

Erkenntnis

Asymmetry and the Geometry of Reason

--Manuscript Draft--

Manuscript Number:	ERKE-D-17-00082R2	
Full Title:	Asymmetry and the Geometry of Reason	
Article Type:	Original Research	
Keywords:	Bayesian conditionalization; epistemic utility; formal epistemology; geometry of reason; gradational accuracy; information theory; Jeffrey conditioning; partial beliefs; principle of maximum entropy; probabilism; probability kinematics; probability update; scoring rules; convex analysis	
Corresponding Author:	Stefan Lukits University of Toronto Toronto, ON, CANADA	
Corresponding Author Secondary Information:		
Corresponding Author's Institution:	University of Toronto	
Corresponding Author's Secondary Institution:		
First Author:	Stefan Lukits	
First Author Secondary Information:		
Order of Authors:	Stefan Lukits	
Order of Authors Secondary Information:		
Funding Information:	Social Sciences and Humanities Research Council of Canada (756-2017-0286)	Dr. Stefan Lukits
Abstract:	<p>The geometry of reason is the view that the underlying topology for credence functions is a metric space, on the basis of which axioms and theorems of epistemic utility for partial beliefs are formulated. It implies that Jeffrey conditioning must cede to an alternative form of conditioning. The latter fails a long list of plausible expectations. One solution to this problem is to reject the geometry of reason and accept information theory in its stead. Information theory comes fully equipped with an axiomatic approach which covers probabilism, standard conditioning, and Jeffrey conditioning. It is not based on an underlying topology of a metric space, but uses a non-commutative divergence instead of a symmetric distance measure. I show that information theory, despite initial promise, also fails to accommodate basic epistemic intuitions.</p>	
Response to Reviewers:	<p>I have a nicely formatted version of my response to the referees here:</p> <p>https://tinyurl.com/erkeresp</p> <p>Here is the same information in plain text.</p> <p>Comments for Referees</p> <p>Reviewer #1</p> <p>I am happy that the author has responded to my previous comments listed in their response. A couple of mostly niggly points on the revised manuscript:</p> <p>(1) p. 2: Isn't it more an issue of rationality rather than numerical effectiveness? Perhaps delete: "numerically most effectively represented". I agree that the term "numerical effectiveness" is misleading and ambiguous. I wanted to keep the door open to qualitative representations of partial beliefs that run parallel to a representation in numbers. I have changed the passage to "the best quantitative model of partial</p>	

beliefs is such that partial beliefs correspond to probabilities"

(2) p. 5: Perhaps "agree" is better than "aligned" at the bottom. Also, perhaps "The information theorist is the better Bayesian" or "information theory is the better Bayesianism" is better shortly after? I have incorporated both of these suggestions in the revision.

(3) p. 15: "The conclusion follows." Is it worth restating the conclusion here? I have deleted this sentence in the revision.

(4) p. 26: "Unfortunately for Pettigrew..." This was a little confusing. Perhaps rephrase: "Unfortunately for Pettigrew, the Log score also has a claim to uniqueness, namely, ..." I have changed the passage to "Unfortunately for Pettigrew, the Log score also has a claim to uniqueness. It is the only proper scoring rule which fulfills locality."

(5) p. 41: "They are roughly aligned..." Perhaps inserting "respectively" somewhere here would help the reader. Yes! I have inserted the missing "respectively."

(6) p. 62: "degree of confirmation theory". Would simply "confirmation theory" be better? I deleted "degree of" for the revision.

(7) p. 69: Perhaps replace "classification" for "clarification"? I have deleted this expression altogether and replaced the parenthetical expression by "It would help, for example, to know that all reasonable non-commutative difference measures used for updating are ill-behaved."

Reviewer #2

Summary

This revised manuscript is improved and may possibly be accepted after carrying out major revisions. Given the number of comments and the severity of some of them, I can see an argument for rejecting this manuscript; see below for details.

Major Comments

The major problem I have with this problem is that there are a large number of things in it which are not quite right – to my eyes.

I have made substantial changes to the manuscript following the recommendations of the referee. The major changes are with respect to the following items:

- (x) Clarify the relationship between affine and convex constraints
- (x) Change the setup for the probability space, following Predd et al.
- (x) The Log score fulfills LOCALITY only on probability functions
- (x) Fill out and clarify the proof for symmetry
- (x) Change the treatment of continuity, as LP-"conditioning" isn't even continuous with standard conditioning in standard conditioning cases

Minor Comments

Page 2: "the updating scenario permits it"? I have replaced this confusing expression by "when possible"

"if there is no further information, mutually disjoint and jointly exhaustive events are equiprobable" – that's too simplistic. Surely, for $\Omega = \{\omega_1, \omega_2, \omega_3\}$ the PoI does not recommend that $P(\omega_1) = P(\omega_2 \cup \omega_3)$. Quite right! I have replaced the passage by the following: "if there is no further information, then mutually disjoint and jointly exhaustive events distinguishable by name only are equiprobable."

"report" ? I was trying not to commit to prediction or other types of belief representation, but I agree that as it stands the expression is confusing. I have tried to improve the situation as follows: "Let the agent's 'report' over these three outcomes be $\mathbf{c} = (c_1, c_2, c_3)^T$. The report may represent a partial belief or an attempt at prediction."

Some of the c_i may be zero, right? It's worth stating this explicitly. I was hoping that the expression "non-negative real numbers" was sufficient to allow for zeroes.

"she has no other concerns" – why not say that L captures all the agent cares for? I have changed this passage to "the agent does not care for anything outside of what the loss function is able to capture."

Please, do use the word strict/strictly everywhere. It is too confusing for readers otherwise. I followed this recommendation and replaced "proper/propriety" by "strictly

proper/strict propriety” whenever applicable.

Page 4, can we not visualise non-Euclidean space? I have changed the clause to “which is more readily accessible to intuition.”

Page 5, there seems to be a word missing in the last sentence (after the first appearance of ‘Bayesian’). This is a sentence that needed to be improved in response to the first reviewer, so the problem has been fixed.

Page 6, cross entropy updates can cope with more complicated constraints, not just affine constraints. Convexity of the feasible region is normally required to guarantee uniqueness of the solution. Thank you for pointing this out; I was only dimly aware of the relationship between affine and convex constraints, nicely illustrated in Paris’s Uncertain Reasoner’s Companion in Proposition 6.1 on page 66. I have changed the passage to the following: “The more general updating situations include affine constraints (as in the notorious Judy Benjamin example), of which Jeffrey-type updating scenarios are a special case, and even more complicated constraints where the evidence only allows for a convex region of credence functions.”

“The Log score is asymmetric, but unlike the Brier score not unique among its asymmetric peers” – these (non-)uniqueness claims require more hedging. I have made the statement more precise by reformulating “The Log score is asymmetric, but there are other asymmetric strictly proper scoring rules.”

