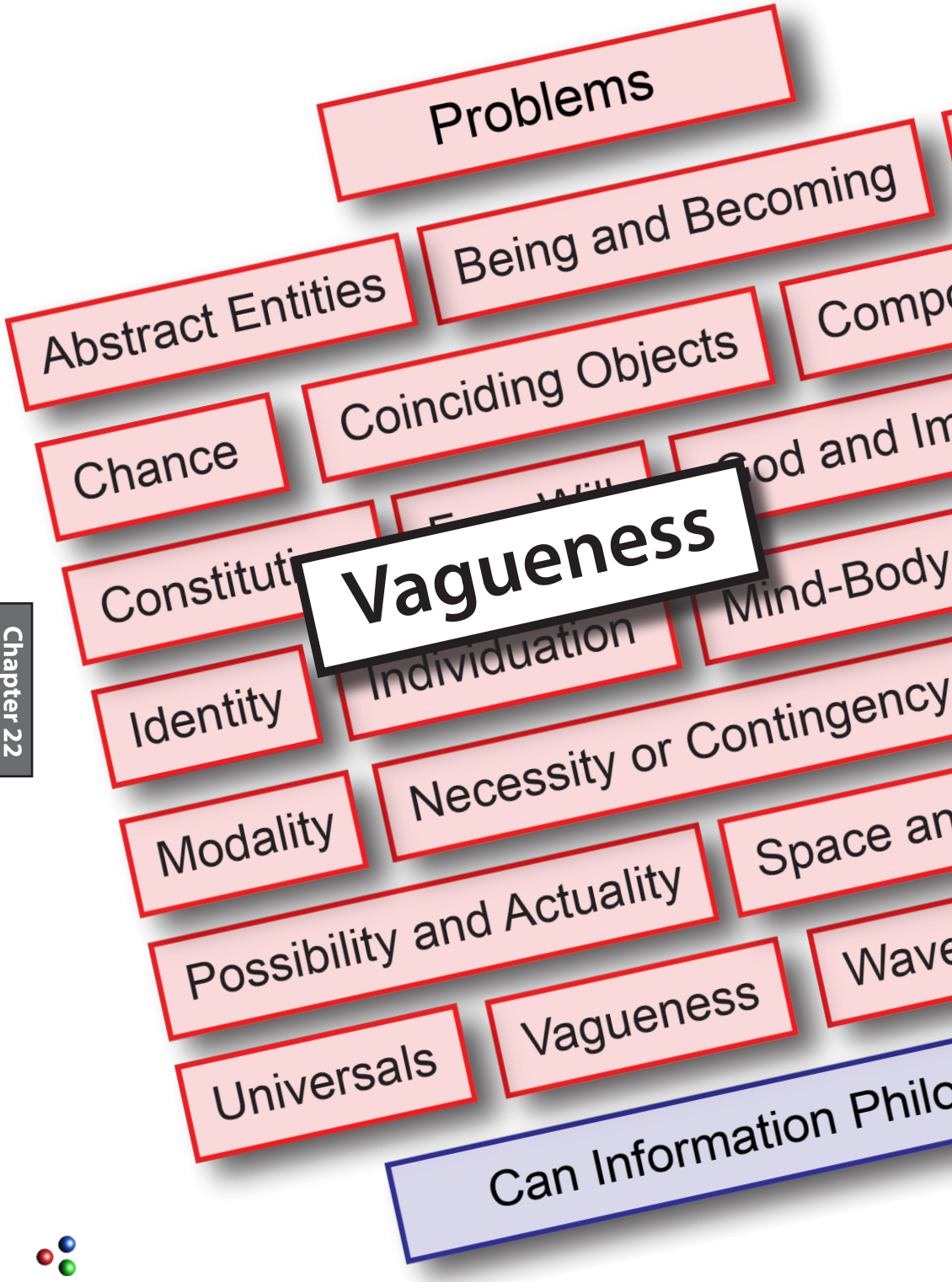
Problems
Abstract Entities
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Vagueness

Vagueness of meaning was a concern in analytic language philosophy long before it referred to the fuzzy boundaries of material objects that led to Peter Unger's "Problem of the Many."

