WITCHCRAFT, DIVINATION AND SCIENCE
INDIGENOUS METAPHYSICS AND KNOWLEDGE[1]

MARK SCHRÖDTER

University of London, School of Oriental and African Studies 1998

I.

There are various situations, described in ethnographies of 'primitive' peoples, which are subject of interpretation and re-interpretation for they are not immediately comprehensible for Western anthropologists. When Evans-Pritchard (1956) reports that the Nuer hold 'twins are birds', the anthropologist is puzzled. If this statement is taken literally, the Nuer seem to make a category mistake, for twins do not belong to a category subsumable under or assimilable to birds.

Cooper (1975) summarises the attempts anthropologists have made to dissolute this and similar problems. First, some explain such statements with the natives' disability to see the contradictions or with a conscious ignorance of them in favour of other, non-logical criteria. Second, others have argued such statements are scientifically meaningless, hence they can not be attributed a value of 'truth' or 'false' since they have expressive, emotive or symbolic meaning. The third position regards the contradictions as a result of misunderstandings through bad translations or insufficient considerations of the context and background of the statements in question. As a forth alternative Cooper tries to proof that contradictions in some cases only arise by analysing the statements with standard logic instead of other, appropriate forms of logic.

For further investigations in problems concerning anthropological analysis especially in respect of 'strange' practices or (seemingly) inconsistent beliefs, these four approaches shall be projected into the common conceptual dualism of the 'emic' and 'etic' approach. In anthropology the concepts 'etic' and 'emic' often draw the dividing line between approaches allegedly from the point of view of the observers and the observed, the former applying the anthropologist's own models the latter taking indigenous categories into account. The dualism often corresponds with various opposing schools of thought, like structuralist/symbolists, positivists/interpretivists, universalists/relativists, etc.

However, there are anthropologist who wouldn't situate their work in either of these perspectives. Thus it is worth to analyse the 'emic' enterprise of grounding the analysis on indigenous categories and ask: *To what extend is any project to ground anthropological analysis on indigenous categories at best irrelevant, at worst doomed to failure?*[2]

---

[1] Essay for the MA Course in Social Anthropology, School of Oriental & African Studies, University of London

[2] This was the essay question posed in the course 'General Principles in Social Anthropology'.

I will be analysing two ethnographic examples. The first is derived from Evans-Pritchard (1937) and was subject of a debate in the 1970's. Cooper (1975) tried to dissolute contradictions in a set of indigenous statements by applying an alternative logic, where Salmon gives a more conventional interpretation. Parallel to the critique of Salmon on Cooper, I elaborate a critique on Eglash (1997) for his mathematical interpretation of a divination system in Senegal. The emic-etic-distinction serves as a rough framework for considering the questions about grounding the anthropological enquiry on indigenous categories or on allegedly universal mathematical and logical models and how to reconciliate such epistemological dichotomies.

II.

Evans-Pritchard (1937: ch. I) describes a set of beliefs among the Azande regarding witchcraft, which entails a contradiction. Witchcraft is inherited by the unilateral line; the sun is a witch if the father is one and the daughter is a witch if the mother is one. Since all Azande are related to each other, it follows, that all Azande must be witches. However, there is a reliable test, which detects post-mortem by searching for a particular substance in the belly, if a person is actually a witch. This test has given sometimes positive and sometimes negative results. Consequently, the statements 'all Azande are witches' and 'some Azande are witches' are both true, which is a contradiction.

<div style="text-align: right">Zande</div>

Cooper (1975) argues, that this contradiction only occurs when conceived through standard logic. An alternative logic was elaborated by Hans Reichenbach for the interpretation of certain problems arising in quantum mechanics, where some fundamental logical and physical principles stand in contradiction to each other. In order to guarantee the validity of some physical principles, which were in danger when following previous interpretations of quantum mechanics, he rejected for this particular case the validity of the standard logic in favour of the three value logic. It allows a third truth value, which is neither 'true' nor 'false' but 'indeterminate'. Cooper tries to demonstrate that the set of beliefs the Azande held can be put in the same logical order as the statements involved in the interpretation of quantum mechanics. Thus if the premiss 'Everyone biologically related to a witch is a witch' is indeterminate, it follows from the structure of the three value logic, that the conclusion 'All Azande are witches' is indeterminate as well. The contradiction is resolved.

<div style="text-align: right">three value logic
in Zande</div>

Ron Eglash (1997) conducted his research in Dakar, Senegal, were Bamana diviners taught him their divination system. First they were reluctant to reveal the secret of the system to the anthropologist but when he explained them a graphical representation of the Cantor Set[3] they were amazed and gave in. By drawing rapidly four vertical dashed lines in the sand the diviner created a random variation of dashes (fig. 1, appendix). Four of these 'matrixes' serve as the foundation and the lines are reorganised and summarised into symbols, which are again combined to get new ones. The entire procedure follows fixed rules, one of them is the recursive use of the mathe-

<div style="text-align: right">Bamana</div>

---

[3] In 1877 Cantor used a recursive function for showing graphically that some qualities are more infinite than others.

matical function 'addition modulo 2',[4] so that 16 symbols in a sequence are created (fig. 2). Each symbol stands for an archetypical concept (travelling, desire, health) and belongs to a 'house'. Through the procedure the symbols will be located in different houses. Under the influence of palm liqueur and marijuana, which improves the occult vision, the diviner generates a narrative out of the constellation, beginning with a 'desire for travel', for example, if 'desire' is in the house of 'travelling'.

Cooper and Eglash both try to approach indigenous knowledge on a quite unusual way for anthropologists. To analyse 'puzzling' phenomena like beliefs in witchcraft or divination in terms of mathematics or non-standard logic seems to be the strongest form of imposing Western models of thought on indigenous peoples. On the other hand, if these models are conceived as reflecting the objective reality, they are no longer a Western privilege. Are *the anthropological analyses in Zande and Bamana grounded on 'discovered' indigenous or 'imposed' western categories?*

Salmon (1978) doubts that the Azande use a non-standard logic. He doesn't deny the isomorphic relation between the set of beliefs of the Azande and the set of statements interpreting quantum mechanics, but questions that three value logic is applied by the Azande. According to Salmon, Reichenbach's criteria for employing this logic is the untestability *in principle* of a statement. In quantum mechanics this is the case, since the measurement of one quantity makes it physically *impossible* to measure its counterpart[5] and the other way round. Although it is *not directly testable*, whether 'Everyone biologically related to a witch is a witch' in the Azande case it can be detected post-mortem if somebody actually is/was one. Thus it *not untestable in principle*. Hence, according to Salmon, the three value logic should not be applied.[6]

Parallel to Salmon's critique on Cooper, Eglash's account could be questioned. It has to prove firstly, that the Bamana divination system could be explained in terms of recursive functions and, if this is the case, secondly, that the Bamana actually apply them.

