

ALGEBRAIC STRUCTURE OF ANCIENT MESOPOTAMIAN OMENS

Andrew Schumann

*University of Information Technology and Management in Rzeszow
Poland*

andrew.schumann@gmail.com

Vladimir Sazonov

*University of Tartu
Estonian Military Academy
Estonia*

vladimir.sazonov@ut.ee

Joanna Töyräänvuori

*University of Helsinki
Finland*

joanna.toyraanvuori@helsinki.fi

Abstract: In this paper,¹ it is shown that we can reconstruct an intuition of Boolean algebra in Mesopotamian divination with different omen series organized as catalogues. Each separate omen was formulated as a conditional statement “if a sign p , then an event q ” so that it has only the positive truth value in the Boolean algebra. This means that omen catalogues can be considered as a dataset containing some logical axioms (only true propositions). It is the earliest form of binary thinking which was logically correct.

Keywords: omen, divination, Boolean algebra, Mesopotamia, logic, divination

INTRODUCTION

This paper represents a study of ancient Mesopotamian omens within the framework of formal logic. Divination was a significant art of Mesopotamian culture for thousands of years, used to communicate with gods and to entail information from them (see more on divination and prophecy in Ulanowski 2020 [2019]; Nissinen 2010). But some of the logical aspects used by the Mesopotamians in compiling lists of omens have traditionally been overlooked by

scholars. For instance, K. Ulanowski (2020 [2019]: 49) conventionally affirmed that “[d]ivination appears to have been natural and common in the ancient world. Generally, the art of divination provides answers to questions *post hoc ergo propter hoc*”. This *post hoc ergo propter hoc* (“after this, therefore because of this”) means a logical fallacy, when something appears first, and after that, the second appears and the first is declared the cause for the second. For example, a witch spat on the ground and it started to rain. So spitting on the ground is considered the cause of the rain: if she spits, then it is raining. And the Mesopotamian omens were regarded in the way of the *post hoc ergo propter hoc* fallacy. Nevertheless, in our study we are going to show that divination is not a wrong teaching on causes, based on this fallacy, but it is a teaching on signs that had some features of logical calculus.

HISTORICAL CONTEXT OF MESOPOTAMIAN OMENS

Divination in ancient Mesopotamia is first attested in the written record in the 3rd millennium BCE, although it likely had oral precedents (Frahm 2011: 20–21). The first indisputable evidence for a divine message sent to a mortal is from the time of Gudea, ruler of the 2nd Dynasty of Lagaš (c. 2124 BCE) (Annus 2010: 1). However, omen literature formed into a distinct textual genre during the Old Babylonian period (2000–1595 BCE) (see Köcher & Oppenheim & Güterbock 1957; Jeyes 1989; Zorzi 2017). People in ancient Mesopotamia (Sumer, Akkade, Babylonia, Assyria, etc.) believed that the gods communicated with mortals by placing omens everywhere in the universe, seeing the heavenly bodies as the ‘writing of the gods’. This is also why the interpretation of the omens required a learned professional to ‘read’ and interpret them, to translate their message for the lay audience.

Winitzer correctly pointed out that “the study of Mesopotamian divination literature or, more specifically, the omen collections reflecting the various divination techniques from ancient Mesopotamia, has occupied a curious place within its parent discipline of Assyriology” (Winitzer 2017: 1). We know now that divination was an essential part in ancient Mesopotamian cultic and ideological practices (see, e.g., Snell 1974; Starr 1977; Biggs 1985; Jeyes 1989; Reine & Pingreer 1998; Richardson 2006; Maul 2007, 2013; Archi 2010; Glassner 2012; Annus 2010, 2015; Koch-Westenholz 2000, 2002, 2005, 2013, 2015; Winitzer 2010, 2013, 2017), among other forms of witchcraft (see, e.g., Abusch 2002, 2008, 2010, 2020). Ancient conceptions of magic can be divided into attempts to *influence* the physical world by suprarational means and attempts to *derive information* about the physical world using suprarational means, the latter of

which describes divination. The connection between divination and magic and their easy equivalence has been questioned in recent literature (e.g., Nissinen 2020; Sørensen & Petersen 2021), although standard anthropological literature views them as two sides of the same coin: magic being used to manipulate the supernatural world in order to affect the perceived connections between things, whereas divination is based on observing these connections (e.g., Stein & Stein 2015 [2005]: 148; Greenwood 2020 [2009]: 125). One of the forms of Mesopotamian divination was presented by omens – a list of signs on the basis of which a prediction can be made about appropriate events in the future. At the same time, there was a strong correlation between an omen (sign) and a forecasted event such that the prediction was formulated as a conditional statement (implication): “if an omen, then an event”. We are going to show that this implication was treated by the Mesopotamians as a special logical connective along with a conjunction (“... and...”) in the antecedent: “*if an omen and another omen and ..., then an event*”.

There were two broad categories of omens in Mesopotamia: omens that could be produced or *provoked* at will and those that happened without human provocation and were merely *observed* (Koch-Westenholz 1995: 10). In the first category were omens requiring a medium, including extispicy, hepatoscopy, teratomancy, lecanomancy, and libanomancy. Divided further into celestial and terrestrial omens, the second category consisted of astronomical, calendric and weather-related observations, the configuration of waterways and the appearance of inanimate objects and vegetation, the behaviour of animals, and even the behaviour of humans, including the observation of sexual acts and birth defects in children. Omens of the latter kind were collected in vast text editions, some of them including up to 12,000 omens (e.g., *Šumma ālu*, *Šumma izbu*; see Zorzi 2011, 2021).

