Tuning Procedures in Ancient Iraq

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T he discovery, from the 1960s until the present, of a small corpus of about twenty texts concerning strings, tuning, and performance from ancient Iraq (loosely equivalent to "Mesopotamia") and Syria has transformed our view of the earliest stages of music history. Not only is this corpus by far the earliest recorded expression of what might be called "music theory," but these texts also belong to a highly sophisticated musical culture that had been forgotten for approximately two millenia, before the decipherment of cuneiform writing in the nineteenth century. This corpus represents a truly forgotten first chapter of music history. It also occupies a unique phase of music history due to the fact that, according our available evidence, there are no predecessors and no obvious successors.[1]

The Mesopotamian texts concerning the technicalities of music are written in cuneiform script, in the Akkadian language, and on clay tablets. They were excavated from sites in modern Iraq (the north was known as Assyria and the south Babylonia) and Syria. None of these texts are precisely dated; however, they can be very approximately dated by period from the analysis of script, language, and orthography. The earliest of these texts, the tuning text (so named because it is the only clear example of instructions for tuning), dates to the Old Babylonian period, conventionally ca. 2000-1500 BCE. Thus, they precede by approximately one millennium anything

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[1] Despite the fact that a connection with ancient Greek music theory has been argued, the connections are in my opinion indirect. This is not to say that there is no connection between Mesopotamia and Greece, but that the similarities were probably general characteristics of Mediterranean music cultures in Antiquity. The only major evidence of these cultures that has survived comes from Mesopotamia and Greece. For an investigation into this matter, including earlier bibliography, see Franklin 2002.

comparable from other pre-Christian civilizations, such as Greece and China, from which music theory and notation texts have survived. Other relevant texts date from the Middle Assyrian (1500-1000 BCE), Neo-Assyrian (1000-600 BCE), and Neo-Babylonian (1000-600 BCE) periods.[2] All the Mesopotamian texts are united by the use of a terminology for music that, according to the approximate dating of the texts, was in use for over 1,000 years. The nature of our sources from ancient Mesopotamia allows us only isolated glimpses into what is a vast first chapter of music history. Nevertheless, the fact that this set of musical terms remained consistent over such a period of time confirms our view of a highly conservative musical culture, which is not inconsistent with our knowledge of the conservative nature of Mesopotamian culture in general.

It must be borne in mind that interpretation of the tuning text is dependent on other texts that date from a much later period. Most important, the enumeration of string dichords, together with string numbers, is known from a text dating as much as a thousand years later (see below).[3] This is an unavoidable problem in Mesopotamian studies in general. We have to work with our available evidence, much of which is separated by hundreds of years. While this is not ideal, we are aided by the conservatism of Mesopotamian scribal traditions. In many facets of Mesopotamian

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[2] Important examples are the Middle-Assyrian song catalogue wherein songs are classified by mode (KAR 158), a Neo-Assyrian text of incipits associated with string names (BM 65217+), a Neo-Babylonian listing of mathematical coefficients that includes string names together with their corresponding dichords (CBS 10996), and a Neo-Babylonian diagram of a seven-pointed star with string names and a chart of dichords (CBS 1766). For an overview of the subject with bibliography, see Mirelman, forthcoming. The terms "Neo-Assyrian" and "Neo-Babylonian" refer to the same period, but are distinguished by the Assyrian (northern Iraq) and Babylonian (southern Iraq) origins of the texts. Cuneiform tablets are customarily referred to with museum sigla (thus, BM = British Museum, CBS = Catalogue of the Babylonian Section, of the University Museum at the University of Pennsylvania). The other method is by first publication, thus KAR = Keilschrifttexte aus Assur religiösen Inhalts (Leipzig, 1919 onwards). In the transcription of Akkadian words below, š indicates "sh" as in "sheep", ḫ indicates "ch" as in "loch", a macron (e.g. ī) indicates a long vowel, and a circumflex (e.g. û) indicates a long vowel which is a result of contraction.

[3] "Dichord" refers to a pair of strings, which can also be a mode name. See below for a detailed consideration of this central concept.

culture, elements of second-millenium culture were continued and renewed in the first millenium BCE.

The theoretical or notation texts written on cuneiform tablets consist of the following principal sources, or categories of texts:[4]

(1) The tuning text (Old Babylonian).

