Against the Statistical Account of Special Science Laws[1]

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Abstract

John Earman and John T. Roberts advocate a challenging and radical claim regarding the semantics of laws in the special sciences: the statistical account. According to this account, a typical special science law "asserts a certain precisely defined statistical relation among well-defined variables" (Earman and Roberts 1999) and this statistical relation does not require being hedged by ceteris paribus conditions. In this paper, we raise two objections against the attempt to cash out the content of special science generalizations in statistical terms.

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1. Introduction

John Earman and John T. Roberts defend a view according to which fundamental physics states laws that are expressed by universal generalizations (which are not qualified by any ceteris paribus condition or proviso). By contrast, the special sciences do not state universal laws but rather statistical generalizations. Since this account of special science 'laws' does not have a name we call it the *statistical account*. According to the statistical account, special science generalizations are to be interpreted either as statements about actual non-strict correlations or as statements that are 'mostly true'. Earman and Roberts claim that the statistical account does not require a qualification by ceteris paribus (henceforth, cp) conditions. As a consequence, cp-conditions are neither needed for the fundamental laws (because they are strict) nor for the special science generalizations. This seems to be a prima facie advantage for the statistical account because the exact meaning of cp-conditions remains controversial.

In this paper, we will leave aside Earman and Roberts's claim about the laws of physics. We focus on special science generalizations and present two objections against the statistical account.

2. Terminology

In order to lay a foundation for our arguments against the statistical account, we review two useful distinctions that are commonly drawn in the recent literature on cp-laws.

Gerhard Schurz (2002) distinguishes *exclusive* and *comparative* cp-laws. Exclusive cp-laws state that systems display a certain behavior provided there are *no* disturbing factors. The disturbing or interfering factors have to be *absent* for the behavior in question to be displayed. Newton's first law may be an example of an exclusive cp-law, as it describes the behavior of a body in the absence of forces. Other cp-laws require that certain (sometimes unspecified) factors remain *constant* as opposed to being absent. An example is the following law: 'if the supply of a commodity increases (decreases), the price decreases (increases)'. The law is a comparative cp-law because it requires that certain factors remain constant (e.g. demand). Cp-laws may be both exclusive and comparative, as, for instance, in the above example. It is not only required that the demand remains constant (which is often explicitly mentioned), it is furthermore tacitly assumed that there are no state interventions, natural catastrophes, wars etc. Strictly speaking, exclusive cp-laws can be reconstructed as special cases of comparative cp-laws with the relevant variables set to the value 0. However, exclusive cp-laws play a major role in the context of idealizations and special treatments of this case have been suggested. We follow the literature in distinguishing exclusive from (other) comparative cp-laws.

Earman and Roberts introduce a second helpful distinction (that is independent of the first distinction). The distinction of lazy and non-lazy cp-conditions.[4] They argue that a cp-clause is dispensable if all exceptions to the law (and other conditions that have to obtain in order for the generalization to be true) *can* be listed and it is merely a matter of convenience and the result of "laziness" that the conditions are not listed explicitly. Earman and Roberts refer to such a finite list as a "lazy" cp-clause. According to Earman and Roberts, only "non-lazy" cp-clauses are proper cp-clauses: a proper cp-clause is an open clause

[4] See also Earman, Roberts, and Smith (2002, 283f). Schurz uses the terminology of definite versus indefinite cp-conditions for the same distinction (Schurz 2002, section 3).

of which we do not know how to complete it. For what follows we will distinguish two senses of non-lazy, both of which can be found in Earman and Roberts (1999).

i. *Non-Lazy*$_1$: According to the first reading of non-laziness, the list of exceptions and conditions is open-ended and thus cannot be completed (Earman and Roberts 1999, 439, 441, 444, 467).
ii. *Non-Lazy*$_2$: According to the second reading, disturbing factors that might need to be taken into account in order to complete the cp-clause are outside the conceptual and methodological resources of the special science in question and, thus, cannot be captured. (Earman and Roberts 1999, 462f).

Cp-laws or cp-clauses that are non-lazy$_2$ need not be non-lazy$_1$. Even if the relevant conditions cannot be stated in the vocabulary of the special science, there might be a finite list if we allow for further conceptual resources (of, for instance, the physical sciences).

