Title: An Alternative to the Hierarchy of Sciences

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Abstract:

An Alternative to the Hierarchy of Sciences

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Philosophy Graduate Student Association Conference
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Introduction

- *Diverse and increasingly specialized sciences*
- *The relationships between the sciences, their objects and methods*
- *Interdisciplinary science*



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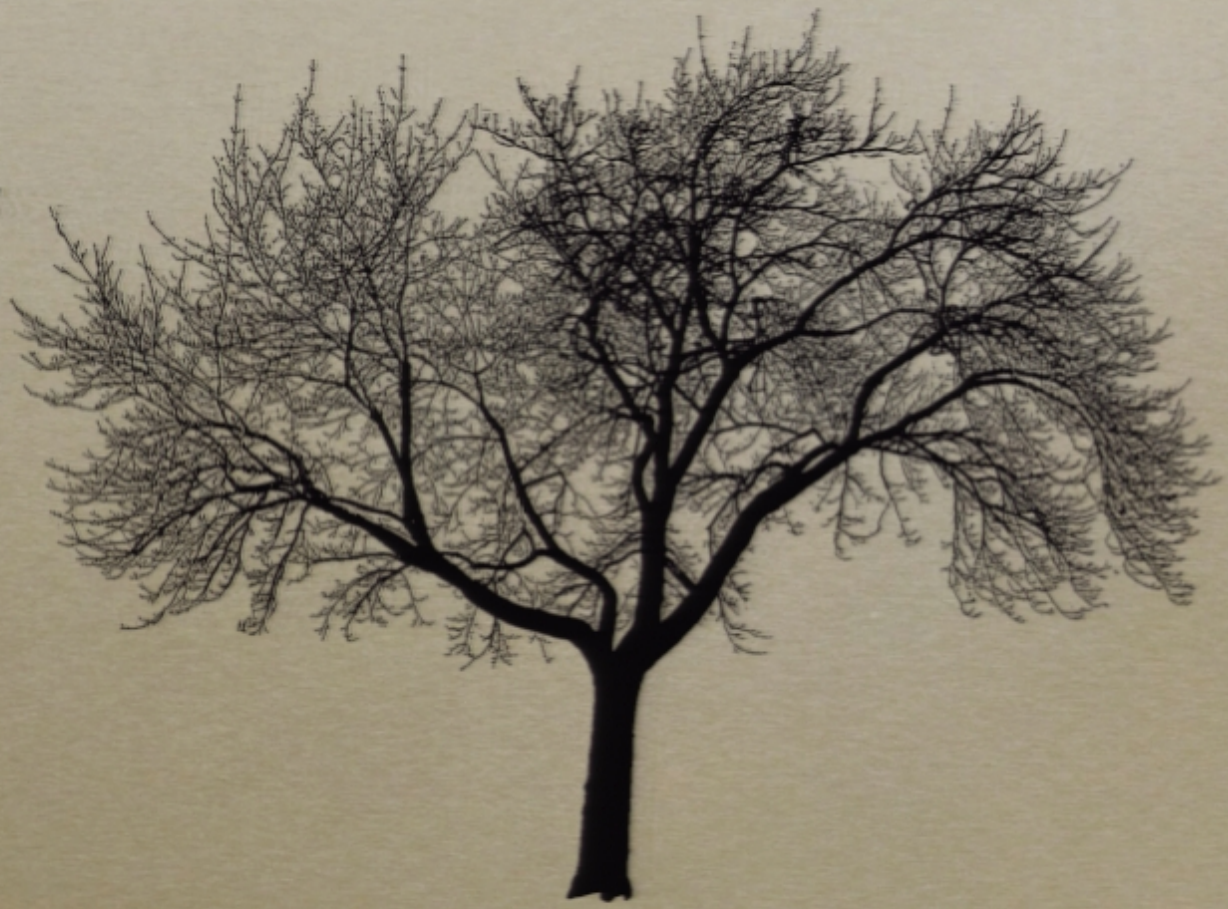
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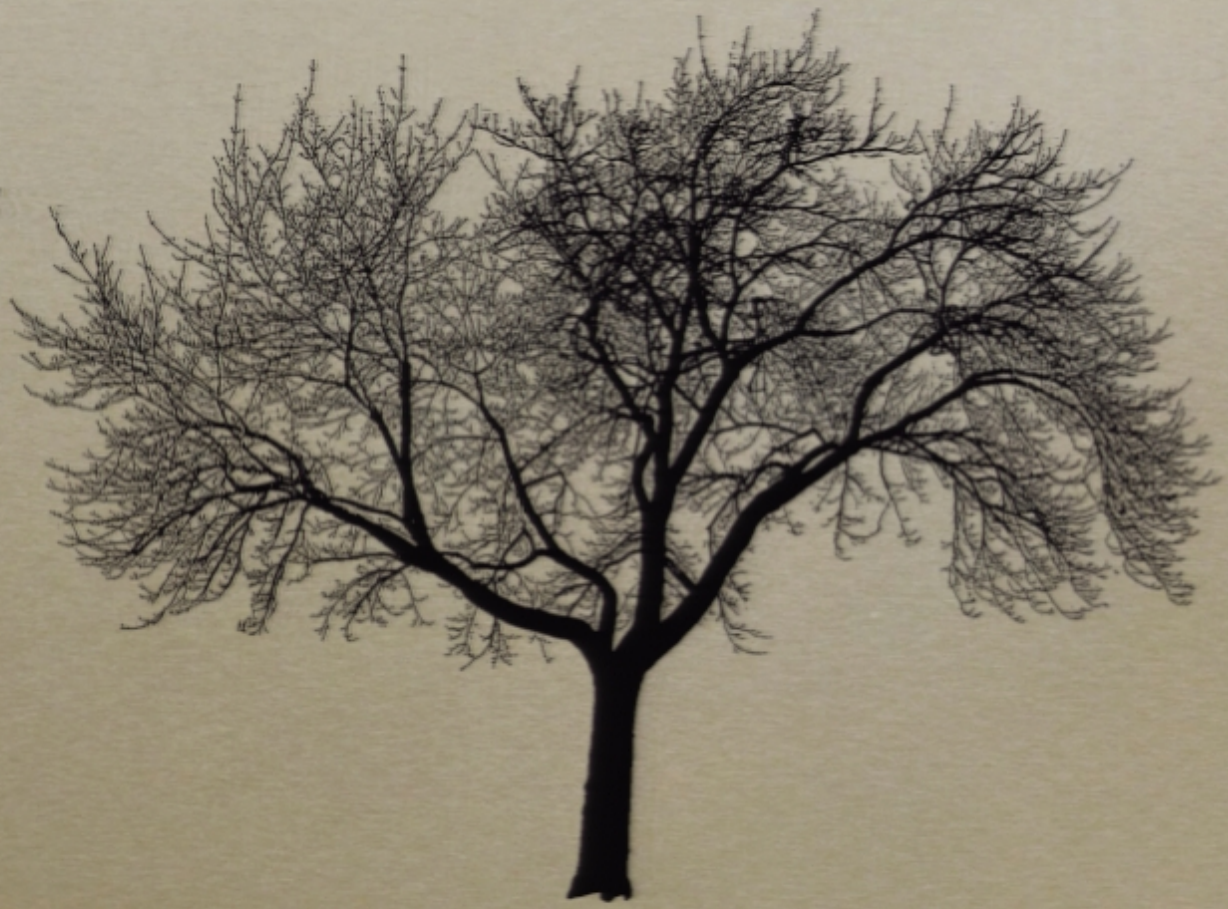
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Outline

- *Oppenheim and Putnam*
- *Three Objections*
- *Comparing Complexity*
- *Sciences and Levels*
- *The New Model*

Oppenheim and Putnam

"Unity of Science as a Working Hypothesis" (1958)

- *Anticipates an ideal unified science*
- *Describes six levels of organization*
- *Connects them via micro-reduction*

Unity of Science

- *Unity of language (vocabulary)*
- *Unity of laws (explanatory principles)*
- *Science tends in this direction*

Micro-Reduction

If T_1 and T_2 are two theories, then T_2 is reduced to T_1 iff:

1. *The vocabulary of T_2 contains terms not in T_1.*
2. *Any observational data explainable by T_2 are explainable by T_1.*
3. *T_1 is at least as well systematized as T_2. (p.5)*

Branches of theory can also be micro-reduced

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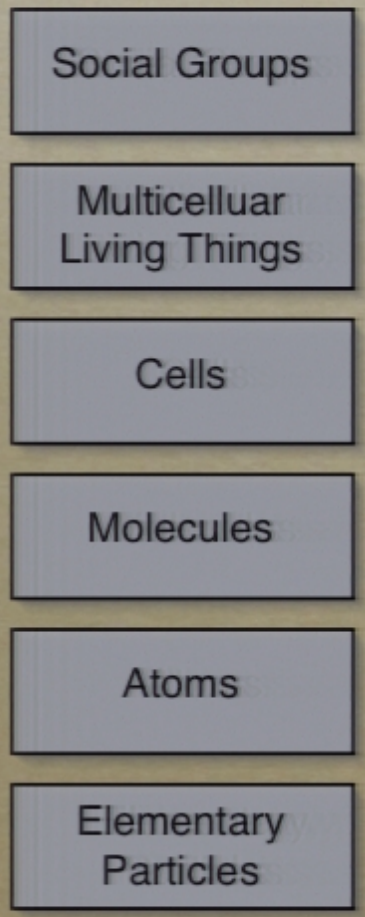
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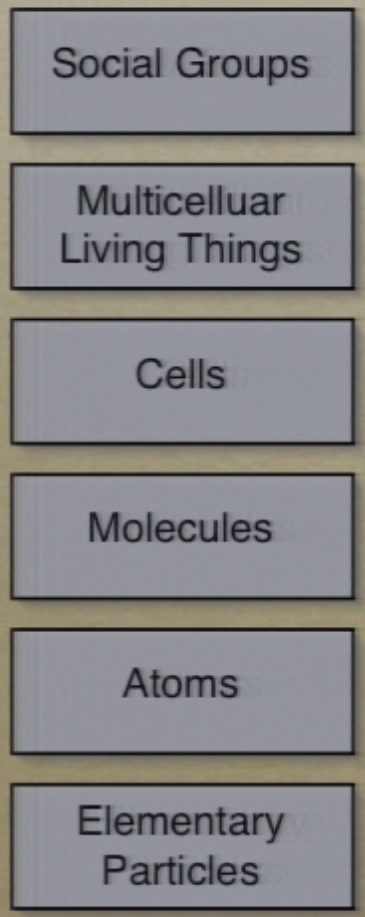
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Hierarchy of Sciences



