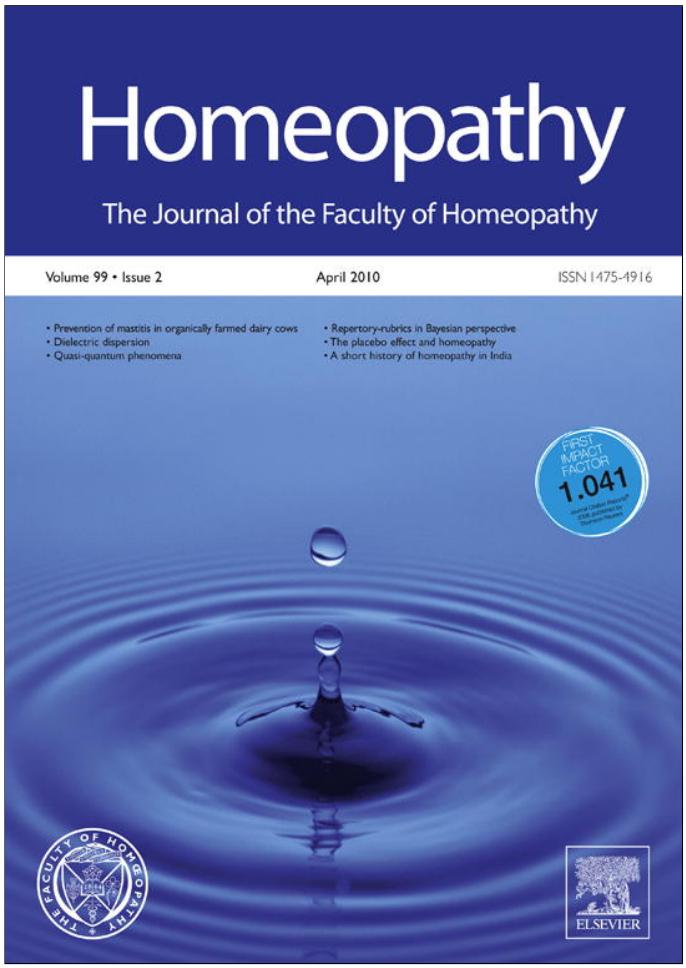
Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

http://www.elsevier.com/copyright

Author's personal copy

Homeopathy (2010) 99, 113–118
© 2010 The Faculty of Homeopathy
doi:10.1016/j.homp.2010.02.002, available online at http://www.sciencedirect.com

ORIGINAL PAPER

Opposite repertory-rubrics in Bayesian perspective

ALB Rutten[1,*] and H Frei[2]

[1]*Commissie Methode en Validering VHAN (Dutch Association of Homeopathic Physicians), Aard 10, 4813 NN Breda, The Netherlands*
[2]*Institute for Complementary and Alternative Medicine, KIKOM, University of Berne, Kreutzplatz 6, CH-3177 Laupen, Switzerland*

Introduction: **Hitherto entries have been added to a rubric in the repertory when patients responding well to a specific medicine showed the corresponding symptom. Continuing like this, theoretically every medicine will eventually appear in every rubric.**
Method: **This becomes clear if we compare opposite symptom-rubrics. Polarity Analysis (PA) subtracts opposite rubrics and has been shown to improve clinical results.**
Conclusion: **The source of this problem and the reason for the success of PA are clear from Bayesian perspective. A reliable repertory should be based on Bayesian principles.**
Homeopathy (2010) **99**, 113–118.

Keywords: Bayes; Repertory; Polarity Analysis; Homeopathy

Introduction

The importance of a symptom to the prescription of an homeopathic medicine on the basis of repertorisation is expressed by its grading. Grades can be determined by clinical evaluation of a proving symptom,[1,2] by the number of observations of this symptom related to the total number of symptoms of the medicine,[3] and by Likelihood ratios (LRs).[4–6] In 'polar symptoms,' where if a symptom is mentioned in opposite rubrics, the grading also determines their polarity. It is thus very important how carefully a symptom is introduced into the Materia Medica.

