Auxiliary Assumptions, Unification, and Intelligent Design: A Defense of Contrastive Testability

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Abstract

Boudry and Leuridan argue that in a number of cases—and specifically in the case of intelligent design—a theory can be intuitively testable, but not contrastively testable according to Sober's definition. I argue that their purported counterexamples rely on misunderstandings of the concept of contrastive testability and the version of intelligent design criticized by Sober. I also argue that the liberalization of contrastive testability suggested by Boudry and Leuridan is trivial.

Keywords: testability; contrastive testability; empirical significance; auxiliary assumptions; unification; intelligent design

1 Introduction

Over the last two decades, Elliott Sober (1990, 1999, 2007, 2008) has developed and defended a criterion of testability that, unlike falsifiability, covers probabilistic hypotheses and, unlike typical Bayesian criteria, covers hypotheses that cannot be assigned probabilities. Relying on the concept of suitable auxiliary assumptions, Sober defines the testability of a theory only in contrast to another theory, and argues that intelligent design (ID) cannot be tested against evolutionary theory (ET).

While Boudry and Leuridan (2011, §3.6, B&L from now on) agree with Sober that testing is contrastive, they criticize his conception of suitability as too restrictive, arguing that it does not allow for certain intuitively valid inferences that would render ID testable, but disconfirmed. To liberalize the conception, they suggest an additional sufficient condition for suitability based on simplicity and unification.

In this note, I will argue that B&L misconstrue both Sober's criterion of testability and the version of ID that Sober claims cannot be tested against ET. As a result, the inferences they claim to be intuitively valid either are not, or can be accommodated by Sober's criterion. And while B&L do not spell out their sufficient condition for suitability explicitly, it trivializes contrastive testability in a number of plausible interpretations.

However, B&L have pointed to a real problem. It just lies neither with the auxiliary assumptions nor with contrastive testability, but rather with the hypotheses themselves and Sober's contrastive conception of confirmation.

2   Contrastive testability, contrastive confirmation, and suitability

Sober (2008, 152) defines contrastive testability as follows:

Definition 1 (Sober). Hypothesis H_1 can now be tested against hypothesis H_2 if and only if there exist true auxiliary assumptions A and an observation statement O such that (i) $\Pr(O|H_1 \,\&\, A) \neq \Pr(O|H_2 \,\&\, A)$ [and (ii) A is suitable for H_1, H_2, and O].

Definition 2 (Sober). [Auxiliary assumptions A are suitable for H_1, H_2, and O if and only if] we now are justified in believing A, and [...] the justification we now have for believing A does not depend on believing that H_1 is true or that H_2 is true and also does not depend on believing that O is true (or that it is false).

$\Pr(O|H \,\&\, A)$ is called the *likelihood* of H (for O, given A). Thus H_1 is testable against H_2 if and only if their likelihoods for some observation O given some A differ, where it must be possible to justify A without relying on the truth of H_1, H_2, O, or $\sim O$. Note that it is irrelevant for A's suitability whether H_1, H_2, O, or $\sim O$ could be justified by relying on the truth of A.

Sober (2008, 145) argues by way of example that, on pain of triviality, not every auxiliary assumption is suitable. Imagine that Jones is being tried for murder, and that a size 12 shoe print, cigar ash, and .45 Colt shells have been found at the crime scene. To establish the alternative hypothesis that Smith is the culprit, Sober explains, it is not enough to simply stipulate the assumption that Smith is a Colt-owning smoker with size 12 feet, while Jones is not. For an analogous stipulation with the roles of Smith and Jones reversed would lead to the opposite conclusion.

In this example, the question is one about *confirmation*, not testability. The tacit switch relies on two further assumptions. First, a hypothesis is tested by an observation O if and only if it is confirmed or disconfirmed by O. Thus if a stipulated auxiliary assumption is not suitable for confirming a hypothesis (such as that Smith is the murderer) or disconfirming it by confirming its competitor, it is also not suitable for testing it.

Furthermore, Sober (1999, 48) states for any relation R:

If a set of observations provides a test of a proposition because it bears relation R to that proposition, then a proposition is testable when it is possible for there to be a set of observations that bears relation R to the proposition. Testing is to testability as dissolving is to solubility.