List A and List B: It is preferable to only have the explanation of the feature in the list. All evaluations and examples should appear outside the list. I have made the corresponding adjustments and moved evaluations and examples to the main text, except in List B where I provide one example per list item which makes the abstract property more immediately intuitive (and there is some symmetry and organization to the list in so far as each list item gets an example).

List A, no substantiation is made for the “other scores” column. Given that this column plays no role in this manuscript, I suggest to delete it. I am happy to do this, but want to point out that (a) the ‘other scores’ column clarifies that there are no other scores beside the Log score and its close relatives which will fulfill all plausible desiderata; (b) the ‘other scores’ column illustrates that while the Brier score is uniquely symmetrical, the Log score is not uniquely asymmetrical, and while the Log score uniquely fulfills locality, the Brier score does not uniquely violate locality.

Page 8, the set up of the probability space is unsatisfactory. Why not simply say that “the finite set of elementary events Ω is generated by n binary variables”? The original (pre-revision) event space \mathcal{A} did not only contain events such as $A \cup B$ and $\text{complement}\{A\} \cup B$, but also their unions. This induced logical relations between the events in \mathcal{A} which then posed constraints on credence functions that qualify as probabilities. The space of credence functions which violated the logical relations (and which may or may not have fulfilled Kolmogorov’s axioms of probability) was vast -- 2^{256} for three binary variables. I thought it was important to include this information to avoid the objection “But what about credence functions which violate the logical relations (and possibly also probabilism)? Might they outperform probabilistic credence functions that obey the logical relations?” This was a real concern, and I included the complicated set up in order to address it. The referee disagrees that my setup did any of this work, and I agree. There is no proof of the claim in the pre-revision paper that “all arguments defending probabilism in this paper do not only justify probabilistic credence functions over non-probabilistic ones that obey the logical entailment relationships, but ad fortorem also over non-probabilistic ones that disobey the logical entailment relationships”—the referee even believes that this claim is false. As a result, I have to settle for now with a more modest claim for the paper and restrict myself to credence functions that are logically coherent and determined by the numbers they assign to mutually exclusive and collectively exhaustive events. I used Predd/Seiringer/Lieb/Osherson/Poor/Kulkarni’s setup in the revision, who also restrict their attention to this type of credence function.

The negation symbol “ \neg ” is normally not a superscript. When logical notation (\neg) is used, then one normally uses \wedge instead of \cap . I agree that this is inconsistent. I have consistently changed the notation to set notation, as I am taking events to be sets.

Page 9/10: This just means that you accept the additivity axiom. At this point [at the very latest], you need to give a precise definition of the credence functions you are working with:

$C := \{c : P\Omega \rightarrow [0, \infty) \mid \sum_{\omega \in \Omega} c(\omega) > 0 \text{ \& } \emptyset \neq E \Rightarrow c(F) + c(E) = c(F \cup E)\}??$ I have replaced my more idiosyncratic setup by

Predd/Seiringer/Lieb/Osherson/Poor/Kulkarni's setup in the revision, so this concern has been addressed. See referee's comment on page 8 and my response above.

"All arguments defending probabilism in this paper do not only justify probabilistic credence functions over non-probabilistic ones that obey the logical entailment relationships, but ad fortior also over non-probabilistic ones that disobey the logical entailment relationships." No. See my later comments on logarithmic scores. I have replaced my more idiosyncratic setup by

Predd/Seiringer/Lieb/Osherson/Poor/Kulkarni's setup in the revision, so this concern has been addressed. See referee's comment on page 8 and my response above.

The first paragraph of Section 2.2 is a mess. Since the set of probability functions is convex, its convex hull is equal to this set. This set is a proper subset of the set of credence functions. For a credence function c which is also a probability function, one can of course chose $p = c$. This result holds much more widely for continuous strictly proper scoring rules and credence functions which do not satisfy additivity, see [2]. [3] only considers probabilistic credences. I have replaced the passage in the revision by the following more accurate and detailed version: "For any vector c in the vector space of credence functions, there is a vector p in the set of probability functions which is closer to each possible world than c , where closeness is evaluated in terms of a suitable measure of closeness, for example a continuous strictly proper scoring rule (Predd et al., 2009, call continuous strictly proper scoring rules 'proper scoring rules' and use the corresponding Definition 2 to prove de Finetti's result in Theorem 1 on page 4788). If c is not a probability function, then the vector p is strictly closer to each possible world than c . If c is a probability function, then one trivially chooses $p = c$." delete bracket on evidence. Recommendation implemented.

Classical information theory only considers P probabilistic credences. Their logarithmic loss function is an expectation, $P(\omega) \log(Q(\omega))$. According to this expected loss, $Q(\omega) = 1$ for all $\omega \in \Omega$ is the best possible choice. Since standard information rules out such credences by stipulation, this is no internal problem for them. The relation between their logarithmic scoring rule and the logarithmic scoring rule popular in formal epistemology circles [which is strictly proper also for non-probabilistic credences] is discussed in [1]. In your equation 12, this logarithmic scoring rule is not local for non-probabilistic credences. This is absolutely correct and an astute observation. I have added a reference to Landes and the following explanation to the paragraph: "Note that the Log score violates locality on $\mathcal{D} \setminus \mathcal{P}$, so that arguments using the unique characteristic of the Log score to fulfill locality presupposes an independent argument for probabilism (see Landes, 2015)." Add 'p.' to the Hendrickson bracket. I also noticed how awkward "1918" is as a page number, but for consistency's sake left out the 'p.' — I am easily persuaded and have added the 'p.' for clarification.

Page 14: add that close relatives have the same extrema. I have added the following remark: "They do not differ from them in terms of optimization (i.e. their extrema are equivalent)."

Lemma 3.2: You should define \leq for functions. Presumably, it's some point-wise dominance notion. I have added a definition of $f_1 \leq f_2$ in terms of point-wise dominance.

Lemma 3.4: Do you mean $(\nabla H) - 1 = \nabla(H^*)$ or $(\nabla H) - 1 = (\nabla H)^*$? I mean $\nabla(H^*)$ and have disambiguated accordingly in the revision.

"Brier" – Brier (twice) I fixed the typo. Thanks for catching it.

"Lemmas 3.4, 3.5, and 3.6 establish theorem 3.1" – how, why? I have decided to replace this proof with a better one based on Reinhard Selten's work. My proof differs in several interesting respects from Selten's, but the basic idea is his.

Page 22: A scoring rule cannot embrace an epistemic norm. I have improved this passage to read "I describe a scenario where one way for an advocate of the Brier score to escape a dilemma described there is to embrace regularity."

The paragraph on confirmation measures is under-developed and best omitted. As recommended by the referee, I have deleted the paragraph on confirmation.

