Parameterization as a framework for modeling contested scientific concepts

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Contested concepts in science

Many scientific concepts are contested in that experts disagree about their proper use and extension. For example, biologists employ competing notions of SPECIES, GENE, and NATURAL SELECTION, and cognitive scientists disagree about the nature and extension of COGNITION and REPRESENTATION. We have several well-established strategies for modeling scientific and lay concepts—e.g. definitions for well-behaved classical concepts, homeostatic property clusters for vague concepts—we have few illuminating methods for modeling concepts whose extensions are contested in this way. I propose a method called parameterization for fruitfully modeling contested concepts.

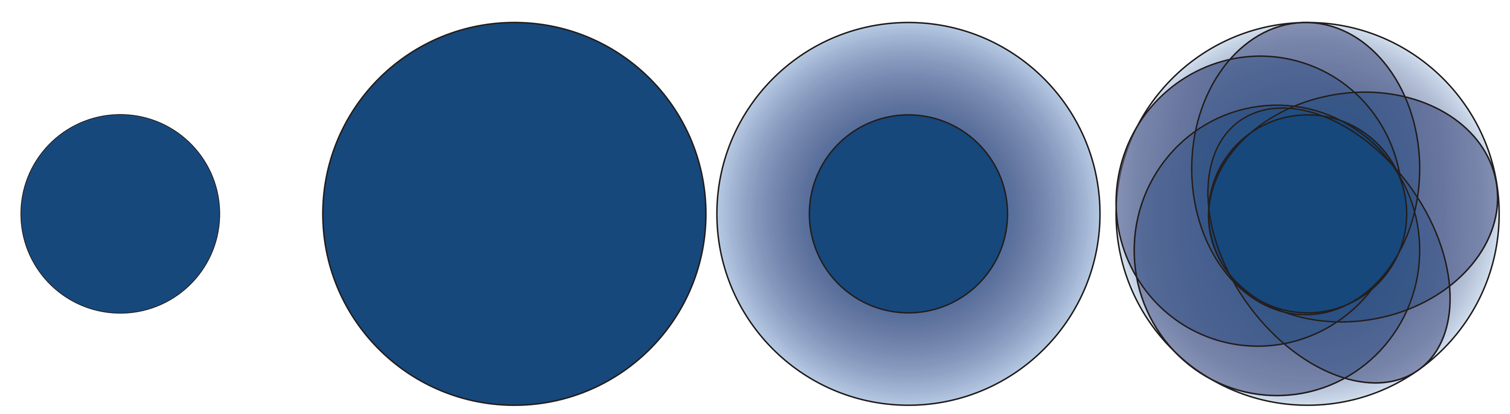

Fig. 1 Contested extensions. **1.1:** conservative. **1.2:** liberal. **1.3:** ecumenical. **1.4:** parameterized.

Parameterization

Contested concepts exhibit a core of common practices for use (e.g. some inferences are always licit), but vary with respect to other rules of application. In parameterized explication, some terms are treated as parameters that can take various interpretations as values. Varying the interpretation of a parameter produces variations in the extension of the explicated term, thus modeling the diversity of ascriptions and inferential roles we find in scientific practice. A successful parameterization reveals both a core of common practices concerning the use of a term (in its unparameterized elements), as well as major topics of disagreement (in its parameterized elements). Categories represented by parameters are often ripe for further empirical or philosophical inquiry.

> A linear equation with variables and parameters (in red):
> $y = mx + b$

For example, the JTB account of knowledge draws wider assent than any more specific explication of its terms. I.e., most agree that JTB delivers correct verdicts in most cases although they do not agree how to ascribe belief, truth, or justification.

> The JTB theory of truth:
> Knowledge is justified, true belief.

Selection parameterized

The case of NATURAL SELECTION offers an example of relatively well-covered territory. Consider the following explication of selection, based on Richard Lewontin's account:

> Selection occurs where:
> 1. there is a population of individuals,
> 2. there is variation in the traits of those individuals,
> 3. possession of the traits is partly heritable,
> 4. variation in traits causes variation in individual fitness.

By accepting interpretations of the parameters that have different extensions, selectional phenomena can selectively include or exclude boundary cases. The parameterized account makes explicit the dimensions of flexibility in the concept of SELECTION that enable its generalizability to novel contexts.

	natural selection	artificial selection	cultural evolution	evolutionary algorithm
individual	Darwinian individual	Darwinian individual	cultural artifact (meme)	candidate problem solution
heritable	e.g. germ-line transmission	e.g. germ-line transmission	reproduction by/in humans	conservation of components
fitness	no. successful offspring in natural conditions	no. successful offspring selected by breeder	no. offspring in culture	no. offspring after selection by fitness function

Cognition parameterized

The scientific concept of COGNITION is not as well-understood, and there are ongoing disputes about its extension. Extant debates tend to turn on how to interpret "representation," glossing over other issues. The following explication models most of variance in scientists' judgments:

> Cognition is the operation of mechanisms, where
> 1. the mechanisms belong to a subject,
> 2. the mechanisms represent the subject's environment, and
> 3. the mechanisms manage the behavior of the subject.

If the explication above is adequate to the variation in scientific judgments about the extension of COGNITION, it suggests that further philosophical attention ot the nature of cognitive subjects and behavior is warranted.

	face perception	extended memory	embodied audition	tomato-seeking
belong to subject	parts of biological organism	mechanisms serving organism	parts of biological organism	parts of biological organism
represent	representations with NDC	representations	adaptive mechanisms	pushmi-pullyu representations
manage behavior	autonomous locomotion, articulation	autonomous locomotion, articulation	autonomous locomotion, articulation	autonomous locomotion incl. plant activity

Conclusion

Parameterization offers a perspicuous method of representation for contested concepts, reflecting understanding of scientific disagreement.

Selected literature

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