If we consider the divination system (fig. 2) it is obvious, that the recursive function mod 2 is not applied in every step of the sequence. Eglash acknowledges, that 'Recursion is generally defined as any iterative mathematical function in which the output of each iteration is used as the input for the next iteration.' (p. 116) But in the Bamana case we don't have such a simple recursion.[7] After the first three depths are

---

[4] To say it simple: modulo 2 (mod 2) makes of odd numbers 1 and of even numbers 0, e.g. 5 mod 2=1.

[5] The measurement of the position p makes the measurement of the momentum q at the same time impossible.

[6] Even if Cooper 'imposed' the three value logic on the Azande, this can not be done in a funny constructive manner. Alternative forms of logic with n-values can not be constructed arbitrary. The meta-language of every logic is the two value logic, since every statement *about* n-value logic must be true or false (cf. 'mehrwertige logic' in: Klaus, 1972)

[7] A simple example for recursion is a mirror hold in front of another mirror and you placed in between. Say, the mirrors are in such a distance from each other that they reduce your picture to ½ of the original size. The recursive function is thus: $f(x) = ½x$. The mirror in front of you gets your picture as the input reflects it reduced to the other, gets it reduced back, throws it reduced back, and so on. Another example is the structure of a tree with it's roots and branches, and sub-branches, and sub-branches, and ....

generated (see fig. 3 step 1–3) the recursion would get at its end, if the diviner didn't generate through recombination of the first four symbols another set of four symbols (step 4). This recombination is a rearrangement with no recursive function involved. With this additional set the recursion continues (step 5–6) till it reaches its end. Fourteen symbols are thus generated. With the last symbol of each set the recursion goes on (step 7). The final symbol is created by applying the recursive function on the first and the last symbol (step 8). Although this is a recursive step, it doesn't lie in the nature of the recursive function itself, to take just the very first and the last symbol to create the final one.

In sum, there are two steps in the recursive sequence (step 4 and 8) which are exceptional. This doesn't mean, that the sequence can not be described as recursive, but it is ambiguous, unless not exactly specified by rules. The equivocal character of the divination system becomes obvious if we are to create a greater depth than five. Firstly, it lies in the nature of the system, that we have to create an additional set of four matrixes with dashed lines (with less then four there would be one symbol left in depth 2 or 3). But then it is not clear at which point to create the new symbols through rearranging. This could be done once, which leads to 24 symbols (fig. 3), or twice, which leads to 32 symbols (fig. 4). In addition the combination with the last symbol could be done in different depths, but the two examples above shall be sufficient to demonstrate the internal logic of the divination system, as far it can be analysed on the basis of Eglash's ethnography.

What does this mean for anthropologists? Since the Bamana sand divination is not unequivocal it could be argued, it was a matter of interpretation to describe it as recursive. One the one hand, the output of one process is the input of the next is a objective fact (which is the necessary condition for recursion) and on the other hand, there are steps allowing different possibilities if we are to extend the recursive depth. Similarly, that the diviners are consciously applying recursion may be supported by the fact, that they were amazed by the Cantor Set and that they sometimes employ a more elaborated version of this system, which shows, that they 'are not simply applying mod 2 again and again in a mindless fashion' (p. 118). Yet it could be objected, that they adopted their system according to the Cantor Set, what Eglash admits: 'But it may be that the emphasis was partly done for my benefit, as a bit of mathematical translation to better fit the Cantor Set model.' (p. 116). Of course, this interaction between the mathematician and the diviners could be interpreted exactly the other way round: It is not that the diviners merely adopted their system to the appearance of the Cantor Set, but they comprehended its inner structure and assimilated it!

consequences for anthropological theory

In his seminal work Horton (1967) not only highlights the differences of western science and 'magico-religious thought' but also the similarities.[8] According to Horton these systems of thought have in common the circumstances in which they are applied. If the common sense explanations, which are often sufficient for compre-

Alternative approaches: Explanation of witchcraft with context

---

[8] Horton was often criticised for this comparison. Maybe the comparison of 'traditional' science with 'modern' science or 'traditional' religion with 'modern' religion would be more methodically adequate. But this critique in not significant in this context, since it is for the question of everyday thought and high level theories.

hending the world, are exhausted then new explanations are derived from higher level theories, scientific as well as magico–religious. Cooper agrees with this 'jump' people do, in the case of the Azande from two to three value logic. Opposing Cooper, Salmon questions that the belief system of witchcraft is a genuine high level theory. He refers to an example in Evans-Pritchard (1957) where the Azande do not derive from an abstract belief system concrete statements but refer directly to it to explain very concrete phenomena in everyday life.

Consequently, Salmon suggests a solution of the seemingly contradictions by referring directly to details in the ethnographic data in Evans-Pritchard (1957). Witchcraft is said to be inherited only to close relatives and may 'fade out' or be 'cool', only a potential, but not a performative ability. Thus the Azande only believe the premiss 'Everyone biologically related to a witch is a witch' on the first glance but actually regard it as false. Hence they don't accept the conclusion 'All Azande are witches'.

Eglash's analysis of the divination system has a functional connotation. In general, there is nothing wrong with that. But he takes no symbolic value of the performance into account although he mentions it. It may seem as if the diviners are only concerned 'with the infinity of possible futures and must show how they can be narrowed down to a predicted unity' (p. 119). Eglash concedes that the anthropologist may consider the diviners as theoreticians but 'their mathematics is driven by the performative requirements of their work' (p. 119). And in an elegant analysis he parallels the social context of the diviners and of the European mathematician Cantor, for as the diviners are outsiders in their society, Cantor was so in his mathematical 'subculture'. However, a more 'classical' account surely wouldn't have emphasised the recursive functions in the divination system but may have focused on the ritual action involved.

