

# Simplicity, Its Failures – And a Naturalistic Rescue?

(Manuel Bremer, University of Cologne)

Simplicity is often mentioned as a criterion to accept one theory out of a set of mutual exclusive theories which are able to explain and predict the same data. There are accounts of ontological simplicity, simplicity of the conceptual framework of a theory, and simplicity of the laws of a theory. All these notions are less than explicated. I give an overview on different proposals and confront the notion of simplicity with Eli Hirsch's *division problem*.

Ontological simplicity and simplicity of conceptual framework seem to fail. Simplicity of the laws of a theory as a criterion is also in trouble. Simplicity of laws might be nothing more than a feature of explanatory power. And simplicity of laws is beset with the *division problem* as well. Only a naturalistic theory of simplicity might save the concept. I close by looking at some empirical theories concerning simplicity built into our cognitive architecture.

## §1 Ontological Simplicity

Quine's definition of ontological simplicity tells us to take as the ontological commitment of a theory those entities which it quantifies over. Ontological economy is measured by the number of kinds of entities which are quantified over: "To be is to be the value of a bound variable."

However, there are several difficulties with this proposal:

- (i) Quantifiers do not account for all ontological commitments of a theory. Even if in a sentence we *quantify* only about objects, still there has to be something which is responsible for the applicability of the predicate, so that the theory that includes such sentences is committed to the corresponding properties. (So the friend of "truth-makers" argues.)
- (ii) To be counted are not the entities, but the *kinds* of entities, since in many theories there are denumerable many entities.
- (iii) This difficulty is even more pressing if we take a purely *syntactic* view on theories counting only the domains of quantification, so that all 1<sup>st</sup>. order theories are equally economical; especially if we introduce more primitive predicates instead of individual entities (e.g., "x is meaningful" instead of meanings). How is this trade-off to be avoided or measured? (cf. Oliver 1996:2ff.)
- (iv) The justification of ontological simplicity might refer to *Occam's Razor*. However, it is not obvious how this principle (usually understood as not assuming any entities that are not

needed to *explain* what one set out to explain) is related to Quine's criterion of ontological simplicity.

The complete failure of an a priori criterion of ontological simplicity, however, can be shown by invoking Eli Hirsch's (1993) division problem. Hirsch brought up the problem of "strange languages": A strange language carves reality up in a way that is completely at odds with our conceptual scheme. It might introduce kinds by disjunctive definitions. A strange language might have the kinds *cathouse* and *housecar*. These are defined – viewed from our point of view:

$\text{cathouse}(x) := x \text{ is a cat or } x \text{ is a house}$

$\text{housecar}(x) := x \text{ is a house or a car.}$

This language has the same expressive power as our own language, since our kinds can be introduced:

$\text{cat}(x) := \text{cathouse}(x) \wedge \neg \text{housecar}(x)$

$\text{house}(x) := \text{cathouse}(x) \wedge \text{housecar}(x)$

$\text{car}(x) := \text{housecar}(x) \wedge \neg \text{cathouse}(x)$

Now, the strange language possesses fewer kinds than our language. To use this language or take it as a theory of the world leads to less ontological commitment measured in Quine's fashion. That sounds absurd.

A solution could be to demand that the kinds to be quantified over are *natural kinds*. So we would need a theory of natural kinds. That's no easy enterprise (cf. Hirsch 1993:53-78).

Furthermore this might require a strong metaphysical background theory a philosopher in the tradition of the Logical Positivists tries to avoid. And these metaphysical background theories needed to introduce the required notion of natural kind cannot themselves be compared by a criterion of ontological simplicity (by assumption)! Even if we got such an ontological account of natural kinds we still would need a further argument why the language of our theories should inherit this natural ontology (instead of incorporating a scientific ontology – which could be just the ontology of a strange language).

Without a clarified notion of natural kind the criterion of ontological simplicity is too weak. Ontological simplicity as a criterion of theory choice fails.

## §2 Simplicity of Conceptual System

The basic idea behind conceptual simplicity is that the more simple our stock of primitive predicates is the more definitional interconnections are required in our theories to arrive at the

full stock of predicates. So our theories will be more systematic. Since systematicity is a value with respect to theories conceptual simplicity is seemingly justified.

A simple count of predicates will not do since any number of predicates (e.g., P, Q, R) can be reduced to a single relation in the following manner:

$$S(x,y,z) \equiv P(x) \wedge Q(y) \wedge R(z)$$

the individual predicates can be reintroduced in the fashion of:  $P(x) \equiv (\exists x)(\exists z)S(x,y,z)$ .