If a patient responds well to a specific homeopathic medicine the characteristic symptoms of that patient are regarded as an indication to prescribe this medicine in the future. The symptom 'amelioration from motion' is regarded as an important indication for the medicine *Rhus toxicodendron* (*Rhus-t*) because many doctors have experienced that patients responding well to *Rhus-t* are often characterised by 'amelioration from motion'. This medicine is therefore entered in bold type (similar to Boenninghausen's high grades) in Kent's repertory-rubric 'amelioration from motion' (RADAR 10.0, Full Synthesis). But *Rhus-t* is also, in plain type (corresponding to Boenninghausen's low grades), represented in the rubric 'aggravation from motion'. This means that there are also patients with 'aggravation from motion' who respond well to *Rhus-t*, but much less than with the opposite symptom.

From a statistical point of view this is not surprising; random variation is normal in all observations and especially in living systems. But does the symptom 'aggravation from motion' confirm the choice of *Rhus-t*? Every homeopathic physician knows that the repertory has misleading entries. Such misleading entries are expected more often regarding frequently prescribed medicines. This is one of the reasons that many homeopathic repertorisation software packages offer the opportunity to exclude the most frequently prescribed medicines from the repertorisation. This is a rather crude way to suppress misleading information and does not tackle the real problem.

Another way to handle this problem is '*Polarity Analysis*' (PA).[7] PA is a further development of Boenninghausen's concept of contra-indications. In this paper we investigate the source of the problem, its extent and possible methods to deal with it.

Symptoms and chance

A symptom is normally a chance continuum. Not every '*Arsenicum* patient' is chilly, but the average *Arsenicum*

*Correspondence: ALB Rutten, Commissie Methode en Validering VHAN (Dutch Association of Homeopathic Physicians), Aard 10, 4813 NN Breda, The Netherlands.
E-mail: lexrtn@Concepts.nl, heiner.frei@hin.ch
Received 4 June 2009; revised 26 January 2010; accepted 4 February 2010

Author's personal copy

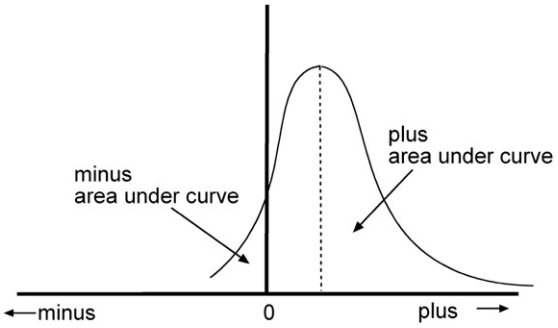


Figure 1 The chance continuum.

patient is chilly. The chilliness may be of various degrees: a small number of *Arsenicum* patients are extremely chilly, a small number not at all chilly and the majority somewhat chilly. The intensity of the symptom for the '*Arsenicum* population' (population that responds well to *Arsenicum)* is distributed as in Figure 1, the well known Bell or Gaussian curve. There is a saying ''*If you hear hoof-beats, think of horses, not zebras*'' because most hoof-beats are produced by horses. If you hear that the patient is chilly, you are more likely to think of *Arsenicum* rather than *Phosphorus*. Many homeopathic symptoms have a chance continuum, and the opposite symptom is also present in the homeopathic repertory. Figure 1 could represent the symptom 'chilliness' as the positive symptom and 'warmth' as the negative variant at the extreme left of the curve. More than 80% of the area under the curve is in the positive or chilly section. The position of the peak of the curve is the mode of degree of chilliness; most *Arsenicum* patients are on average chilly. Only a small portion of the *Arsenicum* patients are warm-blooded.

Aggravation and amelioration from motion

The rubric 'motion aggravates' in RADAR 10.0 (full Synthesis) contains 290 medicines and 'motion ameliorates' 183 medicines. The rubrics have 144 medicines in common. Figure 2 shows a part of the repertorisation of both rubrics. Figure 3 shows the repertorisation of the same symptoms, but with elimination of 20 polychrests. Now both rubrics have 125 medicines in common; *Calcarea carbonica* is discarded because it is in both rubrics in the first grade, but *Belladonna* is also discarded since it has 'aggravation from motion' in the third grade and 'amelioration from motion' in the first grade. The average *Belladonna* patient has 'aggravation from motion', so eliminating polychrests could obscure important information.

We see that *Abrotanum* (*Abrot*) is present in both rubrics in plain type, so both symptoms have been seen in provings and/or in clinical cases. This probably means that the mean of the chance continuum lies between both opposites and the symptom has no predictive value for an effect of *Abrot*. *Sulphur* appears bold in both rubrics; understandably, as *Sulphur* is one of the most frequently prescribed medicines. In total, 51 medicines appear in both rubrics in the same grade.