Omens concerning eclipses were considered to be the most potent. Many types of omens were analysed by several scholars (Abusch 2020; Koch-Westenholz 2002; etc). One of the last profound studies was done by Abraham Winitzer in 2017. Previously, Sallaberger devised a threefold typology for Mesopotamian omens. The first category consisted of omens observed in wild nature, such as signs in sheep livers, small animals, and the stars. The second category represented phenomena in cultivated nature, such as rain, plant and animal species in agriculture. The third group was connected to some human actions, such as housebuilding or some rituals (Sallaberger 2000: 242–243).

People in Mesopotamia (in our context people writing in the Akkadian language in Babylonia, Assyria, etc.) believed that the omens were sent by the gods, but the fates announced by the signs were not considered unavoidable; they were considered warnings rather than absolute portends of coming events.

Hence, they examined the omens not as causes of events, but strongly as their signs. The *Weltanschauung* of omens assumed that the heaven connects all the parts of the world together, especially since the stars could be observed every night and, therefore, all signs could be recorded (Koch-Westenholz 1995: 19; Maul 2013: 49; Hirvonen 2014: 5).

In ancient Greece, the Stoic and Epicurean philosophers developed logic, based on inferences from signs (σημείωσις) with the following major premise: “if a sign (σημεῖον), then an event”. For example, “if she has milk in her breast, then she has given birth to a child” or “if he has a scar, then he had a wound” (Sextus Empiricus, *Pyrrhoniae Hypotyposes* II: 106; *Adversus Logicos* II: 252, 254–255). Then they applied some inference rules, such as *modus ponens* and *modus tollens*:

“If the sign p , then the event q ; there is the sign p ; therefore, the event q is forecasted”, if p , then q ; p ; then q (*modus ponens*).

“If the sign p , then the event q ; there is no event q ; therefore the sign p cannot be applied”, if p , then q ; not- q ; then not- p (*modus tollens*).

Some Stoic examples of *modus ponens* were taken from the Mesopotamian divination: (i) “If somebody was born at the rise of Sirius, he never dies at sea” (*si quis oriente Canicula natus est, in mari non morietur*); (ii) “Fabius was born at the rise of Sirius” (*Fabius oriente Canicula natus est*); (iii) “Fabius never dies at sea” (*Fabius in mari non morietur*) (Cicero, *De Fato* VI, 12). It is known that the Stoics published many books on divination. For example, Chrysippus, the father of propositional logic, discussed the whole theory of divination in two books (*Chrysippus, qui totam de divinatione duobus libris explicavit sententiam*) (Cicero, *De Divinatione* I, 6). We assume that the Stoic propositional logic was grounded on some logical ideas of Mesopotamian omens. In any case, the Stoics were inspired by divination in developing their own logical system.

Divination was inferred by means of *modus ponens*: *Omen list*: “If the sign p , then the event q ”; *observer*: “there is the sign p ”; *diviner*: “then it will be the event q ”; and concerned the future of individuals (e.g., their health, safety, and happiness) or various social groups (e.g., ecological, political or military concerns). It was thought that such information could most readily be attained through communication with the divine realm (Koch 2013: 4). The event announced by an omen could be avoided or prevented by appropriate actions and rites to avert evil, the chief one among them a ritual called *namburbû* (Sum. nam.bûr.bi). These were prophylactic rituals meant to avert inauspicious portents before they took on tangible form (Maul 1994). Omens were for the most part interpreted in order to influence the king, and in some cases the unfavourable omens could even be neglected (Maul 2013: 48–49).

The empirical basis for assuming a connection between a sign and an event was first based on an observed repetition of a temporal connection between a certain sign and an event. Regardless of the type of omen, their formulation was similar: there was a *protasis* (“if p happens...”), followed by an *apodosis* (“...then q will happen”). These can further be divided into three different types. Omens could consist of 1) a simple protasis followed by a simple apodosis, 2) simple protasis followed by a complex apodosis, and 3) a complex protasis, where singular signs are connected by a conjunction, followed by a simple apodosis. There were also complex apodoses followed by asyndetically joined forecasts. Mesopotamian omen catalogues also sometimes contain ‘impossible omens’, omens that could not possibly come to pass. But they were enumerated along with ‘possible omens’ to cover all possible logical combinations of different omens and their negations. Let p be a sign for divination. Then we have the following prediction: “if the sign p , then the event q ”. Let us take p' as the sign that is opposite to p . It is possible that one of the two signs (either p or p') is impossible, then its opposite sign is ever possible. For instance, if “the sun appears in the evening watch” is a sign opposite to “the sun appears in the morning watch”, then we see that only one sign from both is possible, namely “the sun appears in the morning watch”.

Omens can serve as an important source for reconstructing the everyday lives, religious beliefs and ideological views of the Mesopotamians. U. Jeyes (1989: 1) argues that “divination played a major role in Ancient Mesopotamia and of the various types of divination in use, extispicy was perennially the most esteemed,” likely due to the material cost of the practice. As Winitzer (2017: 456) correctly remarks: “Mesopotamian divination, as met in the early omen collections, reflects the realization of a new way to conceptualize knowledge, or, indeed, a new attitude toward what the very meaning of knowledge is or could be.” But omens can also be considered sources for reconstructing the logical thinking and rational mental processes practiced and accepted by the people of ancient Mesopotamia. In modern terms, logical thinking is understood by logicians not only as rational thinking but also as mechanical thinking within an algebraic structure. Therefore, we do not think logically in everyday life because it is not a natural way of thinking. So, logic is not innate knowledge and we can know it only after deep learning.