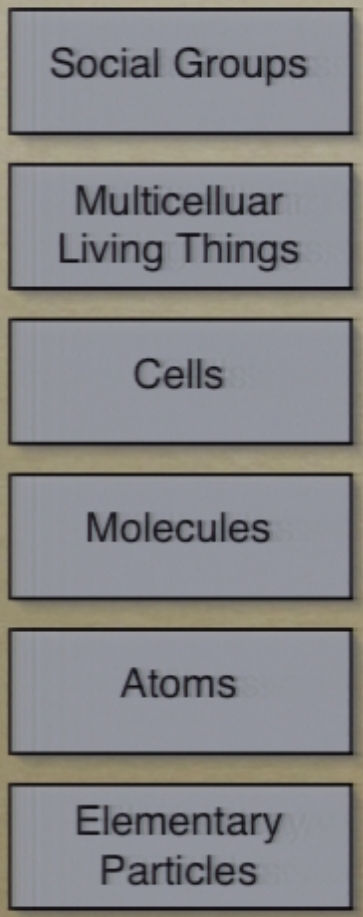
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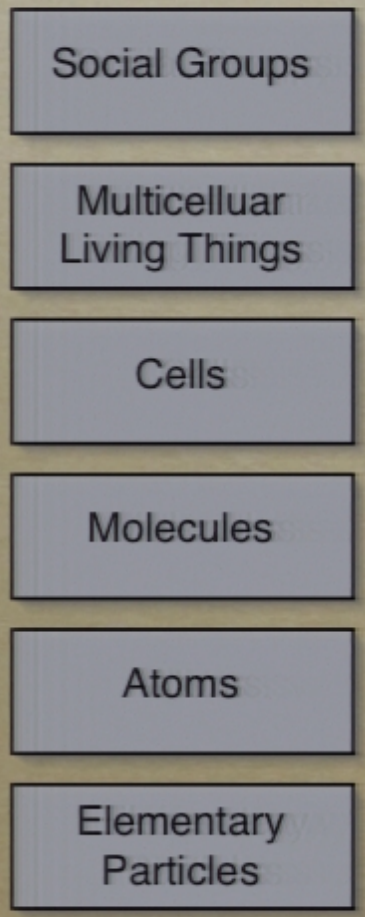
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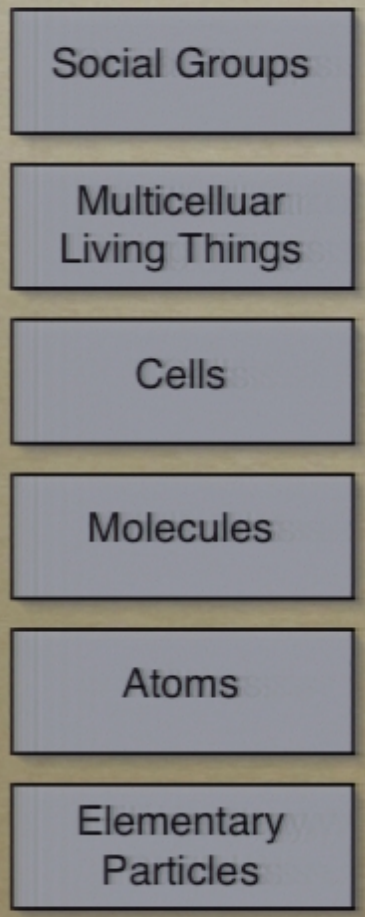
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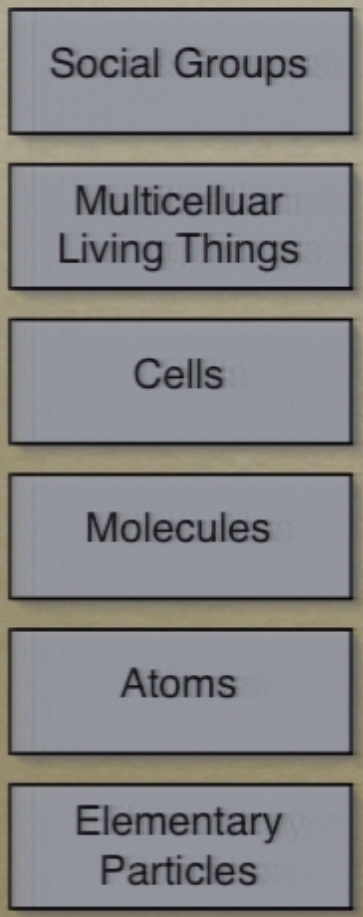
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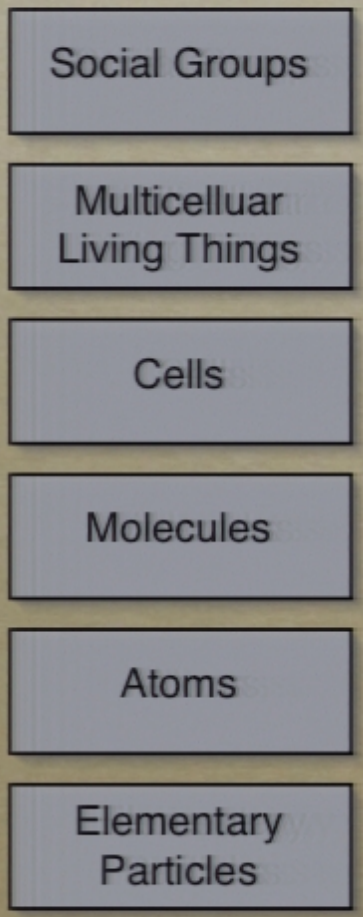
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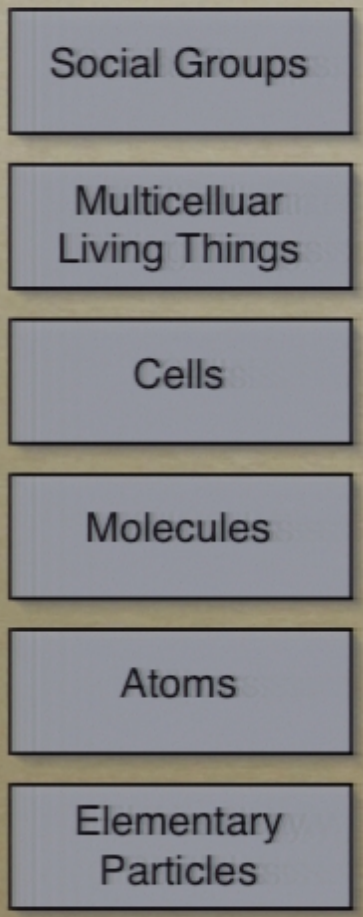
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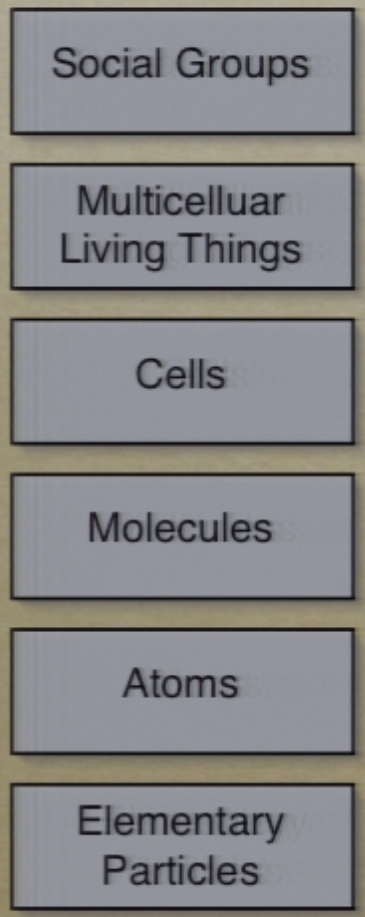
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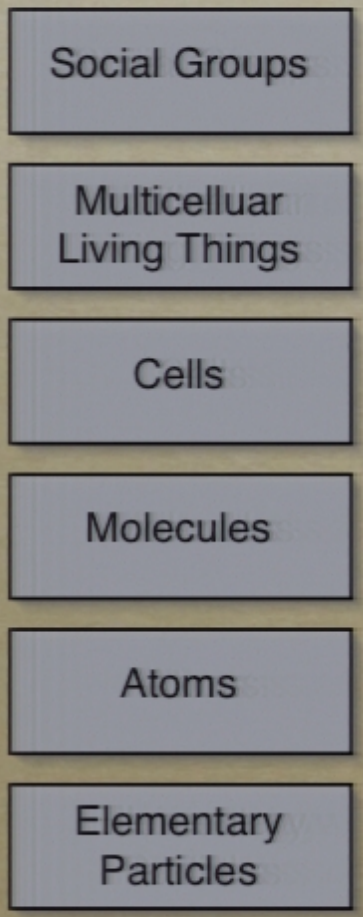
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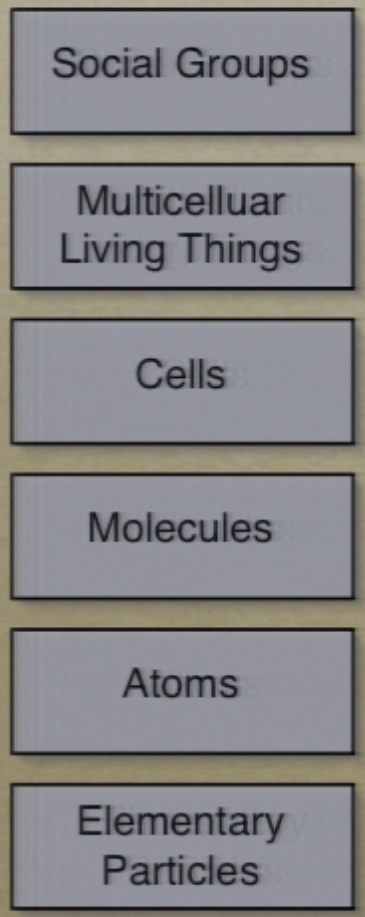
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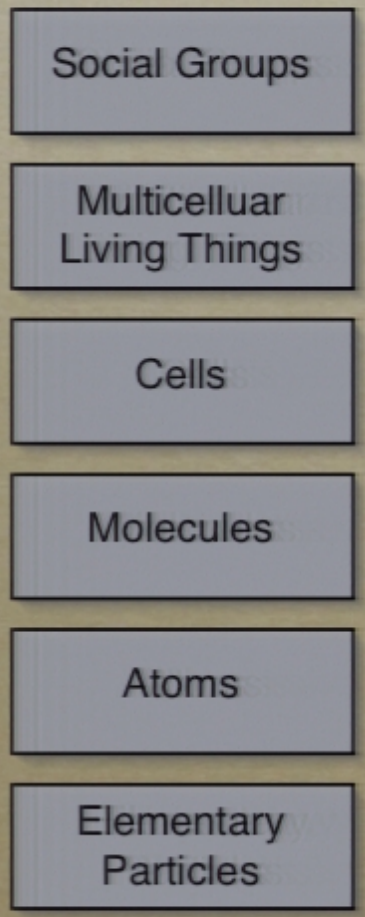