Last paragraph of Section 4.1: Agreed; but so what? You are really comparing apples to oranges here. I have added an explanatory note: "The greater penalty for Tatum may strike one as counterintuitive, but it is a natural consequence of a scoring rule violating LOCALITY." I don't understand the apples to oranges comparison. Tatum's forecast is 12% for colour 1; Casey's is 10%. Colour 1 turns out to be true. It is initially counterintuitive that Tatum is penalized more severely than Casey by the Brier Score (the Log Score, obeying LOCALITY, penalizes Casey more severely than Tatum).

Page 25 on Joyce: No, Joyce shows no such thing. The result you refer to is proved in [2] for continuous and strictly proper scoring rules. The result of Joyce is properly

stated in 5.1. I have changed the wording of this passage to make my claim more accurate and to give proper credit to Predd et al.

Page 27: I found the last part of the second to last paragraph opaque. I agree. I was hoping to illustrate the argument in the next paragraph. Sometimes there is an independent reason for uniqueness (a pistol pointed at you to identify a unique candidate)—my argument is that the need for uniqueness cannot be added to the list of reasons supporting the uniqueness of the candidate. If Peter, Paul, and Mary are my children, and I tell you (with a pistol on my chest) that Peter is my favourite child, then the list of reasons why he is my favourite child includes his cleverness, his haircut, and his disdain for Pokemon cards, but it does not include the fact that I chose him when coerced to identify a favourite child.

The next paragraph should be connected to the rest of the text. See my response to the last comment.

Theorem 4.4: Again, this only holds for probabilistic credences. How to save some kind of locality notion for logarithmic scoring rules which are strictly proper for all credence functions is discussed in [1]. Excellent point and not something I had considered. I inserted the following explanatory paragraph (thanks to this referee), “Note, however, that the Log score only fulfills LOCALITY if the domain on which LOCALITY is evaluated is probabilistic credences. Jürgen Landes discusses how to save some notion of locality for logarithmic scoring rules which are strictly proper for all credence functions (see Landes, 2015).”

How can a scoring rule vindicate conditioning? I have changed the passage as follows: “Given Leitgeb and Pettigrew’s assumptions, standard conditioning is vindicated, but Jeffrey conditioning is ruled out.”

Page 32: Sure, but we can also embed into a different space (or even manifold) with a different [e.g., Riemannian or symplectic] metric. I have added the qualification “this geometric relationship is not necessarily Euclidean”—anticipating the more detailed explanation in the next paragraph.

INVARIANCE: that’s very vague. I have specified the requirement as follows: “An updating method ought to be partition invariant in the sense that introducing irrelevant subpartitioning does not change the outcome of the update.”

[4] does not justify probabilism. That’s right. I removed the reference to probabilism. (Does Theorem 7.2 in Landes, 2015, “justify” probabilism in terms of information theory?—not quite, but it creates a strong association between them.)

Page 40: these are different (non-equivalent) metrics which – of course – give different distances and hence make different recommendations. The point (perhaps not so remarkable) is that not only do they give different distances but also change the ordering of who is closer to whom.

(49): GExp A not defined. I was hoping that the detailed reference to Leitgeb and Pettigrew would make the definition unnecessary. It is not used anywhere else in the paper.

5.4.1: LP updating differs from conditionalisation. No continuity argument is required to make this point. The continuity argument is indeed way simpler than in my pre-revision version. My original “parallel sequence of updating scenarios” is unnecessary, as the referee correctly points out. In the post-revision version, however, I have retained the idea of a continuity requirement, this time to express the desire that updating in Jeffrey type updating scenarios should be continuous with standard conditioning in the sense that where standard conditioning applies, LP updating doesn’t give us a different result than standard conditioning. As the referee points out, LP updating is not “continuous with standard conditioning” in this sense. This is why the referee calls it “LP updating” rather than “LP conditioning,” which is my terminology in the paper. I am open to changing my terminology, although I have not done so in the current version. I have changed and simplified the whole subsection 5.4.1 to reflect the referee’s concern.

(58): that’s not a probability function. Quite right (a calculation error), but based on the changes to this whole subsection (see previous comment), the algebra has disappeared and this is no longer a problem.

Page 48/49: This only applies within the standard Bayesian framework. LP are silent about how to use their probabilities for decision making. Also, in their approach a finite amount of information can change posterior probabilities from or to zero. Good point. It is ironic that I missed this considering that I have a subsection dedicated to EXPANSIBILITY, which restates the concern of the referee. For example, the probabilities $(0, 1/3, 2/3)$ are LP-updated to $(5/24, 13/24, 1/4)$ for $P'(E_3)=1/4$. A wide swath of evidence will result in a strictly positive posterior probability for events with a prior zero probability in LP updating. I have deleted the passage making the decision-

theory/information-theory claim.

5.4.4: this needs to be better motivated. It does look to me like these agents use different partitions and hence it is not immediately clear why Invariance should apply here. I have added the following to motivate INVARIANCE: “In the following example, Sherlock Holmes and Jane Marple agree on all relevant facts and on their prior probabilities, but LP conditioning leads to a divergence in posterior probabilities.”

Page 52: Why would one use standard conditioning in a previous step when one later uses LP updating? In section 6.2 of their paper “An Objective Justification of Bayesianism II” (2010), Leitgeb and Pettigrew vigorously defend standard conditioning. The referee is correct here that LP conditioning is not “continuous” with standard conditioning in a stronger sense than I describe in the paper—I have addressed this problem in my response to the recommendation for pages 48/49. The impression that LP’s paper gives, however, is such that standard conditioning should be applied when possible (when $P(E)=1$) and LP conditioning otherwise. The referee’s observation highlights the problem with LP conditioning.

Surely, the proper way is to specify the total available evidence, which either pronounces on X_0 or not. Either way, it’s clear how the update should be carried out. There are two steps here. We end up with an event (X_0) whose probability in the first step is diminished to zero. Then additional evidence comes in calling for further updates. These two steps are not meant to be available as ‘total evidence’ in one single step.

Page 55: The first paragraph conflates all sorts of intuitions and metrics. I take this to be referring to the following section: “Near the boundary of \mathbb{S}^{n-1} , information theory reflects the horizon effect just as our expectation requires. The problem is near the centre, where some equidistant points are more divergent the closer they are to the middle.” I have deleted the word “equidistant” in the revision, but the problem remains that – as the referee correctly identifies – the whole idea of collinear horizon is based on a conflation of metrics. I am aware of this; in fact, I am currently working on a paper that presents a coordinate-free approach to scoring rules which is less dependent on geometric intuitions. To address how problematic collinear horizon is in this paper (in its defence, it does have the interesting feature of showing that both the geometry of reason and information theory fail the horizon requirement), I have expanded the following passage in subsection 5.4.6: “The way I have formalized the HORIZON and COLLINEAR HORIZON requirement is artificial in the face of the more comprehensive epistemic intuition. COLLINEAR HORIZON conflates divergences and metrics as it is dependent on the Euclidean idea of collinearity and equidistance. In a more integrated account it would be desirable to have these requirements reformulated in a more general fashion; convexity may play a major role in such a reformulation.”