Traditionally, the Greeks have been seen as the first to develop methods of deduction upon which all later schemes of systematic thought are based. There were two logical theories established in ancient Greece: the Aristotelian syllogistic and the Stoic propositional logic about inferences from signs (the so-called $\sigma\mu\epsilon\iota\omega\sigma\iota\varsigma$). Some Mesopotamian roots can be readily traced for the Stoic theory. The fact of the matter is that the Mesopotamian art of divination by

means of omen catalogues is a kind of logical inference from signs to the same extent as the Stoic theory, as we are going to show. The ancient Greek habits of thought, practices of language and mathematical methods are seen as laying the foundation for what we call logic (Corcoran 1972; Netz 1999). Nevertheless, in the list of omens we can reconstruct an algebraic structure (see the truth tables below), which shows that the Mesopotamians were the first to propose an algebraic way of drawing conclusions – centuries before their Hellenistic counterparts.

Omens are grouped as lexical lists, having evolved into prestigious repositories of traditional knowledge by the first millennium BCE (Veldhuis 1996: 113–114, 132–133). A number of similarities have also been detected between the legal codes and the omen catalogues (Lawson 1994; Rochberg 2004; Annus 2010; Guinan 2014). The internal structure of law articles resembles the structure of omen lists, containing the same implications “if p , then q ”. To the same extent, it is assumed that to these implications the following two inference rules are applied: *modus ponens* and *modus tollens*. It is clearly visible in the trial records in Akkadian. It would seem that the similar structure of omens and legal codes had some common reasons (Lawson 1994: 82–83; Rochberg 2004: 53; Guinan 2014: 105–119). Like Mesopotamian laws, omen lists are usually composed by using *šumma* (‘if’) at the beginning of a clause (Manetti 1993 [1987]: 6). Choosing signs in omens was based on binary oppositions like either raven or falcon, either front or back, either right or left, etc. (Guinan 1989: 229; 1996: 6). It is very important, since it means that each sign is considered as either a positive or a negative omen and, therefore, we deal with a binary (Boolean) thinking in the divinatory reasoning. The syntagmatic association of omens refers to the connection between a specific protasis and the following apodosis, while the paradigmatic association refers to applying different opposing signs (Sallaberger 2000: 240).

LOGICAL CONTEXT OF MESOPOTAMIAN OMENS

From the very beginning omens were compiled through the so-called “divinatory empiricism” (Manetti 1993 [1987]: 7), consisting of recording events which had actually occurred in the past one after the other (*vaticinium ex eventu*): “if a sign (omen) [was], then an event [was]”. It was a logical fallacy, called *post hoc ergo propter hoc* (“after this, therefore because of this”). This rule of composing omens is typical for “historical oracles”, in which the apodosis of the conditional occurs rather in the past tense. Nevertheless, over time omen texts were organized as “codes which cover a finite series of completely identifiable

cases” (ibid.). This type of structure of omen series started to appear from the second quarter of the second millennium BCE in the Old Babylonian period. Here we find codes or systematic collections of very detailed divinatory signs presented in all possible combinations. Zorzi (2009) paid attention to the fact that in the bird omens (BM 108874) there is an asymmetry in implications with opposite signs. For instance, let us consider the following four signs: ‘falcon’, ‘raven’, ‘crossing from the right of the man to his left’, ‘crossing from the left of the man to his right’ (Zorzi 2009). As a consequence, we have the four signs where there are the two possible directions of crossing. This means that there are 2^2 possible combinations: (i) ‘falcon’ & ‘crossing from the right of the man to his left’; (ii) ‘falcon’ & ‘crossing from the left of the man to his right’; (iii) ‘raven’ & ‘crossing from the right of the man to his left’; (iv) ‘raven’ & ‘crossing from the left of the man to his right’. Thus, the algorithm for composing omens of this type is as follows. Let us take $2k$ signs, where $k \geq 1$, since only binary oppositions are considered. Then we have 2^k of all possible combinations of the protasis in conditionals. At the same time, each possible combination is presented as an item in long lists of divinations containing all the combinations.

Hence, we deal with a code of conditionals: (i) **if** ‘falcon’ & ‘crossing from the right of the man to his left’, **then**...; (ii) **if** ‘falcon’ & ‘crossing from the left of the man to his right’, **then**...; (iii) **if** ‘raven’ & ‘crossing from the right of the man to his left’, **then**...; (iv) **if** ‘raven’ & ‘crossing from the left of the man to his right’, **then**..., where for $2k$ signs, where $k \geq 1$, we always have 2^k conditionals for foreseeing. With this, foreseeing any logical inconsistency or contradiction is thereby avoided. Each opposite sign is contained in another protasis of another conditional. And for different oppositions at the place of consequent, we observe different oppositions at the place of protasis.

Each combination from (i) to (iv) gives either the positive sign “favourable” or negative sign “unfavourable”. From the context we know that ‘falcon’ is a positive sign and ‘raven’ is a negative sign. At the same time, ‘crossing from the right of the man to his left’ is a positive sign and ‘crossing from the left of the man to his right’ is a negative sign. Let us denote a positive sign by +1 and a negative sign by -1. Then we have:

- (i) If (+1 & +1), then +1;
- (ii) If (+1 & -1), then -1;
- (iii) If (-1 & +1), then -1;
- (iv) If (-1 & -1), then +1.