Durkheim established the distinction between sacred, religious rites and profane, technical acts. Compatible to this line Eglash's analysis might have a Malinowskian connotation in a sense that social action appears to the observer merely as means to an end. The mathematical functions in the divination system serve as a method to create 16 symbols for generating narratives about the future. This technique may be superfluous, since the diviners could give an interpretation for their clients just 'from scratch'. Anthropologists have often stressed the function of rituals for the maintenance of the social status. Do the diviners merely perpetuate their status as gifted outsiders by performing the ritual of rearranging dashes lines in the sand? Eglash tried to persuade the diviners to reveal their secret by offering them high amounts of money. But they eventually give in not until he showed them the Cantor Set. Now the diviners could accept the anthropologist as 'one of them' and explained him their technique. But when they were going to reveal the last secret, namely how the interpretation of the symbols works, the anthropologist had to undergo a complex ritual (he had to eat a bitter kola nut, a chicken was 'killed', and more) 'to compensate for the harmful energy released in telling of the secret' (Eglash, p. 116). This ritual could be interpreted as another evidence for its function of establishing and maintaining a particular social status.

But maybe western anthropologist can't understand important aspects of the action at all. It could be doubted if any analysis can grasp the meaning, the rituals have for the diviners, not to forget the effect of the palm liqueur and the marijuana involved 'to improve the occult vision'.

However, these various ways of interpretation should not give rise to pessimistic relativism. Lindholm (1997) characterises the postmodern enterprise by summarising Shweder, an influential psychological anthropologist:

> 'there can be no *a priori* way to give preference to any attribute of an object over any other attribute, nor is there in principle a limit to the number of attributes any object may be said to reveal or contain' (p. 749).

Everybody can give his account on divination and witchcraft, they are all equally valid and 'true' and 'real', since, as Shweder concludes (in: ibid.: 749), 'there are as many realities as there are ways „it" can be constituted or described'. And, as if this was not enough, there is not only no certainty how to approach the observed, now uncertainty is the virtue of observer as well, if we follow Rabinow:

> 'so committed to a doctrine of partiality and flux for which even such things as one's own situation are so unstable, so without identity, that they cannot serve as objects of sustained reflection' (in: ibid.: 749).

Consequently the wisdom of anthropology should be: 'all things are equally alike and equally different' (Shweder, ibid., 749).[9] We shall now see, whether mathematics and logic could be considered as a stable and reliable bridgehead for the anthropological analysis at least in our case.

Some anthropologist assume the impossibility to comprehend phenomena like the natives do, we can just give various interpretations. Whorf (1956) may be read in this pessimistic way. He has put forward the argument for a strong determination of the manner the world is conceived through language. He found the Hopi language fundamentally different from the European, which form very different categories even for the basic understandings of space and time. Whorf wrote in the spirit of Collingwood (1940), who's treatise on metaphysics supports his strong relativist position. Collingwood defines the metaphysics as a historical science with the task to explicate the 'absolute presuppositions' of 'ordinary' science. They mark the tacit statements on which the whole discipline or school of thought in question rests. Although an absolute presupposition is in this sense the very foundation of knowledge, since 'it determines the entire structure of that science by determining the questions that arise in it, and therefore determining the possible answers. Thus every detail in these respective sciences depends on what absolute presuppositions they respectively make.' (p. 52)

Collingwood stresses that metaphysical investigations can find the absolute presuppositions in systems of thought but not assess them whether they are true or false. For if a statement is subject to the question for its being true or false, it ceases to be an absolute presupposition, but is a relative presupposition. Naturally this position can only hold its claim on a philosophical fundament which rejects the existence of an objective, independent from the human consciousness existing, reality. Once an

---

9   Such positions are so ridiculous, that one desires to throw Engels' *Dialectics of Nature* on their desk and ask: 'Have you ever heard of the difference between essence and appearance and the dialectical relationship between them?', apart from the anger one has to swallow in order not to explode, in respect of the ethical 'anything goes'–principle this attitude supports.
Lindholm (1997) demonstrates with an example derived from Heidegger in which a hammer is in infinitely different ways describable but has a rather universal usage which is literally intuitively grasped surely by all people all over the world. Here we approach one of the different conceptualisations 'objectivity' could have in anthropological enquiry.

objective reality is introduced, consciousness and theoretical concepts are reflections of or derived from it.[10] Consequently we can – at least for our purpose – speak of two different views about mathematics and logic, deferring in their claim to be derived from reality or pure intellectual constructions.

What does this mean for the divination system and the contradictions in the set of beliefs in witchcraft? If we suppose mathematics and logic to be reflections of reality, it is possible that not only the western scientists but also indigenous peoples apply them. The Western ethnoscientist can 'discover' mathematical or logical models in indigenous thought. Eglash is fascinated by the manner in which the divination system deduces the variety of infinitive events to a amenable number of 16 symbols as a point of departure to create narratives about the future.[11] According to Eglash 'the recent discovery of deterministic aperiodicy – as framed by nonlinear dynamics – maps quite well onto the traditional African conceptions of tricksters and related forms of causal unpredictability. Quantum mechanics allows the comprehension of events, unpredictable on one level of the material reality to be predictable on another.[12] Quite complementary, chaos theory deals with physical systems governed by predictable laws which behave unpredictable. Such research results suggest a dialectical relationship between chance and determinism (MacGarr, 1996). Of course it requires careful investigations to examine whether these principles can actually be applied without confusing different levels of the material and social reality. But nonetheless can the results of science enlighten certain conceptions of cultures different from those of 'the West'.