(2) Other Old Babylonian fragments from the city of Nippur, the content and purpose of which are obscure.

(3) The "Hurrian Hymns" found at the Syrian coastal city of Ugarit, dating from the mid-second millennium. They are in the Hurrian language, which is unrelated to Akkadian. The text of the hymns is accompanied by performance instructions consisting of Babylonian (Akkadian) dichord names together with numbers. It is certain that these texts are a form of notation although there are widely varying interpretations regarding how the notation should be realized.

(4) A catalogue of song incipits associated with dichord/mode names (Middle Assyrian).

(5) Neo-Assyrian and Neo-Babylonian period texts where strings of a lyre or harp are associated with incipits of prayers.

(6) A table of strings and dichords (Neo-Babylonian).

(7) The seven-pointed star text where the points of the star are associated with particular string names; a table of numbers below represents dichord sequences (Neo-Babylonian).

(7) Interpolated vowels and syllable sequences in cultic songs, together with limited performance instructions, such as the specification of instruments (Late Babylonian).

(8) Lexical texts, somewhat like native dictionaries, which include musical terminology.

The important unifying element of all the theoretical texts is the use of a common terminology, the basis of which is the dichords of a lyre or harp (see Figure 1 below for a table of these dichords).[5] The principle of the dichord is central to Mesopotamian music theory. The term "dichord" refers to three separate but related concepts. First, a dichord is a pair of open strings, defined by number, and given a name, e.g., *išartum* (which means literally "straight, correct, normal") is the dichord

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[4] See Mirelman, forthcoming, for details and further bibliography.

[5] An exception is category seven, which has a separate performance tradition and utilizes a different set of musical terms.

between strings 2 and 6; *qablītum* (which means literally "middle") is the dichord between strings 5 and 2.[6] Second, and by extension, the dichord name can be the name of an interval; and, third, it can refer to an instrument's tuning or "mode." Thus, a dichord can refer simply to a physical pair of open strings, which could be played successively or harmonically. However, depending on the context, it can also refer to the interval formed between these two open strings, and/or the mode. For example, the dichord/interval of *išartum* is between strings 2 and 6. As modes, *išartum* is defined by its dichord (strings 2 and 6) being "clear," and *qablītum* by its dichord (strings 5 and 2) being "unclear."

The string names are based on a symmetrical conception of nine strings, with a central fifth string. Figure 1 is a literal translation of the Mesopotamian terms for the nine strings of the lyre or harp (we are uncertain about which stringed instrument), which are the basis for the system of dichords. A further concept that is central to the dichord system is the equivalence between strings 1 and 8, and strings 2 and 9. The

Figure 1. Mesopotamian terms for the nine strings of a musical instrument

(1) front string
(2) following string
(3) third, thin string[7]
(4) fourth, small string; Ea made it[8]
(5) fifth string
(6) fourth string from behind
(7) third string from behind
(8) second string from behind
(9) back string

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[6] The order in which the dichord pairs are referred to here (e.g., "5-2" as opposed to "2-5") corresponds to the order in which they occur in the theory texts. The theory texts enumerate the dichords according to a pattern that is not consistently ascending or descending.

[7] It is unclear why string 3 is called "thin."

[8] String 4 has an alternative name based on the belief that it was created by the god Ea/Enki.

system is heptatonic, although there are nine strings. It is explicitly stated in the tuning text that the tightening or loosening of strings 1 or 2 is always accomplished simultaneously with the tightening or loosening of strings 8 or 9 respectively. We must assume, therefore, that strings 8 and 9 were either in unison or in an octave relationship with strings 1 and 2.

The tuning text is known from two manuscripts. A large part of the tuning text is extant although some of it had to be reconstructed, based on logical deduction and our knowledge of other theory texts. In particular, the Neo-Babylonian table of strings and dichords (item no. 5 in Figure 1 above) is essential to an understanding of the