Logically, we can reconstruct the following truth tables for ‘not’ (negation or opposition), & (conjunction), and \Rightarrow (implication), respectively:

Truth table for ‘not’, where “not- p ” converts the sign’s value of p to its opposite, i.e., makes a positive sign negative and a negative sign positive:

p	not- p
+1	-1
-1	+1

Truth table for ‘&’, where “ p & q ” gives a positive sign if and only if p and q are simultaneously positive and otherwise it gives a negative sign:

p	q	composite sign “ p & q ”
+1	+1	+1
+1	-1	-1
-1	+1	-1
-1	-1	-1

Truth table for ‘if then’, where “if p , then q ” gives a negative sign if and only if p is positive and q is negative and otherwise it gives a positive sign:

p	q	composite sign “if p , then q ”
+1	+1	+1
+1	-1	-1
-1	+1	+1
-1	-1	+1

From these truth tables, we obtain:

- (i) If (+1 & +1), then +1 = if +1, then +1 = +1;
- (ii) If (+1 & -1), then -1 = if -1, then -1 = +1;
- (iii) If (-1 & +1), then -1 = if -1, then -1 = +1;
- (iv) If (-1 & -1), then +1 = if -1, then +1 = +1.

We see that in the protasis from (i) to (iv), we have all possible combinations of positive and negative values: (+1 & +1), (+1 & -1), (-1 & +1), (-1 & -1). But in the apodosis, the positive value +1 takes place if and only if in the protasis both values are positive simultaneously or negative simultaneously. Then in the apodosis there is assumed to be a logical operation of equivalence (‘if and only if then’) with the following truth table.

Truth table for 'if and only if then', where "if and only if p, then q" gives a negative sign if and only if p is positive and q is negative or p is negative and q is positive:

<i>p</i>	<i>q</i>	composite sign "if and only if <i>p</i> , then <i>q</i> "
+1	+1	+1
+1	-1	-1
-1	+1	-1
-1	-1	+1

Then each separate omen with two signs *p* and *q* has the following formal notation: "If (*p* & *q*), then (if and only if *p*, then *q*)", with the following truth table:

<i>p</i>	<i>q</i>	<i>p</i> & <i>q</i>	if and only if <i>p</i> , then <i>q</i>	If (<i>p</i> & <i>q</i>), then (if and only if <i>p</i> , then <i>q</i>)
+1	+1	+1	+1	+1
+1	-1	-1	-1	+1
-1	+1	-1	-1	+1
-1	-1	-1	+1	+1

This means that each separate omen of this series was formulated by the Mesopotamians in the way to be an always true proposition in the Boolean algebra. Hence, verses of divinations from (i) to (iv) give propositional tautologies (axioms) – expressions which are always true (positive).

Let a separate omen have only one sign *p*. Then its formal notation is as follows: "If *p*, then *q*". This expression is also a tautology of Boolean algebra. For example, "[if a snake...] is seen, [th]at house will be dispersed" (Freedman 2006: 121). In this omen there is only one sign ("snake") that is negative. It gives, therefore, a negative forecasting. If it was positive, then it would give a positive forecasting.

Let a separate omen have three signs or more: *p*, *q*, *r*, ... then its formal notation is thus: "If (*p* & *q* & *r* & ...), then (*p*, *q*, *r*, ... are equivalent)". But this expression is a tautology of Boolean algebra, too. Summing up, in the divination list of BM 108874 (Zorzi 2009), we can reconstruct the Boolean algebra <{-1, +1}, 'not', '&', 'if then', 'if and only if then'>, defined on the positive +1 and on the negative value -1 with the following four logical operations: negation ('not'), conjunction ('&'), implication ('if then'), and equivalence ('if and only if then'). In this Boolean algebra, each omen is defined in the way to be an axiom, that is, to be a proposition that always has the truth value +1, according to the truth tables.

In the protasis of omens we can find a conjunction connecting different signs. But sometimes we deal with a strong disjunction in the apodosis. For instance:

šumma *tuḫmum ziqti sāmūtim mali* ⇒ *ummānāti ina šērim šūmum iṣabbat* še’am *samānum iṣabbat*

If the spleen was full of red pocks ⇒ thirst will seize the troops in the hinterland; (or:) *samānu*-disease will seize the barley (Winitzer 2017: 96).

In this example, we see only one sign (“the spleen was full of red pocks”) that is negative and, hence, gives a negative forecasting. Nevertheless, this forecasting is one of the two possibilities: either “thirst will seize the troops in the hinterland” or “*samānu*-disease will seize the barley”.

The binary thinking based on the Boolean algebra is universal for many other omen series, e.g., for some tablets 1–21 (OPKF 17). Let us show it. From the context, we see that “white fungus” (*katarru pešū*) is a negative sign. Their possible combinations with other signs are as follows:

5. DIŠ KA.TAR BABBAR *ina ne-rib* KÁ T[ÛR ...] SAG.PA.LAGAB É NA [...].
15. DIŠ KA.TAR *ina É iš-pik-ki* GAR É BI *i-ḥar-[ru-ub]*.
16. DIŠ KA.TAR BABBAR *ina qi-rib* É [NA GAR] É BI *ip-pe-eḥ-[hi?]*.
17. DIŠ KA.TAR BABBAR *ina šu-bat* NA ZAG GAR BIR-*aḥ* É BI.
18. DIŠ KA.TAR BABBAR *ina šu-bat* NA GÛB GAR *sa-dir* É BI.