Thus recursion and chaos theory could serve as a bridgehead to describe and explain Bamana divination and three value logic may contribute to resolving the (alleged) contradictions in Zande witchcraft belief. It then could be discussed if the natives not only *apply* these models (which is objectively assessable in this view), but are even *conscious* about them. Moreover, on this foundation it may or may not become possible to grasp the idiosyncratic meanings the actors assign to their practices.

applying models
and being conscious
of them

In following the contrary view, it is asserted that mathematics and logic are merely based on absolute presuppositions which mark a framework particular to western thought and different from other knowledge systems. Unless it can not be proved,

---

[10] Marx is only one of the many different materialist schools. His famous quote may be interpreted as reductionistic: 'It is not the consciousness of men that determines their existence, but, on the contrary, their social existence that determines their consciousness.' Trotzky may sounds more dialectic but this is, of course, exactly in the spirit of Marx: 'The human mind is a product of the development of matter, and at the same time it is an instrument for the cognition of this matter; gradually it adjusts itself to its function, tries to overcome its limitations, creates ever new scientific methods, imagines ever more complex and exact instruments, checks its work again and yet again, step by step penetrates into previously unknown depths, changes our conceptions of matter, without, though, ever breaking away from this basis of all that exists.' (all quoted in: Baghavan, 1987, pp. 11).
I believe in a stratified concept of reality. The possibility *in principle* of the approximation of truth decreases with an increase of complexity from the atomic to the social level of reality (see Roy Bhaskar (1989) for distinction between transitive/intransitive objects of science).

[11] This reminds at interpretations of other divination systems. C.G. Jung in the foreword to 'The I Ching' (1967) refers to his a-causal principle of 'synchronicity' opposed to the diachronic principle of causality, which was merely a statistic truth.

[12] Werner Heisenberg (who formulated the indeterminacy principle of quantum mechanics) and Erwin Schrödinger: 'And so we have the paradox [→ dialectic!] that, from the point of view of the physicist, chance lies at the root of causality...' (quoted in: Baghavan, 1987: 72).

that the indigenous peoples in question apply (incidentally) the same models as the anthropologist, it is likely that the former use models incommensurable to latter (or the latter to the former!). Whorf (1956) has argued in favour of such an incommensurability and the consequence for the western ethnoscientist is at best, that his mathematical or logical models make description or explanation only comprehensible for herself. She can not claim, to get an understanding of the subject matter (divination, witchcraft) like the natives themselves.[13]

III.

It could be questioned that the different approaches to mathematics and logic necessarily have the impact on anthropological research of splitting it into two unreconcilable schools. Although there is no strict analogue relationship, this distinction corresponds with the 'emic'-'etic' approaches discussed above. *In some respects this dividing line breaks down*. For example, there *are* mathematical facts to discover. The Bamana sand divination system consists of 16 symbols which allows for 65.536 combinations. This is a fact, independent of the human consciousness or one's conception of mathematics.

Additionally, arguments have been given for rendering the etic-emic divide irrelevant (Barnard, 1996). The conceptual pair has not to be comprehended as the search for underlying principles and governing rules on the one hand and the 'native's point of view' on the other hand. One example to overcome this dichotomy may be the view, that human beings conceive the world through cultural or social structures, which in return shape their conception of the world. Thus, the individual perceptions are not that idiosyncratic as they may sometimes seem. Another argument might see universal cognitive (brain) structures responsible for similar cognitive (mathematical, logical) models of the world. Another position may hold, that the emic-etic distinction looses its sharpness, since all anthropological data has to be interpreted and emic as well as etic models are difficult to define.

Leach (1954) has tried to overcome this dichotomy of imposed structure and actor's meaning by asserting, that rituals make the social structure explicit. For Durkheim social action is either of sacred or profane *type*. Leach goes beyond Durkheim in conceiving rituals as having structure-functional and symbolic *aspects*:

> 'Ritual in its cultural context is a pattern of symbols; the words into which I interpret it are another pattern of symbols composed largely of technical [e.g. mathematical, logical, (M.S.)] terms devised by anthropologists [...]. The two symbol systems have something in common, namely a common *structure*. In the same way, a page of music and its musical performance have a common structure [example from Russell]' (Leach, 1954: 15)

Eglash's application of ethnomathematics demonstrated etic grounding perhaps in its most extreme form. He has shown how Westerners can at least approach the divination system in a way that it is not seen as arbitrariness. He hasn't tried to interpret

Conclusion

---

[13] If this was the aim of anthropology, I would like to see the western anthropologist, who is able to grasp the 'world of meaning' of other people living in his own culture. Can an anthropologist ever 'understand' an internet-freak, a bank manager, a pop star or a child?

symbols, but gets nonetheless an understanding for indigenous practices. And the diviners themselves didn't see their system as incommensurable, since it could be learned if the anthropologist follows their instruction, although it could be argued, that Eglash was not interested in exploring his abilities for an occult vision through palm liqueur and marijuana.

Maybe Cooper has taken the analogy of the Azande's belief in witchcraft with the anomalies in quantum mechanics too far. But his contribution is to allow for the indigenous peoples a form of logic, where there is more then 'true' or 'false'. However, in this case I agree with Salmon, who finds this is unnecessary and provides a different and more appealing interpretation.

Referring to the etic-emic distinction introduced in the beginning, we can state: The project of grounding anthropological analysis on indigenous categories is irrelevant, if objective, 'etic' knowledge is to be grasped, since there *are* universal categories. On the other hand, it is doomed to failure, if subjective, 'emic' insights, totally different from 'our' own or, perhaps more exact, different from the anthropologist's conception of the world are to be grasped. Apart from the fact, that symbols can be interpreted in various ways, we can never know, if there are some (spiritual) dimensions which are never amenable for science. But if we do not have illusionistic expectations against science this dualism can be overcome.

Horton (1967) warns the reader 'from the trap which the Western layman characteristically falls into – the trap which makes him feel he is keeping up with the scientists when in fact he is no nearer to them than the African peasant.' (p.186) I shall add: Everything stands or falls with the questions asked if it is for knowledge about the material, social or spiritual world. For some realms of human experience there may be no way to approach them. But in general, anthropologists and scientists can get better insights into other cultures than the layman, if the questions asked can be answered at all. Equally there are 'primitive' theoreticians who can assimilate the world more adequate than indigenous laymen, when the questions asked are adequate to their models. Moreover, there are thousands of occasions, where the 'modern' and the 'primitive' models of thought are congruent.
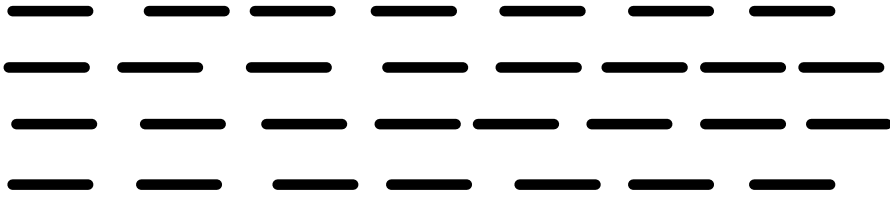
<div align="right">M.S.05.05.1998</div>