Now we can understand why many homeopathic practitioners are not keen on using the large rubrics in repertories. If, say, we want to differentiate between *Sulphur* and *Rhus-t* and the patient appears to have 'amelioration from motion' we see bold entries for both medicines. But the *Sulphur*-entry in the rubric 'aggravation from motion' is also bold.

Polarity Analysis

During the Swiss ADHD double blind trial Frei developed PA to increase the reliability and accuracy of the prescriptions.[8] The Boenninghausen Arbeitsgemeinschaft in Germany later adopted this procedure for their computer program based on the revised edition of Boenninghausen's Therapeutic Pocket Book.[9] This repertory adds polar symptoms (the opposite symptom) automatically to the repertorisation and calculates the difference of the sum of grades of polar patient symptoms and the sum of grades of opposite symptoms: the 'polarity difference'. A positive polarity difference means that the mode of the chance continuum lies in the positive region of the chance continuum (Figure 4). The rubrics in the Boenninghausen repertory are smaller (motion aggravates 126, motion ameliorates 102 medicines), but the most important entries are similar. Three other computer-repertories based on the unrevised editions of Boenninghausen's Therapeutic Pocket Book have since adopted PA (Boenninghausen module of RADAR,[10] jRep[11] and Amokoor.[12]).

By subtracting the entries in the rubric 'motion aggravates' from the rubric 'motion ameliorates' we get negative values for 37 medicines. For these medicines 'motion ameliorates' may even be a contra-indication (i.e. a negative polarity difference lowers the probability of improvement by this medicine). Some of these entries are shown in Figure 5. In the Full Synthesis repertory 47 medicines

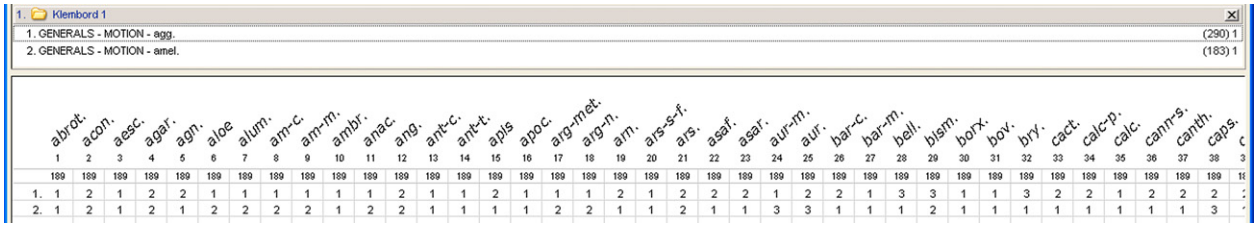


Figure 2 Repertorisation of two opposite rubrics, 'motion aggravates' and 'motion ameliorates'.

Author's personal copy

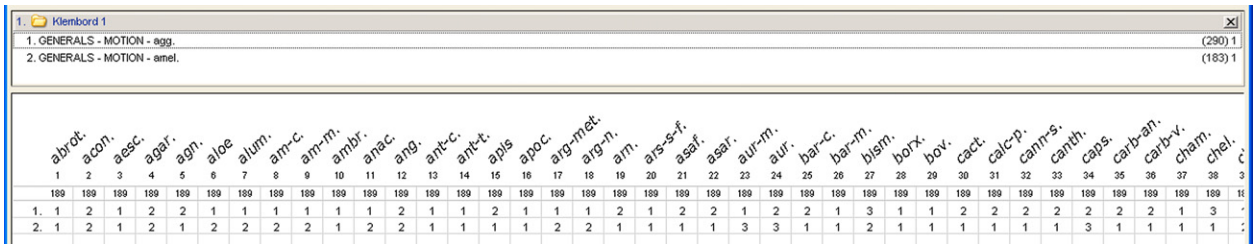


Figure 3 Same repertorisation as Figure 2, with 20 polychrests excluded.

are contra-indicated if we subtract the rubric 'motion aggravates' from 'motion ameliorates'. Therefore, about half of the entries of the symptom 'motion ameliorates' (183 entries) is misleading, because the entries are in the same degree (51 entries) or in a stronger degree (47 entries) present in the opposite rubric.