By the *converse* of this relation, a stipulated auxiliary assumption is not suitable for the testability of two hypotheses because it is not suitable for the testing of two hypotheses.

Thus H_1 can be tested against H_2 if and only if there is an O such that O confirms H_1 against H_2 or O disconfirms H_1 against H_2. This suggests

Definition 3. O now confirms hypothesis H_1 against hypothesis H_2 if and only if there exist true and suitable auxiliary assumptions A such that $\Pr(O|H_1 \& A) > \Pr(O|H_2 \& A)$.

Definition 3 is equivalent to Sober's definition of O favoring H_1 over H_2 (Sober 2008, 32), except that it takes auxiliary assumptions into account. This is necessary because "hypotheses rarely make observational predictions on their own" (Sober 1999, 54). B&L tacitly rely on definition 3 when criticizing Sober's conception of suitability by arguing that, in some cases, ID is intuitively confirmed but not contrastively confirmed according to definition 3. Like Sober and B&L, I will therefore assume definition 3 for the following discussion.[1] The problem with contrastive testability, B&L claim, lies with Sober's definition of suitability.

3   Contrastive testability and valid inferences

B&L argue against Sober's claim that ID "cannot be tested against evolutionary theory, at least at present" (Sober 1999, 66f; cf. 2008, 148). More generally, they argue that many examples of intuitive confirmation are not examples of contrastive confirmation. I will discuss each of their four examples in turn.

3.1   Excursion or Murder?

B&L suggest to change Sober's example of the murder case so that the evidence additionally includes blood stains and broken glass in the bedroom but no body, the supposed victim (a landlord) is a non-smoker who neither owns a gun nor has size twelve feet, and the investigating detective has to decide between

H_1 The landlord was murdered.

H_2 The landlord is alive and left for an unexpected walk.

H_3 The landlord killed himself and was dragged away.

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[1]For the record, I doubt that it is correct: For confirmation, one must take the maximal set of suitable auxiliary assumptions into account. Since the following discussion will be about whether specific auxiliary assumptions *can*, not *should* be included, this will not make a difference.

B&L (§3.1) claim:

> If the detective favors the murder hypothesis, we submit that she is
> justified in making the additional assumption that the hypothesized
> murderer, whoever it was, wears a size 12 shoe, smokes cigars and
> used a Colt .45. This would be a matter of sound detective work, not
> of baselessly accusing Smith or Jones.

This is probably correct, but also irrelevant because the question was not whether
the detective can infer the anatomy, smoking habit, and possessions of a hypothet-
ical murderer, but whether H_1, H_2, or H_3 is confirmed by the evidence. Sober's
definition of suitability does not lead to a problem in this case. For one, given that
even unexpected walks tend not to involve gun shells, shattered glas, and profuse
bleeding, all of which are more probable in case of a murder, H_1 is contrastively
confirmed against H_2 by the evidence. Thus definition 2 of suitability is not too
exclusive for H_1 to be contrastively confirmed against H_2. It is also fairly plausible
that H_1 is contrastively confirmed against H_3 because it is arguably more probable
that someone breaks a window when illegally entering a bedroom than when
dragging a body. In any case, the evidence does not obviously intuitively confirm
H_1 against H_3 either, so there is no counterexample.

Of course, B&L are not interested in the confirmation of H_1, but of A_1.[2] They
give what I take to be meant as a rephrasing of H_1:

O A size 12 shoe print, cigar ash, and shells from a Colt .45 revolver were
found in the bedroom.

H_1 The landlord was murdered by X.

A_1 X wears a size 12 shoe, smokes cigars and owns a Colt .45.

B&L note that any plausible auxiliary assumptions K that we may justify inde-
pendently of the evidence at hand do "not warrant our adopting A_1. Only the
conjunction of K with O and H_1 does". But again, the question should not be
whether A_1 is confirmed, but whether H_1 is confirmed. B&L have switched the
roles of the hypothesis and the auxiliary assumptions: In their informal descrip-
tion, B&L state that the detective favors H_1, that is, counterfactually assumes H_1
to be justified, and can thus infer the anatomy, smoking habit, and possessions of
the hypothetical murderer. The correct description of the situation is thus:

O A size 12 shoe print, cigar ash, and shells from a Colt .45 revolver were
found in the bedroom.