5. If white fungus [...] in the entryway of the gate of the court[yard? ...] grief in that house [...].

15. If there is <white> fungus in a warehouse, that house will be devas[tated].

16. [If there is] white fungus in the middle of [a man’s] house, that house will be closed up.

17. If there is white fungus on the right in a man’s residential quarter – dispersal of that house.

18. If there is white fungus on the left in a man’s residential quarter, that house will be normal. (Freedman 1998: 192–193)

The logical meaning of these verses is as follows:

5. If –1 (“white fungus”) & +1 (“in the entryway of the gate of the courtyard”), then –1 (“grief in that house”). It is equal to +1.

15. If –1 (“white fungus”) & +1 (“warehouse”), then –1 (“that house will be devastated”). It is equal to +1.

16. If –1 (“white fungus”) & +1 (“in the middle of [a man’s] house”), then –1 (“that house will be closed up”). It is equal to +1.

17. If –1 (“white fungus”) & +1 (“on the right in a man’s residential quarter”), then –1 (“dispersal of that house”). It is equal to +1.

18. If –1 (“white fungus”) & –1 (“on the left in a man’s residential quarter”), then +1 (“that house will be normal”). It is equal to +1.

On the other hand, “black fungus” (*katarru šalmu*) is a positive sign that along with all other signs gives only positive prognoses:

49. DIŠ KA.TAR GE₆ *ina tal-lak-ti É NA GAR ka-liš AL.SA₆.*
 50. DIŠ KA.TAR GE₆ *ina GÚ.ḪAŠ šu-bat É LÚ it-tab-ši SUḪUS É BI GI.NA.*
 51. DIŠ KA.TAR GE₆ *ina šu-bat LÚ ZAG it-tab-ši lu ÚKU NÌ.TUK.*
 52. DIŠ KA.TAR GE₆ *ina šu-bat LÚ GÙB it-tab-ši LÚ ú-wa-at-tar.*
 54. DIŠ KA.TAR GE₆. EŠ ŠÀ É NA *ma-lu-ú EN É NÌ.TUK SUḪUŠ.BI GI.NA.*

49. If there is black fungus on the path to a man’s house, it will be entirely favourable.

50. If black fungus appears on the back of the residential quarter of a man’s house, the foundation of that house will be secure.

51. If black fungus appears on the right in a man’s residential quarter if he is poor, he will become rich.

52. If black fungus appears on the left in a man’s residential quarter, the man will become prominent.

54. If black fungi fill the interior of a man’s house, the owner of that house will become rich; its foundation will become secure. (Freedman 1998: 194–197)

Formally:

49. If +1 (“black fungus”) & +1 (“on the path to a man’s house”), then +1 (“it will be entirely favourable”). It is equal to +1.

50. If +1 (“black fungus”) & –1 (“on the back of the residential quarter of a man’s house”), then +1 (“the foundation of that house will be secure”). Hence, we have “if (+1 & –1), then +1”, but it is equal to +1 in the Boolean algebra.

51. If +1 (“black fungus”) & +1 (“on the right in a man’s residential quarter if he is poor”), then +1 (“he will become rich”). It is equal to +1.

52. If +1 (“black fungus”) & –1 (“on the left in a man’s residential quarter”), then +1 (“the man will become prominent”). It is equal to +1.

54. If +1 (“black fungus”) & +1 (“the interior of a man’s house”), then +1 (“the owner of that house will become rich; its foundation will become secure”). It is equal to +1.

The sign “red fungus” (*katarru sāmu*) is negative and gives only an unfavourable forecasting together with all other signs:

60. DIŠ KA.TAR SIA *ša mi-iq-tu₄ MU.NI ina É LÚ ZAG GAR ŠUB-di É.*
 61. DIŠ KA.TAR SIA *ša mi-iq-tu₄ MU.NI ina É LÚ GÙB GAR ŠUB-di É.*

60. If red fungus named *miqtu* appears on the right in a man’s house – abandonment of the house.

61. If red fungus named *miqtu* appears on the left in a man's house – abandonment of the house. (Freedman 1998: 196–197)

Formally:

60. If -1 (“red fungus named *miqtu*”) & $+1$ (“on the right in a man's house”), then -1 (“abandonment of the house”). It is equal to $+1$.

61. If -1 (“red fungus named *miqtu*”) & -1 (“on the left in a man's house”), then -1 (“abandonment of the house”). It is equal to $+1$.

Thus, different omen series are composed in the way to be axioms of Boolean algebra (that is, to have only the value $+1$) and, therefore, we can reconstruct the same Boolean algebra $\langle\{-1, +1\}, \text{'not'}, \text{'&'}, \text{'if then'}, \text{'if and only if then'}\rangle$ in different omen series.

CONCLUSION

We may conclude that the algebraic structure of ancient Mesopotamian omen catalogues since the Old Babylonian period reconstructed in the form of the truth tables, as defined above, is a kind of binary calculus applicable to all forms of ancient Mesopotamian omens presented as a list of opposing signs. This binary logic is a by-product of Akkadian *šumma*-clauses (conditional statements of the form “if p , then q ”), which were simply treated by the Mesopotamians logically – through an application of *modus ponens* and *modus tollens*; in the same way conditional statements were understood by the Stoics and are understood nowadays in modern logic.