APPENDIX

Fig.1 : four random dashes are drawn (Eglash 1997)

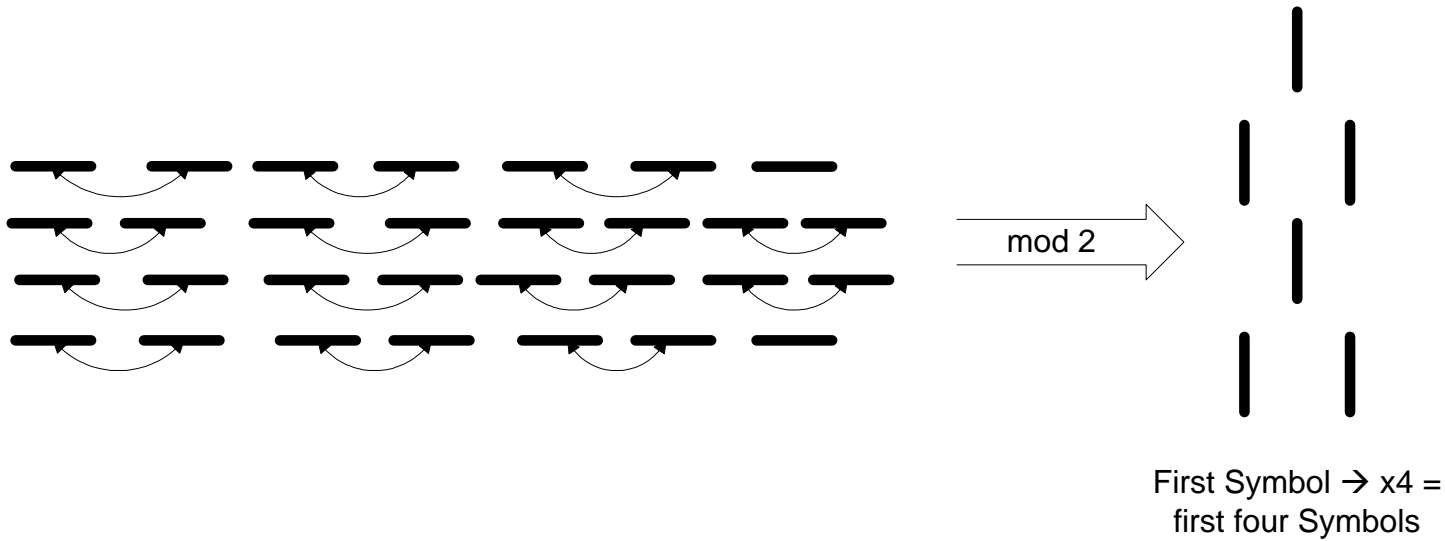First Symbol → x4 =
first four Symbols

Fig.2a: each of the dashes are paired, and the odd/even results recorded (Eglash 1997)
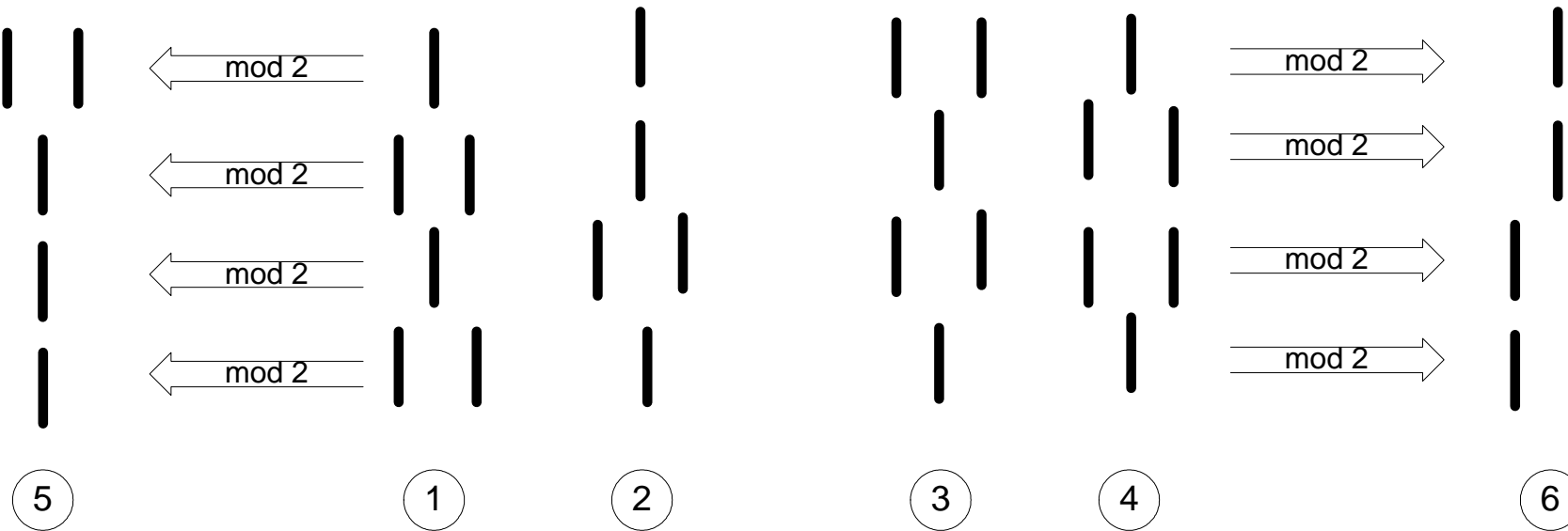
Fig 2b: The process is repeated four times, resulting in four symbols. Each row of the first two symbols and the last two symbols are paired off to generate two new symbols (Eglash 1997)
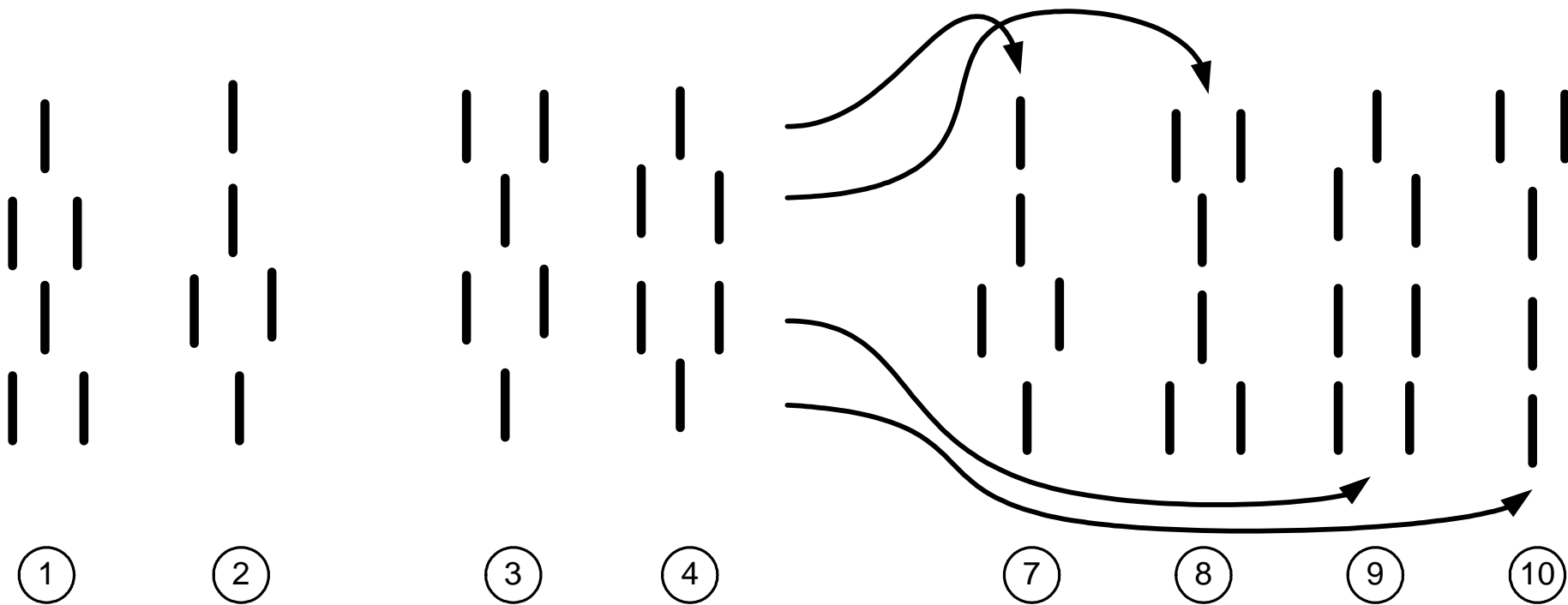
