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Cuneiform *Šumma* Sentences: Conditionals or Implications?

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Abstract:
For a long time, it was believed in Assyriology and related disciplines that *šumma* sentences, or grammatical conditionals, which appeared in cuneiform texts and tablets of astrology, exorcism, law, extispicy, oneiromancy, medicine, and divination, were linguistic expressions of logical conditionals. F. Rochberg (2010; 2016) extended this belief, suggesting that they are even material conditionals. Andrew Schumann (2017; 2020; 2021) followed this, claiming that, as a result, we can trace the origin of symbolic logic in cuneiform writings, through which it moved to Greece. In this paper, after presenting this approach, I will challenge it by showing that *šumma*/IF sentences and similar constructs in cuneiform literature are arguments or implications that suffer from the same confusion between conditional and implication that Quine (1953/1966) highlighted when criticizing C.I. Lewis.
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1. The Notion of Conditional Statements

Assyriologists analyzing the tablets of the Mesopotamian civilization, especially in law, medicine, and divination (and to a lesser extent in other disciplines), discovered statements with a consistent syntactic form. As J. Bottéro puts it, "… all these treatises were uniformly developed according to the same framework of thought expression." (Bottéro 1992, 169-70) They recognized this framework as conditional statements and relative phrases (e.g., "whoever"), which functioned similarly to conditionals. Philologists referred to the antecedent of these conditional statements as the *protasis* and their consequent as the *apodosis*.

J. Bottéro further explains the syntactic nature of oneiromancy entries as follows: "Each entry is introduced by a hypothesis (which grammarians call "*protasis*"), to underline the theme of the dream taken as an omen, and ends with an "*apodosis*" to draw from it the pertinent prediction." (114) R. Westbrook describes this framework in law, stating, "The law is expressed as a series of individual cases, the circumstances of which are put into a hypothetical conditional sentence,

followed by the appropriate legal response – in the particular case. For example: If an ox gores an ox and causes its death, the owners of both oxen shall divide the value of the live ox and the carcass of the dead ox. While there is some variation within this framework – for example, the protasis can begin "a man who ...," or the whole rule can be cast as a direct order ("a loan of fungibles shall not be given to ... a slave") – the approach is always the same." (Westbrook 2003, 17) In medicine, we find a similar situation, for example, M. J. Geller follows Rochberg's footsteps (see below) in reading the medical statements as conditional (2010, 12, 15).

The Akkadian conjunction for condition is the word "*šumma*=IF", which is placed in front of the dependent clause. The verb in this clause (if present) is usually in the past tense, typically preterit, while the main clause is usually in the present tense without an equivalent of "then"[1]. An example is the following article (no. 6) from *Hammurabi's* code, translated into English with its Old Babylonian transliteration (Roth 1995, 82):

Old Babylonian Transliteration	**Translation**
šumma awīlum makkūr ilim u ekallim išriq awīlum šû iddâk u ša šurqam ina qātišu imḫuru iddâk	If a man steals valuables belonging to the god or to the palace, that man shall be killed, and also he who received the stolen goods from him shall be killed.

Here we have "*šumma*/IF," the verb of the dependent clause "*išriq*/steals" in preterit (translated into present for grammatical reasons), and the main verb "*iddâk*/to be killed" in the present tense.

However, historians of logic and logicians followed the steps of Assyriologists, adopting their characterization of the essence and nature of Akkadians statements. Thus, the scholarship of Assyriology and the history of logic and science accepted the treatment of conditionality in Mesopotamian scientific treatises. But are they really conditionals? To answer this question, we must jump many centuries into the twentieth-century quarrel of strict implication between C. I. Lewis and W.V. Quine. But before doing this, we need to inspect the supposed cuneiform conditionals more closely.

2. The Conditional in Assyriology, History of Science, and Logic

The interpretation of the Akkadian terms "*šumma*" or "*-ma*" in cuneiform scientific texts has faced several challenges, despite some progress. To illustrate this, I shall consider three examples: the first from a scholar, the second from a historian of science, and the third from a logician.