A_2 The landlord was murdered by X.

H_4 X wears a size 12 shoe, smokes cigars and owns a Colt .45.

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[2]They assume that the detective "tentatively favors" H_1 and want to determine whether A_1 can
be justified (Boudry, personal communication).

If the competing hypothesis is, for example, 'X does not wear a size 12 shoe, smokes cigars, or owns a Colt .45', one can see that the evidence contrastively confirms H_4 when we help ourselves to some auxiliary assumptions that are justified independently of the evidence at hand (e. g. the general frequency of other people's cigar ash, shells, and footprints found in private bedrooms).

3.2   Motivated expert or lazy dilettante?

Moving on to ID, B&L (§3.3) consider a situation in which "William Paley, reflecting on the origin of the human eye, constructed the following design hypothesis, conjoined with two additional assumptions":

H The human camera eye was created by an intelligent designer.

A_1 The designer is interested in creating camera eyes.

A_2 The designer is capable of designing something as complex as the camera eye.

They claim that "the adoption of both A_1 & A_2 seems reasonable enough, since their negation is completely uninteresting, in the sense of being very unlikely to yield [O]", which asserts the existence of camera eyes.[3] Specifically,

> the likelihood of both H & $\sim A_1$ and H & $\sim A_2$, viz. $\Pr(O|H$ & $\sim A_1)$ and $\Pr(O|H$ & $\sim A_2)$ is extremely low. If we follow Sober's approach, however, this gives us no reason for adopting A_1 & A_2, because, in the absence of background knowledge about the designer, the independence rule is violated.

This argument for the intuitive confirmation is somewhat questionable, since $\Pr(O|H$ & A_1 & $A_2)$ can be low for some O, H, A_1, and A_2 even if $\Pr(O|H$ & $\sim A_1)$ and $\Pr(O|H$ & $\sim A_2)$ are low as well. More importantly, it misconstrues the situation: Paley has developed the hypothesis $H_1 \Hbar H$ & A_1 & A_2,[4] and B&L claim that, because O is extremely improbable under the assumption of H & $\sim A_1$ and H & $\sim A_2$, H_1 is intuitively confirmed. Now, since by construction $\Pr(O|H_1)$ is high, O also contrastively confirms H_1 against $H_2 \Hbar H$ & $\sim A_1$ & $\sim A_2$, because, presumably, $\Pr(O|H_2)$ is very low.[5]

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[3]Strictly speaking, due to the use of the descriptive phrase, H either entails the existence of the human eye (in Russell's paraphrase), or presumes its existence (in Strawson's paraphrase). H should rather be 'All camera eyes were created by an intelligent designer' or similar. Similarly, A_1 and A_2 should be preceded by "If there is exactly one designer, …".

[4]'$\Hbar$' denotes equivalence.

[5]In a footnote, B&L (§3.3, n. 4) further argue against the independence rule on the basis that "there do not seem to be many ways of justifying the introduction of an auxiliary *except* by taking the observations into account which we set out to explain. […] Take for example: $A_1^* =$ 'Naive set theory suffers from Russell's paradox.' [T]here is no use incorporating it as an auxiliary, because it has no bearing on our observations in any way." This confuses justifying a statement with justifying its inclusion in the set of auxiliary assumptions that one considers. Sober does not restrict the latter.

This response does not show that Sober's claim that ID cannot be tested against ET is mistaken, however, for Sober (2007, 3; cf. 1999, 62; 2008, 132) expressly considers a minimal version of ID:

> The single thesis of what I will call mini-ID is that the complex adaptations that organisms display (e. g., the vertebrate eye) were crafted by an intelligent designer.

Thus Sober considers neither H_1 nor H_2, and in fact repeatedly notes that he assumes that the designer's intentions are unknown because the designer itself is not specified in any way (Sober 1999, 65; Sober 2007, 6; Sober 2008, 128, n. 14).