Fig 2c: The four symbols are read sideways to create four more symbols (Eglash 1997)
[This is non-recursively, M.S.]
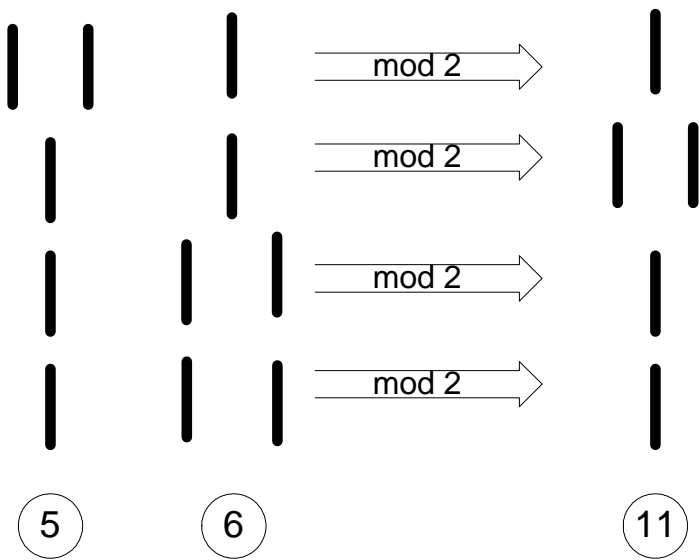
Fig 2d: The two newly generated symbols are again paired off to generate an eleventh symbol (Eglash 1997)
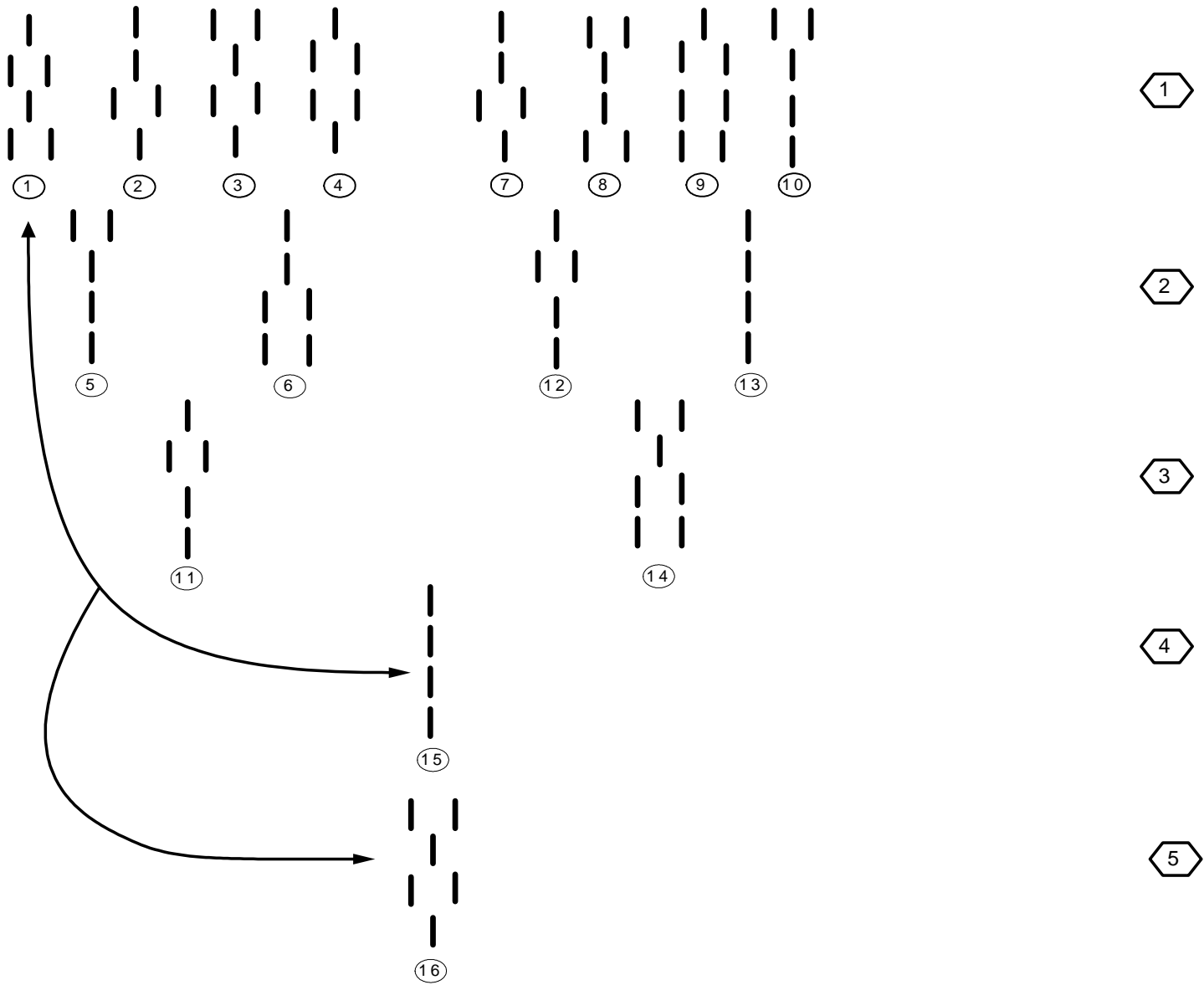
Fig 2e: The four new symbols are used to generate another three, which are placed underneath them, creating a second set of seven (Eglash 1997). Mod 2 is applied to the last symbols (11+14) and then to the first and the last (1+15) to get the very last one (16).