Goodman tried in a series of papers (1943, 1949, 1950, 1952, 1966, 1972) to substitute this account by a calculus of conceptual simplicity. He considers the non-logical definitional basis of theories, and with respect to that: the number of arguments in a predicate, the type of the predicate, and properties like reflexivity, symmetry and a version of transitivity. Starting with the postulate that predicates with a single argument (which by definition are irreflexiv, non-symmetric and non-transitiv) get the value "1" of simplicity the overall value of a definitional basis can be measured. Interdefinability theorems of predicate stocks make one definitional basis to spread its simplicity value. The general principle is that one stock of predicates cannot be more complex than another one which can define its primitives.

Conceptual simplicity gives no overall account of simplicity (e.g., concerning the ontology or concerning the laws of two theories both expressed within the same conceptual framework). And conceptual simplicity seems to be tied to semantic fundamentalism or atomism; the primitive predicates have to be independent of each other. This presupposition is, at least, controversial.

The decisive problem of conceptual simplicity is the *devison problem*. The argument of §1 shows us that the *conceptual system* of the strange language is, at least, not more complex than the conceptual system of our own language. So we are free to use a strange language, which is absurd.

A solution, which also solves the problem ontological simplicity has with the devison problem, could be a naturalistic account: Strange language are to be rejected, because we are built to speak non-strange languages. This is the structure of our language faculty. We just cannot speak strange languages, since we have to take them as strange.

Hirsch (1993:116) rejects this solution of the devison problem. According to Hirsch the naturalist gives us only a vacous account why we do not speak strange languages, and so it could be inquired why we are built this way. We need, according to Hirsch, a further argument. However Hirsch's complaint misconstrues the very point of giving a naturalistic account. The naturalistic way out is taken, because a priori reasoning seems unable to solve the division problem. The failure of a priori accounts is evidence that something else has to

step in. Giving a naturalistic answer *means* in principle to point to facts where further argument would be futile. Further inquiries from the philosopher's easy chair are referred to investigations of our language faculty in the cognitive sciences.

A naturalistic methodology, which is not chosen because of its own simplicity, therefore can solve the division problem and might save criteria of ontological and conceptual simplicity – if the further difficulties they are facing can be overcome as well. Otherwise conceptual simplicity will fail.

### §3 Simplicity of the laws of a theory

Competing theories might describe and explain the same data by laws of different complexity. There are several accounts of the simplicity of the laws of a theory. The most promising seems to be Sober's improvement on Popper's account. Popper (1959) identifies simplicity with the degree of falsifiability. An implied sentence is, therefore, less or equally simple than the implying sentence. And law statements with less predicates in their antecedent are the more simple laws, because a universally quantified conditional with less conjunctive clauses in its antecedents is easier to falsify. For example: " $(\forall x)F(x) \supset H(x)$ " is easier to falsify than " $(\forall x)(F(x) \wedge G(x) \supset H(x))$ ", since any F can be taken to test the first statement whereas we need an F that is G to test the second. Popper's account, nevertheless, leads to contraintuitive results: If falsifiability is our main aim we should choose theories which commit themselves to unnecessary details or overgeneralise, since they are more easy to falsify! (cf. Barker 1961, Goodman 1961, Post 1961/62, Turner 1991) [Similar problems are faced by Quine's (1963) thesis that simplicity improves verifiability.]

Sober (1975) tries to save a criterion like Popper's. According to Sober those laws are the most simple which need the least information to derive prognoses. A law is relevant with respect to the question "F(a)?" if its consequent entails "F( )". Laws differ in simplicity by their requirements on deriving an answer to the question. " $(\forall x)(G(x) \wedge H(x) \supset F(x))$ " needs the information "G(a)" and "H(a)". A law with only one conjunct would need less further information to answer the question, and so would be more informative itself. So in terms of information economy it is more simple. Since information economy is valuable, simplicity is. Sober's idea seems to save an a priori criterion of simplicity of law statements. It does not. The first objection, I will not pursue here, concerns the question whether Sober's criterion of simplicity delivers an independent criterion of theory choice or whether Sober's more simple laws are just the laws which have more explanatory power, so that simplicity of laws reduces to explanatory power. If this is true – if possession of less antecedent conditions just means to

have wider application, i.e. to have more power to unify a theory -, then an independent a priori account of simplicity fails.

The second objection restates our old problems. Once again the division problem occurs. In Sober's account everything depends on the specification of the antecedent of the law statement. Depending on the *conceptual* scheme of the theory we will arrive at a corresponding information economy. Sober's theory needs a supplementation by a theory of natural kinds, as Sober admits. Now, this leaves us where we were in §1. We have to add, however, that our theory of natural kinds cannot be chosen – by assumption of the function of this theory – because of its simplicity in terms of information economy, falsifiability etc. We are left with the need of a metaphysical account of natural kinds which is not restricted by *any* criterion of simplicity at all. Once again the naturalistic account seems to be more promising.