Each separate omen was formulated as a composite conditional statement “if a sign p & a sign q & a sign r ..., then an event s ” so that this statement has only the positive truth value in the Boolean algebra. This means that omen catalogues can be considered as a dataset containing only logical axioms (always true propositions). It is the earliest known form of binary thinking which was logically correct from the point of view of modern logic.

NOTE

¹ This paper is an extended version of the short paper “Omens as Logic” (Schumann & Sazonov 2021).

REFERENCES

- Abusch, Tzvi 2002. *Mesopotamian Witchcraft: Toward a History and Understanding of Babylonian Witchcraft Beliefs and Literature*. Ancient Magic and Divination, Vol. 5. Leiden: Brill/Styx.
- Abusch, Tzvi 2008. The Witch's Messages: Witchcraft, Omens, and Voodoo-death in Ancient Mesopotamia. In: R. J. van der Spek (ed.) *Studies in Ancient Near Eastern World View and Society: Presented to Marten Stol on the Occasion of his 65th Birthday*. Bethesda: CDL, pp. 53–68.
- Abusch, Tzvi 2010. A Neo-Babylonian Recension of *Maqlû*: Some Observations on the Redaction of *Maqlû* Tablet VII and on the Development of Two of Its Incantations. In: J. C. Fincke (ed.) *Festschrift für Gernot Wilhelm anlässlich seines 65. Geburtstages am 28. Januar 2010*. Dresden: Islet Verlag, pp. 1–16.
- Abusch, Tzvi 2020. *Further Studies on Mesopotamian Witchcraft Beliefs and Literature*. Ancient Magic and Divination, Vol. 17. Leiden: Brill.
- Annus, Amar (ed.) 2010. *Divination and Interpretation of Signs in the Ancient World*. Chicago: The Oriental Institute of the University of Chicago.
- Annus, Amar 2015. Divination. In: R. A. Segal & K. von Stuckrad (eds.) *Vocabulary for the Study of Religion*. Leiden: Brill Academic Publishers, pp. 445–450.
- Archi, Alfonso 2010. Divination at Ebla. In: J. C. Fincke (ed.) *Festschrift für Gernot Wilhelm anlässlich seines 65. Geburtstages am 28. Januar 2010*. Dresden: Islet Verlag, pp. 45–56.
- Biggs, Robert D. 1985. The Babylonian Prophecies and the Astrological Traditions of Mesopotamia. *Journal of Cuneiform Studies*, Vol. 37, No. 1, pp. 86–90. <https://doi.org/10.2307/1359960>.
- Corcoran, John (ed.) 1972. *Ancient Logic and Its Modern Interpretations*. Proceedings of the Buffalo Symposium on Modernist Interpretations of Ancient Logic, 21 and 22 April, 1972. Dordrecht & Boston: D. Reidel. Available at <https://archive.org/details/ancient-logic-modern-interpretations/mode/2up>, last accessed on 24 April 2024.
- Frahm, Eckart 2011. *Babylonian and Assyrian Text Commentaries: Origins of Interpretation*. Guides to the Mesopotamian Textual Record, Vol. 5. Münster: Ugarit-Verlag.
- Freedman, Sally M. 1998. *If a City Is Set on a Height. Volume 1: The Akkadian Omen Series Šumma ālu ina mēlē šakin*. Tablets 1–21. Occasional Publications of the Samuel Noah Kramer Fund 17. Philadelphia: The University of Pennsylvania Museum.
- Freedman, Sally M. 2006. *If a City Is Set on a Height. Volume 2: The Akkadian Omen Series Šumma ālu ina mēlē šakin*. Tablets 22–40. Occasional Publications of the Samuel Noah Kramer Fund 19. Philadelphia: The University of Pennsylvania Museum.
- Glassner, Jean-Jacques 2012. Droit et Divination: Deux Manières de Rendre la Justice: A Propos de Dinum, Usurtum et Awdtum. *Journal of Cuneiform Studies*, Vol. 64, No. 1, pp. 39–56. <http://dx.doi.org/10.5615/jcunestud.64.0039>.
- Greenwood, Susan 2020 [2009]. *The Anthropology of Magic*. London: Routledge.
- Guinan, Ann 1989. The Perils of High Living: Divinatory Rhetoric in *Šumma Ālu*. In: H. Behrens & Darlene Loding & Martha D. Roth (eds.) *DUMU-E2-DUB-BA-A. Studies in Honor of Åke W. Sjöberg*. Philadelphia: Samuel Noah Kramer Fund & University Museum, pp. 227–235. Available at <https://www.academia.edu/37884194/>, last accessed on 24 April 2024.