Figure 2. One of two known cuneiform tablets of the tuning text (UET VI/3, 899, British Museum)
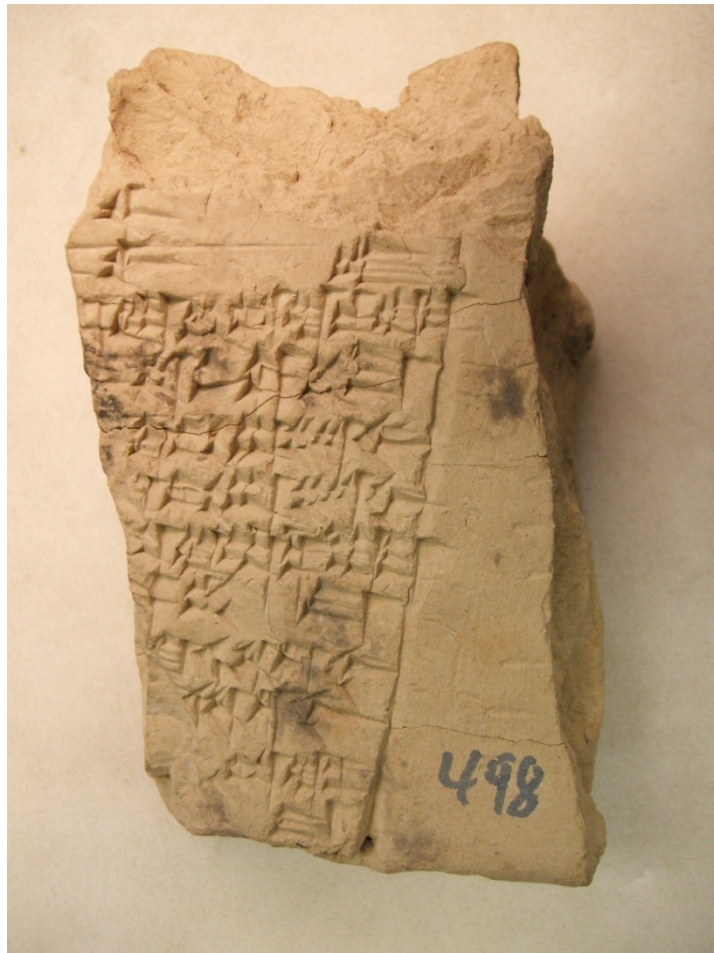
terminology in the tuning text. Two manuscripts of the tuning text have been published (Gurney 1968; Mirelman and Krispijn 2009); see Figure 2 for a photograph of the most recently published manuscript.

Both manuscripts date to the Old Babylonian period, and both were excavated from the city of Ur in southern Babylonia. No further information concerning the precise location of the find-spots is available. For example, we do not know if the texts belonged to a music teacher, or whether they were housed in the scribal school. From internal evidence, I have attempted to show that due to differences in language, style, and handwriting, the two manuscripts were written by different scribes. This evidence is significant because it suggests that the tuning text was not the isolated invention of a single scribe, but that it was a text which must have been known in the city of Ur during the Old Babylonian period, at least among a certain group of specialists.

The tuning text is a set of instructions for tuning a stringed instrument known as a *sammû*.[9] The identification of this instrument is uncertain. I translate the term as a lyre, but all we know for sure is that it was a nine-stringed musical instrument. The tuning text seems, at first sight, not to be a manual for fine-tuning of the *sammû*. Instead, it is a manual for changing the tuning of the instrument from one mode to another, through a cycle of modes.

What may be called modulation from one mode to another is achieved either by successive loosening or successive tightening of dichords.[10] A key feature of a certain mode is the nature of its named dichord being "clear," e.g., the *išartum* dichord between strings 2 and 6 is "clear." The identification of a certain mode is also

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[9] For a complete translation of the tuning text, see Mirelman 2010.

[10] My use of the word "modulation" simply means conversion of the instrument's open string arrangement; it does not imply movement through modes during performance.

dependent on another interval being "unclear," as we shall see below. We have no information outside of the tuning text itself explaining what exactly is meant by "clear" and "unclear" in a musical context. The Akkadian adjective *zakû*, used in the tuning text to describe dichords, has the meaning of "clear, clean, pure." Conversely, *la zakû* is used to mean "unclear, unclean, impure."[11] The Akkadian adjective is normally used to describe liquids, metals, the sky, or people (in connection with freedom from a claim, or guilt). As I state below, most commentators have understood the unclear interval as a tritone, which becomes clear by resolving to a perfect 5th or 4th. This is inferred from the sources rather than articulated explicitly. I will return to the question of precisely what is meant by the concept of clear intervals below.