Figure 5: How can it be unclear, whether a point is a midpoint or not? A calculation should make things clear, no? I thought so, too! There is no algebra that I am aware of that would show identity between midpoint and point E. The Lambert-W function must be calculated numerically; using matlab I was not able to find a difference between midpoint and point E, but theoretically speaking they could be so close to each other (while not being identical) that my numerical methods are insufficient to demonstrate the difference.

(70): What if $\beta > \alpha$? Good point. I have added the necessary qualification: “can be expressed using three

variables suitably constrained to yield probabilities (for example, $\alpha - \beta > 0$).”

C is not right: there are some $\min\{\dots, 0\}$ missing. True—however, I have excluded those cases by noting earlier “assuming that LP conditioning does not ‘fall off the edge’ as in case (b) in Leitgeb and Pettigrew, 2010ii, page 253.”

Please, do show the algebra. I wrote out the identity in the text of the paper (see revision) and checked again that it nicely reduces to a trivial identity, which it (remarkably) does.

Page 59: Do not use the “simplification”. There’s no point in introducing a symbol which is only used a handful of times. I concur. I implemented the recommendation.

(78): The reasonable thing to require might be to point out that $\|b - a\|$ is symmetric in a and b , while information geometry is not. Hence, collinear horizon should then only require that $D_{KL}(B, A) > D_{KL}(B, C)$. A and B are metrically closer to the centre than B and C ; and should therefore be SR-closer to each other than B and C , given that both pairs (A,B) and (B,C) are metrically equidistant. The referee is correct that there was an incongruity in the original text, although I can’t quite align it with the referee’s comment. I have fixed the incongruity as I understand it (for example, “ a,b,c ” had to be

replaced by “ p, p', q', q ”).

I can't make much sense out of the caption of Figure 6. The caption is explained at the end of section 5.5.2, but I agree that the whole comparison is a bit far-fetched. I was noticing the similarity in pattern, but I have no explanation for it. I am happy to cut this passage from the paper entirely.

References

[1] Jürgen Landes. Probabilism, Entropies and Strictly Proper Scoring Rules. *International Journal of Approximate Reasoning*, 63:1–21, 2015.

[2] J.B. Predd, R. Seiringer, E.H. Lieb, D.N. Osherson, H.V. Poor, and S.R. Kulkarni. Probabilistic Coherence and Proper Scoring Rules. *IEEE Transactions on Information Theory*, 55(10):4786–4792, 2009.

[3] Leonard Jimmie Savage. Elicitation of personal probabilities and expectations. *Journal of the American Statistical Association*, 66(336):783–801, 1971.

[4] John E. Shore and Rodney W. Johnson. Axiomatic Derivation of the Principle of Maximum Entropy and the Principle of Minimum Cross-Entropy. *IEEE Transactions on Information Theory*, 26(1):26–37, Jan 1980.

Title: Asymmetry and the Geometry of Reason

Author: Stefan Lukits

Affiliation: University of Toronto

Contact:

20 22 nd Avenue East
Vancouver BC V5V 1T4
Canada

604-321-3440

sedimyle@gmail.com


```
This is pdfTeX, Version 3.14159265-2.6-1.40.16 (TeX Live 2015/W32TeX)
(preloaded format=pdflatex 2016.4.6)  22 JUL 2018 23:00
entering extended mode
  restricted \writel8 enabled.
  %&-line parsing enabled.
**./jeco-erkenntnis.tex
(./jeco-erkenntnis.tex
LaTeX2e <2016/03/31>
Babel <3.9q> and hyphenation patterns for 81 language(s) loaded.
(c:/TeXLive/2015/texmf-dist/tex/latex/base/article.cls
Document Class: article 2014/09/29 v1.4h Standard LaTeX document class
(c:/TeXLive/2015/texmf-dist/tex/latex/base/size12.clo
File: size12.clo 2014/09/29 v1.4h Standard LaTeX file (size option)
)
\c@part=\count79
\c@section=\count80
\c@subsection=\count81
\c@subsubsection=\count82
\c@paragraph=\count83
\c@subparagraph=\count84
\c@figure=\count85
\c@table=\count86
\abovecaptionskip=\skip41
\belowcaptionskip=\skip42
\bibindent=\dimen102
) (c:/TeXLive/2015/texmf-dist/tex/latex/geometry/geometry.sty
Package: geometry 2010/09/12 v5.6 Page Geometry
(c:/TeXLive/2015/texmf-dist/tex/latex/graphics/keyval.sty
Package: keyval 2014/10/28 v1.15 key=value parser (DPC)
\KV@toks@=\toks14
) (c:/TeXLive/2015/texmf-dist/tex/generic/oberdiek/ifpdf.sty
Package: ifpdf 2011/01/30 v2.3 Provides the ifpdf switch (HO)
Package ifpdf Info: pdfTeX in PDF mode is detected.
) (c:/TeXLive/2015/texmf-dist/tex/generic/oberdiek/ifvtex.sty
Package: ifvtex 2010/03/01 v1.5 Detect VTeX and its facilities (HO)
Package ifvtex Info: VTeX not detected.
) (c:/TeXLive/2015/texmf-dist/tex/generic/ifxetex/ifxetex.sty
Package: ifxetex 2010/09/12 v0.6 Provides ifxetex conditional
)
\Gm@cnth=\count87
\Gm@cntv=\count88
\c@Gm@tempcnt=\count89
\Gm@bindingoffset=\dimen103
\Gm@wd@mp=\dimen104
\Gm@odd@mp=\dimen105
\Gm@even@mp=\dimen106
\Gm@layoutwidth=\dimen107
\Gm@layoutheight=\dimen108
\Gm@layouthoffset=\dimen109
\Gm@layoutvoffset=\dimen110
\Gm@dimlist=\toks15
) (c:/TeXLive/texmf-local/tex/latex/aries/setspace.sty
Package: setspace 2000/12/01 6.7 Contributed and Supported LaTeX2e
package
```

```

Package: `setspace' 6.7 <2000/12/01>
) (c:/TeXLive/2015/texmf-dist/tex/latex/footmisc/footmisc.sty
Package: footmisc 2011/06/06 v5.5b a miscellany of footnote facilities
\FN@temptoken=\toks16
\footnotemargin=\dimen111
\c@pp@next@reset=\count90
Package footmisc Info: Declaring symbol style bringhurst on input line
855.
Package footmisc Info: Declaring symbol style chicago on input line 863.
Package footmisc Info: Declaring symbol style wiley on input line 872.
Package footmisc Info: Declaring symbol style lamport-robust on input
line 883.

Package footmisc Info: Declaring symbol style lamport* on input line 903.
Package footmisc Info: Declaring symbol style lamport*-robust on input
line 924
.
) (./october.sty (c:/TeXLive/2015/texmf-
dist/tex/latex/amsfonts/amsfonts.sty
Package: amsfonts 2013/01/14 v3.01 Basic AMSFonts support
\@emptytoks=\toks17
\symAMSa=\mathgroup4
\symAMSb=\mathgroup5
LaTeX Font Info: Overwriting math alphabet `\'mathfrak' in version
`bold'
(Font) U/euf/m/n --> U/euf/b/n on input line 106.
) (c:/TeXLive/2015/texmf-dist/tex/latex/amsfonts/amssymb.sty
Package: amssymb 2013/01/14 v3.01 AMS font symbols
) (c:/TeXLive/2015/texmf-dist/tex/latex/amsmath/amsmath.sty
Package: amsmath 2016/03/10 v2.15b AMS math features
\@mathmargin=\skip43
For additional information on amsmath, use the `?' option.
(c:/TeXLive/2015/texmf-dist/tex/latex/amsmath/amstext.sty
Package: amstext 2000/06/29 v2.01 AMS text
(c:/TeXLive/2015/texmf-dist/tex/latex/amsmath/amsgen.sty
File: amsgen.sty 1999/11/30 v2.0 generic functions
\@emptytoks=\toks18
\ex@=\dimen112
)) (c:/TeXLive/2015/texmf-dist/tex/latex/amsmath/amsbsy.sty
Package: amsbsy 1999/11/29 v1.2d Bold Symbols
\pmbraise@=\dimen113
) (c:/TeXLive/2015/texmf-dist/tex/latex/amsmath/amsopn.sty
Package: amsopn 2016/03/08 v2.02 operator names
)
\inf@bad=\count91
LaTeX Info: Redefining \frac on input line 199.
\uproot@=\count92
\leftroot@=\count93
LaTeX Info: Redefining \overline on input line 297.
\classnum@=\count94
\DOTSCASE@=\count95
LaTeX Info: Redefining \ldots on input line 394.
LaTeX Info: Redefining \dots on input line 397.
LaTeX Info: Redefining \cdots on input line 518.