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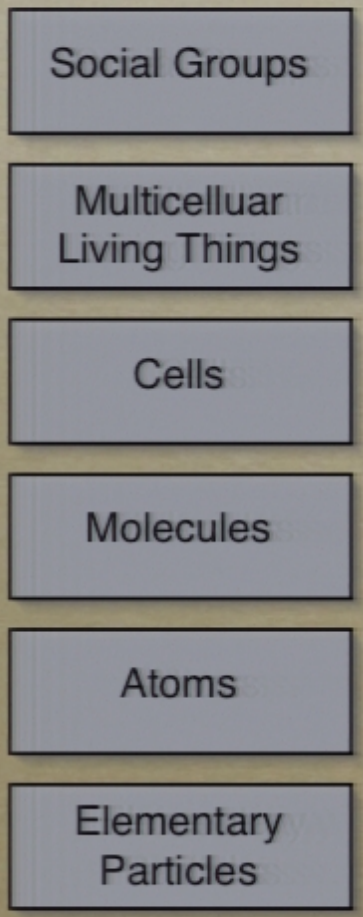
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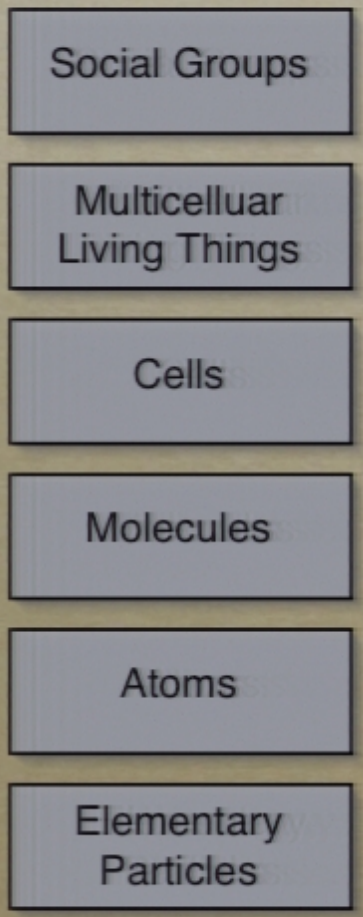
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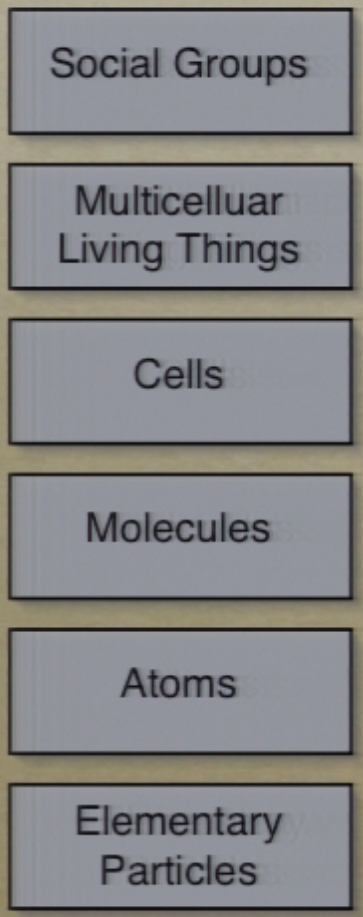
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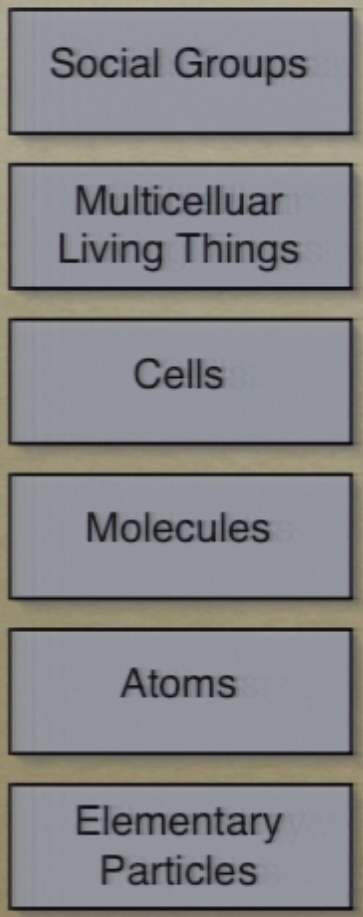
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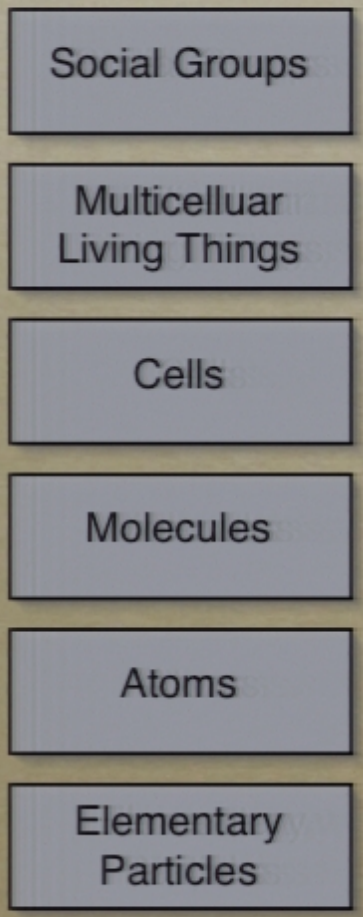
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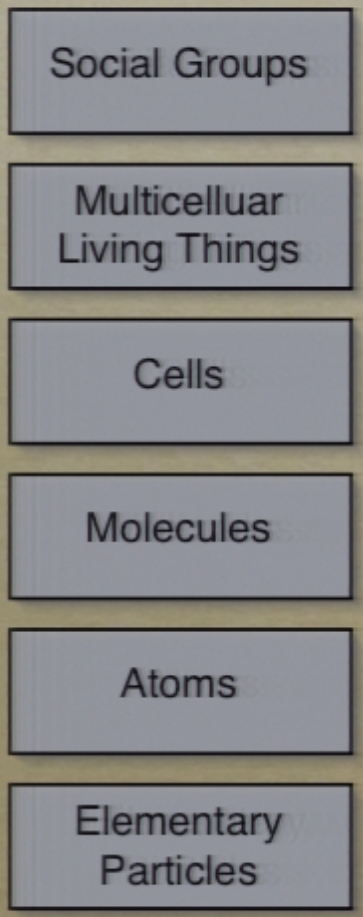
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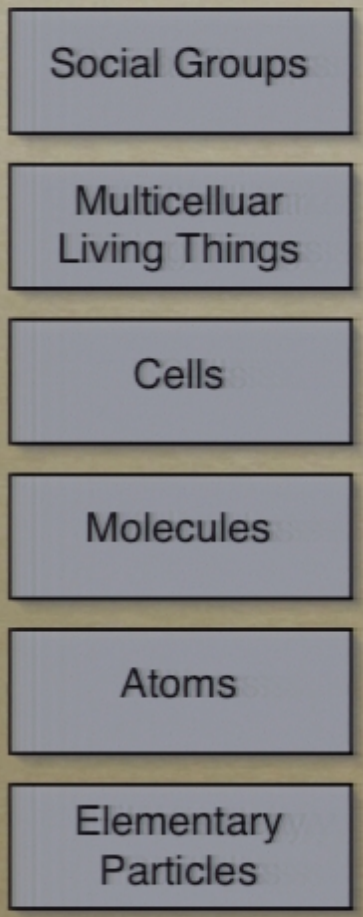
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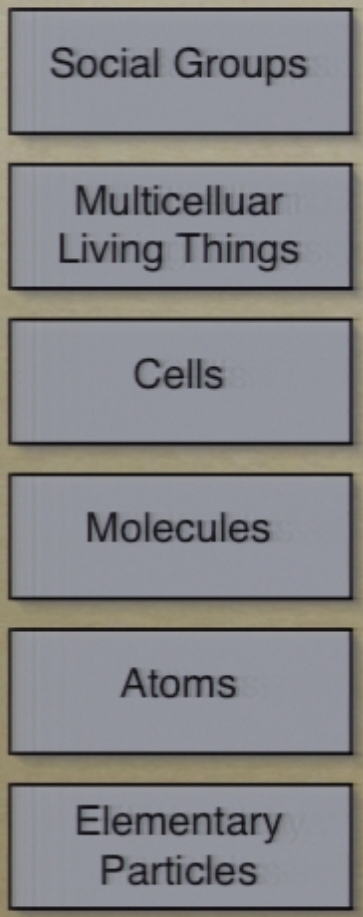
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Three Objections