This also defuses another criticism: B&L (§3.4, n. 7) claim that in Sober's approach, it is not clear how to "separate the central hypothesis from auxiliary assumptions". Since Sober is considering the contrastive testability of mini-ID, every other assumption must be an auxiliary assumption. Otherwise, definition 1 (which is not restricted to specifically "central" hypotheses) has been misapplied. Design hypotheses different from mini-ID can of course be contrastively testable against ET (cf. Sober 1999, 61).

This points to a core misunderstanding of Sober's criterion. B&L (§3.3) take the role of the auxiliary assumptions to consist in "fleshing out a hypothesis", that is, they consider auxiliary assumptions to somehow become conjuncts of the hypothesis. They rest this interpretation on Sober's claim that auxiliary assumptions are "used to bring the hypotheses [...] into contact with the observation O" (Sober 2008, 145). But this is mistaken, for Sober (1999, 54; 2007, 5f; 2008, 144) introduces auxiliary assumptions to address Duhem's point that hypotheses (whether "fleshed out" or not) rarely make observational assertions on their own, but rely on other hypotheses and individual facts to get "into contact" with observations (Duhem 1914).

3.3   A designer with little choice

B&L consider the possibility to "view the goals and abilities of the designer as the adjustable parameters of the model" (§3.4) and imagine a situation in which

> only a few 'parameters' in the design hypothesis [...] provide an elegant explanation for phenomena that resist any conceivable naturalistic explanation [...]. The fact that the choice of auxiliaries about the designer's intentions and attributes $(A_1, ..., [A_m])$ would depend on the observations we set out to explain $(O_1, ..., O_n)$, without the support of independent background knowledge, would then be of little concern.

m is here assumed to be much less than n.[6] But then, assuming that each observation determines one parameter, it is enough to make m observations to determine

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[6]Boudry (personal communication). The quoted text mistakenly contains 'A_n' instead of 'A_m'.

all parameters, at which point the remaining observations follow from the model. Thus, for example, $\Pr(O_{m+1} \,\&\, \dots \,\&\, O_n \,|\, \text{ID} \,\&\, O_1 \,\&\, \dots \,\&\, O_m) > \Pr(O_{m+1} \,\&\, \dots \,\&\, O_n \,|\, \text{ET} \,\&\, O_1 \,\&\, \dots \,\&\, O_m)$, because, I assume, ET would be a "naturalistic explanation". Since furthermore $O_1, \dots, O_m$ have not been justified by assuming $O_{m+1}, \dots, O_n$, $\sim O_{m+1}, \dots, \sim O_n$, ET, or ID, it holds that $O_{m+1} \,\&\, \dots \,\&\, O_n$ contrastively confirms ID against ET.[7]

Again it has to be kept in mind that the version of ID that B&L are considering in the example is not mini-ID. In fact, Sober (2008, 2.19) states explicitly that, since the designer is not specified, mini-ID has enough free parameters (in form of the possible intentions and abilities implicit in the concept of a designer) to accommodate any sequence of observations.

3.4   A designer who writes on animals

B&L (§3.4) consider a scenario in which verses of the Hebrew Bible are observed on beetles, and consider the following hypothesis and auxiliary assumptions:

H Beetles are created by an intelligent designer.

A_1 The intelligent designer has the ability to create beetles, is inordinately fond of them, and he has used their bodies to inscribe his Word.

B&L state that it is doubtful that there is a naturalistic explanation of the observations. However, even if all animals displayed bible verses, there were no maladaptations, and no evidence for ET whatsoever, an "adherent of Sober's approach [...] would be unmoved [...], because the adoption of auxiliary [A_2] (the properties of the Judeo-Christian God) still depends upon looking at $O_1, \dots, O_n$ (without independent background knowledge)". Thus, while intuitively the observations clearly confirm ID, they do not confirm ID contrastively (§3.4).

It is clear that the observation that beetles (or all animals) have bible verses inscribed on them ($O_1, \dots, O_n$) contrastively confirms the hypothesis $H_1 \vDash H \,\&\, A_2$ against ET, because even without auxiliary assumptions, the likelihood of H_1 for $O_1 \,\&\, \dots \,\&\, O_n$ is higher than the likelihood of ET. Thus H_1 (which is again different from mini-ID) is contrastively confirmed and provides no counterargument to definition 2.