2.1 Jean Bottéro

Bottéro believed that Babylonian scribes formulated their conditional statements through two main methods: empiricism and apriorism[2]. He described empiricism in Babylonian divination as follows:

> The oldest layers of oracles have thus a very good chance of having been formed in this way: from an observation of a sequence of events that do not have any apparent link between them, but were noticed to have followed each other once, it was thought that such events would always follow one another. That what we would call empiricism. (1992, 132)

The same empiricism is found in medicine (172), where its principle is *post hoc, ergo propter hoc* (131). Apriorism, on the other hand, is related to the cuneiform writing system. This system, as we know, used pictograms as a writing medium; for example, a foot represents "to walk" or "to stand up":

> Hence the idea could originate that the two finger-shaped outgrowths, instead of the expected single one, written by the gods on the livers of their victims indicated, beyond doubt, duality, opposition, and conflict, and played in a sense the role of the "pictogram" of rivalry and competition in the "divine writing system," just like the perforations expressed the breach. The way of seeing things became a norm, unexpressed but always applied, based on the rule that governed the writing system: whenever the same sign appeared in an omen, one could "read" in it the same future event. (133)

In oneiromancy, this apriorism is evident, and the relationship between antecedents and consequents is primarily semantic. Conditionals are based "a real, imaginary, analogical, or purely conventional relationship, that made one the sign or the symbol of the other." (119) Even in Babylonian conditional laws, the relationship remains semantic: "what connects the first fact to the second is either custom, traditional social coercion, or the explicit will of the authorities." (172)

Bottéro described the relationship between the antecedent and the consequent of a cuneiform conditional as akin to the relationship between a hypothesis and a conclusion. He noted that "the conclusion drawn in the apodosis is naturally as general and permanent as the elements in the hypothesis on which it is based: venereal disease or "epilepsy" in the medical treatise, and amputation of the hand, the fine, or the imprisonment in the "code" [of *Hammurabi*]." (172)

2.2 Francesca Rochberg and Material Implication

Rochberg considered the *šumma* sentences as evidence of the rationality of cuneiform scholarship (*ṭupšarrutū*). She argued that, in addition to their conditionality, these sentences had a rational origin. She believed that the cuneiform scholars, or *ṭupšarri*, derived their conditionals through analogy rather than through accidental observations or empiricism, as Bottéro thought (Rochberg 2016, 144). From her perspective, this gives *ṭupšarrutū* more credit for rationality. However, as we saw above, Bottéro did not deny the rationality of the *ṭupšarri*; he even considered analogy to be part of the *a priori* attitude of the *ṭupšarri*.

Concerning the conditionality of the *šumma* sentences, Rochberg considered them as material implications: "on a formal analysis, the omens appear to have a greater affinity with statements of material implication (PQ), and in fact, first-order logical statements of the form "P implies Q" are the equivalent of the conditional statement "If P then Q"." (Rochberg 2010, 396) Rochberg's main argument for this is that the antecedents of *šumma* sentences in most Babylonian treatises contain impossible events, such as the sun rising at midnight. These conditions make the truth conditions of *šumma* sentences the same as those of material implication.

2.3 Andrew Schumann and Axiomatization of Treatises

Although Rochberg merely offered "material implication as a possible way to view the logic of the omen statements [and other disciplines]," and stated that "it has been used as a heuristic, without claiming a Babylonian awareness of this logic," (396) Andrew Schumann took this further in a series of papers (2017; 2020; 2021) in which he tried to trace the history of (symbolic) logic back to Semitic thought. Having done this, he then attempted to make links between Greek (symbolic) logic and the supposed Semitic one. Thus, his history of logic has two major claims: (1) that the origin and genesis of symbolic logic lie in the intellectual activities of Semitic people, and (2) that this logic was transmitted to the Greeks and then spread worldwide.

In his genealogical project, Schumann has relied on the Assyriologists' conception of "*šumma"* clauses in addition to Rochberg's findings. The main idea of Schumann's reconstruction is his consideration that the primary domains for practicing symbolic logic in Babylonia were law,

divination, and medicine. Therefore, he viewed the discovered law tablets (e.g., *Ur-Nammu* (ca. 2047-2030 B.C.), *Lipit-Ishtar* (ca. 1900-1850 B.C.), *Hammurabi* (1728-1686 B.C.)) as codes or axiomatic constructions in conditionals. Judges would use these to decide cases through modus ponens or modus tollens rules. Thus, he states:

> The Sumerians and Akkadians founded a legal system for which trial decisions had to be reached by deducing them from the law code by applying the following two inference rules which are basic now for the modern symbolic logic, too: *modus ponens* and *modus tollens*. Recall that *modus ponens* is formulated as follows: if two sentences A and $A \Rightarrow B$ are true, then the sentence B is true, also. The rule of *modus tollens*: if the sentence $A \Rightarrow B$ is true and the sentence B is false, then the sentence A is false, too. Each law code contains **implications** $A \Rightarrow B$ which are examined as true forever. Each court should have considered a factual case C of indictment that was verified by testimonies or signed documents and then the court should have found out an appropriate general A for this C. After that the court judgment can have deduced a verdict B by *modus ponens* applied two times:
>
> $A \Rightarrow B; C \Rightarrow A; C$
> ———————
> B.
>
> The latter sentence is a verdict what should be done (which punishment B should be chosen) according to the rule $A \Rightarrow B$ from the code of laws. (2017, 130, italics in the original, emphasis is mine)