- *Failed predictions*
- *Anti-reductionism*
- *Inflexible hierarchy*

Failed Predictions

We have failed to micro-reduce:

- *social science to rational agents*
- *memory and learning to neurology*
- *cellular biology to genetics*
- *chemistry to physics*

To this one can reply "Wait and see..."

Anti-Reductionism

Why has micro-reduction failed?

- *Fodor's "Special Sciences" (1974) argues from multiple realizability*
- *Garfinkel's "Reductionism" (1981) argues that micro-explanations don't answer macro-questions*

There is a large literature on reductionism

Inflexible Hierarchy

- *Sciences like biology and chemistry span multiple levels*
- *Sciences like astronomy, geology, meteorology, do not seem to fit*
- *Some big things are simple, some small things are complex*

Lessons Learned

To improve on Oppenheim and Putnam we should:

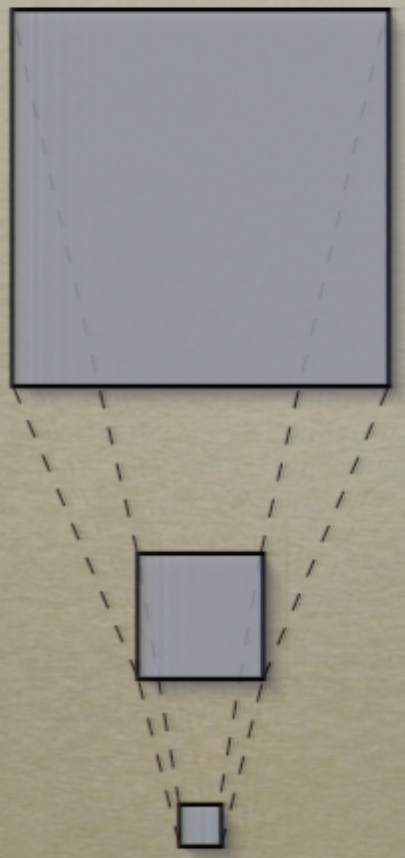
- *Allow for autonomy of special sciences*
- *Provide a better account of reduction*
- *Distinguish sciences more flexibly*

Comparing Complexity

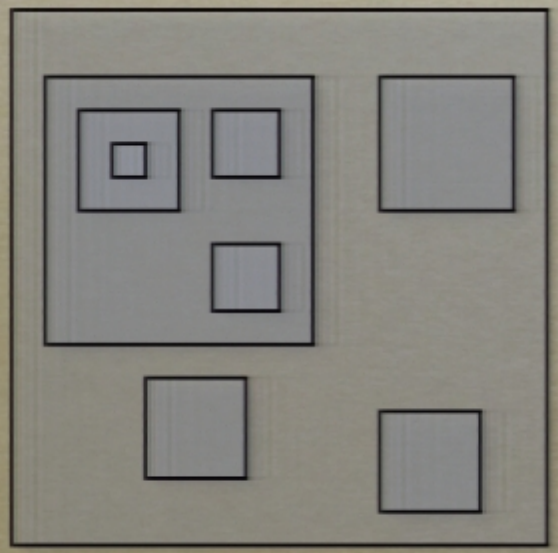
- *Grain size*
- *Parts and wholes*
- *Complexity measures*

Grain Size

- *In general, big things are more complicated than small things.*
- *Pros: simple and intuitive notion*
- *Cons: size isn't everything*

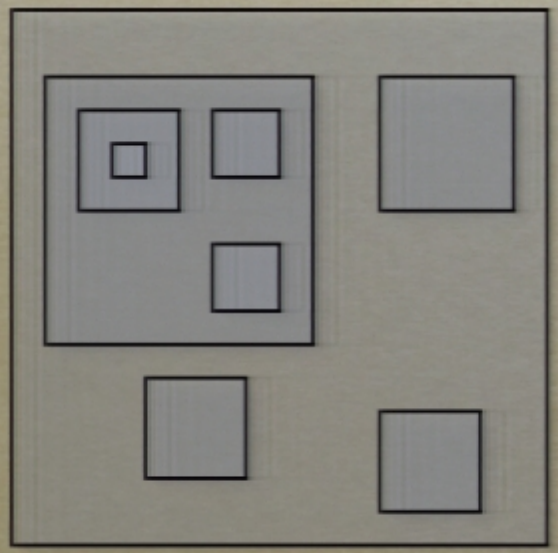


Parts and Wholes



- *By breaking wholes down repeatedly into parts we get a sense of levels of complexity*
- *Pros: captures size and more subtle differences in structure*
- *Cons: ignores the relationships between parts*

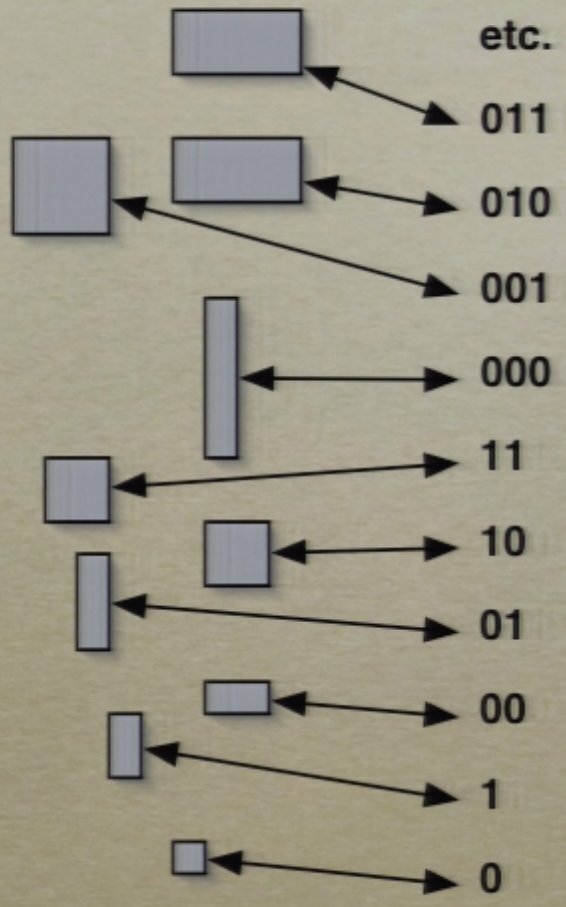
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Complexity Measures

- *We can measure the complexity of things by the complexity of their descriptions; simple things have short descriptions*
- *Pros: captures size, structure, and part relations*
- *Cons: hard to apply*



Essentials

- *To compare grain sizes, parts, or descriptions we must agree on what counts as a grain size, a part or a whole, and a proper description*
- *We need to have a common language to describe and compare the objects in a set*

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Sciences and Levels

Using what we have learned,

- *Define the domain and language of a science*
- *Define a level of complexity*
- *Apply our complexity tools*

Domains and Languages

We distinguish a community of scientists and use it to define:

- *A **domain** of objects which interest them as members of the community*
- *A (technical) **language** which they use to describe the things in the domain*

Properties of Domains

- *A domain will contain **elementary objects**, things which have no parts inside the domain, or have the simplest descriptions in the domain. These define the floor of the domain.*
- *The ceiling need not be as clearly defined.*

Properties of Domains

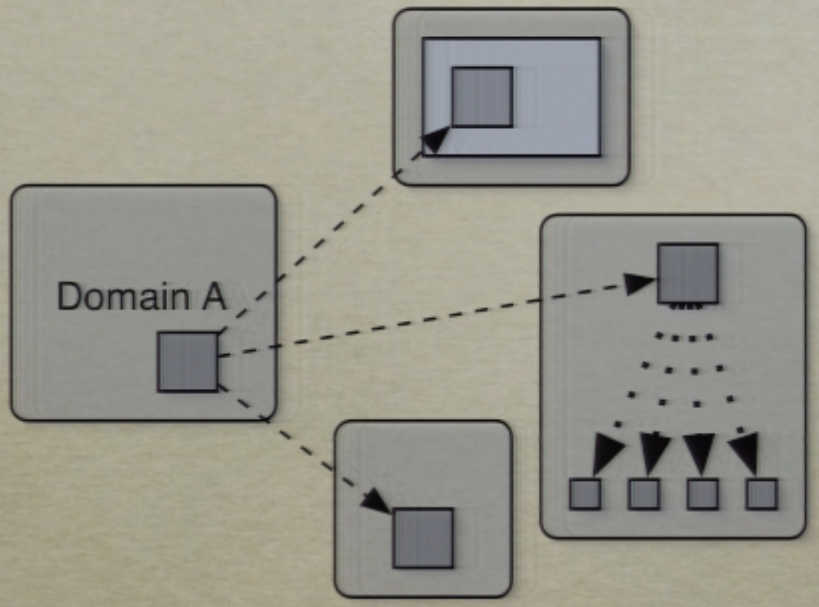
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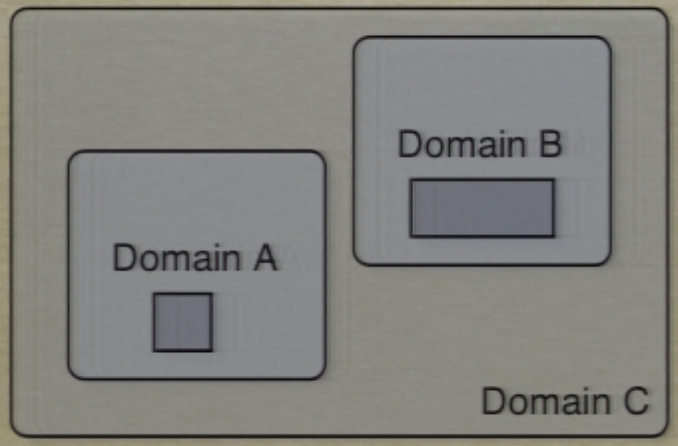
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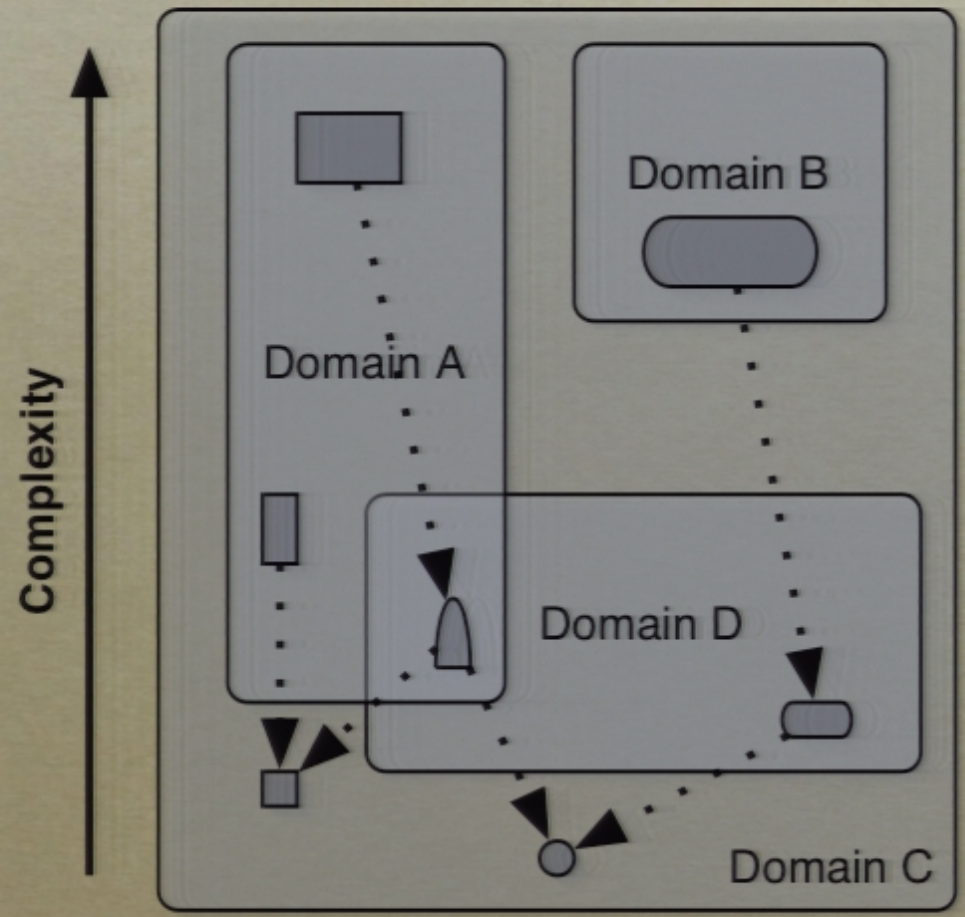
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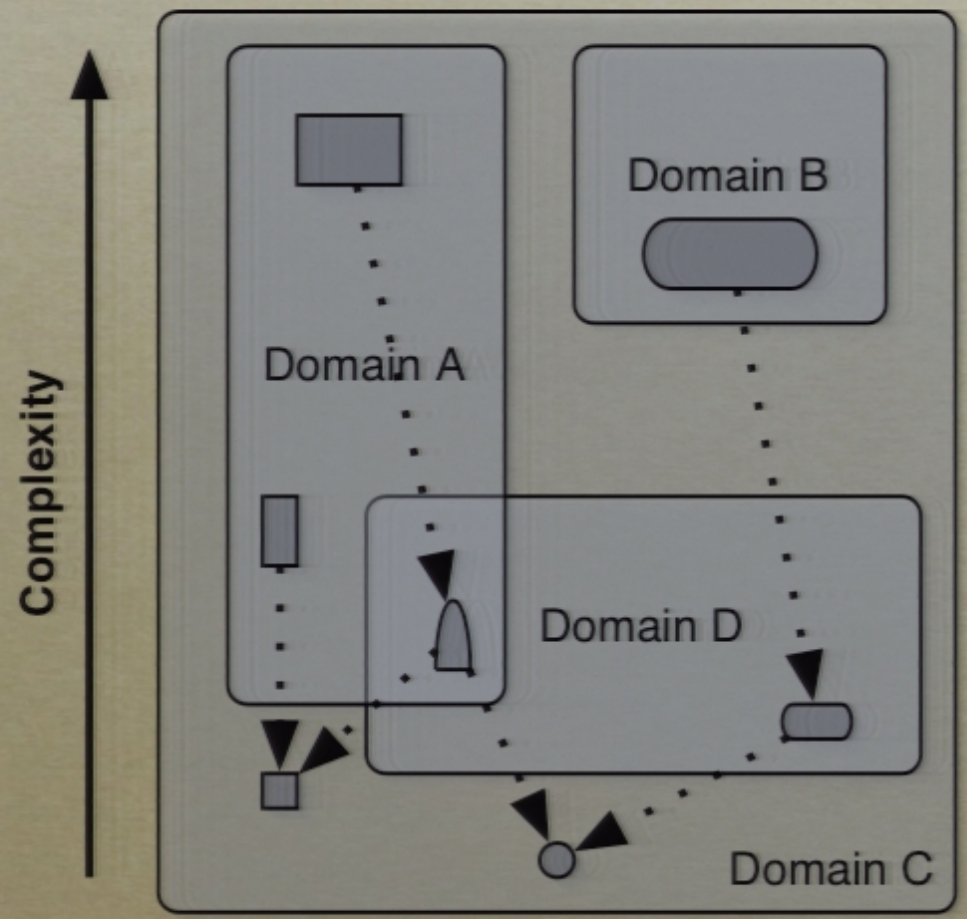
Levels of Complexity



