatical e
    - Lambda formalism

- Rationale:

. Allows "creating functions from the combination o

Principle of compositionality:

applied to variables"

Allows ·to open the arity· of an expression

Abstraction-

Example2:

Example 1:

Blonde

Predicate

x.(Blonde(x)

Bald(x))

Sentence Blonde(x)

x.Blonde(x)

. Sentence

l x.Blonde(x)(pedro)
q
b
Reduction-

. Example:

. sentence l

x.Blonde(x)(pedro)
Blonde(pedro)
4.15 © António Branco sentence
for A compositionalsimple semantics
a fragment
of q Lexical semantics
Portuguese · V
Form
Meaning

l ® loves Pred

® l y. l
x. Love(x,y) Nprop
Pedro ®
Cons

Nprop® Rita Cons

rita4.16 © Antonio Branco

- Structural semantics

  - Semantic rule 1, for SN:

    - If SN → *Det Nprop* and the semantic representation of *Det* is *Det'* and the semantic representation of *Nprop* is *Nprop'*,

      then the semantic representation of SN is *Det'(Nprop')*.

  - Semantic rule 2, for SV:

    - If SV → *V SN* and the semantic representation of *V* is *V'* and that of *SN* is *SN'*,

      then the semantic representation of SV is *V'(SN')*.

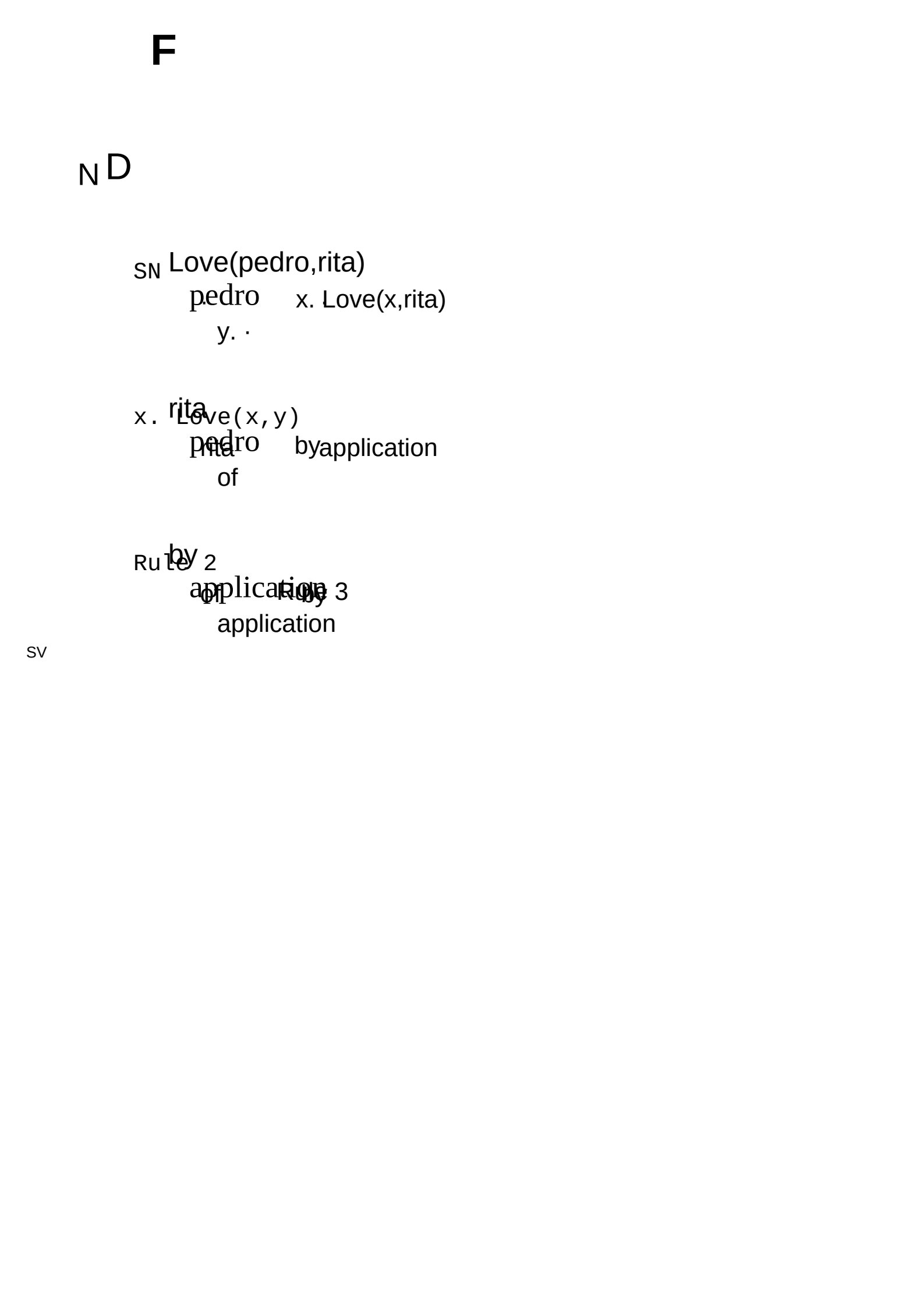
  - Semantic rule 3, for S:

    - If S → *SN SV* and the semantic representation of *SN* is *SN'* and that of *SV* is *SV'*,

      then the semantic representation of S is *SV'(SN')*. 4.17

  - Example: *Pedro loves the Rita*

    - N D


F
N D
SN Love(pedro,rita)
pedro
x. Love(x,rita)
y. .
x. rita
Love(x,y)
pedro
rita
by application
of
Rule 2
by
application
of
Rule 3
application
SV

4.18

·Mimic· reductio
Encode translations to the met
· instantiation
ex:

q

q ·Mimic· abstraction-
·
ex:
sv(SV) → v(SV), sn(SN). 4.19

analysis

love(X,Y)

q

semantic Automatic Þ Prolog terms

Associate each variable with a value(X,Y) ... exp.: exp

Rule 1

no **the pedro loves the** **love(pedro,**

sn(pedro)

v(Y^X^love(X,Y))

sv(X^love(X,rita))

sn(rita)

n(pedro)

n(rita)

det

4.20

. Conclusion

. q

Index

· Semantic knowledge

Metalanguage

Compositionality

Automatic semantic analysis

How to represent the semantics of remaining

in technological solutions?

sv(SV) --> v(SN^SV), sn(SN). f(F) --> sn(SN), sv(SN^F). sn(N) --> det, n(N). v(Y^X^love(X,Y)) --> [loves]. n(pedro) --> [pedro]. n(rita