Unger's vagueness comes from the lack of any precise boundary for a cloud in the sky,

> "as science seems clearly to say, our clouds are almost wholly composed of tiny water droplets, and the dispersion of these droplets, in the sky or the atmosphere, is always, in fact, a gradual matter. With pretty much any route out of even a comparatively clean cloud's center, there is no stark stopping place to be encountered. Rather, anywhere near anything presumed a boundary, there's only a gradual decrease in the density of droplets fit, more or less, to be constituents of a cloud that's there." [1]

The quantifiable information in any physical object far exceeds the amount that is picked out by human perceptions or conceptions of what the object is. A similar problem exists for an ideal or fictional object, especially as represented in human language, because of the fecundity of the human mind to imagine variations in meaning.

In our quest to understand the fundamental nature of reality, our understanding of quantum physics shows that the most microscopic objects have an irreducible vagueness in the form of Heisenberg's uncertainty principle. The wave function is a probabilistic estimate of the possible locations for finding a particle. The possible locations are virtually infinite compared to the particle size. We might say that quantum objects have the highest degree of metaphysical vagueness known.

In his 1975 article, "Vagueness, Truth, and Logic," Kit Fine gave specific examples of different types of vagueness in analytic language philosophy:

1 Unger () 'Mental Problems of the Many.' *Oxford Studies in Metaphysics*, 23, Chapter 8. p.197.

> "Suppose that the meaning of the natural number predicates, nice1, nice2, and nice3, is given by the following clauses:
>
> (1) (a) n is nice1 if n > 15
>
> (b) n is not nice1 if n < 13
>
> (2) (a) n is nice2 if and only if n > 15
>
> (b) n is nice2 if and only if n > 14
>
> (3) n is nice3 if and only if n > 15
>
> Clause (1) is reminiscent of Carnap's (1952) meaning postulates. Clauses (2) (a)-(b) are not intended to be equivalent to a single contradictory clause; somehow the separate clauses should be insulated from one an other. Then nice1 is vague, its meaning is under-determined; nice2 is ambiguous, its meaning is over-determined; and nice3 is highly general or un-specific. The sentence 'there are infinitely many nice3 twin primes' is possibly undecidable but certainly not vague or ambiguous." [2]

In the 1980 third edition of his *Reference and Generality*, Peter Geach, asked how many hairs of a cat are essential to its identity.[3]

Perhaps the classic example of vagueness, in the sense of borderline cases which are transitions between relatively well-defined cases, is the Sorites paradox.[4]

The concept of vagueness as an intrinsic problem rooted in the ambiguity and contextuality of language alone was most clearly stated by Charles Sanders Peirce in 1902,

> "A proposition is vague when there are possible states of things concerning which it is intrinsically uncertain whether, had they been contemplated by the speaker, he would have regarded them as excluded or allowed by the proposition. By *intrinsically uncertain* we mean not uncertain in consequence of any ignorance of the interpreter, but because the speaker's habits of language were indeterminate." [5]

2 Fine (1975) 'Vagueness, truth and logic.'*Synthese* 30.3 (1975): 265-300.

3 See Peter Geach in chapter 36.

4 See chapter 32 for more details.

5 Peirce (1902) *Dictionary of Philosophy and Psychology*, J.M. Baldwin (ed.), New York: MacMillan, p. 748.

Some "epistemicists" think that vagueness is caused by human ignorance. They often hold the related view that chance is not ontological, but only the result of human ignorance.

But as the Sorites paradox shows, there is no deductive or inductive logic that can establish the borderline case. It is not ignorance. It is, as Peirce says, intrinsic to the lack of a unique and determinate threshold case. While there is no connection with language, the indeterminate nature of physical boundaries or borderlines is related to the ontological nature of chance and possibilities.

Vagueness and the Two-Slit Experiment

We can define vagueness precisely as the volume of space around a particle trajectory where the square of the quantum wave function (we call this the "possibilities function") has a significant non-zero value. This is the volume where there is some probability of finding the particle.

When that vague probability spreads out so as to hit both slits, the famous interference pattern appears on the distant screen. If the non-zero probability, the vagueness, is narrowed or focussed to fall onto just one of the two slits, the interference pattern disappears. It is the information in the abstract probability that interferes with itself in the two-slit experiment.