Instead of a few discrete levels, we now have:

- *an axis of complexity against which we can compare objects*
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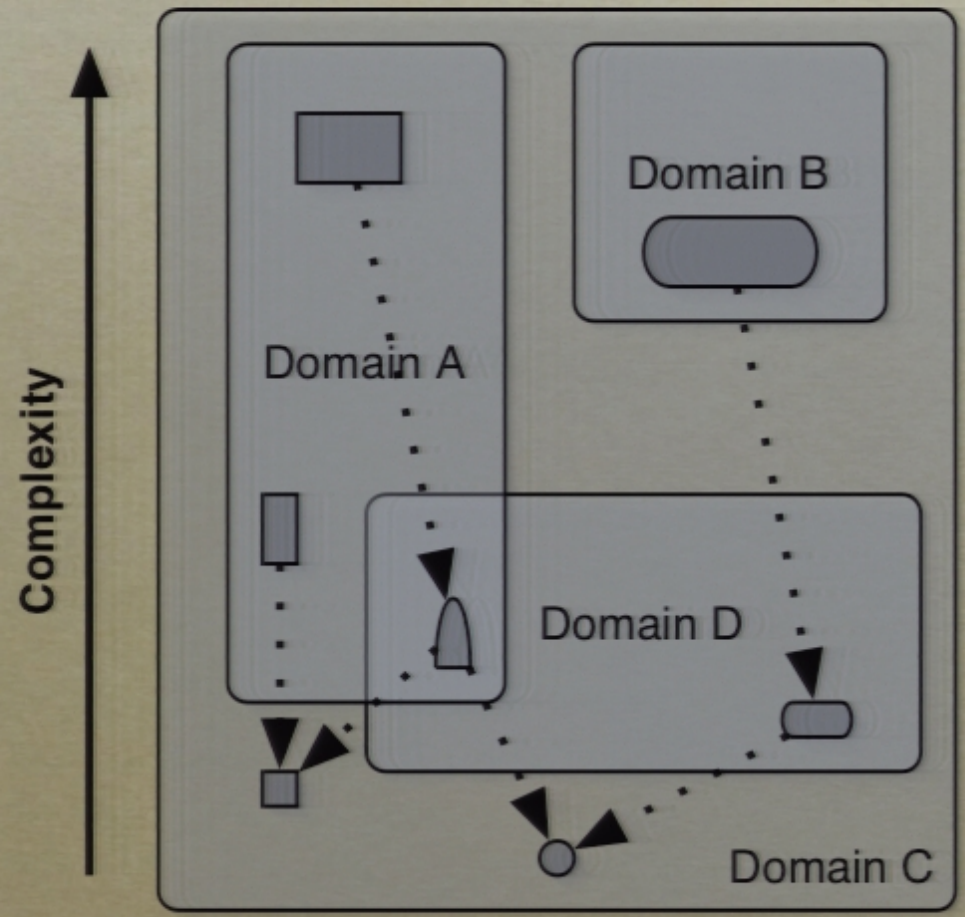
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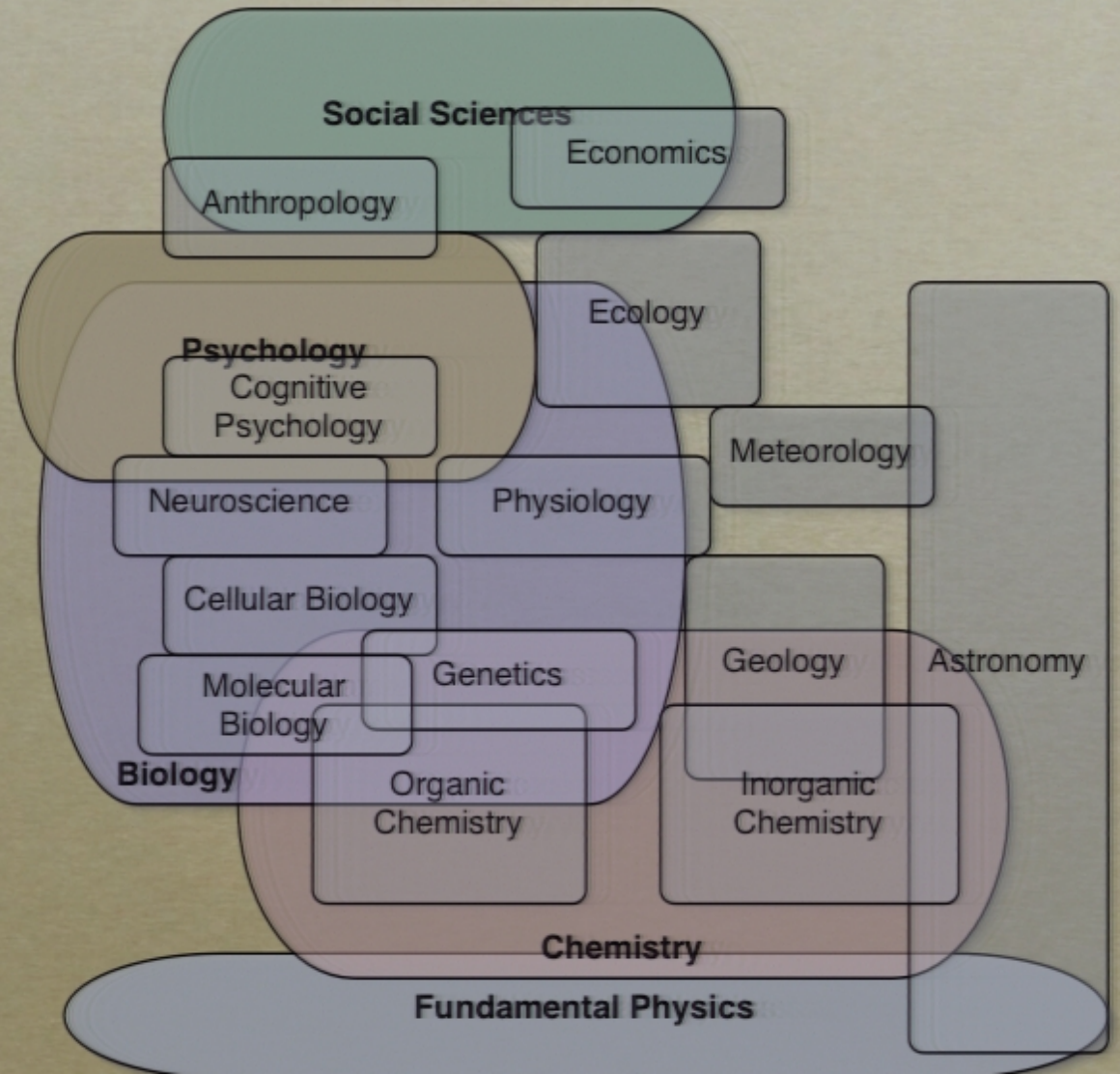
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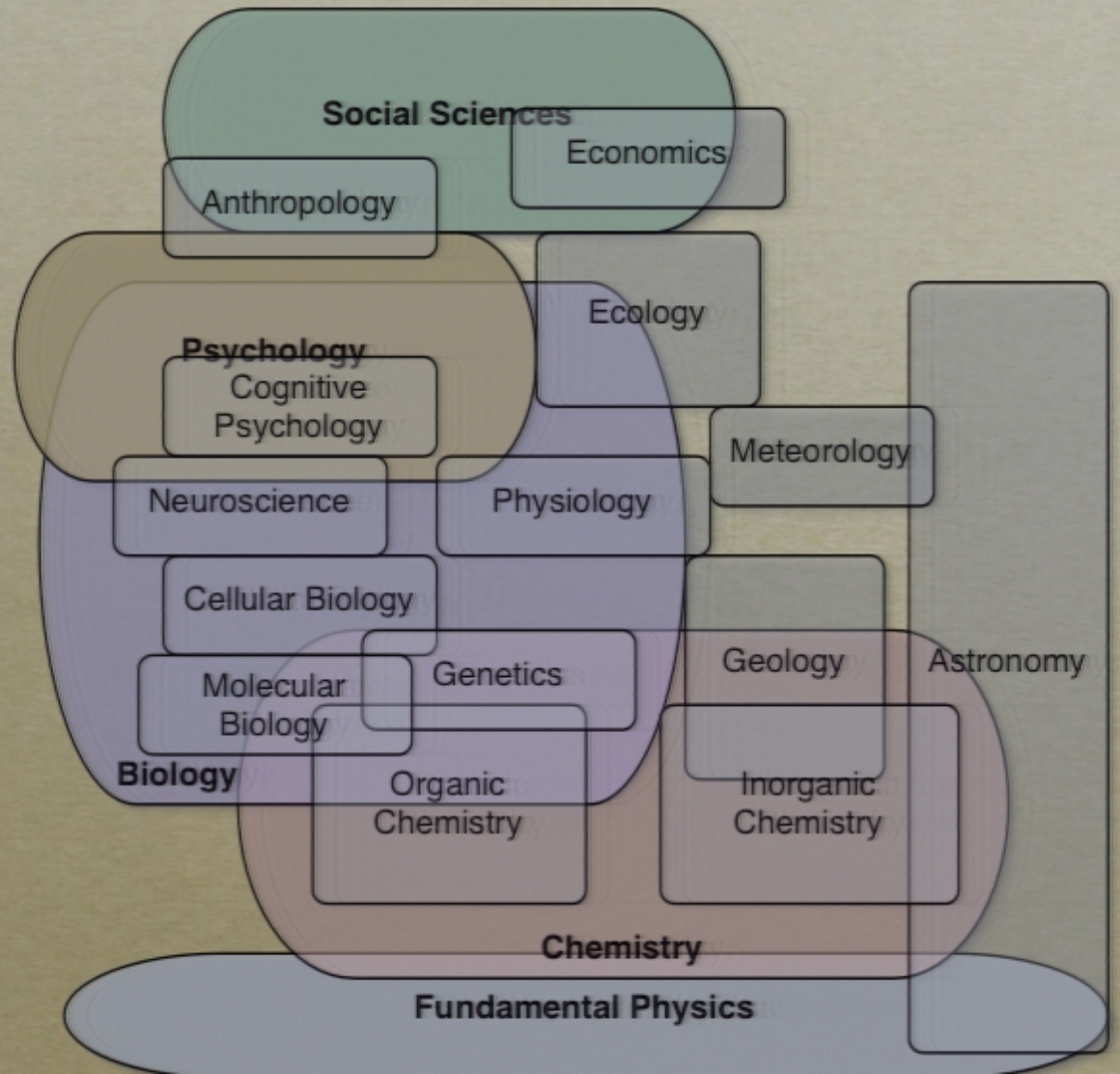
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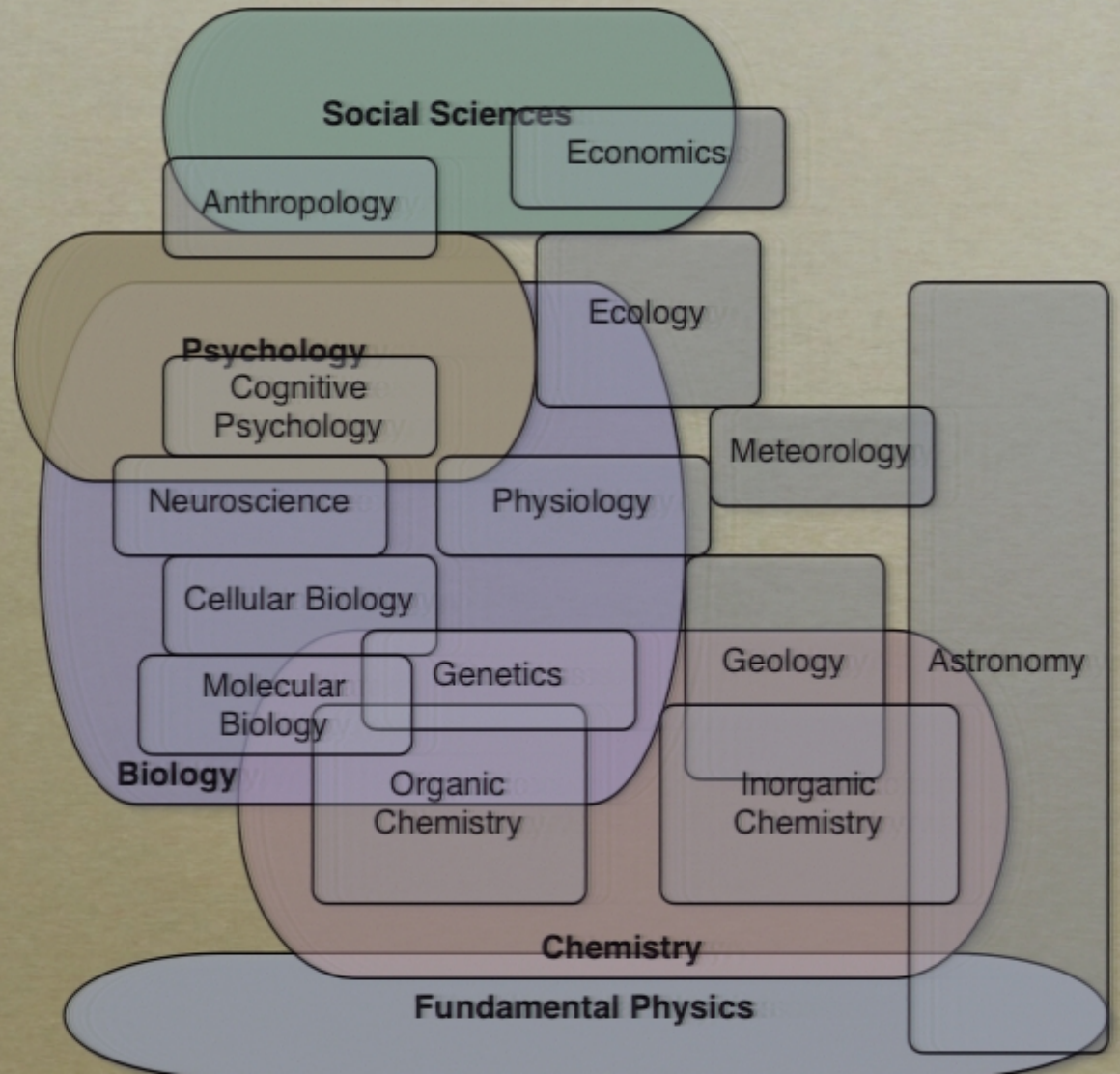
An Artist's Impression