The tuning text follows an "if X then Y" format that is found in various other Mesopotamian texts, such as law codes and omens. In law codes, it highlights a particular offense, followed by the punishment, e.g., "if a man commits a robbery and is caught, that man will be killed" (Hammurabi's Laws, no. 22). In omens, the identification of a physical feature of the world (such as the liver) had a precise consequence, e.g., "if the left lobe (of the liver) is covered by a membrane and it is abnormal, the king will die from illness" (Koch-Westenholz 2000, 102, no. 328). Similarly, the tuning text follows the format of identifying a feature, followed by an action, which is then followed by a result. For example:

> If the lyre is *išartum* and you play an <unclear> *qablītum*, you loosen the second string and the back string (for me) and the lyre is *kitmum*. (lines 13-16)[12]

This clause, the structure of which is replicated throughout the tuning text, can be subdivided into diagnosis, treatment (or action), and result. Accordingly, the diagnosis

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[11] For the remainder of this article, I will not use quotation marks to enclose *clear* and *unclear*, although they are implied.

[12] Line numbers in the tuning text are according to Mirelman 2010. The < > signs indicate a part of the text that, from the context, we can deduce was omitted by the scribe. The [ ] indicate parts of the text that are broken, and therefore reconstructed.

is: "If the lyre is *išartum* and you play an <unclear> *qablītum*." This means that if the instrument is tuned according to the *išartum* mode, you can confirm this proposed diagnosis by playing *qablītum* (strings 5-2), and hearing that this interval is unclear.[13] If the *qablītum* interval is unclear, you can be sure that the instrument is indeed tuned to the mode of *išartum*. A further element in this initial diagnosis, which is not specifically stated but implied, is to play the *išartum* dichord. As has already been stated, dichord names refer to specific dichords as well as modes; being in a mode is partially defined by the fact that the mode-name's dichord is clear. Thus, an unstated although probable first step in the initial diagnosis is to play the *išartum* dichord between strings 2 and 6, and to check that it is indeed clear. Therefore, we can propose that there are two steps involved in the diagnosis: checking to ensure that one interval is clear, and that the other is unclear.

The diagnosis is followed by treatment: "you loosen the second string and the back string (for me)."[14] The treatment is concerned with the interval *qablītum*, which has just been diagnosed as unclear. The issue at hand now is to make this unclear interval clear. Thus, loosening the second string and the back string will make the unclear interval of *qablītum* clear. The "back string" is the Mesopotamian term for the ninth string, which is logical: remember there are nine strings in total. The *qablītum* dichord consists of strings 5 and 2; loosening string 2 together with string 9 (we may assume that string 9 was tuned in parallel octaves with string 2) will alter the *qablītum* dichord and make it clear.

The end result of a process of diagnosis and treatment is "and the lyre is *kitmum*," which in turn prepares the way for the next step in the tuning cycle:

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[13] "Strings 5-2" means the dichord between strings 5 and 2, not strings 5 through 2.

[14] The words "for me" are enclosed in parenthesis to indicate the existence of a particle in the Akkadian language that may indicate a directive action towards the speaker. This may indicate the pedagogic function of the tuning text.

> If the lyre is *kitmum* and you play an unclear *išartum*, you loosen the fourth string from behind (for me) and [the lyre is *embūbum*.] (lines 17-20)

This next clause thus begins with a proposed diagnosis of *kitmum,* the mode to which the instrument should already be tuned at this point in the modulation cycle. The format of this clause is already familiar from the previous clause. The proposed diagnosis is followed by a test—if you play the *išartum* dichord and it is unclear, the instrument is indeed tuned to *kitmum*. The action is to loosen the "fourth string from behind," which is string 6. The *išartum* dichord (strings 2 and 6) now becomes clear and, as a result, the instrument is now tuned to the mode of *embūbum*.

The entire text consists of a tightening and a loosening section of approximately equal length. The sequences of successive tightening in the tightening section, or successive loosening in the loosening section, lead to the same starting point, which is the mode of *išartum* ("normal"). Figure 3 is an illustration of the transition between the tightening and loosening sections, involving the dichords of *išartum* ("normal") and *qablītum* ("middle"), and the modes of *kitmum* ("closed") and *išartum* ("normal"). Following the conclusion of the tightening section, the text includes a (restored) subscript indicating that the preceding text is the tightening section (see Figure 3).