Translating PA into the chance continuum means that the peak (mode) of the curve (Figure 1) lies in the middle between the two opposites if the medicine is in the same degree in both opposite rubrics. The stronger the polarity difference the greater the distance between the mode and the zero point between two opposites. A strong polarity difference means that one pole of the two opposites is a 'keynote' for the medicine. A strong negative polarity difference means a strong contra-indication.

PA proved effective in a Randomised Controlled Trial on ADHD (Figure 6).[7,8] PA alone increased the effectiveness of the first prescription from 28% to 48%. The effectiveness of the first prescriptions increased by about 70%, and of the second prescriptions by more than 40%.

For many rubrics of the non Boenninghausen Modules of the RADAR repertory PA, reduces the size of the rubric considerably, see Table 1. The results are also quite different from those achieved by discarding the 20 polychrests from the repertorisation.

PA corrects for a structural problem of the repertory. If entries are based on absolute occurrence in provings and successful cases, eventually every medicine will appear in every rubric. PA introduces relative occurrence by subtracting the rubric from the opposite symptom-rubric. PA also introduces a new procedure in homeopathic repertorisation: contra-indication due to the presence of a symptom. There is evidence that PA can be effective, but of course, it only works for symptoms with opposite symptoms in the repertory. To understand how it works and to extend this idea to symptoms without opposites we must refer to Bayesian theory.

Bayes' philosophy

Bayes' theorem, published in 1763, deals with predictions from experience in the past.[13] It tells us that chances of success with a medicine increase if a symptom is frequently present in patients cured by that medicine, more frequently than in other patients.[14] This is expressed by the Likelihood Ratio (LR). If the symptom 'loquacity' occurs four times more frequently in Lachesis patients than in other patients LR = 4.

Bayes' theorem is expressed in a formula that is derived from the mathematical rule of conditional probability.[15]

$$\text{Posterior odds} = \text{LR} \times \text{prior odds}$$

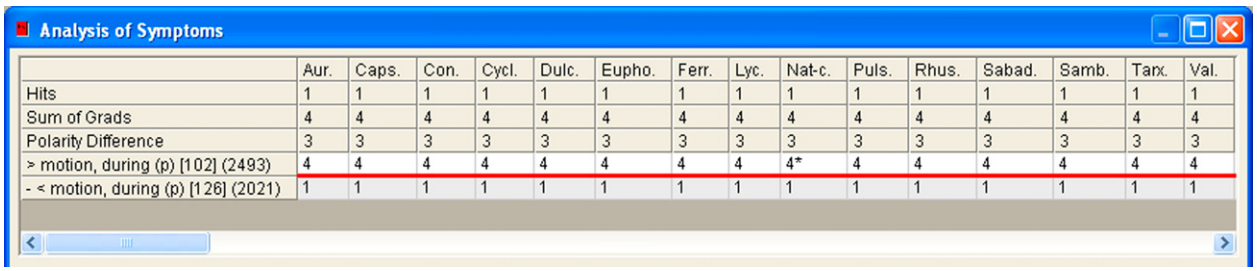
where odds = chance/(1 − chance) and chance = odds/(1 + odds).

LR is the frequency (prevalence) of a symptom in the population 'cured' by a certain medicine divided by the frequency of the same symptom in the remainder of the whole treated population.

For the calculations of LR we used the formula $LR = (a/(a+c))/(b/(b+d))$ as in the 2 × 2 contingency (Table 2).

Suppose that the symptom 'amelioration from motion' is present in 40% of the patients responding well to *Rhus-t* and in 5% of the remainder of the population, then LR = 40/5 = 8. If the symptom is present the odds that *Rhus-t* will work rises from, say, one to nine towards eight to nine, the chance from 10% to 47%.

The Bayesian formula shows how the contra-indication works. Suppose that the symptom 'amelioration from motion' is present in 2.5% of the *Bryonia* population and in 5% of the remainder of the population, then LR = 0.5.



	Aur.	Caps.	Con.	Cycl.	Dulc.	Eupho.	Ferr.	Lyc.	Nat-c.	Puls.	Rhus.	Sabad.	Samb.	Tarx.	Val.
Hits	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sum of Grads	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Polarity Difference	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
> motion, during (p) [102] (2493)	4	4	4	4	4	4	4	4	4*	4	4	4	4	4	4
- < motion, during (p) [126] (2021)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Figure 4 PA of 'motion ameliorates' and 'motion aggravates', first results, where medicines are indicated by 'motion ameliorates'.