```

```

\Mathstrutbox@=\box26
\strutbox@=\box27
\big@size=\dimen114
LaTeX Font Info: Redefining font encoding OML on input line 634.
LaTeX Font Info: Redefining font encoding OMS on input line 635.
\maccc@depth=\count96
\c@MaxMatrixCols=\count97
\dotsspace@=\muskip10
\c@parentequation=\count98
\dspbrk@lvl=\count99
\tag@help=\toks19
\row@=\count100
\column@=\count101
\maxfields@=\count102
\andhelp@=\toks20
\eqnshift@=\dimen115
\alignsep@=\dimen116
\tagshift@=\dimen117
\tagwidth@=\dimen118
\totwidth@=\dimen119
\lineht@=\dimen120
\@envbody=\toks21
\multlinegap=\skip44
\multlinetaggap=\skip45
\mathdisplay@stack=\toks22
LaTeX Info: Redefining \[ on input line 2739.
LaTeX Info: Redefining \] on input line 2740.
) (c:/TeXLive/2015/texmf-dist/tex/latex/xcolor/xcolor.sty
Package: xcolor 2007/01/21 v2.11 LaTeX color extensions (UK)
(c:/TeXLive/2015/texmf-dist/tex/latex/latexconfig/color.cfg
File: color.cfg 2007/01/18 v1.5 color configuration of TeX/TeXLive
)
Package xcolor Info: Driver file: pdftex.def on input line 225.
(c:/TeXLive/2015/texmf-dist/tex/latex/pdftex-def/pdftex.def
File: pdftex.def 2011/05/27 v0.06d Graphics/color for pdfTeX
(c:/TeXLive/2015/texmf-dist/tex/generic/oberdiek/infwarerr.sty
Package: infwarerr 2010/04/08 v1.3 Providing info/warning/error messages
(HO)
) (c:/TeXLive/2015/texmf-dist/tex/generic/oberdiek/ltxcmds.sty
Package: ltxcmds 2011/11/09 v1.22 LaTeX kernel commands for general use
(HO)
)
\Gread@gobject=\count103
) (c:/TeXLive/2015/texmf-dist/tex/latex/colortbl/colortbl.sty
Package: colortbl 2012/02/13 v1.0a Color table columns (DPC)
(c:/TeXLive/2015/texmf-dist/tex/latex/tools/array.sty
Package: array 2014/10/28 v2.4c Tabular extension package (FMi)
\col@sep=\dimen121
\extrarowheight=\dimen122
\NC@list=\toks23
\extratabsurround=\skip46
\backup@length=\skip47
)
\everycr=\toks24

```

```

\minrowclearance=\skip48
)
\rownum=\count104
Package xcolor Info: Model `cmy' substituted by `cmy0' on input line
1337.
Package xcolor Info: Model `hsb' substituted by `rgb' on input line 1341.
Package xcolor Info: Model `RGB' extended on input line 1353.
Package xcolor Info: Model `HTML' substituted by `rgb' on input line
1355.
Package xcolor Info: Model `Hsb' substituted by `hsb' on input line 1356.
Package xcolor Info: Model `tHsb' substituted by `hsb' on input line
1357.
Package xcolor Info: Model `HSB' substituted by `hsb' on input line 1358.
Package xcolor Info: Model `Gray' substituted by `gray' on input line
1359.
Package xcolor Info: Model `wave' substituted by `hsb' on input line
1360.
) (c:/TeXLive/2015/texmf-dist/tex/latex/float/float.sty
Package: float 2001/11/08 v1.3d Float enhancements (AL)
\c@float@type=\count105
\float@exts=\toks25
\float@box=\box28
\@float@everytoks=\toks26
\@floatcapt=\box29
) (c:/TeXLive/2015/texmf-dist/tex/latex/graphics/graphicx.sty
Package: graphicx 2014/10/28 v1.0g Enhanced LaTeX Graphics (DPC,SPQR)
(c:/TeXLive/2015/texmf-dist/tex/latex/graphics/graphics.sty
Package: graphics 2016/01/03 v1.0q Standard LaTeX Graphics (DPC,SPQR)
(c:/TeXLive/2015/texmf-dist/tex/latex/graphics/trig.sty
Package: trig 2016/01/03 v1.10 sin cos tan (DPC)
) (c:/TeXLive/2015/texmf-dist/tex/latex/latexconfig/graphics.cfg
File: graphics.cfg 2010/04/23 v1.9 graphics configuration of TeX Live
)
Package graphics Info: Driver file: pdftex.def on input line 95.
)
\Gin@req@height=\dimen123
\Gin@req@width=\dimen124
) (c:/TeXLive/2015/texmf-dist/tex/latex/tools/enumerate.sty
Package: enumerate 2015/07/23 v3.00 enumerate extensions (DPC)
\@enLab=\toks27
) (c:/TeXLive/2015/texmf-dist/tex/latex/lineno/lineno.sty
Package: lineno 2005/11/02 line numbers on paragraphs v4.41
\linenopenalty=\count106
\output=\toks28
\linenoprevgraf=\count107
\linenumbersep=\dimen125
\linenumberwidth=\dimen126
\c@linenumber=\count108
\c@pagewiselinenumber=\count109
\c@LN@truepage=\count110
\c@internallinenumber=\count111
\c@internallinenumbers=\count112
\quotelinenumbersep=\dimen127
\bframerule=\dimen128

