OpenLogos and Logos Model

CmpE590 Research Project Presentation - Atakan Yuksel
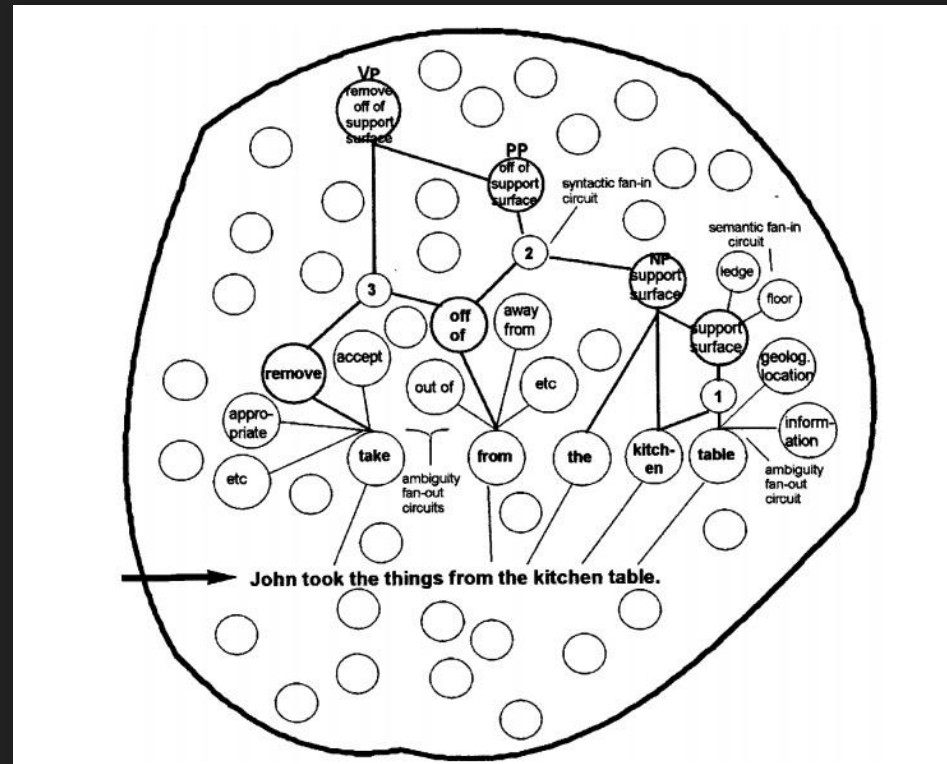
Outline

- What is Logos Model and Historical Background
- Architecture of Logos Model
- Semantico-Syntatic Abstraction Language (SAL)
- Logos Model Rules
- Rule Matching
- Limitations of Logos Model
- References