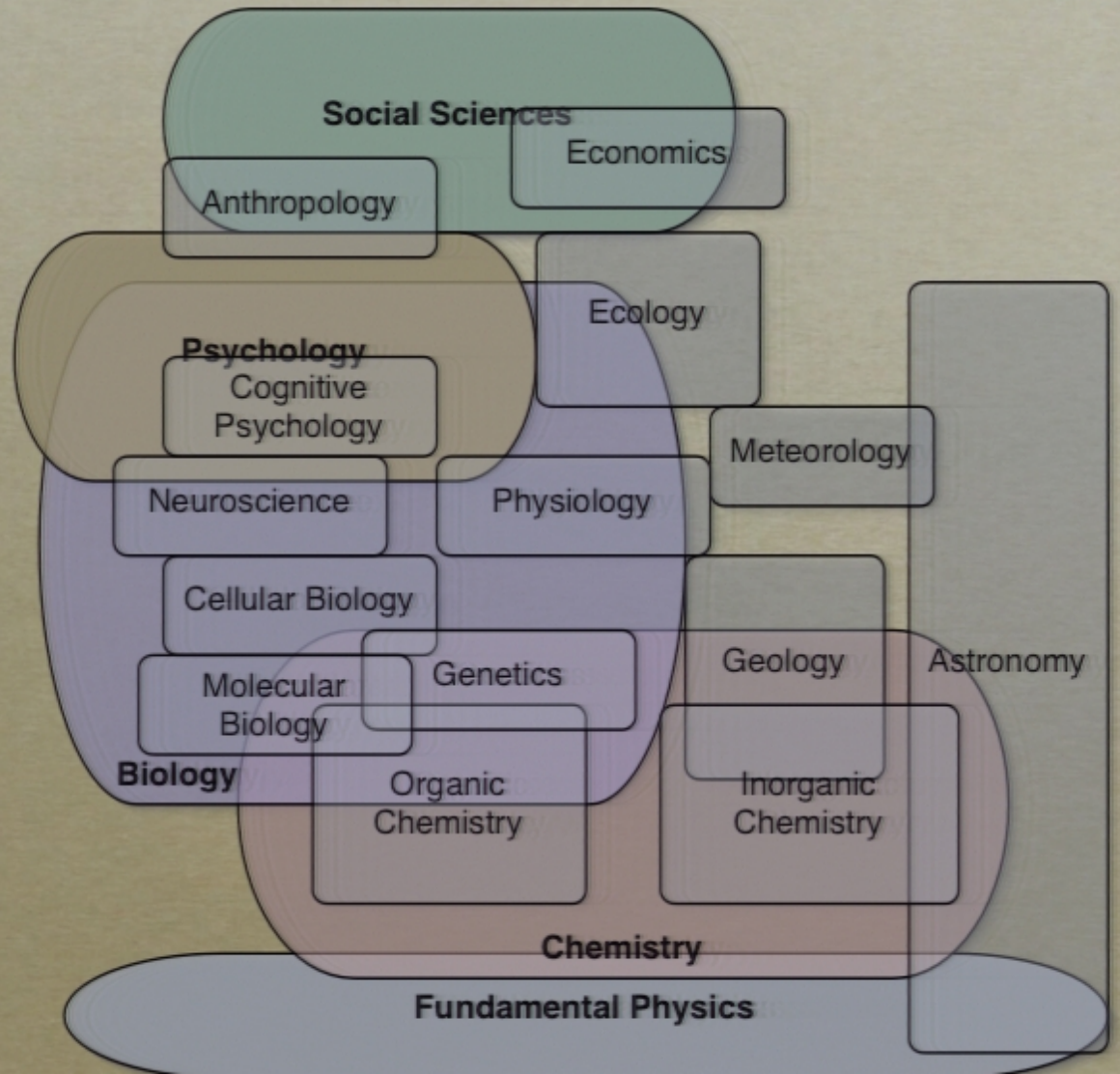
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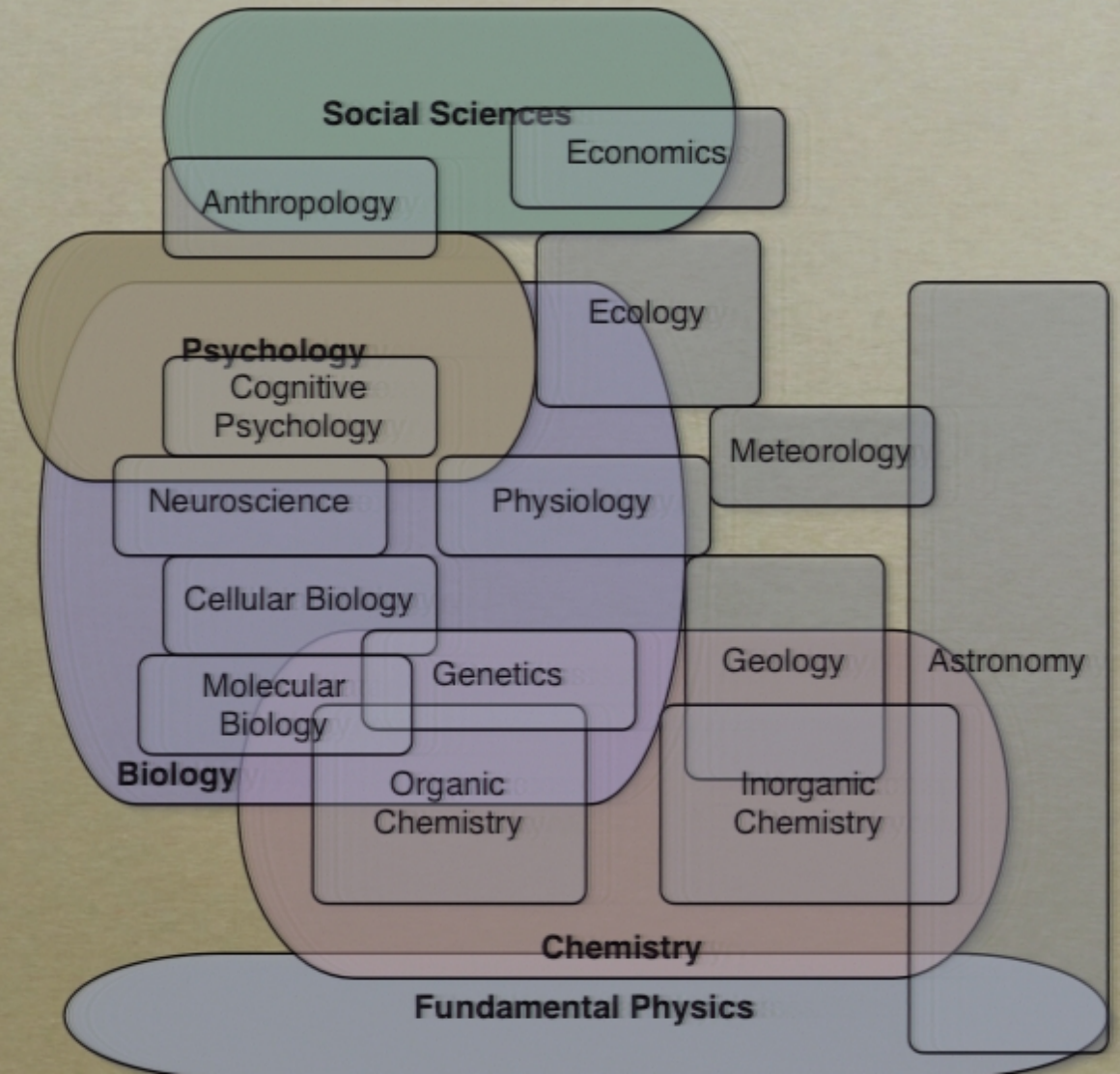
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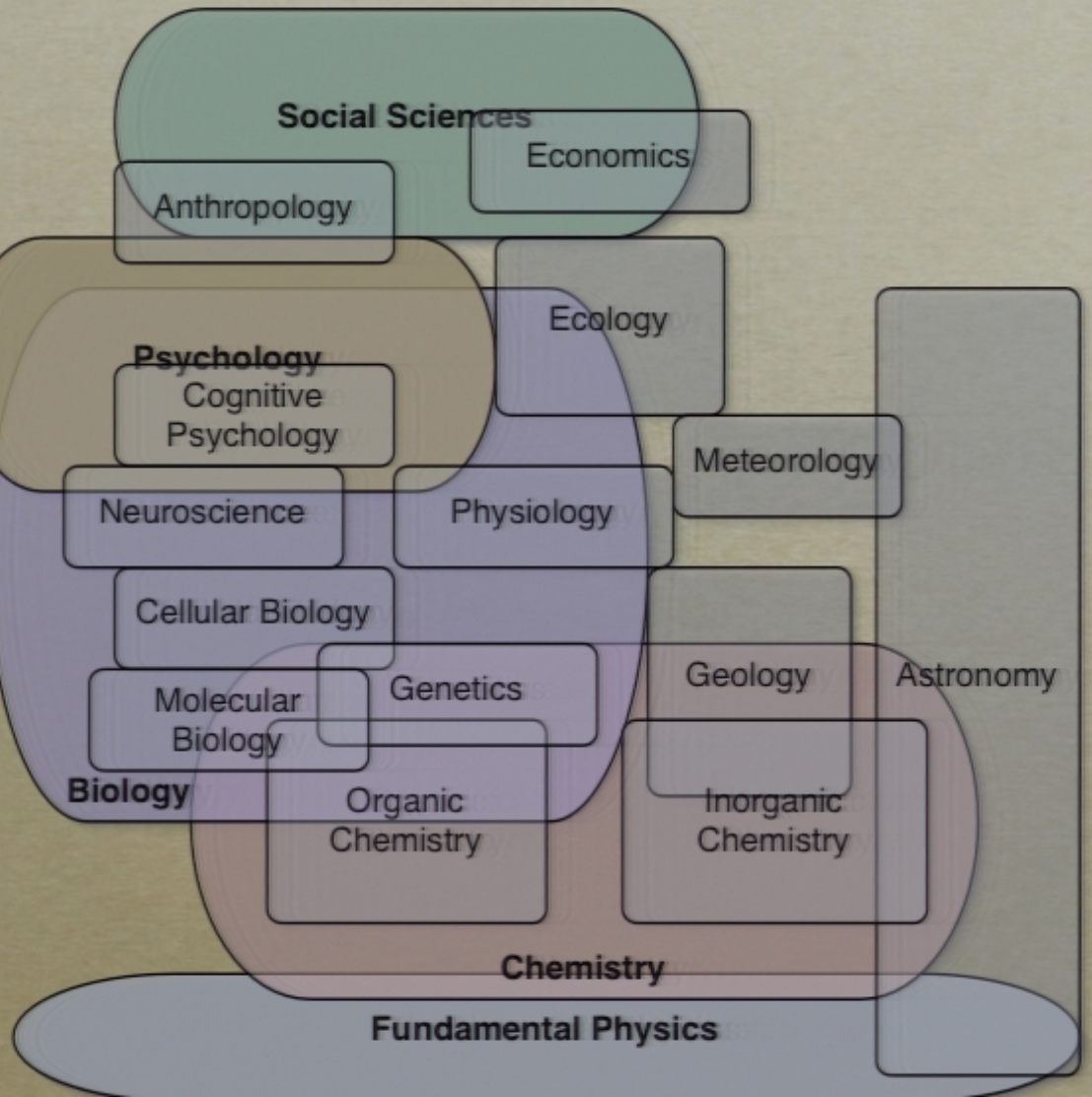
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Advantages