Figure 3. The transition between the tightening and loosening sections in the tuning text
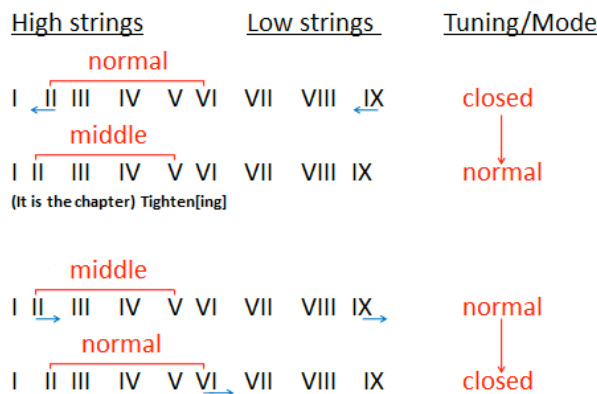
Figure 4 below is a translation of the first three clauses of the loosening section, while Figure 5 outlines the clear and unclear nature of particular dichords, the combination of which defines a particular mode. For example, the mode of *išartum* is defined by strings 2-6 being clear and strings 5-2 unclear. Loosening string 2 (together with string 9, which is in an octave relationship with string 2) will make the 5-2 dichord clear, but it will also make the 2-6 dichord unclear. The instrument will now be in the *kitmum* mode. Subsequently, loosening string 6 will make the 2-6 dichord clear, but it will also make the 6-3 dichord unclear. The instrument is now in the *embūbum* mode.

Figure 4. The first three clauses of the loosening section

If the lyre is *išartum* (strings 2-6) and you play an <unclear> *qablītum* (strings 5-2), you loosen the second string and the back string (for me) and the lyre is *kitmum*. (lines 13-16)

If the lyre is *kitmum* (strings 6-3) and you play an unclear *išartum* (strings 2-6), you loosen the fourth string from behind (for me) and [the lyre is *embūbum* (strings 3-7).] (lines 17-20)

[If the lyre is *embūbum* (strings 3-7) (and) you play an unclear *kitmum* (strings 6-3), you loosen the third string (for me) and the lyre is] *pītum* (strings 7-4). (lines 21-24)[15]

Figure 5. The Seven Mesopotamian Modes of the Loosening Section

Mode	Clear	Unclear
išartum	2-6	5-2
kitmum	6-3	2-6
embūbum	3-7	6-3
pītum	7-4	3-7
nīd(i) qablim	4-1	7-4
nīš tuḫrim	1-5	4-1
qablītum	5-2	1-5

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[15] As above, < > indicate parts of the text that was omitted by the scribe, and [ ] indicate parts of the text that have been reconstructed.

The system is an elegant and practical means of tuning. Notice that the steps in testing clear and unclear intervals follow a sequence where there is always a string in common with the preceding dichord, or the string is directly above or below a string in the previous dichord. Thus, the physical action of testing dichords involves plucking open strings with one finger/hand in the sequence 2 (+9), 2 (+9), 3, 2 (+9), 3, 3, 4, 3, 4, 4, 5, 4, 5, 5; for the other finger/hand, the sequence is 6, 5, 6, 6, 7, 6, 7, 7, 1 (+8), 7, 1 (+8), 1 (+8), 2 (+9), 1 (+8).[16] Apart from the jumps involved in the pairing of strings 1 and 2 with strings 8 and 9, the limited and minor hand movements involved in the playing and testing of dichords during modulation and/or tuning must have made the process easy to remember and relatively quick to accomplish.[17]

The tightening section (partially reconstructed, as has already been mentioned) follows the same sequence from *išartum* to *išartum*, but in the opposite direction; that is, *qablītum*, *nīš tuḫrim,* etc. Each mode is defined by the same criteria as the loosening section, with the same dichords as clear and unclear. The difference is that the first string (as represented in Table 1 above) in the unclear dichord is tightened, instead of the second string loosened. Consequently, in the mode of *išartum* the *qablītum* dichord (strings 5-2) is unclear. In the loosening section, string 2 (and string 9, probably in an octave relationship, as already stated) is loosened. In the tightening section, string 5 is tightened. A further difference in the tightening section is that in each procedure the resulting mode bears the same name as the dichord that has just been made clear. In the tightening section, there is no need to confirm the fact that the instrument is now tuned to the new mode at the end of each procedure (as was the case

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[16] The number 1 follows 7 in the heptatonic system. String 1 is tuned together with string 8, and string 2 is tuned together with string 9.