Schumann even considered the Babylonians to have been the discoverers of the logical universal/general and particular, which were amalgamated in their symbolic logic. This claim depends on Rochberg's thesis that *šumma* sentences are first-order logical statements of the form "P implies Q":

> In the Sumerian and Akkadian codes of laws, for the first time there were introduced some general notions as generalizations of particulars. The word to denote a generalization is *mimma* or *mimma šumšu* (Akkadian: "whatever"), e.g.: *mimma mala iddinu ītelli* (Laws of *Hammurabi* §113, §116) "Whatever he originally gave as the loan." Implicitly, it means that suitable Hammurabi laws §113 and §116 concerning all the items given as the loan cover all the cases: "If there is whatever he originally gave as the loan, then rules §113 and §116 should take place." Let us assume that somebody gave an ox as the loan. Then we can apply the following composite implication: "If he gave an ox as the loan (A), then it is the case of whatever he originally gave as the loan (B). From this it follows that rules §113 and §116 of the Law Code of Hammurabi should be applied for giving this ox as the loan (C)." Formally: $((A \Rightarrow B) \& (B \Rightarrow C)) \Rightarrow (A \Rightarrow C)$. Hence, this *mimma* ("whatever") assumes a logically correct construction of conditional propositions (**implications**) with a logical rule of transitivity of **implication**. All the same is as it holds in the modern symbolic logic. (128, emphasis is mine)

Schumann has also extended his reconstruction to the texts of cuneiform divination, applying the same principles as in law. "In Babylonian divinations, each individual forecast is presented strongly as the conditional: "if a sign (omen), then an event"," (2021, 722) and "each complete divination

list (code) was composed rather as a logical system." (725) In addition, Schumann has added an algebraic model for reasoning in omen lists, which I shall display below.

This genealogical project is beset by the following difficulties:

1. Schumann has assumed as a certain fact that the tablets of cuneiform laws are codes. However, there have been many discussions about the nature of these laws, and it seems that they are not actually codes from the point of view of one of the main supporters of the conditional nature of their propositions. Thus, Bottéro says:

> Mesopotamian law was essentially an unwritten law… The principles of the laws were not deduced or formulated in explicit terms, but it was as if they were incorporated in a diffuse mass of traditions that generations automatically transmit to each other in any given cultural group, just as with language. (1992, 181)

2. Schumann considered Hammurabi's Code to constitute the axioms of what we could call the logico-legal Babylonian system. However, even if we accepted Hammurabi's laws as a code, we couldn't accept them as a basis for the sentences of the cases which he claims are inferred according to this code by logical inference.

3. However, for Schumann's argument to be coherent, there must be compatibility between Hammurabi's Code and the codes of the Neo-Babylonian era. We should compare Hammurabi's Code with these Neo-Babylonian codes to see whether they are compatible, especially in terms of penalties. We have only one incomplete published code from the seventh century (about 700 B.C.) (Roth 1995, 143-52), which is nearly from Sippar, the same city as the cases Schumann analyzed. Although it is incomplete, it contains some articles that suggest it was incompatible with Hammurabi's Code. These are as follows:

> **Hammurabi's Code (Roth 1995):**
> 163. If a man marries a wife but she does not provide him with children, and that woman goes to her fate – if his father-in-law then returns to him the bridewealth that that man brought to his father-in-law's house, her husband shall have no claim to that woman's dowry; her dowry belongs only to her father's house.
> 164. If his father-in-law should not return to him the bridewealth, he shall deduct the value of her bridewealth from her dowry and restore (the balance of) her dowry to her father's house.
>
> **The Neo-Babylonian (Sippar) Code:**
> 10. A man who gives a dowry to his daughter, and she has no son or daughter, and fate carries her away – her dowry shall revert to her paternal estate.
>
> **Hammurabi's Code:**
> 167. If a man marries a wife and she bears him children, and later that woman goes to her fate, and after her death he marries another woman and she bears children, after which the father then goes to his fate, the children will not divide the estate according to the mothers; they shall take the dowries of their respective mothers and then equally divide the property of the paternal estate.
> 173. If that woman should bear children to her latter husband into whose house she entered, after that woman dies, her former and latter children shall equally divide her dowry.