3. Lange's Dilemma

The problems concerning cp-laws are usually introduced by way of a dilemma, according to which law statements of the special sciences are either false empirical or trivially true statements. Many laws, such as Galileo's law are false if the law is read as a strict (universal) generalization. The claim 'whenever a body falls, it falls according to the equation: $s = \frac{1}{2} gt^2$' is false, because in water and other media the equation does not correctly describe the behavior of the bodies in question. Similarly the claim 'if the supply of a commodity increases (decreases), the price decreases (increases)' is false if read as a strict generalization, because there may be state interventions and other factors which lead to counter-instances to the strict generalization. This is the *first horn* of the dilemma ("falsity").

If, on the other hand, the law is hedged by a cp-clause, then Galileo's law becomes 'whenever a body falls (freely), it falls according to the equation: $s = ½ gt^2$, *unless some interfering factor intervenes*'. This claim appears to be trivially true, at least if the notion of an interfering factor is not further specified. If what is meant by an interfering factor is simply 'a factor that makes the law turn out to be false', the hedged claim says no more than 'the relation $s = ½ gt^2$ holds, unless it does not'. This is the second horn of the dilemma ("trivialty"). In what follows, we will call this 'Lange's dilemma' (named after Marc Lange 1993, 235). The dilemma poses a challenge for an account of truth-conditions of cp-law statements.

4. Statistical Accounts of special science laws

Earman and Roberts are quite pessimistic with regard to spelling out the truth conditions of cp-laws. However, this is not a major problem, they argue, because fundamental laws are not in need of cp-clauses and special science generalizations should not be understood as cp-laws either. Rather cp-laws play the scientific role of gesturing towards underlying generalizations that are more precise and not in need of cp-clauses:

> [A] 'ceteris paribus law' is an element of a 'work in progress', an embryonic theory on its way to being developed to the point where it makes definite claims about the

> world. It has been found that in a vaguely defined set of circumstances, a given generalizations has appeared to be *mostly right* or *mostly reliable*, and there is a hunch that somewhere in the neighborhood is a genuine, well-defined generalization, for which the search is on. (Earman and Roberts 1999, 466; emphasis added)

The essential point in this quote is that the *preliminary* formulation of a cp-law – that is "mostly right or mostly reliable" – belongs to the "context of discovery" of a search for a well-defined generalization. In the case of the special sciences, the result of the successful search for a well-defined generalization is a *statistical* generalization. By way of illustration Earman and Roberts refer to a case Kincaid discusses as an example of a statistical generalization: Jeffery Paiges' study of revolutions in agrarian societies. Earman and Roberts discuss one of Paiges' empirical findings as an example of a special science generalization: commercial hacienda systems tend to lead to agrarian revolt, whereas plantation systems tend to lead to labor reform (also mentioned in Roberts 2004, 165). Paiges argues for these claims on the basis of classifications (e.g. hacienda systems as opposed to other agrarian systems) and statistical analyses.

The statistical account permits two readings. According to the first and more liberal reading, Earman and Roberts reconstruct Paiges' statistical generalization as follows: '*It is mostly true* that commercial hacienda systems lead to agrarian revolt, whereas plantation systems lead to labor reform.' This mostly-statement is true, if it is the case that a generalizations holds in the majority of intended applications, i.e. if it is the case that in the majority of agrarian systems the generalization 'if it is a commercial hacienda, then …' holds. It is essential to this reading that a special science generalization is qualified by the operator ‘it is mostly true. For this reason we will call this reading of the statistical account the ‘mostly-reading’. It is worth stressing two points regarding this reading: firstly, a sentence of the form ‘it is mostly the case that p’ allows ‘p’ to be a *deterministic* as well as *statistical* a generalization. Secondly, Earman and Roberts claim that there is no need of a cp-clause. The clause has been replaced by ‘it is mostly right’. The non-strict character of the generalization is derived from the fact that the generalization does not hold in all (but the majority of) intended applications.

Elsewhere Earman and Roberts present their account of special science generalizations in slightly different words. Typical special science generalizations, they argue, are claims about “actual correlation among variables across various populations” (Earman and Roberts 1999, 467). These statements assert “a certain precisely defined statistical relation among well-defined variables” (Earman and Roberts 1999: 467, also Roberts 2004). That is, special science laws are *statistical generalizations* of the following form:

> In population H, a variable P is positively statistically correlated with variable S across all sub-populations that are homogeneous with respect to the variables V_1, …, V_n (Earman and Roberts 1999: 467).