- Guinan, Ann K. 1996. Left/Right Symbolism in Mesopotamian Divination. *State Archives of Assyria Bulletin*, Vol. 10, pp. 5–10. Available at <https://www.academia.edu/37884045/>, last accessed on 24 April 2024.
- Guinan, Ann K. 2014. Laws and Omens: Obverse and Inverse. In: J. C. Fincke (ed.) *Divination in the Ancient Near East*. University Park: Penn State University Press, pp. 105–122. <https://doi.org/10.1515/9781575068794-012>.
- Hirvonen, Joonas 2014. *Plants, Animals, and Bodies of Water: The Significance of Color Terminology in the Nature Omens of the Omen Series Šumma ālu ina mēlê šakin*. Diss. (MA Thesis). University of Helsinki. Available at <https://core.ac.uk/download/pdf/33725061.pdf>, last accessed on 2 May 2024.
- Jeyes, Ulla 1989. *Old Babylonian Extispicy: Omens Texts in the British Museum*. Istanbul: Nederlands historisch-archaeologisch instituut te Istanbul.
- Köcher, Franz & Oppenheim, A. L. & Güterbock, Hans G. 1957. The Old-Babylonian Omen Text VAT 7525. *Archiv für Orientforschung*, Vol. 18, pp. 62–80. Available at <http://www.jstor.org/stable/41637502>, last accessed on 2 May 2024.
- Koch, Ulla Susanne 2005. *Secrets of Extispicy: The Chapter Multabiltu of the Babylonian Extispicy Series and Nisirti Baruti Texts Mainly from Assurbanipal's Library*. Alter Orient und Altes Testament 326. Münster: Ugarit-Verlag.
- Koch, Ulla Susanne 2013. Concepts and Perception of Time in Mesopotamian Divination. In: L. Feliu & J. Llop & A. Millet Albà & J. Sanmartín (eds.) *Time and History in the Ancient Near East: Proceedings of the 56th Rencontre Assyriologique Internationale at Barcelona, 26–30 July 2010*. Winona Lake: Eisenbrauns, pp. 127–142. <https://doi.org/10.5325/j.ctv1bxgzf2.17>.
- Koch, Ulla Susanne 2015. *Mesopotamian Divination Texts: Conversing with the Gods: Sources from the First Millennium BCE*. Guides to the Mesopotamian Textual Record, Vol. 7. Münster: Ugarit-Verlag.
- Koch-Westenholz, Ulla 1995. *Mesopotamian Astrology: An Introduction to Babylonian and Assyrian Celestial Divination*. CNI Publications 19. Copenhagen: Museum Tusulanum Press.
- Koch-Westenholz, Ulla 2000. *Babylonian Liver Omens: The Chapters Manzazu, Padanu and Pan Takalti of the Babylonian Extispicy Series Mainly from Assurbanipal's Library*. CNI Publications, Vol. 25. Copenhagen: Museum Tusulanum Press.
- Koch-Westenholz, Ulla 2002. Old Babylonian Extispicy Reports. In: C. Wunsch (ed.) *Mining the Archives: Festschrift for Christopher Walker on the Occasion of His 60th Birthday, 4 October 2002*. Dresden: Islet, pp. 131–145. Available at <https://archive.org/details/mining-the-archives/mode/2up>, last accessed on 2 May 2024.
- Lawson, Jack N. 1994. *The Concept of Fate in Ancient Mesopotamia of the First Millennium: Toward an Understanding of Šimtu*. Wiesbaden: Harrassowitz.
- Manetti, Giovanni 1993 [1987]. *Theories of the Sign in Classical Antiquity*. Transl. by Christine Richardson. Bloomington: Indiana University Press.
- Maul, Stefan M. 1994. *Zukunftsbewältigung: Eine Untersuchung altorientalischen Denkens anhand der babylonisch-assyrischen Löserituale (Namburbi)*. Baghdader Forschungen 18. Mainz am Rhein: Zabern.
- Maul, Stefan M. 2007. Divination Culture and the Handling of the Future. In: G. Leick (ed.) *The Babylonian World*. Oxford: Routledge, pp. 361–372.
- Maul, Stefan M. 2013. *Die Wahrsagekunst im Alten Orient: Zeichen des Himmels und der Erde*. München: C.H. Beck.