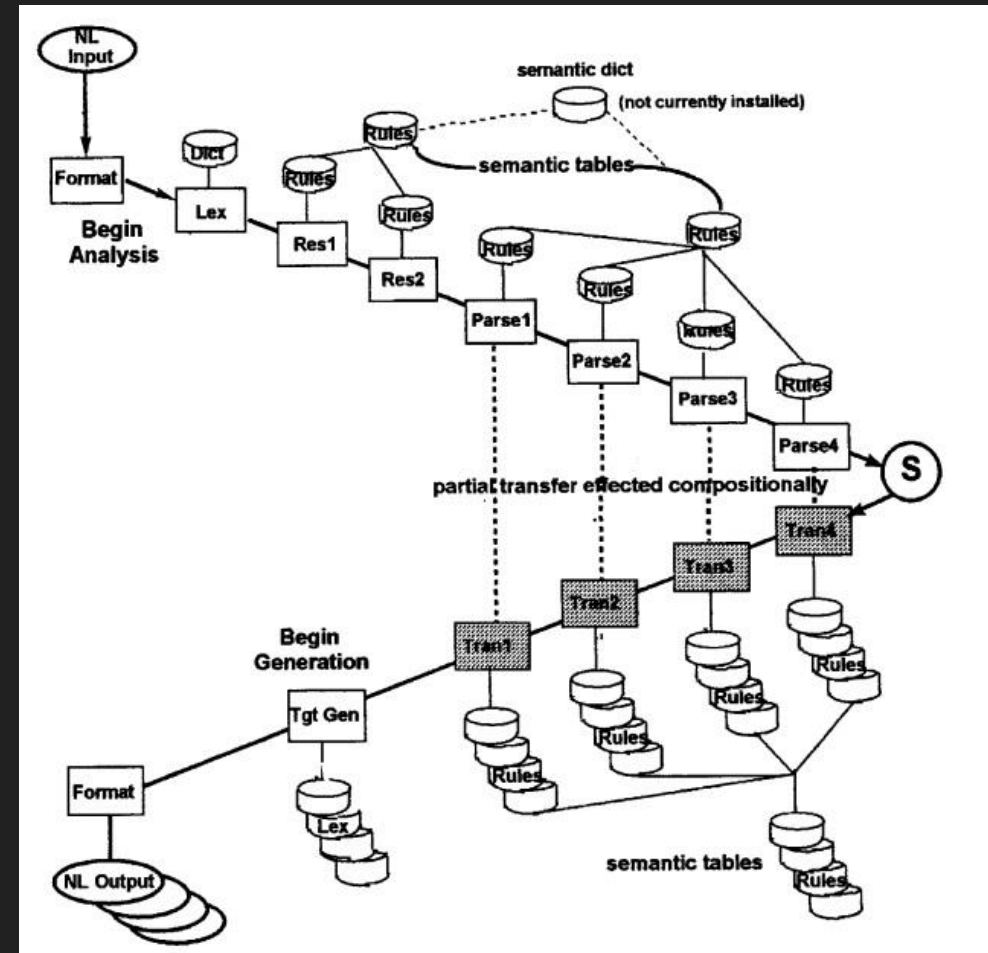# Logos Model and Historical Background

- Requested by US Presidency during Vietnamese War
- Four years later after ALPAC Report (Milestone)
- Rule-Based MT System
- Semantico-Syntactic Abstraction Language
- Mental Process

Architecture of Logos Model

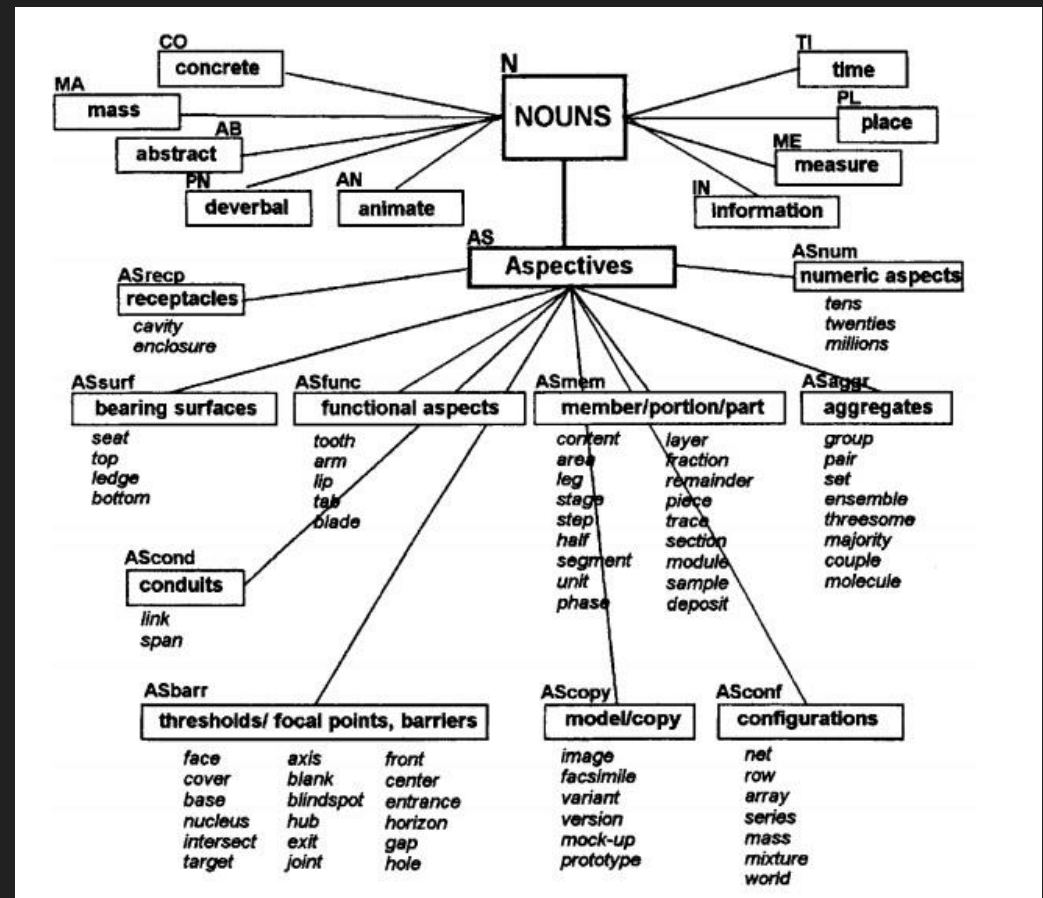John took the things from the kitchen table.