Author's personal copy

Analysis of Symptoms

	Asar.	Carb-a.	Caust.	Chin.	Cocc.	Hep.	M-aus.	Nat-m.	Phos.	Sars.	Selen.	Spig.	Staph.	Bell.	Bry.
Hits	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sum of Grads	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Polarity Difference	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-3	-3
> motion, during (p) [102] (2493)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
- < motion, during (p) [126] (2021)	3	3	3*	3*	3	3	3	3	3	3	3	3	3	4	4

Figure 5 PA as in Figure 4, last results; medicines are contra-indicated if 'motion ameliorates' is present.

If we apply the Bayesian formula the chance that *Bryonia* will work if the symptom is present diminishes from, say, 50% to 33%. LR values between zero and one indicate a contra-indication for a medicine, a value closer to zero is comparable with a stronger negative polarity difference. A low polarity difference or a LR closer to one indicates little difference. If LR = 0.75 chance in the example above diminishes from 50% to 43%.

Many homeopathic practitioners think that it is possible that a medicine can be indicated by both opposite symptoms; the medicine has e.g. 'some reaction to motion'. This situation is represented by a bimodal distribution (Figure 7). The presence of such a situation could be detected by prospective LR assessment. If, say, for 'amelioration from motion' and *Bryonia* LR = 2 and for 'aggravation from motion' and *Bryonia* LR = 8, we will see a bimodal curve with one peak lower than the other.

Discussion

The effectiveness of repertories – and of homeopathy – will decrease if we keep adding entries based on absolute occurrence of symptoms; eventually every medicine will be included in every rubric. Homeopathic practitioners were already aware that frequent use of a medicine is the cause of this problem, although without a clear understanding of why. Bayes' theorem offers the explanation and makes clear what instruments can be applied to overcome this problem. The extent of the problem is considerable. In the rubric 'amelioration from motion' about half of the entries could be misleading. The same amount was found in six repertory-rubrics that were prospectively assessed.[6] PA improves the effectiveness of the first prescriptions by about 70%, despite the fact that PA is only available if opposite rubrics are present.

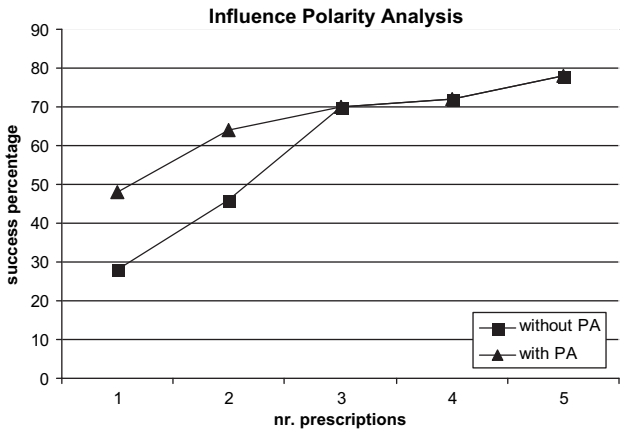


Figure 6 Results of prescriptions, influenced by PA in the Swiss ADHD trial.[7,8]

PA introduces the possibility of using the presence of a symptom as a contra-indication for a medicine. Bayesian philosophy explains that a medicine is contra-indicated if the prevalence of the symptom in the population responding well to that medicine is less than in the remainder of the population.

In accepting Bayesian philosophy we have to shake off some long-existing habits. A patient with 'amelioration from motion' responding well to *Bryonia* will make a greater impression than patients with 'aggravation from motion' because the unexpected makes a greater impact on our memory. We must get used to the idea that Bryonia patients can have 'amelioration from motion', but that this symptom does not increase the chance that Bryonia will work, on the contrary, it will decrease this chance.

The problem of unreliable entries is greater for frequently used medicines, but also for frequently used symptoms, or rather, the size of the symptom-rubric. The prevalence of the symptom 'diarrhoea from anticipation' was 4.4% in the Dutch LR assessment, but Kent's repertory-rubric contains only three medicines. Kent's rubric 'fear of death' contains 103 entries, while the prevalence of the symptom is 3.9%. Prospective assessment of 4072 prescriptions learned that the repertory-rubric 'diarrhoea from anticipation' is incomplete; at least six medicines should be added, also polychrests like *Arsenicum album* and *Lachesis*. The rubric 'fear of death' on the other hand is over-complete; at least 10 entries should be discarded, but, again, not all polychrests.[6]