This suggests that the above special science generalization should be reconstructed as follows: in all intended applications (i.e. all agrarian systems that are homogenous w.r.t. the values of the variables V_1, …, V_n), there is a positive non-strict correlation between commercial hacienda systems and agrarian revolt, as well as between plantation systems and labor reform. This reading captures the non-strict character of special science generalizations by understanding these generalizations as statements about non-trivial conditional probabilities (i.e. conditional probabilities other than 0 and 1).[5] Let us call this reading of the statistical account the 'positive correlation-reading'. Again, Earman and Roberts claim that this reading of special science generalizations appears to dispense with cp-clauses.

In sum, the essential difference between the two readings is that the mostly-reading of special science generalizations is compatible with these generalizations being deterministic and probabilistic, while the positive-correlation-reading requires understanding special science generalizations as non-strict statistical generalizations. Both readings are intended to capture the 'non-strict' character of special science laws without making use of a lazy cp-clause.

In the recent literature, at least one other version of the statistical account has been advocated by Gerhard Schurz.[6] Schurz (2001, 2002) argues that special science laws ought to be understood as *normic* laws of the form 'normally, As are Bs'. What matters most for our present purposes is that normic laws imply what Schurz calls the statistical consequence thesis. The latter thesis consists in the assertion of "a high statistical probability of Ax conditional on Bx" (Schurz 2002, 365) or "numerically unspecified statistical generali-

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[5] Probabilities are interpreted as actual frequencies here, for a discussion of this point see Reutlinger (manuscript).

[6] When characterizing dispositional terms, Rudolf Carnap already refers to an "escape clause" of the form "unless there are disturbing factors or provided the environment is in a normal state" and "usual circumstances in a laboratory" (Carnap 1956, 59).

zations of the form 'Most *A*s are *B*s'" (Hüttemann, Reutlinger, Schurz 2011, section 8.1).[7] Schurz's normic laws can be understood as an instance of the actual-correlation reading. Schurz's as well as Earman and Roberts' views have in common that they reconstruct special science generalizations, which appear to be hedged by a lazy cp-clauses, as statistical generalizations.

The statistical account of special science generalizations (both according to the mostly-reading and the positive-correlation reading) appears to be promising in at least three important respects:

1. Prima facie, a non-lazy cp-clause is not needed.
2. Statistical generalizations are indeed (dis)confirmable by evidence.
3. Statistical generalizations stating correlations capture the non-strict, non-universal, and exception-ridden character of generalizations in the special sciences.

If the statistical account could be defended for special science generalizations the pay-off would indeed be considerable. We will, however, argue that this account does not work. It may be adequate for *some* special science generalizations but not as a general account of special science generalizations. In what follows we present two arguments against the statistical account. The first argument is directed against the mostly-reading. The second argument is directed against both readings.

[7] Schurz (2001, 2002) provides an evolution-theoretic argument for the statistical consequence thesis. A discussion of this argument would exceed the length of this paper (cf. also Reutlinger, Hüttemann and Schurz 2011: section 8.1). Instead we focus only on the conclusion (i.e. the normic account as a special case of the statistical account).

5. Objection I: Cartwright's Dilemma

In this section, we primarily address the mostly-reading.[8] That is, we are interested in the claim that special science generalizations that appear to need a cp-clause, ought to be reconstructed as asserting that the generalization in question holds *mostly*.

We will start with a problem that Nancy Cartwright posed. The point of presenting the problem is not that those generalizations that can in fact be reconstructed according to the mostly-reading fall under the problem. Rather, the problem highlights the fact that there are many special science generalizations that cannot be reconstructed according to this reading in the first place. In her *How the Laws of Physics Lie*, Cartwright presents an argument whose main target is the covering law model of scientific explanation. However, the force of the argument carries over to the statistical account. The gist of the argument can be stated as a dilemma for cp-laws:

> Ceteris paribus generalizations, read literally without the 'ceteris paribus' modifier, are false. […]. On the other hand, with the modifier the ceteris paribus generalizations may be true, but they cover only those few cases where the conditions are right. (Cartwright 1983, 45).

The horns of this dilemma are *falsity* and *restricted applicability*. Newton's first law is an example (again from physics – we will turn to examples from the special sciences shortly) which can be used to illustrate the dilemma:

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[8] The argument also affects the positive-correlation-reading if the positive correlations in questions are *high* correlation and correlations are interpreted as actual frequencies.