#### §4 Simplicity in the Cognitive Sciences

- Chomsky/Halle (1968) investigate the rule system of English phonology. Rules which are equivalent in their productivity can be formulated in different fashion. They propose that the most simple rule formulation is the one *built in* to our language faculty, since the phonological rules and language have to be acquired by children in limited time. Simplicity is not only a feature of the rules as they are written down by the linguist, but is psychological real. Chomsky (1965) applies this kind of reasoning to our (syntactic) language faculty. (On morphology cf. Bochner 1993; on semantics cf. Laurence 1996)
- Simplicity of information processing is, according to Churchland (1990) an epistemic virtue. Those neuronal nets are stable which code information and procedure in such a fashion that an optimal measure of knots is activated. Once undercomplexity has been avoided, simplicity is a virtue since otherwise irrelevant information will be encoded. Choosing the most simple representation uses our storage capacities optimally. This kind of simplicity is selected for and, of course, built in.
- In theories of perception of the gestaltist type simplicity of a figure is a valuable feature (cf. Ehrenfels 1890, 1937, 1988, Kaniza/Luccio 1986, Smith 1988). The corresponding principle of “minimality” claims that our perceptual system organises the perceptual world in such a way that differences and changes are kept minimal (cf. Hochberg 1977:117). So simplicity seems to be built into our perceptual processes as well. This might be so for independent reasons or because the “epistemic virtue” of information economic simplicity applies to our perceptual faculties as well (cf. Attneave 1954, Hochberg/McAllister 1953).

## Bibliography

- Barker, Stephen. (1961). "On Simplicity in Empirical Hypotheses", *Philosophy of Science*, 28, S.162-71.
- Bochner, Harry. (1993). *Simplicity in Generative Morphology*. Berlin/New York.
- Chomsky, Noam. (1965). *Aspects of Syntax-Theory*.
- Chomsky, Noam/Halle, Morris. (1968). *The Sound Pattern of English*. New York u.a.
- Churchland, Paul.(1990). "Simplicity as an Epistemic Virtue: The View from the Neuronal Level",in: Rescher 1990, S.35-46.
- Feuer, Lewis. (1957). "The Principle of Simplicity", *Philosophy of Science*, 24, S.109-22.
- Goodman, Nelson. (1943). "On the Simplicity of Ideas", *Journal of Symbolic Logic*, 8, S.107-21.
- (1949). "The Logical Simplicity of Predicates", *Journal of Symbolic Logic*, 14, S.32-41.
- (1950). "An Improvement in the Theory of Simplicity", *Journal of Symbolic Logic*, 14, S.228f.
- (1952). "New Notes on Simplicity", *Journal of Symbolic Logic*, 17, S.189ff.
- (1961). "Safety, Strength, Simplicity", *Philosophy of Science*, 28, S.150f.
- (1966). *The Structure of Appearance*. Indianapolis u.a. 2.Aufl.
- (1972). *Problems and Projects*. Indianapolis/N.Y.
- Hillman, Donald. (1962). "The Measurement of Simplicity", *Philosophy of Science*, 29, S.225-52.
- Hirsch, Eli. (1993). *Dividing Reality*. New York/Oxford.
- Hochberg (1977). *Einführung in die Wahrnehmungspsychologie*. Darmstadt.
- Laurence, Stephen. (1996). "A Chomskian Alternative to Convention-Based Semantics", *Mind*, 105, S.269-302.
- Oliver, Alex. (1996). "The Metaphysics of Properties", *Mind*, 105.
- Popper, Karl. (1959). *Logic of Scientific Discovery*
- Post, H.R. (1961/62). "A Criticism of Popper's Theory of Simplicity", *British Journal for the Philosophy of Science*, 12.
- Quine, Willard Van Orman.(1960). *Word and Object*. Cambridge/MA.
- (1963). "On Simple Theories of a Complex World", *Synthese*, 15, S.103-106.
- Rescher, Nicholas. (1979). *Cognitive Systematization*. A systems-theoretic approach to a coherentist theory of knowledge. Oxford.
- (1990). (Hg.) *Aesthetic Factors in Natural Science*. Lanham u.a., 1990.
- Searle, John. (1969). *Speechacts*.
- Smith, Barry. (1988). "Gestalt Theory: An Essay in Philosophy", in: ders. (Hg.). *Foundations of Gestalt Theory*. Wien/München, S.11-81.
- Sober, Elliot. (1975). *Simplicity*. Oxford.
- Turner, Peter. (1991). "A Note on Popper's Equation of Simplicity with Falsifiability", *British Journal for the Philosophy of Science*, 42, S.105-109.