B&L (§3.5) modify their example and consider the scenario in which each bible verse is written on exactly one species, and some bible verses are missing from the animal kingdom. They state that in this case, H_1 could predict the existence of the remaining bible verses on some species.

B&L use the example to consider Sober's definition 2 of suitability anew:

> In the (novel) prediction case, the observation O that we use to test our competing hypotheses cannot enter into our considerations for

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[7]It is here important to remember that, unlike logical independence, the independence of justification is not symmetric.

choosing auxiliaries $A_1, \ldots, A_n$, because, by definition, O has not been observed yet. In what sense is the "independence" of $A_1, \ldots, A_n$ to be understood? Is it acceptable if our justification of $A_1, \ldots, A_n$ depends on other observations that are already known? If so, why does Sober not leave room for such cases of predictive success in setting up his intrinsic argument against design?

The answers are fairly straightforward: First, since definition 2 does not distinguish between observations in the past and the future, 'independence' is to be understood as in the previous cases. Therefore, second, the auxiliary assumptions may depend on observations already known.

The third question can be answered by combining the previous reply and the reply to B&L's example of ID as a model with intentions as parameters. While some intentions $A_1, \ldots, A_n$ can be determined by previous observations $O_1, \ldots, O_n$, the hypothesis that Sober considers, (i. e., mini-ID) contains so many parameters (one intention for each observation) that O still cannot be assigned a probability. Thus there is no predictive success.

4   B&L's amendment trivializes contrastive testability

As with his demand that the auxiliary assumptions must be restricted at all, Sober (2008, 145) uses an example to justify his demand that suitable auxiliary assumptions must not depend for their justification on the observations that are used to test the hypotheses (cf. Sober 2007, 6):

> If O is true, so is the disjunction "either H_1 is false or O is true". If you use this disjunction as your auxiliary assumption A_1, then it turns out that the conjunction $H_1 \& A_1$ entails O. This allows H_1 to make a prediction about O even when H_1 has nothing at all to do with O. The same ploy can be used to obtain auxiliary assumptions A_2 so that the conjunction $H_2 \& A_2$ also entails O. Using propositions A_1 and A_2 as auxiliary assumptions leads to the conclusion that the two hypotheses H_1 and H_2 both have likelihoods of unity.

As it stands, this argument proves nothing about the relevance of the restriction for the definition of contrastive testability, since it only shows that for one specific auxiliary assumption, $A \vDash A_1 \& A_2$, both hypotheses' likelihoods are 1. But to show that H_1 cannot be tested against H_2, their likelihoods have to be identical for *all* auxiliary assumptions that are otherwise suitable.

However, the ingenuity of the choice of A_1 is exactly that, if H_1 and H_2 are completely unrelated to O, the likelihood of $H_1 \& A_1$ is 1, while the likelihood of $H_2 \& A_1$ is not. Reconceptualized in this way, Sober's argument is a typical trivialization proof, since it shows that without the restriction, any two hypotheses can be tested against each other. The argument has two tacit assumptions that are relevant here. First, a sentence S (here: $\neg H_1 \vee O$) logically entailed by a justified

sentence J (here: O) is also justified, since otherwise S might be excluded simply for not being justified. Second, $\Pr\bigl(O\,|\,H_2 \,\&\, (\neg H_1 \vee O)\bigr) \neq 1$. Both of these are plausible.

Since they consider Sober's definition of suitability to be too restrictive, B&L (§1) suggest "an alternative and more lenient account of auxiliary assumptions, based on the explanatory virtue of unification". Unfortunately, they leave the notions of unification and simplicity (which also features in their account) and their exact role in a sufficient condition for suitability[8] on an intuitive level. A very strict sufficient condition that plausibly captures B&L's intention is given by

Definition 4. Auxiliary assumptions A are suitable for H_1, H_2, and O if A are justified and $H_1 \,\&\, A$ as well as $H_2 \,\&\, A$ are simple and unifying.

One could further liberalize this condition by (i) dropping the demand that A be justified, or (ii) changing the 'as well as' into an 'or'. However, even the most restrictive of these sufficient conditions trivializes contrastive testability.

