# Note on binding of match-seeking and match-repelling particles

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## Binding between two primitive particles through match-seeking particle

Let us consider two -particles which are not composite – they are given with their semantic signatures respectively:

Here each of the quantities denotes the property signature vector of the corresponding property of the particle. The matrix represents the property association particle which binds to a pair of properties and in the property graph of the particle. Also there is a semantic significance vector which is associated the property association particle (a.k.a link) . For details refer to [The Signature of Semantic Structures](https://github.com/dimitarpg13/aiconcepts/blob/master/docs/TheSignatureOfSemanticStructures.pdf).

Match-seeking particle binds to a subgraph of the property graph of the particle.

There is a closeness condition which needs to be obeyed in order the particle to bind to the particle .

### Binding matrix of a match-seeking particle

The match-seeking particle exposes a binding matrix :

, , , **. . .** ,

Obviously, each of the blocks is matrix where is the dimension of semantic space. From now on we will denote these blocks of any match-seeking particle as *binding elements* of the match-seeking particle . Each binding element of a match-seeking particle consists of a couple of property particles and connected with association particle . Each binding element is represented by its binding matrix and its semantic significance vector .

Note that in each of those blocks having the general form it is possible to have where represents the null vector in semantic space. However, is never close to the null vector i.e. .

### Binding of match-seeking particle against -particle formulated as optimization problem

Let a primitive particle has the following semantic signature:

Let us denote by the semantic distance between the binding element of and the semantic element of

,

Then we define the following metric:

where

,

The semantic distance of two matrices and , having the same number of columns, is given with:

where and .

Notice that if is incomplete that is – contains only a single property not connected to anything then becomes simply the semantic distance between its sole property particle of the binding element and the corresponding property of the semantic element .

//TODO: finish the opmization problem formulation

### Closeness condition for a bind between match seeking particle and primitive semantic particle

Let us denote by the following diagonal matrix which will be named *Filter matrix* of the match seeking particle:

Here are identity matrices which represent the regions of interest in the semantic signature matrix of to the match seeking particle .

The regions of interest in the semantic signature of are obtained by multiplying with :

## Between two semantic structures

Let us have two semantic structures and .

Let the semantic signature of is given with:

and the semantic signature of is given with:

## Between a primitive particle and a semantic structure