The Neo-Babylonian (Sippar) Code:

15. A man who marries a wife who bears him sons, and whose wife fate carries away, and who marries a second wife who bears him sons, and later on the father goes to his fate – the sons of the first woman shall take two-thirds of the paternal estate, and the sons of the second shall take one-third. Their sisters, who are still residing in the paternal home […].

Given these articles, there was no bridewealth in the Neo-Babylonian code, while it was a common practice during Hammurabi's period (Old Babylonian). Additionally, the share of inheritance for the sons is equal in Hammurabi's code, whereas it is unequal in the Neo-Babylonian code, with two-thirds for the sons of the first wife and one-third for the sons of the second wife.

4. There is not only a difference between the Code of Hammurabi and the Code of Sippar, but there is also a difference between the Code of Hammurabi and the legal practices in the Neo-Babylonian period. This supports what we said in point 2, that social changes lead to changes in laws. For example, in the case of a shepherd stealing the sheep he is tending (and they are not temple sheep), the punishment in the Code of Hammurabi is tenfold (*ibid*., no. 265), while in the Neo-Babylonian period, it differs from that and among themselves as well. The judicial text CBS 5330 states that the punishment is equivalent, while the usual penalties in the Neo-Babylonian period were either double or threefold (Holtz, 2014, 38), and sometimes imprisonment (Oelsner et al. 2003, 963). Likewise, the punishment for stealing temple goods, although thirtyfold as in the case of the text YBC 4154 (Holtz, 2014, 52) or in the case of the text YBC 3771 (*ibid*., 178) cited by Schumann, which matches the Code of Hammurabi, could also be imprisonment or burning as in the records of the thirtieth century (Oelsner et al. 2003, 963). Similarly, a slave who tries to claim he is free from his master and is proven otherwise, has his ear cut off in the Code of Hammurabi (Roth 1995, no. 282), while the judges of Neo-Babylonian Babylon are content with returning him to his master (Holtz, 2014, text BM 33084, pp. 70-73). Lastly, the Code of Hammurabi did not recognize imprisonment, while in the Neo-Babylonian era "there is ample evidence that prisons were in use." (Oelsner et al. 2003, 967)

5. Most of what we have shown in the previous point not only highlights the conflict between Hammurabi's Code and the legal practices of the Neo-Babylonian era, but also demonstrates the contradictions within the legal practices of the Neo-Babylonian era itself, which Schumann analyzed and attempted to prove were subject to a legal axiomatic system. Furthermore, in cases of receiving stolen goods, there is no single punishment; Neo-Babylonian judges imposed either thirty-fold or sometimes double penalties (*ibid*., 965).

6. But is it possible for the Code of Sippar to be as axiomatic for the judges of the trials and documents we have for the Neo-Babylonian era? I suspect that it cannot be too (according to 5 above). However, there is a discrepancy between the code of Sippar and the actual legal practice of the Neo-Babylonian era. For example, Article 12 of that Code states that if a woman whose husband has passed away and has no sons, and "if she has no dowry, a judge shall assess the value of her husband's estate and give her some property in accordance with the value of her husband's estate." (Roth 1995, 147) On the other hand, the practice during this period, according to trials and documents, as Oelsner et al. (2003, pp. 938-39) tell us, was that "wives and daughters had no right to inherit but usually received a share of the paternal estate in the form of a dowry or marital gift."

7. If there had been codes used as axiomatic, it would have been mentioned in the texts we have that the sentences and the judgments were according to them, but this is never mentioned, even though the purpose of legal documentation was not for the law itself but as evidence of the judgment or decision (Holtz 2014, 7). One of the few instances where reference to a higher authority is mentioned in the published cuneiform legal texts is the case that was brought to Babylon under the presidency of Simmagir Nargiya (a high-ranking royal official), and after the judgment was confirmed against the defendant, a reference was made to what was called the "*dātu*" as follows: "The *simmagir* and the judges, his colleagues, consulted (lit.: opened) the (royal) regulation [*dātu*]. On the basis of the (royal) regulation [*dātu*] (the payment of)…etc." (Jursa et al, 2003/4, 257) However, the meaning of the word "*dātu*" is very ambiguous as its translators tell us; they suggested it refers "to royal tax regulations and to procedures regulating the repayment of debts and deposits." (ibid. 259) However, the word itself is not Akkadian but a "Persian loan word," (Oelsner et al. 2003, 912) and was used only "in the Achaemenid and Seleucid times." (ibid.) This may exclude the possibility that there was an axiomatic code in both the Old and Neo-Babylonian eras.