> Every body continues in its state of rest or of uniform motion in a straight line, unless it is compelled to change that state by forces impressed upon it. (Newton 1999, 416)

Without the qualification “unless it is compelled to change that state by forces impressed upon it” Newton’s first law is false. On the other hand, if the law is qualified by a cp-clause, then it applies to very few cases (if any cases at all). Call this dilemma: Cartwright’s dilemma. It is worth noting that Cartwright’s dilemma differs from Lange’s dilemma, as the horns of the latter are *falsity* and *triviality* (see Section 3). Unlike in the case of Lange’s dilemma, Cartwright’s point is not that cp-laws might be trivially true but rather that it is difficult to see why we should care about them if they cover only rarely occurring situations.

The dilemma is not a dilemma for those special science generalizations that might be adequately reconstructed according to the mostly-reading (we have not argued that there aren’t any). The important point of the dilemma is that the mostly-reading cannot be a *general* account of special science laws. The dilemma highlights the fact that there are many generalizations, which appear to need a cp-clause (whether special science or not), because the generalizations cover only rare cases and can thus not be reconstructed as applying to most cases.[9] The important point for the goal of our paper is thus one of the premises of

[9] We are not going to discuss a solution that succeeds in avoiding Cartwright’s dilemma in this paper. See Hüttemann (1998) and (2012) for an attempted solution of this problem.

Cartwright's argument: There are many cp-laws (both in physics and in the special sciences) covering only very special *rarely occurring* situations.

Examples of generalizations in the special sciences that cover only rare cases are not far to seek. Consider two cases from economics: as we have stated before, economic agents maximize their expected utility. Rational agents are assumed to have complete information, transitive preferences etc. These features of agents are usually taken to be idealized because no real world agent has complete information. The law of demand holds under the condition of perfect competition. Perfect competition involves, among other things, perfectly informed agents that are competing and zero transaction costs. Idealized antecedent conditions or idealized conditions of application (such as 'if the population size is infinite …', 'if mating occurs randomly …') are also frequent in the case of generalizations in population ecology and evolutionary biology (Godfrey-Smith 2009, French 2011, Rice 2012). In analogy with Newton's first law and Snell's law, these examples suggest that laws in general should not be read as asserting that the relevant conditions of application obtain frequently. Cartwright's dilemma also applies to the examples from the special sciences: on the one hand, if we understand, say, the law of demand as a claim about what mostly happens, then the law would most certainly turn out to be false. On the other hand, if one qualifies the law by an exclusive cp-clause, then it does not apply to most real world cases.

It is worth pointing out that the problem of 'falsity and restricted applicability' is not genuine to exclusive cp-conditions. The problem might very well arise in the case of comparative cp-laws such as 'if the supply of a commodity increases (decreases), the price decreases (increases)'. As we have seen this statement is a comparative cp-law because (among other things) it requires that certain factors remain constant (e.g. demand). Should we read this cp-law as asserting that (among other things) the constancy of demand is a condition that obtains frequently, i.e. in most markets? It is unlikely – this assumption would presumably turn the law into a straightforward falsehood.

The conclusion we want to draw is that it is inadequate to reconstruct laws of the special sciences as claims about what mostly happens. While it may be true in some cases that a (deterministic or probabilistic) law statement holds in most intended applications, this cannot be a necessary condition for their truth or for their respectability.

One additional remark: we have objected to replacing cp-clauses by phrases such as "it is mostly true". However, the core of our objection is not concerned with the vagueness of "mostly". More importantly, we worry that very often whether or not a generalization is accepted as a cp-law does not at all depend on the frequency with which the relevant conditions are actualized. It is not in general part of the content of a special science law or generalization to state how often (whether characterized vaguely or quantitatively precise) its antecedent conditions are fulfilled (for a similar observation see Hempel 1988, section 5).

6. Objection II: Lange's dilemma and non-lazy cp-conditions

Our second objection applies to the positive-correlation-reading and – a fortiori – to the mostly-reading too. According to the positive-correlation-reading, the *statistical* character of a special science generalization accounts for the exceptions – that is, a generalization has exceptions in the sense that it is a claim about non-trivial conditional probabilities. The following might be an illustration: in all agrarian societies a certain non-strict correlation (e.g. between a certain kinds of farming and kinds of political activities) holds – provided a certain finite number of conditions[10] obtains (stated as the claim that the variables V_1, …, V_n takes particular values). According to Earman and Roberts, one does not need a cp-clause because a non-strict correlation naturally allows for exceptions. However, it is difficult to see how this move could provide a solution to the problem of interpreting special science generalizations. In the remainder of this section, we provide an objection to the positive-correlation reading. This is our second objection to the statistical account of special science generalizations.