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- *Much messier*
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Conclusions

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- *I think the new model works in principle*
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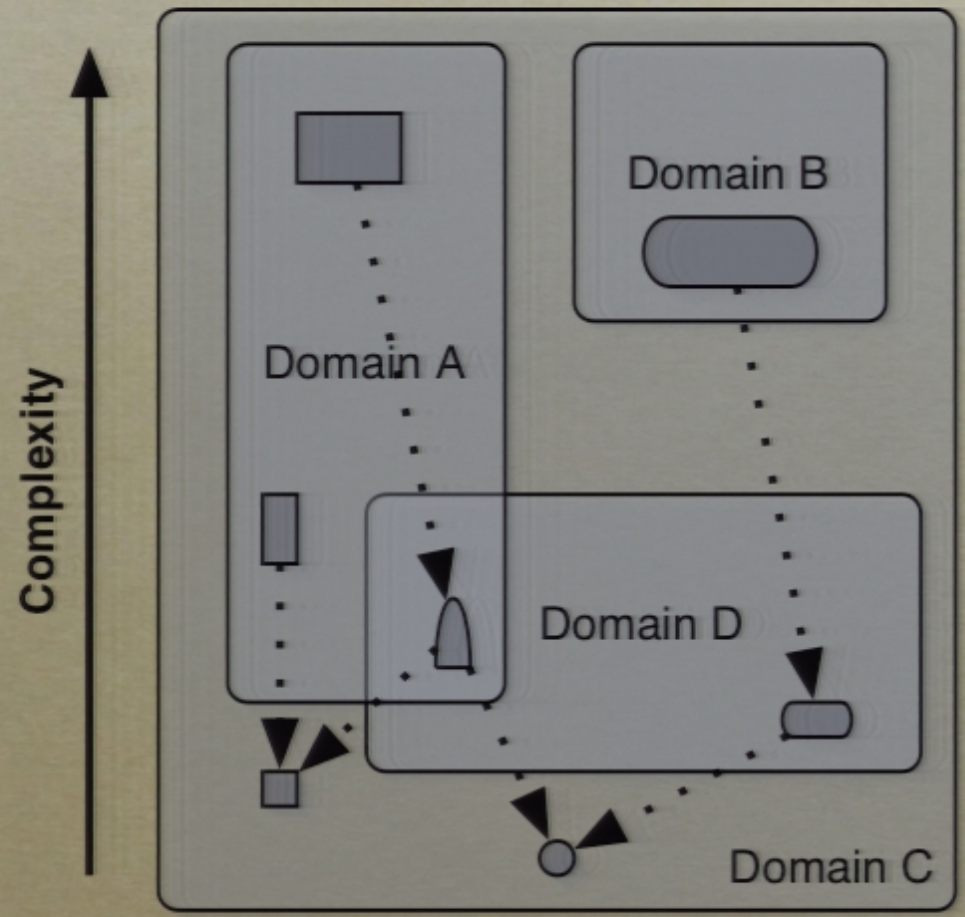
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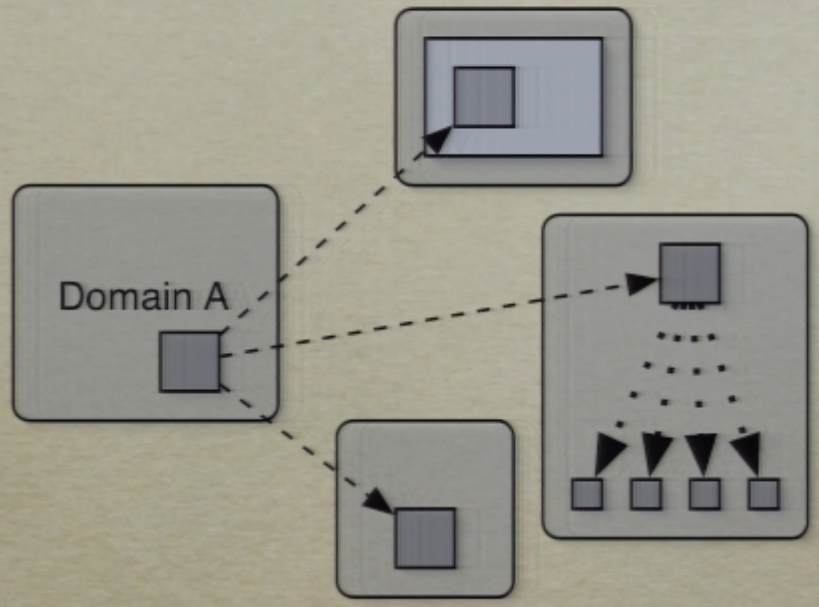