To show that any two hypotheses H_1 and H_2 can be tested against each other, let A^* be any justified statement (for example some correct hypothesis) that is simple and unifies some true observations $O_1, \ldots, O_m$, assigning them a high probability. Assume the analogous for $A^\dagger$ and $O'_1, \ldots, O'_n$. Let further H_1 and H_2 be independent from the observations, A^*, and $A^\dagger$. Then $A \vDash (\sim\! H_1 \vee A^*) \,\&\, (\sim\! H_2 \vee A^\dagger)$ is justified because it is entailed by $A^* \,\&\, A^\dagger$. Now $H_1 \,\&\, A \vDash H_1 \,\&\, A^* \,\&\, (\sim\! H_2 \vee A^\dagger)$ is almost as simple as A^* and $A^\dagger$,[9] and it unifies $O_1, \ldots, O_m$. Since the analogous holds for $H_2 \,\&\, A$, A is a suitable auxiliary assumption. But similar to Sober's trivialization proof, it now holds that $\Pr(O_1 \,\&\, \ldots \,\&\, O_m\,|\,H_1 \,\&\, A) > \Pr(O_1 \,\&\, \ldots \,\&\, O_m\,|\,H_2 \,\&\, A)$, so that $O_1 \,\&\, \ldots \,\&\, O_m$ contrastively confirms H_1 against H_2. Thus H_1 can be tested against H_2.

If definition 4 is liberalized as in (i), the assumption about A^* and $A^\dagger$ can be weakened accordingly. For (ii), A can be defined as $\neg H_1 \vee A^*$, which puts less strict demands on what can be called 'almost as simple as'. Similarly, if definition 1 of contrastive testability itself is changed to allow for different auxiliary assumptions A_1 for H_1 and A_2 for H_2,[10] then $A_1 \vDash \sim\! H_1 \vee A^*$ and $A_2 \vDash \forall x(x = x)$ are enough to show that H_1 can be tested against H_2. In this case, as in (ii), one can even demand that the auxiliary assumptions must unify the very observations used in their justification. Thus with B&L's sufficient condition for suitability, contrastive testability is trivial, as so many criteria of empirical significance before it.

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[8]B&L allow other sufficient conditions, e. g. Sober's, as well (Boudry, personal communication).

[9]Similarly, according to B&L (§3.4) the hypothesis that the landlord from §3.1 staged the crime scene to fake his own death and go underground is arguably "not far more complex" than the hypothesis that he was murdered.

[10]This is in fact what B&L assume (Boudry, personal communication).

5   A problem with contrastive confirmation

B&L (§§1,3.2) consider Sober's definition 2 of suitability a means to avoid gerrymandering of the auxiliary assumptions to fit the observations. And while their examples do not show that the definition is too restrictive,[11] there is a vital problem with contrastive confirmation that, although it has nothing to do with definition 2, may lie at the core of their unease. The gerrymandered auxiliary assumptions that B&L (§2.1) want to avoid can be conjoined with the hypothesis of a designer to form a *new* hypothesis (cf. Sober 2008, 131–133), because Sober's criterion of confirmation contains no restriction whatsoever on the choice of hypotheses to be compared. This poses no problem for contrastive testability, since even gerrymandered hypotheses can be intuitively testable against non-gerrymandered hypotheses. A gerrymandered hypothesis may even be intuitively confirmed against its competitor by some observation O. However, the situation is different for confirmation in light of *all* observations (the total evidence): For many a hypothesis H and many of its observational assertions O, one can construct another (gerrymandered) hypothesis H' that differs from H only in that it asserts $\sim O$. H and H' are contrastively equally well confirmed against any hypothesis (including each other) as long as the total evidence does not contain O. In Bayesianism, the hypotheses may differ in their prior probabilities, so that one is more likely than the other. Proponents of inference to the best explanation may opt for one of the hypotheses because it explains better. B&L might argue that the more simple and unifying hypothesis should be preferred. Contrastive confirmation, however, provides no reason to prefer one hypothesis over the other. Thus, considering that O can be 'The world will end tomorrow', contrastive confirmation may be less discerning than desirable.

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[11]Rather, using a proof similar to the one in §4, it can be shown that definition 2 is too *liberal* (Lutz 2011, §4.2).

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