```

```

\bframesep=\dimen129
\bframebox=\box30
LaTeX Info: Redefining \ on input line 3056.
) (c:/TeXLive/2015/texmf-dist/tex/latex/amscs/amsthm.sty
Package: amsthm 2015/03/04 v2.20.2
\thm@style=\toks29
\thm@bodyfont=\toks30
\thm@headfont=\toks31
\thm@notefont=\toks32
\thm@headpunct=\toks33
\thm@preskip=\skip49
\thm@postskip=\skip50
\thm@headsep=\skip51
\dth@everypar=\toks34
)
\c@theorem=\count113
\c@example=\count114
\c@proposition=\count115
\c@corollary=\count116
\c@definition=\count117
\c@expls=\count118
(c:/TeXLive/2015/texmf-dist/tex/latex/natbib/natbib.sty
Package: natbib 2010/09/13 8.31b (PWD, AO)
\bibhang=\skip52
\bibsep=\skip53
LaTeX Info: Redefining \cite on input line 694.
\c@NAT@ctr=\count119
)) (./jeco-erkenntnis.aux)
\openout1 = `jeco-erkenntnis.aux'.

```

```

LaTeX Font Info:    Checking defaults for OML/cmm/m/it on input line 53.
LaTeX Font Info:    ... okay on input line 53.
LaTeX Font Info:    Checking defaults for T1/cmr/m/n on input line 53.
LaTeX Font Info:    ... okay on input line 53.
LaTeX Font Info:    Checking defaults for OT1/cmr/m/n on input line 53.
LaTeX Font Info:    ... okay on input line 53.
LaTeX Font Info:    Checking defaults for OMS/cmsy/m/n on input line 53.
LaTeX Font Info:    ... okay on input line 53.
LaTeX Font Info:    Checking defaults for OMX/cmex/m/n on input line 53.
LaTeX Font Info:    ... okay on input line 53.
LaTeX Font Info:    Checking defaults for U/cmr/m/n on input line 53.
LaTeX Font Info:    ... okay on input line 53.
*geometry* driver: auto-detecting
*geometry* detected driver: pdftex
*geometry* verbose mode - [ preamble ] result:
* driver: pdftex
* paper: <default>
* layout: <same size as paper>
* layoutoffset: (h,v)=(0.0pt,0.0pt)
* modes:
* h-part: (L,W,R)=(85.35826pt, 457.80486pt, 71.13188pt)
* v-part: (T,H,B)=(113.81102pt, 567.34795pt, 113.81102pt)
* \paperwidth=614.295pt
* \paperheight=794.96999pt

```

```

* \textwidth=457.80486pt
* \textheight=567.34795pt
* \oddsidemargin=13.08827pt
* \evensidemargin=13.08827pt
* \topmargin=4.54103pt
* \headheight=12.0pt
* \headsep=25.0pt
* \topskip=12.0pt
* \footskip=30.0pt
* \marginparwidth=44.0pt
* \marginparsep=10.0pt
* \columnsep=10.0pt
* \skip\footins=10.8pt plus 4.0pt minus 2.0pt
* \hoffset=0.0pt
* \voffset=0.0pt
* \mag=1000
* \@twocolumnfalse
* \@twosidefalse
* \@mparswitchfalse
* \@reversemarginfalse
* (lin=72.27pt=25.4mm, 1cm=28.453pt)

(c:/TeXLive/2015/texmf-dist/tex/context/base/supp-pdf.mkii
[Loading MPS to PDF converter (version 2006.09.02).]
\scratchcounter=\count120
\scratchdimen=\dimen130
\scratchbox=\box31
\nofMPsegments=\count121
\nofMParguments=\count122
\everyMPshowfont=\toks35
\MPscratchCnt=\count123
\MPscratchDim=\dimen131
\MPnumerator=\count124
\makeMPintoPDFobject=\count125
\everyMPtoPDFconversion=\toks36
) (c:/TeXLive/2015/texmf-dist/tex/generic/oberdiek/pdfdoccmds.sty
Package: pdfdoccmds 2011/11/29 v0.20 Utility functions of pdfTeX for
LuaTeX (HO
)
(c:/TeXLive/2015/texmf-dist/tex/generic/oberdiek/ifluatex.sty
Package: ifluatex 2010/03/01 v1.3 Provides the ifluatex switch (HO)
Package ifluatex Info: LuaTeX not detected.
)
Package pdfdoccmds Info: LuaTeX not detected.
Package pdfdoccmds Info: \pdf@primitive is available.
Package pdfdoccmds Info: \pdf@ifprimitive is available.
Package pdfdoccmds Info: \pdfdraftmode found.
) (c:/TeXLive/2015/texmf-dist/tex/latex/oberdiek/epstopdf-base.sty
Package: epstopdf-base 2010/02/09 v2.5 Base part for package epstopdf
(c:/TeXLive/2015/texmf-dist/tex/latex/oberdiek/grfext.sty
Package: grfext 2010/08/19 v1.1 Manage graphics extensions (HO)
(c:/TeXLive/2015/texmf-dist/tex/generic/oberdiek/kvdefinekeys.sty
Package: kvdefinekeys 2011/04/07 v1.3 Define keys (HO)
)) (c:/TeXLive/2015/texmf-dist/tex/latex/oberdiek/kvoptions.sty

```

Package: kvoptions 2011/06/30 v3.11 Key value format for package options (HO)

(c:/TeXLive/2015/texmf-dist/tex/generic/oberdiek/kvsetkeys.sty

Package: kvsetkeys 2012/04/25 v1.16 Key value parser (HO)

(c:/TeXLive/2015/texmf-dist/tex/generic/oberdiek/etexcmds.sty

Package: etexcmds 2011/02/16 v1.5 Avoid name clashes with e-TeX commands (HO)

Package etexcmds Info: Could not find \expanded.

(etexcmds) That can mean that you are not using pdfTeX 1.50 or

(etexcmds) that some package has redefined \expanded.

(etexcmds) In the latter case, load this package earlier.

)))

Package grfext Info: Graphics extension search list:

(grfext)

[.png,.pdf,.jpg,.mps,.jpeg,.jbig2,.jb2,.PNG,.PDF,.JPG,.JPE
G,.JBIG2,.JB2,.eps]

(grfext) \AppendGraphicsExtensions on input line 452.

(c:/TeXLive/2015/texmf-dist/tex/latex/latexconfig/epstopdf-sys.cfg

File: epstopdf-sys.cfg 2010/07/13 v1.3 Configuration of (r)epstopdf for TeX Live

e

))

LaTeX Font Info: Try loading font information for U+msa on input line 61.