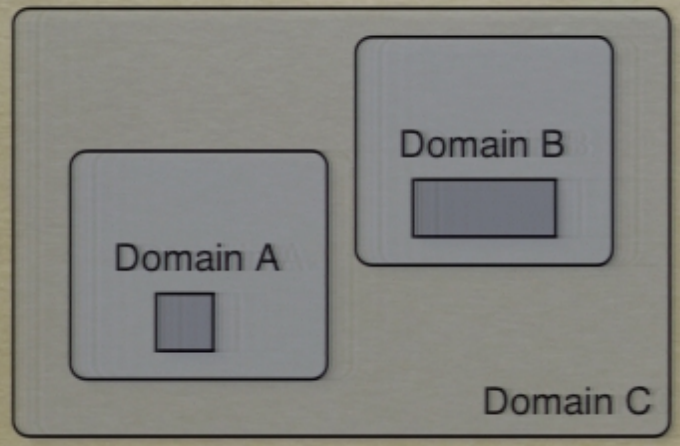
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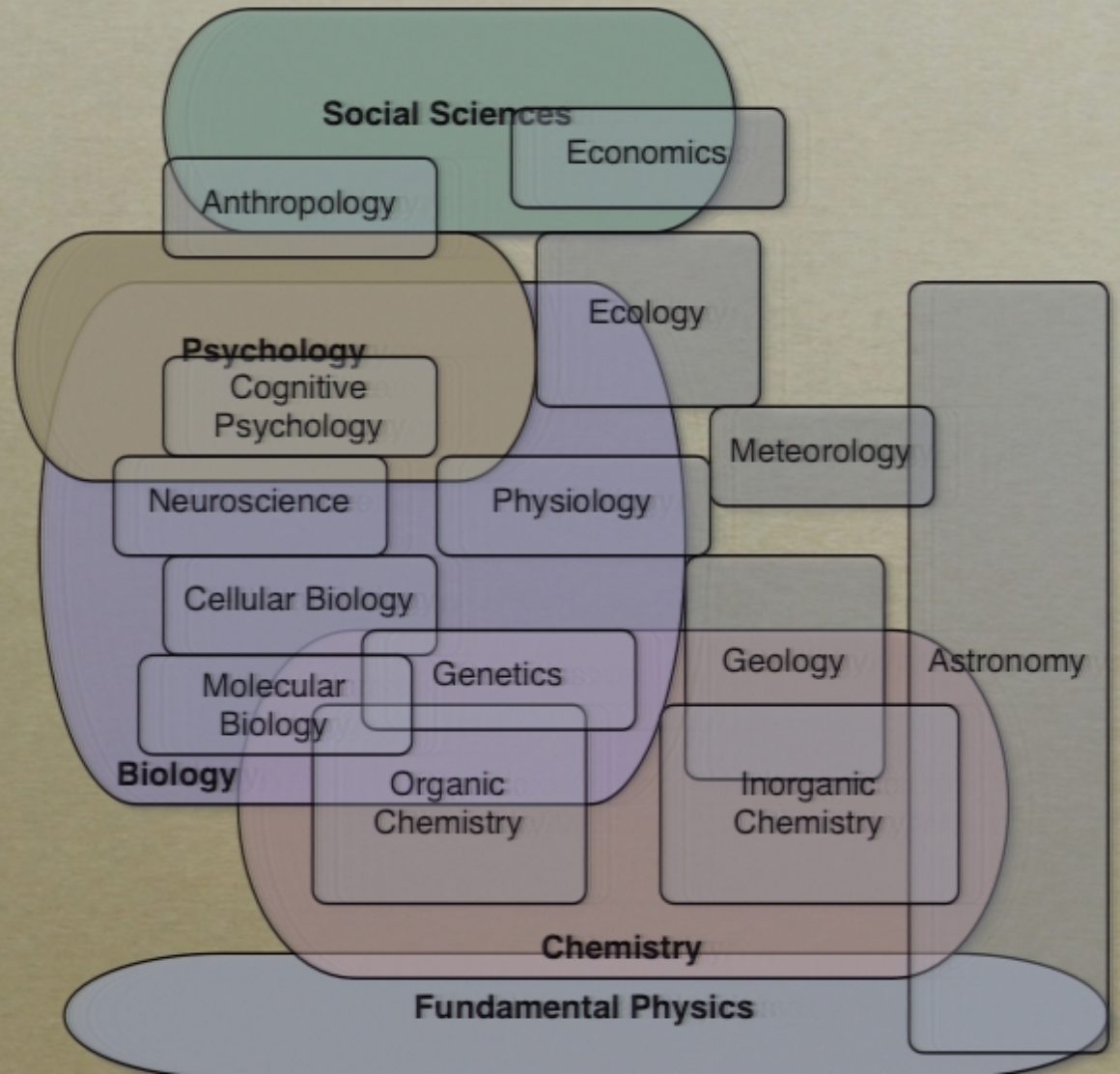




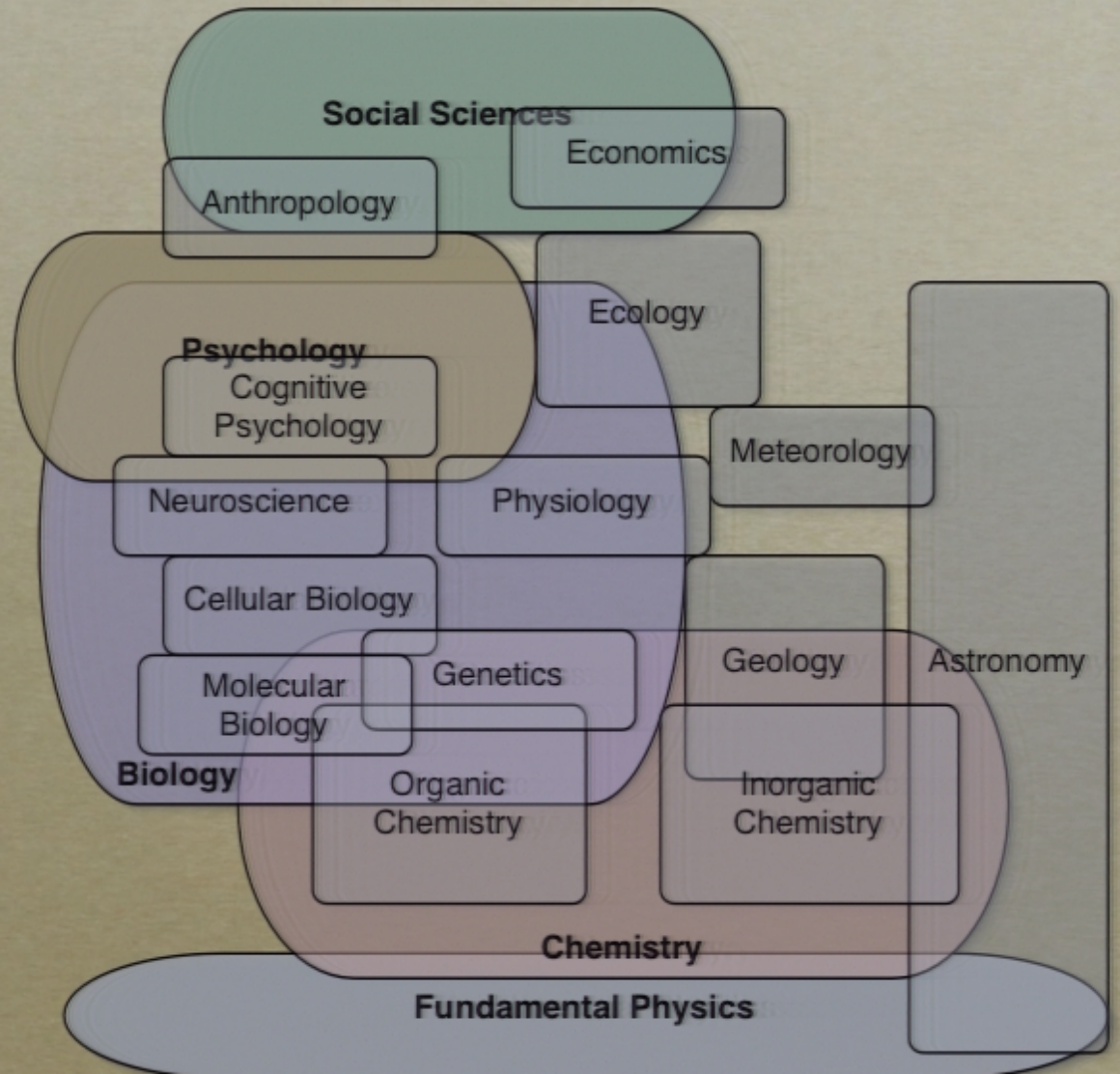
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