Our objection consists in the worry that the statistical account does not get rid of non-lazy cp-conditions. If this worry is justified, then the statistical account does not live up to Earman and Roberts's original aspirations of providing an account of special science laws that does not rely on non-lazy cp-conditions (see end of Section 4). The question we want to press is whether Earman and Roberts are justified to claim that the conditions can be considered to be *lazy* cp-conditions. To be precise, conditions are stated in terms of the variables in $\{V_1, \ldots, V_n\}$ taking a certain (range of) value(s). As mentioned in Section 2, cp-conditions are lazy if the list of conditions is *either* finite ('lazy_1') *or* finite and entirely in the scope of a special science ('lazy_2'). It is a striking fact that Earman and Roberts do not present an argument for the claim for the claim that the list of variables V_1, …, V_n and, thus, the corresponding list of conditions is finite (which is tantamount to the claim that the

[10] Conditions such as the "proximity of progressive urban political parties" (Earman and Roberts 1999, 468).

cp-conditions are lazy cp-conditions). We think they need an argument.

How do non-lazy cp-conditions enter the statistical account? Recall that Earman and Roberts refer to statistical generalizations that include other variables than the antecedent P: “in population H, a variable *P* is positively statistically correlated with variable *S* across all sub-populations that are homogeneous *with respect to the variables* $V_1, \ldots, V_n$” (Earman & Roberts 1999, 467, emphasis added). One way to describe the complex antecedent of this generalization is to say that even probabilistic generalizations are qualified by a comparative cp-clause (Schurz 2002, Reutlinger, Hüttemann and Schurz 2011: section 3.1). The comparative reading of the cp-clause specifies that, for instance, P and S are correlated if other variables $V_1, \ldots, V_n$ take specific values. The comparative reading corresponds to the literal translation of ceteris paribus, i.e. other things being equal.

So, given the comparative reading of cp-conditions, how does a *non-lazy* cp-clause enter the statistical account of special science laws? It is very plausible that the V_i of an economic or ecological statistical generalizations include physical and biological conditions that are not in the conceptual and methodological scope of the discipline in question. Consider two examples. *First,* rational agents are thought of as maximizing their utilities if they are not drugged. The condition of not being drugged might be part of the *implicit* knowledge of economist, but this condition is outside of the scope of standard microeconomics.[11]

Secondly, consider another illustration by Marc Lange. The area law of island-biogeography states:

[11] Similarly, Lange (2002) speaks of “off stage” variables, and Strevens (2008) refers to opaque conditions of application.

> the equilibrium number S of a species of a given taxonomic group on an island (as far as creatures are concerned) increases [polynomially] with the islands area [A]: S = c×Az. The (positive-valued) constants c and z are specific to the taxonomic group and island group. (Lange 2002, 416f.)

Suppose we interpret the area law as a statistical generalization, as the statistical account requires. As Lange observes, the truth of the area law – even on a statistical reading – partly depends on conditions that lie outside of the scope of interest of island bio-geographers.

> There are counterfactual suppositions under which the fundamental laws of physics would still have held, but under which the 'area law' is not preserved. For example, had Earth lacked a magnetic field, then cosmic rays would have bombarded all latitudes, which might well have prevented life from arising, in which case [equilibrium number of a species] S would have been zero irrespective of [the island's area] A. (Lange 2002, 417)

Lange says that the truth of area law depends, among other things, on the actual strength of the magnetic field of the Earth. The law statement would be false if the magnetic field would be different than it actually is. Lange continues:

> The area law is not prevented from qualifying as an island-bio-geographical law […] by its failure to be preserved under [this] […] counterfactual supposition […].

> The supposition concerning Earth's magnetic field falls outside of island biogeography's range of interest. It twiddles with a parameter that island biogeography takes no notice of, or at least does not take it as a variable. (Lange 2002, 418)

In other words, the condition that the magnetic field of the Earth has its actual strength is a relevant condition, i.e. whether it obtains makes a difference to the truth or falsity of the area law. However, this condition is not salient in context of island biogeography.

What precisely do these examples show? *First*, they show that we have a good reason to speak of a non-lazy$_2$ cp-conditions that are relevant for statistical generalizations: that is, these conditions are not in the conceptual and methodological scope of the discipline in question and can thus not be captured by a statistical generalization formulated in the terminology of the special science in question. Thus, understanding special science laws as probabilistic generalizations does at least not replace non-lazy$_2$ cp-conditions.[12] However, even if these conditions are non-lazy$_2$ they need not be non-lazy$_1$. That is, even if the conditions cannot be stated in the vocabulary of the special science, there might be a finite list, if one allows for further conceptual and methodological resources (of other sciences). However, Earman and Roberts provide no argument for the claim that a finite list of such conditions will be available. Nor is there an argument for the claim that a finite list of conditions that fall *inside* the scope of the relevant special science can be given.