PA is only available for symptoms with opposites. For symptoms like 'diarrhoea from anticipation' and 'fear of death' the symptoms 'desire death' comes close to being opposite to the latter, but cannot be regarded as a semantically correct opposite. Many symptom-rubrics have no opposites, including the most concerning complaints without modality. The repertory-rubric 'headache' is a classic example of a rubric that has become utterly useless for finding the right medicine. Symptoms that have no opposites should be assessed by LR research, preferably prospective. But retrospective Bayesian analysis of data can also help to get indications of LR.[16] Databases where the complaint 'headache' and the response to homeopathic medicines are recorded are required. If we know the prevalence of

Author's personal copy

Table 1 Reduction of rubric size after subtracting opposite rubrics and retaining only positive entries

Symptom	*Rubric size*	*Rubric size after PA*
GENERALS – AIR, IN OPEN – agg.	177	92
GENERALS – AIR, IN OPEN – amel.	225	142
GENERALS – AIR, OPEN – aversion to open air	108	60
GENERALS – AIR, OPEN – desire for open air	132	80
GENERALS – ASCENDING – agg.	122	107
GENERALS – ASCENDING – amel.	24	4
GENERALS – BATHING – agg.	89	68
GENERALS – BATHING – amel.	51	27
GENERALS – BENDING, turning – affected part – agg.	85	63
GENERALS – BENDING, turning – affected part – amel.	42	15
GENERALS – BENDING, turning – backward – agg.	52	42
GENERALS – BENDING, turning – backward – amel.	35	25
GENERALS – BREAKFAST – after – agg.	56	32
GENERALS – BREAKFAST – after – amel.	63	36
GENERALS – COLD – agg.	244	207
GENERALS – COLD – amel.	107	37

headache in a population responding well to a specific medicine and the remainder of the population we can calculate LR and estimate what medicines are most useful for this complaint.

With prospective assessment of symptoms we can only assess the medicines that are regularly prescribed and fairly common symptoms, but this category causes the biggest problems. For rare symptoms casuistry is still valuable; the rare symptom will probably occur in a few medicine populations. If a symptom is less rare we can only rely on pooled data. If a doctor has five *Natrium muriaticum* cases and one of them (20%) has 'fear of death' he will consider 'fear of death' as an indication for *Nat-m*. But 100 *Natrium muriaticum* cases from 20 doctors might reveal only two cases with 'fear of death'. Prospective assessment of this symptom showed only three out of 156 *Natrium muriaticum* with fear of death, for this symptom and *Nat-m* LR = 0.49 (95% CI 0.16–1.51).

The possibility of bimodal symptoms (where both opposite symptoms occur) needs to be further investigated by LR assessment. If LR for both opposite symptoms is >1.0 the symptom could be bimodal. It could be interesting to assess food desires and aversions in this respect; the change of a desire into its opposite in different stages of life seems to occur rather frequently.

It is unclear to what extent proving symptoms suffer from the same problem. A proving symptom is also a chance continuum, but if a proving is performed by a larger number of people the relative occurrence becomes more clear. Rabe has analysed the unreliable symptoms identified by Frei in ADHD treatment [8] using the Symptomlexikon, and found that they have a much higher percentage of clinical entries than the reliable ones (54% vs. 9%).[17] From a Bayesian point of view it is obvious that one or two persons with headache in a group of 10 participants is no indication for a repertory-entry.

The changes we propose will not deliver a repertory that can be used for prescriptions without Materia Medica knowledge. Repertorisation should be regarded as a weather forecast: the forecast can be perfect, but what you are going to do the next day will depend of a lot of other variables. In the same way you like the repertory to be reliable, but your prescription will still depend of a careful comparison of the Materia Medica of various medicines. Experienced practitioners know the shortcomings of the repertory and compensate for them intuitively, although the ADHD trial showed that even prescriptions by experienced practitioners improve considerably from PA. For new practitioners a reliable repertory will be a great advance. The closest approach to reliable repertory available today is the revised edition of Boenninghausen's Therapeutic Pocket Book,[1] which has been stripped of all later entries. It is practically the original version used by Boenninghausen. Its use with the addition of PA yields good results.[7,18]

Table 2 2×2 contingency table for assessing relation between symptom and effect

	Good response to the medicine	*Remainder of population*	
Symptom positive	a = True Positives (TP)	b = False Positives (FP)	$a+b$
Symptom negative	c = False Negatives (FN)	d = True Negatives (TN)	$b+d$
	$a+c$	$b+d$	$a+b+c+d$

