

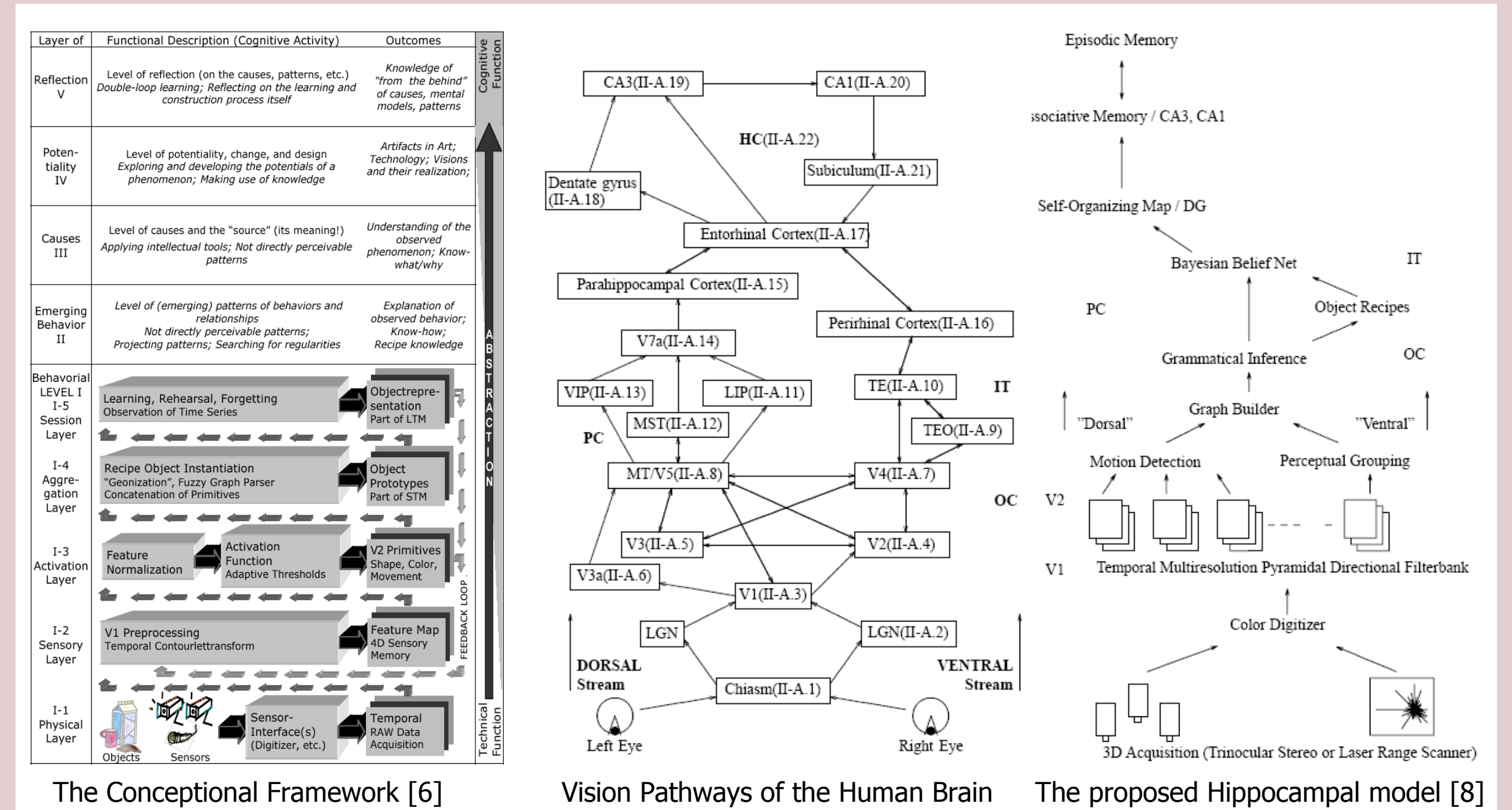
## Objectives and Abstract

- Computer **vision performance** has successfully reached **certain maturity** on dedicated tasks
- Solutions use **discriminative<sup>1</sup>**, **generative<sup>2</sup>**, or also **hybrid methods** as combinations of both
- However, performance declines rapidly whenever solutions are applied to complex tasks (i.e. achieved intelligence level is still more or less at **"insect-like" mechanics**)
- State-of-the-art computer vision is still too **inflexible** and **lacks self-understanding**
- Understanding** can be seen as a psychological process related to a particular object, whereby one gets able to think about it and to apply knowledge to use it for a specific task
- Knowledge** is the outcome of information that an active "knower" already has learnt; adaptive structures are able to generate knowledge in self-organizing manner
- Organizations** are structures of mutual expectation attached to roles which define what each of its members shall expect from others and from himself
- Text** is a form of organization of **complex knowledge**; organizing can be seen as applying linguistic grammar in the sense of a systematic account of some rules
- Humans are able to organize **linguistic knowledge** more or less unsupervised
- Evidence from fMRI and PET studies** show brain areas, activated during linguistic tasks, such as natural language processing, are also activated during object recognition [4]