(c:/TeXLive/2015/texmf-dist/tex/latex/amsfonts/umsa.fd

File: umsa.fd 2013/01/14 v3.01 AMS symbols A

)

LaTeX Font Info: Try loading font information for U+msb on input line 61.

(c:/TeXLive/2015/texmf-dist/tex/latex/amsfonts/umsb.fd

File: umsb.fd 2013/01/14 v3.01 AMS symbols B

) [1

{c:/TeXLive/2015/texmf-var/fonts/map/pdftex/updmap/pdftex.map}} [2]

Package natbib Warning: Citation `mccarthy56' on page 3 undefined on input line 173.

Package natbib Warning: Citation `bregman67' on page 3 undefined on input line 175.

[3]

Package natbib Warning: Citation `selten98' on page 4 undefined on input line 185.

Package natbib Warning: Citation `pettigrew16' on page 4 undefined on input line

e 185.

Package natbib Warning: Citation `leitgebpettigrew10i' on page 4
undefined on input line 196.

Package natbib Warning: Citation `mormann05' on page 4 undefined on input
line 203.

Package natbib Warning: Citation `miller84' on page 4 undefined on input
line 203.

[4]

Package natbib Warning: Citation `mormann05' on page 5 undefined on input
line 216.

Package natbib Warning: Citation `mormann05' on page 5 undefined on input
line 216.

[5] [6] [7] [8]

Package natbib Warning: Citation `howson08' on page 9 undefined on input
line 408.

Package natbib Warning: Citation `joyce15' on page 9 undefined on input
line 409.

Package natbib Warning: Citation `pettigrew16' on page 9 undefined on
input line 409.

Package natbib Warning: Citation `definetti17' on page 9 undefined on
input line 417.

Package natbib Warning: Citation `preddseiringer09' on page 9 undefined
on input line 422.

[9]

Package natbib Warning: Citation `savage71' on page 10 undefined on input line 432.

Package natbib Warning: Citation `joyce98' on page 10 undefined on input line 433.

Package natbib Warning: Citation `mccarthy56' on page 10 undefined on input line 448.

[10]

Package natbib Warning: Citation `pembertonraul6' on page 11 undefined on input line 488.

[11]

Package natbib Warning: Citation `hendricksonbuehler71' on page 12 undefined on input line 516.

! Undefined control sequence.

l.549 {\Orollary

 }~\ref{cor:quiphaef} is useful in determining the entropy
The control sequence at the end of the top line
of your error message was never \def'ed. If you have
misspelled it (e.g., `hobx'), type `I' and the correct
spelling (e.g., `I\hbox'). Otherwise just continue,
and I'll forget about whatever was undefined.

Package natbib Warning: Citation `marschak59' on page 12 undefined on input line 555.

[12]

Package natbib Warning: Citation `landes15' on page 13 undefined on input line 605.

[13] [14]

Package natbib Warning: Citation `pettigrew16' on page 15 undefined on input line 692.

Package natbib Warning: Citation `paul16' on page 28 undefined on input
line 12
24.

[28] [29]

Package natbib Warning: Citation `rockafellar97' on page 30 undefined on
input
line 1321.

[30] [31] [32]

Package natbib Warning: Citation `landes15' on page 33 undefined on input
line
1435.

[33]

Package natbib Warning: Citation `leitgebpettigrew10i' on page 34
undefined on
input line 1465.

[34]

Package natbib Warning: Citation `amari85' on page 35 undefined on input
line 1
490.

Package natbib Warning: Citation `csiszarshields04' on page 35 undefined
on inp
ut line 1500.

Package epstopdf Info: Source file: <contourslp.eps>
(epstopdf) date: 2018-07-22 22:59:39
(epstopdf) size: 51151 bytes
(epstopdf) Output file: <contourslp-eps-converted-to.pdf>
(epstopdf) date: 2018-07-22 22:59:48
(epstopdf) size: 6422 bytes
(epstopdf) Command: <repstopdf --outfile=contourslp-eps-converted-to.pdf contourslp.eps>
(epstopdf) \includegraphics on input line 1505.
Package epstopdf Info: Output file is already uptodate.
<contourslp-eps-converted-to.pdf, id=127, 400.49625pt x 356.33125pt>
File: contourslp-eps-converted-to.pdf Graphic file (type pdf)
<use contourslp-eps-converted-to.pdf>
Package pdftex.def Info: contourslp-eps-converted-to.pdf used on input
line 150
5.
(pdftex.def) Requested size: 320.46199pt x 285.1415pt.

[35]

Package epstopdf Info: Source file: <crj.eps>
(epstopdf) date: 2018-07-22 22:59:39

```

(epstopdf)                                size: 50813 bytes
(epstopdf)                                Output file: <crj-eps-converted-to.pdf>
(epstopdf)                                date: 2018-07-22 22:59:51
(epstopdf)                                size: 7068 bytes
(epstopdf)                                Command: <repstopdf --outfile=crj-eps-converted-
to.pdf c
rj.eps>
(epstopdf)                                \includegraphics on input line 1522.
Package epstopdf Info: Output file is already uptodate.
<crj-eps-converted-to.pdf, id=131, 400.49625pt x 356.33125pt>
File: crj-eps-converted-to.pdf Graphic file (type pdf)
<use crj-eps-converted-to.pdf>
Package pdftex.def Info: crj-eps-converted-to.pdf used on input line
1522.
(pdftex.def)                                Requested size: 320.46199pt x 285.1415pt.
[36 <./contourslp-eps-converted-to.pdf>] [37 <./crj-eps-converted-
to.pdf>]
LaTeX Font Info:    Try loading font information for OMS+cmr on input
line 1566
.
(c:/TeXLive/2015/texmf-dist/tex/latex/base/omscmr.fd
File: omscmr.fd 2014/09/29 v2.5h Standard LaTeX font definitions
)
LaTeX Font Info:    Font shape `OMS/cmr/m/n' in size <12> not available
(Font)                Font shape `OMS/cmsy/m/n' tried instead on input line
1566.

```

Package natbib Warning: Citation `levinstein12' on page 38 undefined on
input 1
ine 1575.

```

[38] [39]
Package epstopdf Info: Source file: <horeff.eps>
(epstopdf)                                date: 2018-07-22 22:59:39
(epstopdf)                                size: 62064 bytes
(epstopdf)                                Output file: <horeff-eps-converted-to.pdf>
(epstopdf)                                date: 2018-07-22 22:59:54
(epstopdf)                                size: 7267 bytes
(epstopdf)                                Command: <repstopdf --outfile=horeff-eps-
converted-to.pdf
f horeff.eps>
(epstopdf)                                \includegraphics on input line 1631.
Package epstopdf Info: Output file is already uptodate.
<horeff-eps-converted-to.pdf, id=162, 400.49625pt x 356.33125pt>
File: horeff-eps-converted-to.pdf Graphic file (type pdf)
<use horeff-eps-converted-to.pdf>
Package pdftex.def Info: horeff-eps-converted-to.pdf used on input line
1631.
(pdftex.def)                                Requested size: 320.46199pt x 285.1415pt.
[40]

```

Package natbib Warning: Citation `shorejohnson80' on page 41 undefined on
input

line 1650.