The reader may have noted Schumann's treatment of conditionals as implications (see my emphasis in his quotes). It is true that logicians sometimes use the word "implication" when they mean "conditional," and they tolerate this usage. However, in Schumann's interpretation, there seems to be more to consider. This brings us to a notable quarrel concerning implication and conditional that occurred between C. I. Lewis and W. V. Quine in the last century.

3. Lewis and Quine on Implication and Conditional

C. I. Lewis sought to understand the conditional "if...then..." as a form of the verb "*imply*," which he termed strict implication. This contrasts with Russell's material implication (Rochberg's implication). Strict implication, denoted as (*p* strictly implies *q* or $p \dashv q$), means "it is impossible for *p* to be true and *q* to be false, or *p* is inconsistent with the denial of *q*." (Lewis 1918, 332-23) Essentially, "*p implies q* is synonymous with *q* is deducible from *p*." (Lewis and Langford 1959, 122) By interpreting the conditional in this way, Lewis developed his famous five modal calculi, which avoided many paradoxes associated with material implication. Two of the most well-known paradoxes he addressed are:

> Paradox of the Material Conditional: Any false statement implies any statement.
> Paradox of Implication: Any statement implies any true statement.
> (Lewis 1918, 225-226)

In addition to avoiding the paradoxes of material implication, strict implication also addresses the problem that no two propositions can be both consistent and independent, represented as

$$-(p \supset -q).\supset .\ p \supset q \text{ (ibid., 122, 144).}$$

Quine, on the other hand, argued that Lewis had conflated implication with the conditional. He pointed out that this conflation resulted from Lewis confusing the mention of words with their use:

> Modal logic received special impetus years ago from a confused reading of "⊃", the material "if-then", as "implies": a confusion of the material conditional with the relation of implication. Properly, whereas "⊃" or "if-then" connects statements, "implies" is a verb which connects names of statements and thus expresses a relation of the named

> statements. Carelessness over the distinction of use and mention having allowed this intrusion of "implies" as a reading of "⊃", the protest thereupon arose that "⊃" in its material sense was too weak to do justice to "implies", which connotes something like logical implication. Accordingly, an effort was made to repair the discrepancy by introducing an improved substitute for "⊃", written "⥽" and called strict implication. The initial failure to distinguish use from mention persisted; so "⥽", though read "implies" and motivated by the connotations of the word "implies", functioned actually not as a verb but as a statement connective, a much strengthened "if-then." (Quine 1953/1966, 165-66)

4. Are *Šumma* Sentences Material Conditionals? And How Should we Think about Them?

I am going to establish the following points:

1) *Šumma* sentences are incomplete: *Šumma* sentences, as used in Babylonian scholastic texts, are inherently incomplete.
2) *Šumma* (scientific) sentences are implications, not conditionals: Because of their incomplete nature, these sentences function more as implications rather than conditionals. This is because:
3) Babylonian scholars' confusion: The Babylonian scholars made a similar confusion with the concept of "imply" as C. I. Lewis did, but in reverse.

1) By saying that *šumma* sentences are incomplete, I mean that their antecedents are not fully provided, and there are gaps in them. This is particularly evident in the Babylonian laws. As mentioned earlier, Bottéro argued against considering the Babylonian tablets of laws as codes. He viewed them as a "work of science devoted to the exercise of *justice.*" (Bottéro 1992, 179, italics in the original) The tablets of laws were intended to be a compendium of cuneiform experience in the domain of legal knowledge, cast in the form of cuneiform treatises, which "are nothing else but types of paradigms or tables." (178) This can be confirmed by passages in the prologue and epilogue of Hammurabi's Code, as well as other Babylonian codes.

> When the god *Marduk* commanded me to provide just ways for the people of the land (in order to attain) appropriate behavior, I established truth and justice as the declaration of the land, I enhanced the well-being of the people. (Prologue in Roth 1995, 80-81)
> He [*Hammurabi*] gladdened the heart of the god *Marduk*, his lord, and he secured the eternal well-being of the people and provided just ways for the land. (Epilogue in Roth 1995, 134-35)
> At that time, the gods *Anu* and *Enlil*, for the enhancement of well-being of the people, named me by name: *Hammurabi*, the pious prince, who venerates the gods, to make justice prevail in the land, to abolish the wicked and the evil, to prevent the strong from oppressing the weak, to rise like the sun-god *Shamash* over all humankind, to illuminate the land. (Prologue, 76-77)

The above quotations contain the aims of Hammurabi's articles. These aims should be added to all the antecedents of *šumma* sentences to make them sensible and complete. I believe we could formulate these antecedents as follows:

a) according to the paradigm of justice,

b) according to traditions, habits, and customs,

c) according to just ways for the people of the land to attain appropriate behavior,

d) according to the eternal well-being of the people to be secured,

e) and according to making justice prevail in the land, to abolish the wicked and the evil, to prevent the strong from oppressing the weak, to rise like the sun-god Shamash over all humankind, and to illuminate the land.