Architecture of Logos Model

- Incremental Approach
- Input analysis RES1,2 and Parse1,2,3,4
- Decoding Tran1,2,3,4

Semantico-Syntatic Abstraction Language (SAL)

- Representation of natural language
- Semantic and Syntactic Information
- WC(Type; Form)
- Hierarchical Organization

Semantico-Syntatic Abstraction Language (SAL)

Literal level	*highchair*
Head morpheme	*chair*
SAL subset	**COsupp** ('concrete noun', 'support surface')
SAL set	**COfunc** ('concrete noun', 'functional device')
SAL superset	**CO** ('concrete noun')
Word class	**N**

Semantico-Syntatic Abstraction Language (SAL)

(1) a.   I like the <u>ham</u> and <u>cheese sandwiches</u>.

   b.   *J'aime les   sandwichs   de jambon et   de fromage.*
             THE SANDWICHES OF HAM   AND OF CHEESE

   c.   *Mir gefallen Schinken- und Käsestullen.*
             HAM-   AND CHEESE-SANDWICHES

(2) a.   I never go to that *bank* or *TV store*.

   b.   *Je ne vais jamais à   cette banque ou à   ce   magasin télévision*
                          TO THAT BANK   OR TO THAT STORE   TELEVISION

   c.   *Ich gehe nie zu jener Bank   oder Fernseh   Lager.*
                    TO THAT BANK OR   TELEVISION STORE

(3)   N(X; SG) CJ(CRD; u) N(X; SG) *N(u; u) → NP

Semantico-Syntatic Abstraction Language (SAL)

(4) a.   corn eating insects

b.   *les   insectes   qui   mangent le   maïs*
THE INSECTS WHICH EAT   THE CORN

c.   *Maisessen-Insekten*
CORN-EAT INSECTS

(5) a.   insects eating corn

b.   *les   insectes   qui   mangent du   maïs*
THE INSECTS WHICH EAT   OF-THE CORN

c.   *Insekten, die   Mais   fraßen*
INSECTS WHICH CORN ATE

Semantico-Syntatic Abstraction Language (SAL)

(7) a. John kept driving the old car.

    b. *John fuhr das alte Auto weiter.*

       JOHN DROVE THE OLD CAR ADDITIONALLY

(8) a. John kept the old car.

    b. *John behielt das alte Auto.*

(9) a. John kept the new car in the garage.

    b. *John bewahrte das neue Auto in der Garage auf.*

Logos Model Rules

- Source Rules (Patterns, Actions, Constraints)
- Target Rules (Actions, Source Rules)
- SemTable (Semantic Analysis)

Source Rule - Example

NL Input:	*an all-purpose sweater*
SAL Input String:	`DET(IDEF; SG) AJ(NAVpred; u) N(COcloth; SG)`

First Rule:

Pattern:	`DET(u; SG) * N(u; SG)`
Constraint:	None
Action:	(i) Attaches `DET` to head `N`;
	(ii) backspaces all but one.

Second Rule:

Pattern:	`AJ(u; u) N(u; u)`
Constraint:	None
Action:	(i) Attaches `AJ` to `N`;

Third Rule:

|	
Pattern:	`N(u; u)`
Constraint:	None
Action:	(i) → `NP`; all elements forming the NP are concatenated as `NP`. `NP` has SAL *Type* and *Form* of head noun, with an indication (in Form field) it is an indefinite `NP`;

SemTable

Semantic Table (SemTab) rule comment line	Transfer
place(vt) N(advertisement, announcement,ad)	FR:*placer N*
	PT: *colocar N*
place(vt) N(order)	FR:*passer N(commande)*
	PT: *fazer N(encomenda)*
place(vt) N(restriction,constraint) on	FR: *imposer N à*
	PT: *impor N a*
place(vt) N(importance) on	FR: *attacher de l'N à*
	PT: *dar N a*
place(vt) N(pressure) on	FR: *faire N(pression) sur*
	PT: *exercer N(press ao) sobre*
place(vt) N(confidence,trust) in N(AN)	FR: *placer N dans N*
	PT: *depositar N(confiança) em N*

Rule Matching

- RES – Single pass, macroparsing
- PAR – 4 parsing module
  - Simple NP formation, scoping of adjectives, auxiliary verb phrase analysis, analysis of adverbial phrase, resolution of -ing, relabeling of should etc., analysis of 'as' and 'any
  - PP attachment problem, analysis of relative clauses
  - Resolution Verbs and noncontiguous verbs
  - intraclausal tense assignment, interclausal verb tense/mood coordination, pronoun resolution

