References

Object-Oriented Design Heuristics, Riel, Addison-Wesley, 1996, Chapter 4
# Relationships between Objects

<table>
<thead>
<tr>
<th>Type</th>
<th>Relation between</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses</td>
<td>(Object)</td>
</tr>
<tr>
<td>Containment</td>
<td>(Object)</td>
</tr>
<tr>
<td>Inheritance</td>
<td>(Class)</td>
</tr>
<tr>
<td>Association</td>
<td>(Object)</td>
</tr>
</tbody>
</table>
Uses

Object A uses object B if A sends a message to B

Assume that A and B objects of different classes

A is the sender, B is the receiver
Containment

Class A contains class B when A has a field of type B

That is an object of type A will have an object of type B inside it
Heuristics for the Uses Relationship

4.1 Minimize the number of classes with another class collaborates
4.2 Minimize the number of message sends between a class and its collaborator

4.3 Minimize the number of different messages a class sends to another class.

4.4 Minimize the product of the number of methods in a class and the number of different messages they send.
Which is more complex?
4.5 If class A contains objects of class B, then A should be sending messages to its fields of type B.

This heuristic prohibits:
- Orphaned fields (ones that are never used)
- Fields that are only accessed in get/set methods
- The one exception to 4.5 is container classes
4.6 Most of the methods defined on a class should be using most of the fields in the class most of the time

4.7 Classes should not contain more objects than a developer can fit in his or her short-term memory. A common value for this number is 6
Combining fields into new classes can reduce the number of fields in a class.

4.8 Distribute system intelligence vertically down narrow and deep containment hierarchies.
No Talking between Fields

4.14 Objects that are contained in the same containing class should not have a uses relationship between them.

![Diagram showing contained objects with uses relationships](image1)

![Diagram showing the containing class sending messages to the contained objects](image2)

- Contained Objects with uses relationships
- The containing class should send messages to the contained objects
4.13 A class must know what it contains, but it should not know who contains it.

Reuse problem
   If A contains B and B uses A
   Then B can not be use independent of A

Complexity problem
   If A contains B and B uses A
   Then A has to work for B to work correctly
   B has to work for A to work correctly
When can Violate 4.13?

If a number of classes depend on each other in a complex way, you can violate 4.13 to reduce the number of classes they interact with.

Wrap the classes in a containing class.

Each contained class sends a message to the containing class, which broadcasts the message to the proper contained objects.
What about Ants & the World?