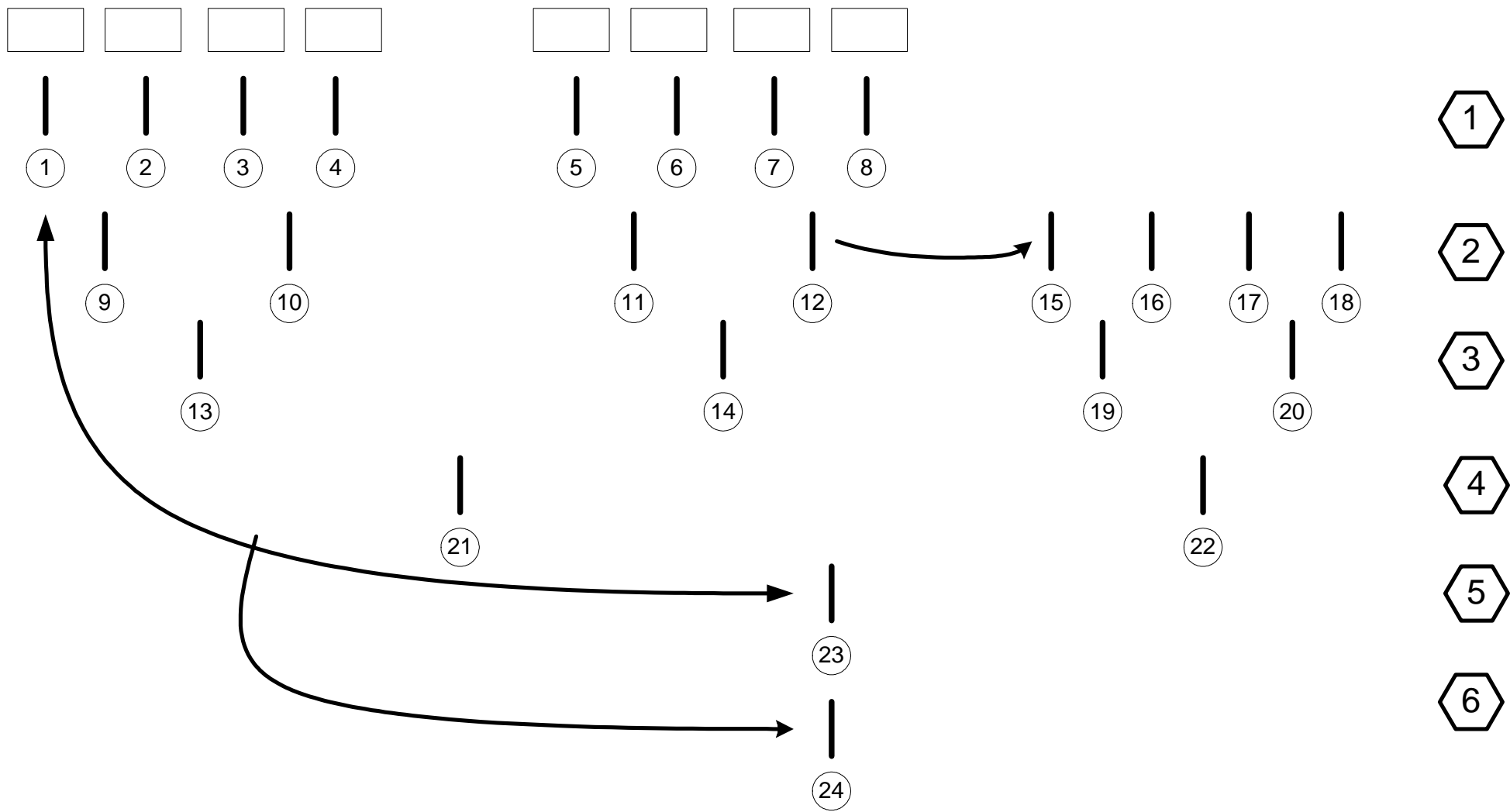
Fig 3: Divination System extended on recursion depth 6 (first version): One additional set of 4 dashed lines drawn in the beginning. *One* new set is generated at depth 2.
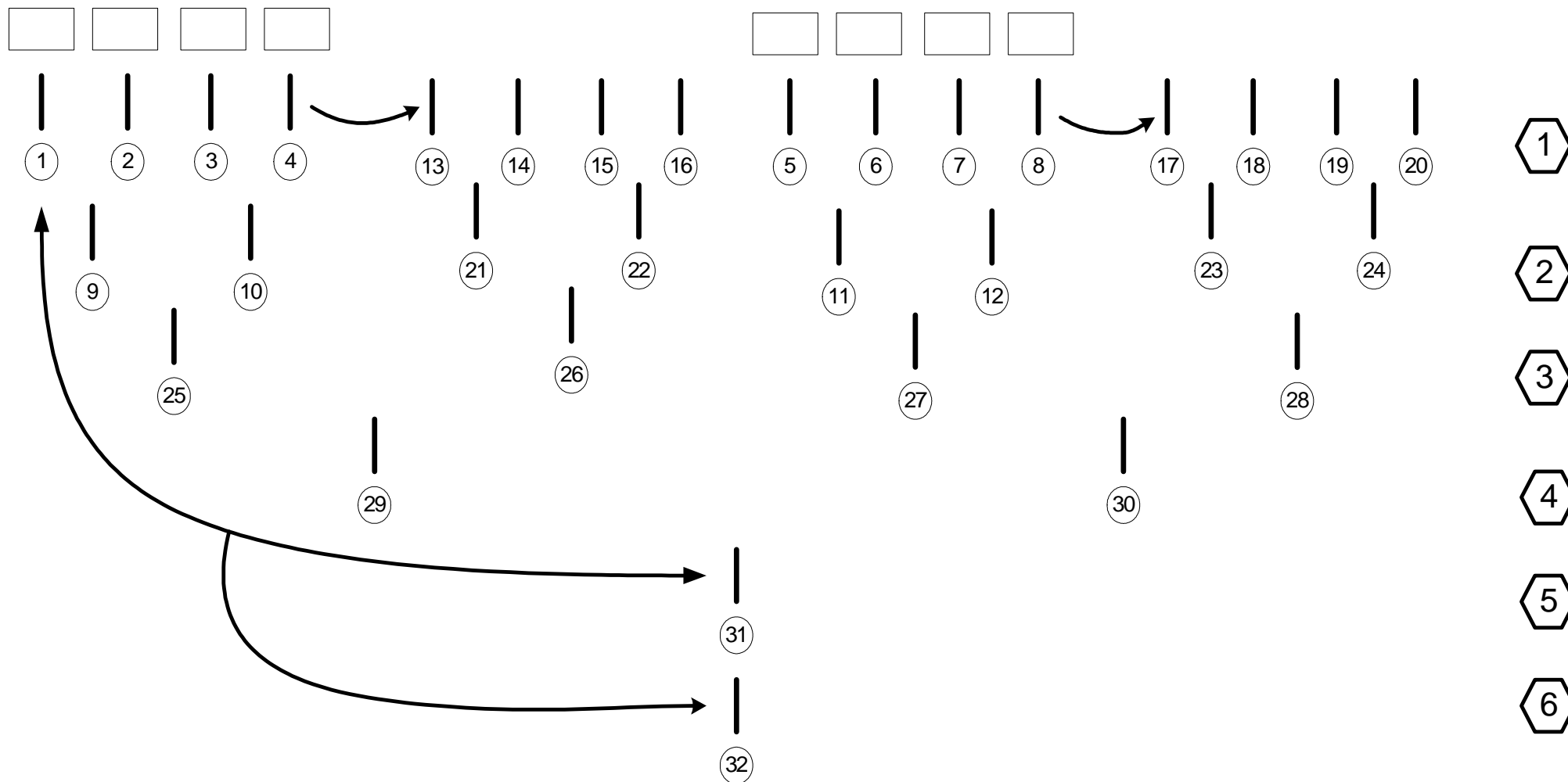
Fig 4: Divination System extended on recursion depth 6 (second version): One additional set of 4 dashed lines drawn in the beginning. *Two* new sets are generated at depth 1.