- Netz, Reviel 1999. *The Shaping of Deduction in Greek Mathematics: A Study in Cognitive History*. Cambridge: Cambridge University Press.
- Nissinen, Martti 2010. Prophecy and Omen Divination: Two Sides of the Same Coin. In: A. Annus (ed.) *Divination and Interpretation of Signs in the Ancient World*. Chicago: The Oriental Institute of the University of Chicago, pp. 341–351. Available at <https://isac.uchicago.edu/sites/default/files/uploads/shared/docs/ois6.pdf>, last accessed on 2 May 2024.
- Nissinen, Martti 2020. Why Prophecy Is (Not) Magic. In: R. Müller & U. Nömmik & J. Pakkala (eds.) *Fortgeschriebenes Gotteswort: Studien zur Geschichte, Theologie und Auslegung des Alten Testaments: Festschrift für Christoph Levin zum 70. Geburtstag*. Tübingen: Mohr Siebeck, pp. 213–226. Available at https://researchportal.helsinki.fi/files/144006899/Nissinen_why_prophecy.pdf, last accessed on 2 May 2024.
- Reiner, Erica & Pingree, David 1998. *Babylonian Planetary Omens. Part Three*. Cuneiform Monographs, Vol. 11. Groningen: Styx.
- Richardson, Seth F. C. 2006. gir3-gen-na and Šulgi's "Library": Liver Omen Texts in the Third Millennium BC (I). *Cuneiform Digital Library Journal*, Vol. 3. Available at http://cdli.ucla.edu/pubs/cdlj/2006/cdlj2006_003.html, last accessed on 2 May 2024.
- Rochberg, Francesca 2004. *The Heavenly Writing: Divination, Horoscopy, and Astronomy in Mesopotamian Culture*. Cambridge: Cambridge University Press.
- Sallaberger, Walther 2000. Das Erscheinen Marduks als Vorzeichen: Kultstatue und Neujahrsfest in der Omenserie *Summa ālu*. *Zeitschrift für Assyriologie und Vorderasiatische Archäologie*, Vol. 90, No. 2, pp. 227–262. <https://doi.org/10.1515/zava.2000.90.2.227>.
- Schumann, Andrew & Sazonov, Vladimir 2021. Omens as Logic. *Nouvelles Assyriologiques Brèves et Utilitaires*, Vol. 3, pp. 192–195. Available at <https://www.academia.edu/58734504/>, last accessed on 2 May 2024.
- Snell, Daniel C. 1974. The Mari Livers and the Omen Tradition. *Journal of the Ancient Near Eastern Society*, Vol. 6, No. 1, pp. 117–123. Available at <https://janescholasticahq.com/article/2241-the-mari-livers-and-the-omen-tradition>, last accessed on 2 May 2024.
- Sørensen, Jesper F. & Petersen, Anders K. 2021. Manipulating the Divine: An Introduction. In: J. F. Sørensen & A. K. Petersen (eds.) *Theoretical and Empirical Investigations of Divination and Magic: Manipulating the Divine*. Leiden: Brill, pp. 1–20.
- Starr, Ivan 1977. Notes on Some Published and Unpublished Historical Omens. *Journal of Cuneiform Studies*, Vol. 29, No. 3, pp. 157–166. <http://dx.doi.org/10.2307/1359678>.
- Stein, Rebecca L. & Stein, Philip L. 2015 [2005]. *The Anthropology of Religion, Magic, and Witchcraft*. London: Routledge.
- Ulanowski, Krzysztof 2020 [2019]. Communication with Gods: The Role of Divination in Mesopotamian Civilization. In: V. Sazonov & H. Mölder & P. Espak & A. Saumets (eds.) *Cultural Crossroads in the Middle East: The Historical, Cultural and Political Legacy of Intercultural Dialogue and Conflict from the Ancient Near East to the Present Day*. Second revised and expanded edition. Tartu: University of Tartu Press, pp. 49–62. Available at <https://library.oapen.org/handle/20.500.12657/23672>, last accessed on 2 May 2024.
- Veldhuis, Niek 1996. On Interpreting Mesopotamian Namburbi Rituals. *Archiv für Orientforschung*, Vol. 42/43, pp. 145–154.

- Winitzer, Abraham 2010. The Divine Presence and Its Interpretation in Early Mesopotamian Divination. In: A. Annus (ed.) *Divination and the Interpretation of Signs in the Ancient World*. Oriental Institute Seminars 6. Chicago: The Oriental Institute of the University of Chicago, pp. 177–197.
- Winitzer, Abraham 2013. A New OB Collection of *Padānum* and Related Omens in Los Angeles. *Zeitschrift für Assyriologie und vorderasiatische Archäologie*, Vol. 103, No. 2, pp. 162–182. <https://doi.org/10.1515/za-2013-0011>.
- Winitzer, Abraham 2017. *Early Mesopotamian Divination Literature: Its Organizational Framework and Generative and Paradigmatic Characteristics*. Leiden & Boston: Brill.
- Zorzi, Nicla de 2009. Bird Divination in Mesopotamia: New Evidence from BM 108874. *Kaskal: Rivista di Storia, Ambiente e Culture del Vicino Oriente Antico*, Vol. 6, pp. 1–51.
- Zorzi, Nicla de 2011. The Omen Series *Šumma Izbu*: Internal Structure and Hermeneutic Strategies. *Kaskal: Rivista di Storia, Ambienti e Culture del Vicino Oriente Antico*, Vol. 8, pp. 43–75.
- Zorzi, Nicla de 2017. Teratomancy at Tigonānum: Structure, Hermeneutics, and *Weltanschauung* of a Northern Mesopotamian Omen Corpus. *Journal of Cuneiform Studies*, Vol. 69, No. 1, pp. 125–150. <https://doi.org/10.5615/jcunestud.69.2017.0125>.
- Zorzi, Nicla de 2021. Ancient Mesopotamian Divinatory Series from the British Museum: New Texts and Joins. *Journal of Cuneiform Studies*, Vol. 73, pp. 193–209. <http://dx.doi.org/10.1086/714660>.

Andrew Schumann (PhD) is Professor, Head of the Department of Cognitive Science and Mathematical Modelling at the University of Information Technology and Management in Rzeszow, Poland. His main research areas focus on Ancient Near Eastern religions, history of logic, and artificial intelligence.

aschumann@wsiz.edu.pl

Vladimir Sazonov (PhD) is Leading Researcher at the Estonian Military Academy and Associate Professor of Ancient Near Eastern Studies at the University of Tartu, Estonia. His main research areas include Mesopotamian royal ideology and religion, imperial concepts, propaganda, and Ancient Near Eastern literary legacy.

vladimir.sazonov@ut.ee

Joanna Töyräänvuori (PhD) holds the Title of Docent in Ancient Near Eastern Studies at the University of Helsinki and the Title of Docent in Cultural History at the University of Turku, Finland. She is currently employed as a university researcher at the Centre of Excellence in Ancient Near Eastern Empires of the Academy of Finland. Her main research areas focus on the political histories of the Late Bronze Age Eastern Mediterranean.

joanna.toyraanvuori@helsinki.fi

www.folklore.ee/folklore