Secondly, if statistical special science laws have *either* (i) non-lazy$_2$-conditions that are at the same time non-lazy$_1$ (i.e. no finite list of them can be provided), *or* (ii) there are

[12] Ironically for Earman and Roberts, Hempel (1988, 152f) argues for this point against Carnap.

additional non-lazy$_1$ cp-conditions that fall inside the scope of the special science in question (if such a case is conceivable), then, we argue, the statistical approach cannot avoid Lange's dilemma. Suppose there is a non-lazy condition C for a higher-level statistical law 'p(B|A & V_1, …, V_n)=x', as sketched in the two examples above. *On the one hand,* if C is not added to the antecedent of the statistical law, then the statistical law is false. This is the first horn (falsity) of Lange's dilemma. *On the other hand*, if C is an open-ended list (non-lazy$_1$), then 'p(B|A & V_1, …, V_n & C)=x' becomes a statement without any clear meaning. According to Earman and Roberts' own reasoning, a law statement including an open-ended list of conditions C is in danger of becoming a trivial truth such as 'most As are Bs, unless something interferes' or 'A and B are correlated in conditions V_1, …, V_n, *unless something interferes*'.

To sum up the result of our second objection, the statistical account does not succeed in solving a problem it was designed for: it fails to dispense with non-lazy cp-conditions.

We will conclude this section by discussing a possible objection to our argument. One might object that the statistical account captures nicely that – and even explains why – there are exceptions to a nomic relation. According to the statistical account, a higher-level statistical law simply describes a frequency that is the result of lazy and non-lazy interferers. One kind of referring to these interfering factors is to speak of 'noise' coming from the environment of the system under description.

We respond to this objection that it is true that in some cases these frequencies obtain and they can be explained by (environmental or lower-level) interfering factors (cf.

Strevens 2008, chapter 10, for an elaborate account of explaining frequencies in this way). However, as we have argued in section 5, in the case of many laws there is not a good reason to believe that there are many of the frequencies required by the statistical account. Even if we focus on cases in which the relevant frequencies exist and in which the frequencies are the result of lower-level interfering or enabling factors, we would like to insist that the description of these lower-level factors is at least non-$lazy_2$ exercise. However, this is just what Earman and Roberts seem to deny.

7. Conclusion

Earman and Roberts advocate the statistical account of special science laws. At first glance, their account has the advantage of capturing the non-strict character of special science generalizations without being committed to allegedly problematic cp-conditions. We have presented two objections to the statistical account. The first objection attempts to establish the view that – contrary to the mostly-reading of the statistical account – it is not correct to say that special science generalizations should be interpreted as statements about what happens in most intended applications of the law. According to our second objection, the statistical account does not get rid of non-lazy cp-conditions. Hence, we conclude that the statistical account does not qualify as a general account of special science laws.

We will conclude with a brief outlook. If our arguments are sound, then statistical account does not succeed in dispensing with cp-conditions. This result motivates the following question: what is the positive account of lazy cp-conditions? Insofar as the authors are concerned, Hüttemann argues for a dispositionalist account of exclusive cp-laws. According to the dispositionalist ‘cp, all *A*s are *B*s’ is true if all *A*s have the disposition to *B*. In his (2012) Hüttemann argues that the two main objections against such an account can be countered, provided there exist laws of composition that describe how different dispositions contribute to one phenomenon. On this basis, he argues, it is (1) possible to account for the fact that referring to a disposition, which is not completely manifest, might nevertheless contribute to an explanation of an actual phenomenon. Furthermore (2), the laws of composition help to explain how we might gain evidence for how a system would behave in the absence of disturbing factors even if actual disturbing factors are present. The contribution of the disturbing factors can be calculated and – on the basis of the laws of composition – it can be ‘subtracted’. This shows that at least some exclusive cp-laws are empirically testable. Reutlinger (2011) advocates an updated version of a completer account. This approach accounts for the truth conditions of a cp-generalization by relying on two essential concepts: (a) the concept of minimal invariance captures a relevance relation between the variables explicitly figuring in the generalization, and (b) the notion of a quasi-Newtonian law is used to describe the influence of disturbing factors.

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