REFERENCES

Baghavan, R.S. 1987. An Introduction to the Philosophy of Marxism. Socialist Platform Ltd. London

Barnard, Alan. 1996. emic and etic. In: Alan Barnard, Jonathan Spencer (ed.). Encyclopaedia of Social and Cultural Anthropology. Routledge. London.

Bhaskar, Roy. 1989. Reclaiming Reality. Verso, London.

Christopher Norris, 1996. Truth, Science, and the Growth of Knowledge in: ??? (sorry!) 105–123

Collingwood, R.G. 1940. An Essay on Metaphysics. Oxford: Clarendon Press, Part 1

Cooper, D.E. 1975. Alternative logic in 'primitive thought'. Man n.s. 10: 2

Eglash, Ron. 1997. Bamana Sand Divination. Recursion on Ethnomathematics. American Anthropologist. 99(1) 112–122

Engels, Frederick. 1987. Dialectics of Nature. In: Marx, Engels, Collected Works. Vol. 25. London

Evans-Pritchard, E.E. 1937. Witchcraft, Oracles and Magic among the Azande. Clarendon Press, Oxford.

Evans-Pritchard, E.E. 1956. Nuer Religion. Oxford University Press, Oxford.

Horton, Robin. 1967. African Traditional Thought and Western Science. in: Horton. Patterns of Thought in Africa and the West.

Klaus, Georg. Manfred Buhr. 1972. Marxistisch-Leninistisches Wörterbuch der Philosophie. Rowohlt Taschenbuch Verlag, Hamburg.

Leach, Edmund Ronald. 1954. Political Systems of Highland Burma: A Study of Kachin Social Structure. London School or Economics. Monographs on Social Anthropology. The Athlone Press. London.

McGarr, Paul. 1994. Engels and natural science. in: John Rees (ed.) The Revolutionary Ideas of Frederick Engels. International Socialism 65, Special Issue

Richard Wilhelm (transl.) The I Ching or Book of changes. Routledge & Kegan Paul. London 1950 and 1967

Salmon, M.H. 1978. Do Azande and Nuer use a non–standard logic? Man n.s. 13, 3.

Whorf, Benjamin Lee. 1956. An American Indian model of the universe. In: J.B. Carroll. Language, Thought and Reality: Selected Writings of Benjamin Lee Whorf. Cambridge, M.I.T.