Introduction to Semantic Structures

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One of the few things that could still interest Felka was emergence. On Diadem, the first world they had visited after leaving Mars in the very first near-light ship, Clavain, Galiana and she had studied a vast crystalline organism which took years to express anything resembling a single 'thought'. Its synaptic messengers were mindless worms, burrowing through a shifting neural network of capillary ice channels threading an ageless glacier.
From "*Redemption Ark*", Chapter 7, Alastair Reynolds, 2002

"You are insane."
She considered. "Well, it is possible, if by 'sane' we mean operating in the functionally predictable attractor volume of mental phase space. I am definitely not that."
From "*Inhibitor Phase*", Chapter 9, Alastair Reynolds, 2021

"Is he coming back?"
"Slowly. I used reefersleep to flood him with mnemonovores. The blockades create distinctive association structures. The mnemonovores target them preferentially, leaving authentic memories intact and help reconsolidate pathways that have been left to wither. It is not perfect, but.."
From "*Inhibitor Phase*", Chapter 10, Alastair Reynolds, 2021

It is a messenger sprite, flying between two nodes. Packaged with information at its point of origin, sent off to be received and digested by the recipient node. These sprites are what they use when a large packet of information needs to be conveyed very rapidly.
From "*Inhibitor Phase*", Chapter 25, Alastair Reynolds, 2021

Things have been going wrong inside them for millions of years – slow failing. Entropic breakdown. All systems succumb in the end, even ruthless machine ones.
From "*Inhibitor Phase*", Chapter 27, Alastair Reynolds, 2021

Basic concepts

Semantic Aspect

Fundamental concept in the theory of Semantic Structures.

Semantic Property

Primitive Semantic Particle

The property set of the primitive semantic particle V will be denoted with $sprop(V)$ or short $\mathcal{P}(V)$.

Semantic Structure; also Composite Semantic Particle

Semantic Distance between semantic structures

Usually, it will be denoted with $sdist(S_1, S_2)$ or short $\ell(S_1, S_2)$.

Association / Semantic link between Primitive Semantic Particles

It will be denoted with $A_{i,j}$ where i is the subscript corresponding to first primitive particle and j is the subscript corresponding to the second one.

Association / Semantic link between Semantic Structures

Aggregation level of semantic structure

Let us consider the semantic structure S_1. S_1 contains n_1 primitive semantic particles; we will denote this set with $\mathcal{S}_1 = \{S_1\}$. Thus, $|\mathcal{S}_1| = |\{S_1\}| = n_1$. Let us denote with $\{\{S_1\} \circ \{S_1\}\}$ the set of distinct pairs of primitive semantic particles from the set $\{S_1\}$. With m_1 we denote the number of elements in $\{\{S_1\} \circ \{S_1\}\}$. Obviously, $m_1 = (n_1 - 1) + (n_1 - 2) + \cdots + 1 = \frac{n_1(n_1-1)}{2}$. Let us sort these m_1 pairs by semantic distance. Let us denote with d_{min} the minimal distance between the particles in a pair and with d_{max} the maximal distance observed in a pair from $\{\{S_1\} \circ \{S_1\}\}$.

Logical view versus Physical view of Semantic Structures

Definition: Instance of a semantic structure