Package natbib Warning: Citation `lukits15' on page 41 undefined on input
line
1652.

[41 <./horeff-eps-converted-to.pdf>] [42]

Package natbib Warning: Citation `mackay03' on page 43 undefined on input
line
1692.

Package natbib Warning: Citation `leitgebpettigrew10i' on page 43
undefined on
input line 1718.

[43]

Package natbib Warning: Citation `fraassen81' on page 44 undefined on
input line
1744.

Package natbib Warning: Citation `lukits14' on page 44 undefined on input
line
1746.

[44]

Package natbib Warning: Citation `wagner02' on page 45 undefined on input
line
1776.

Package natbib Warning: Citation `jeffrey65' on page 45 undefined on
input line
1788.

Package natbib Warning: Citation `diaconiszabell82' on page 45 undefined
on input
line 1789.

Package natbib Warning: Citation `armendt80' on page 45 undefined on
input line
1790.

Package natbib Warning: Citation `skyrms86' on page 45 undefined on input
line
1791.

Package natbib Warning: Citation `howsonfranklin94' on page 45 undefined on input line 1792.

[45]

Package natbib Warning: Citation `leitgebpettigrew10ii' on page 46 undefined on input line 1826.

[46]

Package epstopdf Info: Source file: <threepoints.eps>
(epstopdf) date: 2018-07-22 22:59:39
(epstopdf) size: 45537 bytes
(epstopdf) Output file: <threepoints-eps-converted-to.pdf>
(epstopdf) date: 2018-07-22 22:59:56
(epstopdf) size: 5332 bytes
(epstopdf) Command: <repstopdf --outfile=threepoints-eps-converted-to.pdf threepoints.eps>
(epstopdf) \includegraphics on input line 1856.
Package epstopdf Info: Output file is already uptodate.
<threepoints-eps-converted-to.pdf, id=198, 400.49625pt x 356.33125pt>
File: threepoints-eps-converted-to.pdf Graphic file (type pdf)
<use threepoints-eps-converted-to.pdf>
Package pdftex.def Info: threepoints-eps-converted-to.pdf used on input line 1856.
(pdftex.def) Requested size: 320.46199pt x 285.1415pt.
[47] [48 <./threepoints-eps-converted-to.pdf>]

Package natbib Warning: Citation `jeffrey87' on page 49 undefined on input line 1958.

[49] [50]

Package natbib Warning: Citation `levinstein12' on page 51 undefined on input line 2023.

Package natbib Warning: Citation `levinstein12' on page 51 undefined on input line 2023.

[51] [52] [53] [54] [55]

Package natbib Warning: Citation `selten98' on page 56 undefined on input line 2195.

[56]

Package natbib Warning: Citation `schlesinger95' on page 57 undefined on input line 2235.

Package natbib Warning: Citation `schlesinger95' on page 57 undefined on input line 2235.

[57] [58]

Package epstopdf Info: Source file: <dreieck.eps>
(epstopdf) date: 2018-07-22 22:59:39
(epstopdf) size: 3327170 bytes
(epstopdf) Output file: <dreieck-eps-converted-to.pdf>
(epstopdf) date: 2018-07-22 23:00:00
(epstopdf) size: 279094 bytes
(epstopdf) Command: <repstopdf --outfile=dreieck-eps-converted-to.pdf dreieck.eps>
(epstopdf) \includegraphics on input line 2308.
Package epstopdf Info: Output file is already uptodate.
<dreieck-eps-converted-to.pdf, id=243, 400.49625pt x 356.33125pt>
File: dreieck-eps-converted-to.pdf Graphic file (type pdf)
<use dreieck-eps-converted-to.pdf>
Package pdftex.def Info: dreieck-eps-converted-to.pdf used on input line 2308.
(pdftex.def) Requested size: 320.46199pt x 285.1415pt.
[59] [60 <./dreieck-eps-converted-to.pdf>]

Package natbib Warning: Citation `leitgebpettigrew10ii' on page 61 undefined on input line 2344.

[61] [62] [63] [64] [65] <fleur-concat-edited.png, id=275, 805.0075pt x 359.3425pt>
File: fleur-concat-edited.png Graphic file (type png)
<use fleur-concat-edited.png>
Package pdftex.def Info: fleur-concat-edited.png used on input line 2542.
(pdftex.def) Requested size: 457.80486pt x 204.35579pt.
[66] [67 <./fleur-concat-edited.png (PNG copy)>] <concat2.png, id=283, 995.97093pt x 995.97093pt>
File: concat2.png Graphic file (type png)
<use concat2.png>
Package pdftex.def Info: concat2.png used on input line 2591.
(pdftex.def) Requested size: 457.80486pt x 457.81786pt.
[68] [69 <./concat2.png>]

Package natbib Warning: Citation `hajek03' on page 70 undefined on input line 2641.

[70] [71]

Package natbib Warning: Citation `kopperman88' on page 72 undefined on input line 2709.

[72]

Package natbib Warning: Citation `chino78' on page 73 undefined on input line 2741.

Package natbib Warning: Citation `coombs64' on page 73 undefined on input line 2742.

Package natbib Warning: Citation `harshmanetal82' on page 73 undefined on input line 2743.

Package natbib Warning: Citation `harshmanlundy84' on page 73 undefined on input line 2744.

Package natbib Warning: Citation `coxonetetal82' on page 73 undefined on input line 2746.

Package natbib Warning: Citation `gentleman06' on page 73 undefined on input line 2747.

Package natbib Warning: Citation `vanommenetal13' on page 73 undefined on input line 2748.

Package natbib Warning: Citation `tobler75' on page 73 undefined on input line 2749.

Package natbib Warning: Citation `kopperman88' on page 73 undefined on input line 2750.

[73] [74]


```
sy8.pfb><c:/TeXLive/2015/texmf-  
dist/fonts/type1/public/amsfonts/cm/cmti12.pfb><  
c:/TeXLive/2015/texmf-  
dist/fonts/type1/public/amsfonts/symbols/msam10.pfb><c:/T  
eXLive/2015/texmf-dist/fonts/type1/public/amsfonts/symbols/msbm10.pfb>  
Output written on jeco-erkenntnis.pdf (76 pages, 1118915 bytes).  
PDF statistics:  
 384 PDF objects out of 1000 (max. 8388607)  
 272 compressed objects within 3 object streams  
 0 named destinations out of 1000 (max. 500000)  
 36 words of extra memory for PDF output out of 10000 (max. 10000000)
```