Pipeline
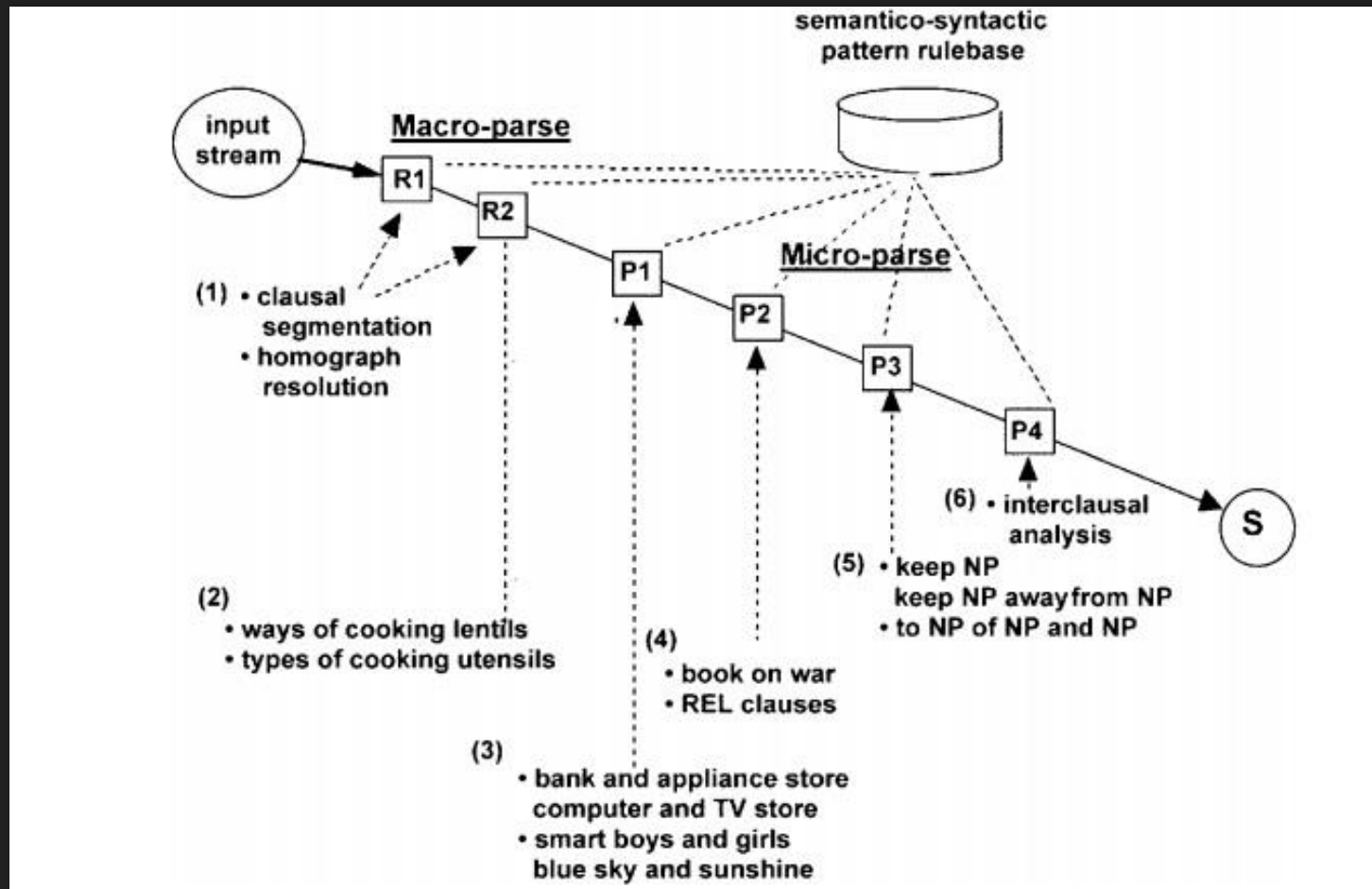
Limitations

- Rule based system – Complexity of SAL Rules

References

- [1] - Bernard (Bud) Scott, "*The Logos Model: An Historical Perspective*" Machine Translation March 2003, Volume 18, Issue 1, pp 1–72

- [2] - Anabela Barreiro et al. "*OpenLogos machine translation: philosophy, model, resources and customization*" Machine Translation/ June 2011, 25:107

- [3] - SCOTT, Bernard; BARREIRO, Anabela. "OpenLogos MT and the SAL representation language". En: Proceedings of the First International Workshop on Free/Open-Source RuleBased Machine Translation / Edited by Juan Antonio Pérez-Ortiz, Felipe Sánchez-Martínez, Francis M. Tyers. Alicante : Universidad de Alicante. Departamento de Lenguajes y Sistemas Informáticos, 2009, pp. 19-26

- [4] - John R. Pierce and John B. Carroll. 1966. *Language and Machines: Computers in Translation and Linguistics*. National Academy of Sciences, Washington, DC, USA.

- [5] - https://sourceforge.net/projects/openlogos-mt/files/

Thanks

Thank you for listening