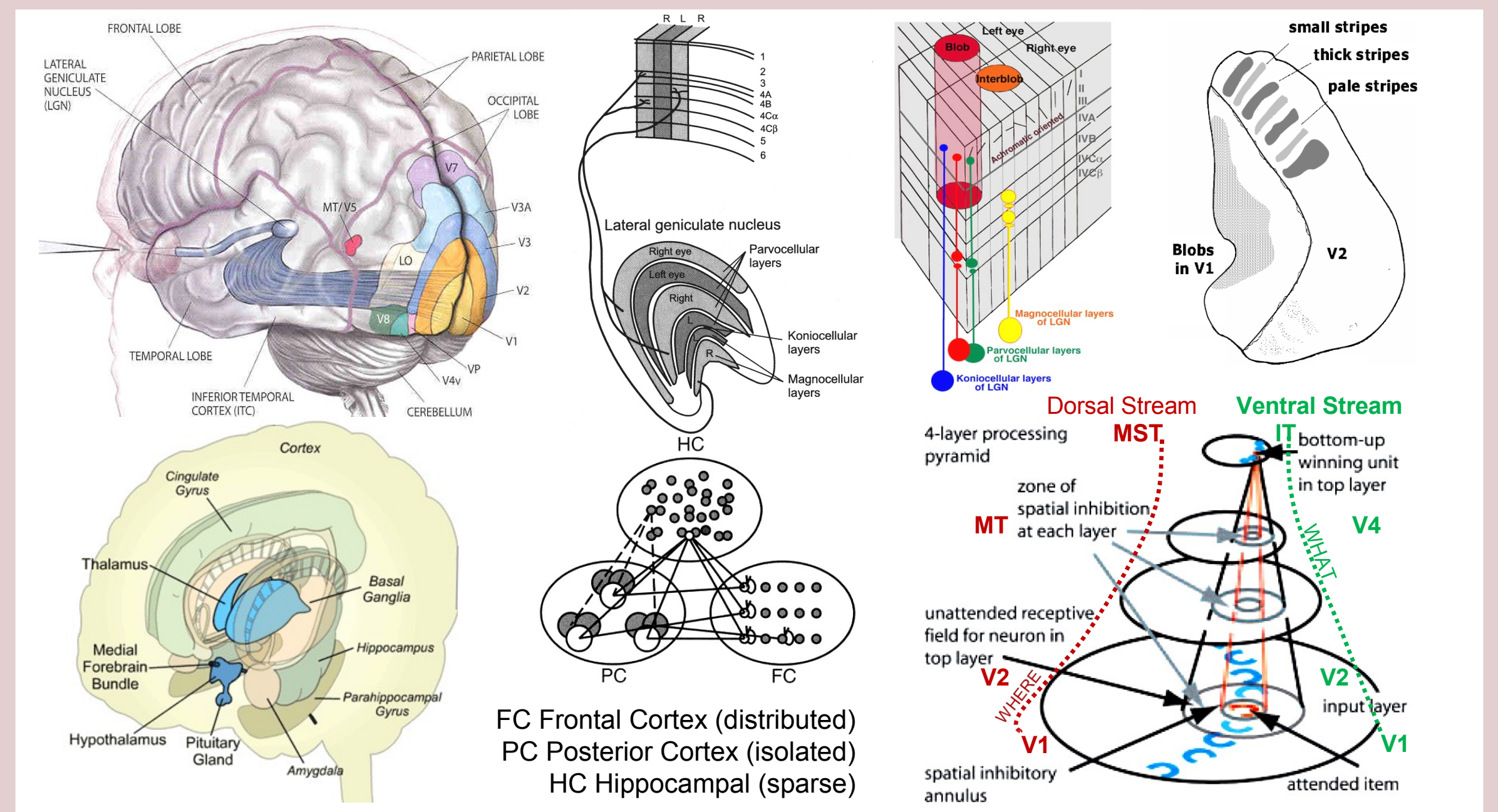
- Therefore, in our work, we recently defined a **homomorphism** between **linguistics** and human **object representation** in order to get able to utilize best way studied and efficiency proven **linguistic concepts**, such as grammar, semantics and semiotics for computer vision modeling
- We propose a new hybrid approach, inspired from neuropsychological findings of the mammalian brain, in particular, a stochastic **Hippocampal-like model** to **computer vision understanding**
- First results show the **successful application** of our defined conceptual framework to vision modeling of hedronal objects by implementing the chain – acquisition – feature extraction – perceptual grouping into primitives – grammatical inference – self-organizing categorization – pattern completion – and pattern separation [8]