2) The previous claim leads us directly to the second claim: that *šumma* sentences may be treated as implications rather than conditionals. This is further supported by Bottéro's descriptions of their nature. Although Bottéro argued that the Babylonians did not recognize abstract law in their treatises (Bottéro 1992, 178), he still believed there was a necessary (or strict, if we use Lewis' terminology) connection between the *protasis* and *apodosis* of the hypotheses in the treatises, even if it was not an objective one (172-73). I think this paradox of not having abstract laws on one hand, and having a necessary (strict) connection between the antecedent and consequent of the hypotheses in the Babylonian treatises on the other – can only be resolved if we recognize the *šumma* sentences as implications rather than conditionals. This can be confirmed by Hammurabi's announcement regarding the nature of his articles as results:

> In order that the mighty not wrong the weak, to provide just ways for the waif and the widow, I have inscribed my precious pronouncements upon my stela and set it up before the statue of me, the king of justice… in order to render the judgments [*dīn*] of the land, to give the verdicts [*diānim*] of the land, and to provide just ways for the wronged. (Epilogue in Roth 1995, 133-34)
>
> These are the just decisions [*dīnāt*] which Hammurabi, the able king, has established and thereby has directed the land along the course of truth and the correct way of lif. (133)

Now we can reconstruct *šumma* sentences completely, along with the implicit premises we have extracted above. I will choose one article from Hammurabi's Code, which Schumann had already selected, as an example.

> §282 If a slave should declare to his master, "You are not my master," he (the master) shall bring charge and proof against him that he is indeed his slave, and his master shall out off his ear. (132)

This can be reconstructed as follows:
If a slave should declare to his master "You are not my master," then according to the just ways for the people of the land to attain appropriate behavior, the master should bring charge and proof against him that he is indeed his slave outing off his ear.
Or symbolically:

$$p \supset (q \supset r)$$

But according to export-import law:

$$(p \supset (q \supset r)) \equiv ((p \,\&\, q) \supset r)$$

Thus, the article is reformalized as:

$$(p \,\&\, q) \supset r$$

And because it is an implication, it should be:

$$(p \,\&\, q) \vdash r$$

The same approach should be applied to all other articles, with careful consideration of choosing the appropriate antecedents and formalization.

Schumann has successfully reconstructed the rationale behind forecasting by considering events as either favorable (positive) or unfavorable (negative). His main idea is to interpret the connectives algebraically and truth-functionally with the structure $\langle\{-1,+1\}, \neg, \&, \Rightarrow\rangle$, where +1 represents the favorable value and −1 represents the unfavorable value. These correspond to the two values of truth, and the interpretation of the connectives $\{\neg, \&, \Rightarrow\}$ is the same as their usual truth-function interpretation. Thus, for example, the following divinations:

(a) If a man leaves (in order to achieve) his purpose and a star twinkles **from the right of** the man to **the left of** the man – favourable.

(b) If (it) twinkles from **the left to the right** – unfavourable.

(c) If a star twinkles **on the back of** the **man from the right to the left** – unfavourable.

(d) If a star twinkles **on the back of** the man **from the left to the right** – favourable

are reconstructed as follows:

(a) $(+1 \,\&\, +1) \Rightarrow +1$;

(b) $(+1 \,\&\, -1) \Rightarrow -1$;

(c) $(-1 \,\&\, +1) \Rightarrow -1$;

(d) $(-1 \,\&\, -1) \Rightarrow +1$. (Schumann 2021, p. 732)

And as axioms as follows:

(a) $((+1 \,\&\, +1) \Rightarrow +1) = (+1 \Rightarrow +1) = +1$;

(b) $((+1 \,\&\, -1) \Rightarrow -1) = (-1 \Rightarrow -1) = +1$;

(c) $((-1 \,\&\, +1) \Rightarrow -1) = (-1 \Rightarrow -1) = +1$;

(d) $((-1 \,\&\, -1) \Rightarrow +1) = (-1 \Rightarrow +1) = +1$ (ibid. 733)

Schumann interprets *šumma* sentences as axioms, but I think it would be more reasonable to interpret them as arguments or implications that have omitted any qualifiers or modals as follows (I shall put my reconstruction in italics):

(a) If a man leaves (in order to achieve) his purpose and a star twinkles **from the right** of the man **to the left** of the man – favourable.
(aa) If a man leaves to achieve his purpose and a star twinkles ***favorably in the front*** *from* ***the right of*** *the man* ***to the left*** *of the man* ***favorably*** $\vdash$ *favorable.*

(b) If (it) twinkles **from the left to the right** – unfavourable.
(bb) If a man leaves to achieve his purpose and a star twinkles ***favorably in the front*** *of the man* ***from the left to the right unfavorably*** $\vdash$ *unfavorable.*

(c) If a star twinkles **on the back** of the man **from the right to the left** – unfavourable.

