# Modeling attractive and repulsive forces between semantic structures

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## Initial Notes

The attractive / repulsive force between semantic structures (**SARF**) acts on different (larger) scales compared to the attractive / repulsive force between properties (**PARF**).

Discovery of mutual attraction happens through regional exploration. Let us have a new semantic structure $S$ constructed from recently parsed data. The chances are that all semantic structures which are attracted to $S$ are in the vicinity of $S$.

Let us consider a newly formed semantic structure $S_1^{new}$. The closest semantic structure will be denoted with $S_0$. On an aggregation level $l_1$ the nearby semantic structure $S_0$ can be represented as a graph of $n_{l_1}$ substructures all of which belong to the set $\{S_0\}_{l_1}$. With $2^{\{S_0\}_{l_1}}$ we denote the power set of $\{S_0\}_{l_1}$.
We want to compute the attractive force between $S_1^{new}$ and $S_0$. Let us assume that in a neighborhood of $S_1^{new}$ there are other structures involving previous instances of $S_1$ - $S_1^{old_1}$, $S_1^{old_2}$, …, $S_1^{old_k}$. For brevity we will denote $\{S_1^{old_1}, S_1^{old_2}, \ldots, S_1^{old_k}\}$ with $\mathcal{S}^{old}$. Let us assume that in the neighborhoods of the elements of $\mathcal{S}^{old}$ there are instances of elements in $2^{\{S_0\}_{l_1}}$ and possibly another instance of $S_0$ itself.
Let us denote with $\left\{\{S_0\}_{l_1}\right\}_i$ the instances of the elements from $2^{\{S_0\}_{l_1}}$ which are in the neighborhood of $S_1^{old_i}$.
Obviously, the semantic distances between $S_1^{old_i}$ and the elements of $\left\{\{S_0\}_{l_1}\right\}_i$ are given as well as the masses and energy signatures of the latter.
We would like to estimate the attractive force between $S_1^{new}$ and $S_0$ by using the information stored in the pairs $S_1^{old_i}$ and $\left\{\{S_0\}_{l_1}\right\}_i$ for $i = 1..k$.

## Recovery of Initial Attractive Force from the bound positions of the component structures

Let us have two structures $S_1$ and $S_2$ which are in bound positions. We will denote with $\vec{r}_1$ the position of the centroid of $S_1$ in general. Similarly, with $\vec{r}_2$ we denote the position of the centroid of $S_2$ in general. The centroid of the compound structure $S_1 \cup S_2$ is given with $\vec{r}_c$. We denote with $\vec{x}_{1,b} = \vec{r}_{1,b} - \vec{r}_c$ and $\vec{x}_{2,b} = \vec{r}_{2,b} - \vec{r}_c$ the semantic distances from the bound positions of $S_1$ and $S_2$ to the centroid of the compound structure $S_1 \cup S_2$. Let us denote with $E(\vec{r}_{1,b})$ and $E(\vec{r}_{2,b})$ the semantic energies of $S_1$ and $S_2$ in bound state. With $\mathfrak{m}_1$ and $\mathfrak{m}_2$ we denote the semantic masses of $S_1$ and $S_2$.