<sup>1</sup>SVM, Neural Networks, Conditional Random Fields, etc., by modeling directly the posterior  
<sup>2</sup>Monte Carlo sampling, Meta heuristics (e.g. EDAs), etc., by modeling both, likelihood and prior

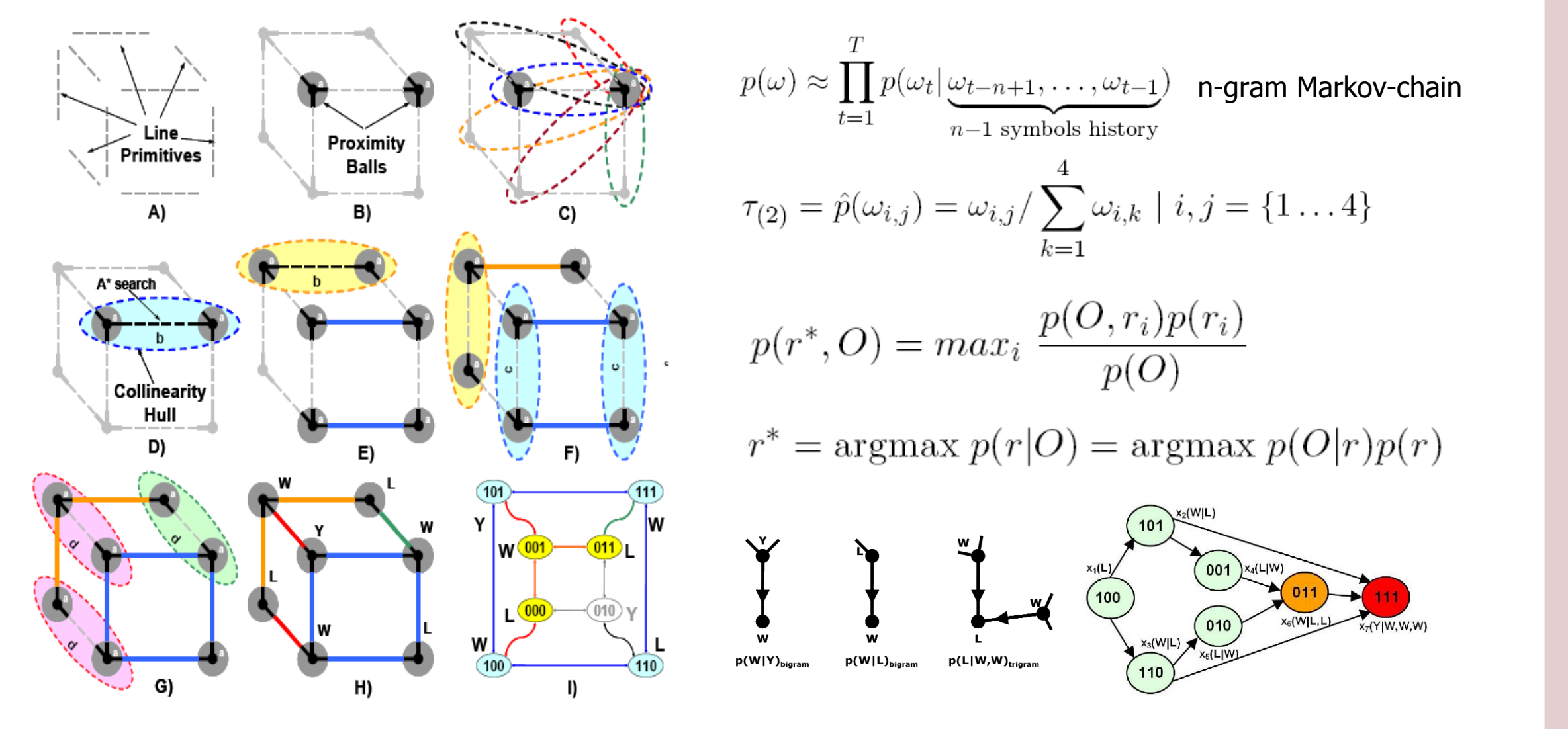
## The Proposed Model



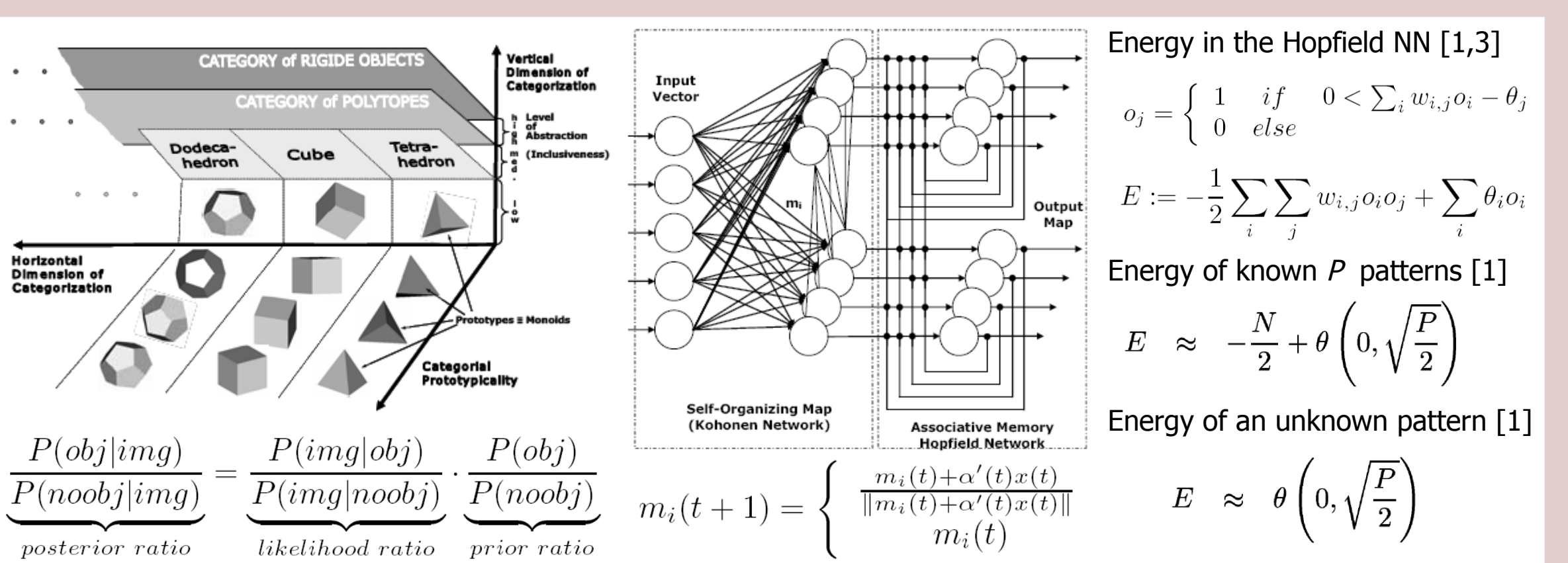
## Human Brain Units [2,6]



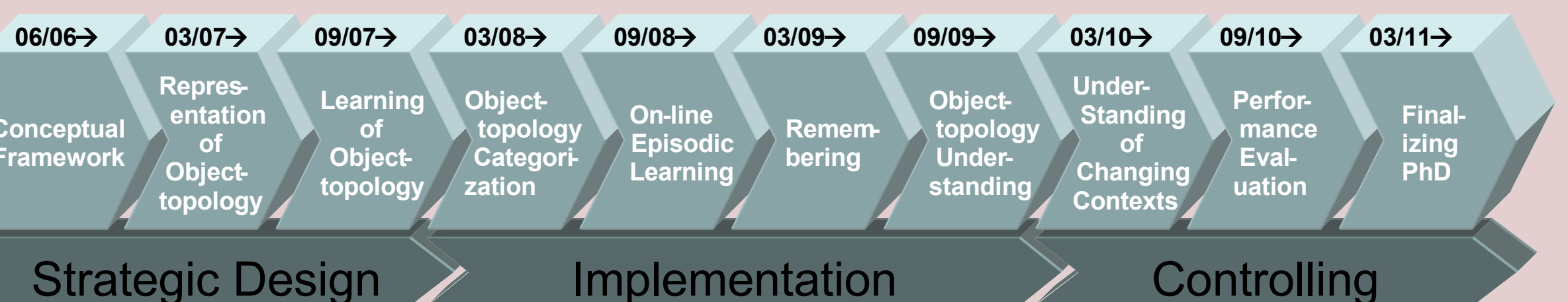
## n-gram Grammatical Inference [7]



## Categorization, Self-Organization, Novelty Detection [8]



## Outlook on Further Work



## Selected References

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- [4] A. Martin. The Representation of Object Concepts in the Brain. Annu. Rev. Psychol. 2007.58:25-45
- [5] D. Denison, E. Keizer, and G. Popova, editors. Fuzzy Grammar: Principles of Categorization. Oxford Univ. Press, 2004.
- [6] P. M. Goebel and M. Vincze. Vision for cognitive systems: A new compound concept. In LNCS, INDIN 07, Austria, 2007.
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