(cc) If a man leaves to achieve his purpose and a star twinkles ***unfavorable behind*** *him* ***from the right to the left favorably*** *⊢ unfavorable.*

(d) If a star twinkles **on the back** of the man **from the left to the right** – favourable
(dd) If a man leaves to achieve his purpose and a star twinkles ***unfavorably behind*** *him* ***from left to the right unfavorably*** *⊢ favorable.*

If we accept this analysis, it should apply to the legal implications as well. Each is valid because all antecedents have the value +1, as does the conclusion. Therefore, the entire implication would have the value +1. The difference between my analysis and Schumann's is that while he sees axioms, I see arguments. The Babylonian treatises are not axioms, invitations to a scientific project, or generators for laws; rather, they are results – final judgments that should not be changed, modified, or altered, as Hammurabi and others insisted. I believe this rigidity is a significant reason for the lagging of Babylonian sciences.

3) I propose extending Quine's analysis of strict implication to apply to *šumma* sentences. We should consider that Babylonian scholars conflated conditionals with implications, or rather, they expressed their conclusions, theories, and implications in the form of conditionals. *Thus, a šumma sentence is not merely a singular conditional sentence but a complete argument*. We could say that what Lewis did with *"imply"*, the Babylonians did with *šumma*. Similarly, what Babylonian scholars did with *šumma*, we often do with some qualification. We describe implication as the tautology of the conditional. Therefore, Babylonian scholars intended their *šumma* to express validity, not an accidental relation or truth function.

In fact, the Babylonian scribes made many intellectual confusions. Rochberg highlighted another significant one related to the concept of "*normal*." According to G. Canguilhem, there have been two main ambiguous meanings of "*the normal*" throughout the history of science (of life). These meanings relate "either to being in accordance with the mean or with certain divergences considered insignificant. Yet, it also sometimes designates an ideal, a positive principle of evaluation, in the sense of a prototype or a perfect form. The fact that these two meanings are always linked, so that the term *normal* is always unclear, comes out even in the advice we are given to help us avoid this ambiguity." (Canguilhem, 122) Rochberg has marked the same confusion of ambiguity in the corpus of cuneiform treatises, "if we search for conceptions of the "*normal*" over a range Akkadian divinatory text, the same ambiguities as Canguilhem described for the concept may be found. That is, "*normal*" can be gauged in terms either of a "mean of measurements" or an ideal, a "positive principle of evaluation," where that ideal is determined by the divine scheme of things." (Rochberg 2016, 108).

However, we should emphasize a difference between Lewis and the Babylonian scholars. Lewis confused implication with conditional, while the Babylonian scholars confused conditional with implication. In other words, Lewis used implication or "*imply*" to express a conditional, whereas the Babylonian scholars used conditional or *šumma* to express implication or "*imply*."

There is another difference between Lewis's confusion and that of the Babylonian scholars. Lewis's confusion, or his definition of the proper "*imply*," was intentional, aimed at constructing a logical theory that avoids the aforementioned paradoxes:

> unless "*implies*" has some "*proper*" meaning, there is no criterion of validity, no possibility even of arguing the question whether there is one or not. (Lewis 1917, 325, italics in the original)

On the other hand, the Babylonian scholars' confusion was unconscious. This aligns with the fact that the Babylonians did not have logical terminology. In other words, logic as a discipline had not yet been created, and there was no distinction between syntax and semantics, indicative and interrogative, assertive and modal. Their language, if it existed, was ambiguous and vague, primitive like Freud's language of dreams, as clearly demonstrated by *šumma* sentences. In short, their logical apparatus was defective.

This conclusion disagrees with Schumann's claim that the genesis of logic was in Mesopotamia and was transferred to the Greeks (especially *Chrysippus* and *Cicero*) through law. Schumann supports his thesis by noting the similarity in content and form between the Law Code of Gortyn and Babylonian codes (Schumann 2017, 137-46).