[17] Whether or not the process of modulation would be quick and efficient enough to be accomplished during performance, or during a break between sections of a performance, is difficult to determine. If this was common practice, it would allow us to speculate on the role of modulation in the Hurrian Hymns, which are examples of notation from mid-second millenium BCE found at Ugarit (Syria) and which use Mesopotamian dichord names combined with numbers.

in the loosening section). This is implied and, in any case, is confirmed at the beginning of the next procedure, e.g., lines 4-11:

> If the lyre is *embūbum* and *kitmum* is not clear, you tighten the fourth string from behind (for me) and *kitmum* will become clear. (lines 4-7)

> If the lyre is *kitmum* and *išartum* is not clear, you tighten the second string and the back string (for me) and *išartum* will become clear. (lines 8-11)

The widely accepted and most elegant interpretation of this system of cyclical tuning and/or modulation proposes that the unclear interval is a tritone, which becomes clear by resolving to a perfect 5th or 4th by tightening or loosening. We cannot be sure that such an interpretation is correct. Indeed, it seems uncomfortably familiar and Eurocentric. I propose to leave the question of the precise nature of the Mesopotamian tuning system open. Jay Rahn has very ably examined the possibilities in great detail in two recent *AAWM* articles (Rahn 2011a, b). What I have attempted to demonstrate here are the bare facts—what we know that is beyond doubt.

The limitations to what we can know only from texts must also be borne in mind when we consider the oral dimension in Mesopotamian culture. It is likely that Mesopotamian music texts are examples of what might be called "orality in written form." It is well known that many cultures transmit knowledge, including musical knowledge, in an essentially oral form, which may be supplemented by writing. Certainly, this is the case with notation in its use almost everywhere, even in Europe.[18] It is also well known that notation and theoretical writings survive in cultures such as ancient India and China, but any attempt to reconstruct and decipher these materials must be tempered by the knowledge that they originated in a musical culture in which notation was not intended to be understood by those who were uninitiated in the oral tradition. Similarly, the culture of ancient Mesopotamia was one in which orality

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[18] Indeed, it has been convincingly argued that Western Medieval musical culture relied to a great degree on oral transmission, despite the use of notation and written treatises (Berger 2005).

certainly played an important role, despite our knowledge of tens of thousands of texts.[19]

To summarize, certain important characteristics of Mesopotamian music theory are apparent from the tuning text:

(1) The tuning text demonstrates the fact that approximately 3,500 to 4,000 years ago the concepts of musical interval, mode, and modulation were already at an advanced stage. Indeed, what has survived (by fortunate accident) from this period probably represents the culmination of a development of tuning and modal procedure that is considerably older.

(2) The tuning text applies to a particular instrument, the *sammû*, which is almost certainly a lyre or a harp; thus, the text is not a universal tuning manual for any instrument.

(3) According to this text, the instrument's "mode" is defined by a particular tuning of the instrument's open strings.

(4) The dichord formed by two open strings separated by three adjacent strings is the basis of the system.

(5) The conception of string dichords spans a heptatonic system, where 7 is followed by 1, etc. There are also seven modes.

(6) There are nine strings, with strings 8 and 9 tuned together with strings 1 and 2 respectively, suggesting a unison or octave relationship and providing further evidence for the heptatonic nature of the system.

(7) The system is a modulation cycle that can be traversed through loosening or tightening of strings. It demonstrates that the principle of gradual modulation through related modes was understood in this period. From the text itself the principle of modulation is conceived as the transformation of an instrument's tuning through the alteration of one string at a time.[20]

(8) If the accepted interpretation of the tuning text is correct, it would mean that relative pitch was important to the Mesopotamians, but precise pitch was not. For example, proceeding through the loosening section from *išartum* through *qablītum* and then onto *išartum* again would result in the instrument being in *išartum,* but one semitone lower than at the start. This view is reinforced by the fact that there seems to be no term for precise pitch in Mesopotamian music theory. There are only terms for strings and dichords, which can also be modes, depending on context.

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[19] For contributions to this issue, see Pruzsinsky and Shehata 2010.

[20] The exceptions are strings 1 and 2, which were tuned together with strings 8 and 9, probably in octaves.

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