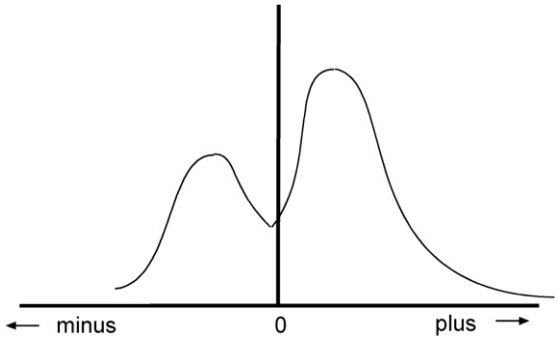


Figure 7 Bimodal curve; both opposite symptoms indicate the medicine.

Author's personal copy

Conclusion

Repertory entries *based on absolute occurrence of symptoms* in 'cured' cases are a major threat to the effectiveness of homeopathy. By regarding the homeopathic symptom as a chance continuum and the homeopathic repertorisation process as Bayesian we can understand why and generate solutions: clinical symptoms should only be entered on the basis of LR-analysis. PA can improve the effectiveness of our method relatively rapidly. The scientific development of homeopathic repertorisation should focus on assessment of the relation between symptoms and successful prescriptions.

References

1 Boenninghausen Cv. In: Gypser K-H (ed). *Boenninghausen's Therapeutisches Taschenbuch*. Stuttgart: Sonntag-Publishers, 2000.
2 Schuricht U. Bemerkungen zur Gradierung der Arzneimittel in Boenninghausens Therapeutischem Taschenbuch. Unpublished results, 2009.
3 Gypser KH. ''Inttermittierende Empfindungen'' – Versuch einer Rubirkenerstellung. Lecture held at the Gleeser Akademie homöopathischer Aerzzte, 2008.
4 Stolper CF, Rutten ALB, Lugten RFG, Barthels RJWMM. Improving homeopathic prescribing by applying epidemiological techniques: the role of likelihood ratio. *Homeopathy* 2002; **91**: 230–238.
5 Rutten ALB, Stolper CF, Lugten RF, Barthels RJ. Repertory and likelihood ratio: time for structural changes. *Homeopathy* 2004; **93**: 120–124.
6 Rutten ALB, Stolper CF, Lugten RF, Barthels RJ. Statistical analysis of sic repertory rubrics after prospective assessment applying Bayes' theorem. *Homeopathy* 2009; **98**: 26–34.
7 Frei H. Polarity analysis, a new approach to increase the precision of homeopathic prescriptions. *Homeopathy* 2009; **98**: 49–55.
8 Frei H, Ammon Kvon, Thurneysen A. Treatment of hyperactive children: increased efficiency through modifications of homeopathic diagnostic procedure. *Homeopathy* 2006; **95**: 163–170.
9 Boenninghausen Arbeitsgemeinschaft, *Boenninghausen's therapeutic pocket book*, revised edn 2006, PC-version 1.6.5, 2000–2008, Ahrweiler, 2006, Available from: www.boenninhausen.de.
10 Schroyens F, Boesy B, Coquillart G, *et al*. *Boenninhausen-module, radar program*. Assesse: Archibel, 2006.
11 Stegemann T, Raess S. jRep, Rottenburg am Neckar, 2006.
12 Steiner U, Amokoor 2008. Homöopathie Software, Immensee, 2007.
13 Bayes T. An essay toward solving a problem in the doctrine of chances. *Philos Trans R Soc Lond A* 1763; **53**: 370–418.
14 Gill CJ, Sabin L, Schnid CH. Why clinicians are natural Bayesians. *BMJ* 2005; **330**: 1080–1083.
15 Woodworth GG. *Biostatistic: a Bayesian introduction*. Wiley, 2004.
16 Wassenhoven Mvan. Towards an evidence based repertory: clinical evaluation of *Veratrum album*. *Homeopathy* 2004; **93**: 71–77.
17 Rabe S. Das ''unzuverlässige'' homöopathische Symptom – Ueberlegungen zu Freis Therapiekonzept des AD(H)S. *ZKH* 2009; **53**(2): 67–71. doi:10.1055/s-0029-1213535.
18 Frei H. *Effiziente homöopathische Behandlung*. Stuttgart: Haug-Verlag, 2007.