In fact, the similarity in form and content is not strong enough to establish the supposed connection. There should be additional philological evidence, such as specific terminology and terms, which does not exist. However, we can claim (as I believe I have demonstrated here) that legal treatises are not codes or axioms to be inferred from; they are treatises about rights and justice, cast in implications and non-adjustable arguments. The same applies to divinatory texts. The algebraic logic behind these treatises consists of implicit premises and qualifiers. Even if we accepted it as an implicit logic, it would be mere modeling, and we could model any discourse logically or mathematically without claiming that the discourse was intended to be logical or mathematical. Reichenbach expressed it as follows:

> The science of logic is a discovery of the Greeks. That does not mean that there was no logical thinking before the Greeks. Logical thought is as old as thought; every successful act of thinking is controlled by the rules of logic. But it is one thing to apply these rules unknowingly in practical thought operations, and another to formulate them explicitly, so as to collect them in the form of a theory. It is this planned inquiry into logical rules which began with Aristotle. (1968, p. 215)

Logic emerged in Greece due to rhetorical discussions in courts, mathematical arguments, and conflicts of physical theories (Lloyd 1990). Contrary to Schumann's claim that *Cicero* was influenced by Semitic people through law (Schumann 2017, 147-49), it was the reverse; the Semitic peoples were influenced by Greek logic and *Cicero's* rhetoric (Daube 1949).

Schumann may believe that we will someday discover a Babylonian treatise on logic. However, even if he thought this, his belief could never be verified because Babylonian science was not written abstractly. As Bottéro and others noted, Babylonian science was tabular, not abstract. Rochberg also clearly expressed the impossibility of Greek logic being influenced by cuneiform writings as follows:

> That the inferential character of Assyro-Babylonian divination appears to coincide with what was known as the "first undemonstrated" inference scheme of Stoic logic seems on the face of it interesting, but not evidently interdependent. At least no textual (or other) evidence exists to link the two. Cuneiform omen texts continued to be copied throughout the Hellenistic period (4th–1st centuries B.C.) as exemplars from the late Babylonian collections stemming from *Babylon*, *Uruk*, and possibly Sippar attest. The fact of their contemporaneity with the activities of the Stoic philosophers in Athens and Alexandria of the 3rd century and later means nothing in and of itself. (Rochberg 2010, 386, n.22)

The historian of Babylonian mathematics, J. Høyrup, has adopted a similar position to Schumann, but in the field of the history of Babylonian mathematics. He claimed that a proof style exists in Babylonian mathematics and expressed our lack of recognition of it as follows: "If we cannot find traces of this reasoning in extant sources, we may safely conclude that this is due *either* to our failing understanding of the sources *or* to the insufficiency of extant sources as mirrors of educational practice." (Høyrup 2005, 112). However, the evidence supports that Babylonian mathematical proof and logic are subconscious, and Babylonian mathematics was not written as theories but only as problems (Kline 1972, 17). To model something for extracting its sub-logic or sub-proof is different from considering that thing itself as logic or a full-fledged abstract mathematical theory.

In fact, what the Babylonians lacked for establishing axiomatic systems, and thus prominently featuring the concept of proof in their texts, was systematicity. Their thinking was not systematic but rather tabular, limited to specific problems. This is mainly related to the nature of the medium that conveyed their knowledge, namely clay tablets. The Babylonian scribe's text was constrained by the limited size and area of the clay tablet on which the scribe recorded their knowledge. To write an epic like the Epic of *Gilgamesh*, they had to inscribe it on several tablets (about 12 in the fullest extent text we have), which exposed it to separation and dispersion. This is unlike the papyrus medium, which could connect a long text like the Book of the Dead into a single papyrus scroll up to nearly 16 meters long. Indeed, we find the concept of systematicity present in the Rhind Papyrus. In any case, the Greeks' use of papyrus enabled them to grasp the lesson of systematicity well, which helped them develop the concept of proof and axiomatic systems. Marshall McLuhan was not mistaken in his famous phrase, "The medium is the message."

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Notes

[1] For an exact account concerning conditional statements in Akkadian, see Huehnergard (1997, 159-60). In addition to "*šumma*," there is another construction for conditionals, which involves placing "*ma*" after the first verb in the sentence, thereby converting the main clause into a dependent clause. This construction resembles English causal adverbial participle clauses. Thus, the sentence "*ilū šarram ul iškunū-ma mātium iḫliq*" could be read as "because/when/if the gods did not install a king, the land perished" or "the gods not having installed a king, the land perished" (for more details, see ibid., 50).

[2] Bottéro described these two features in most Babylonian treatises as science: "It has to be said that the acknowledgment of this care for abstraction convinces us to speak here of research, not of the individual and accidental, but of the universal and the essential. In other words: of "Science"." (1992, 117) But does science consist only of conditionals?