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INNOVATIVE 17-NOTE NUMERICAL SYSTEM AND ITS COMPUTATIONAL METHOD TO IDENTIFY THE EFFECTS AND PSYCHOLOGICAL STATES OF MUSIC SCALE

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ABSTRACT. For centuries, Iranian philosophers and scientists believed that music is related to sciences such as mathematics, the four temperaments of humans, and astronomy; unfortunately, none of them provided explicit rules or mathematical formulations to substantiate their claims. Addressing the gap, this article introduces a 17-note numerical system along with a computational method designed to identify the psychological effects and emotional states associated with musical scales. New concepts, specifically the “innate scale” and “acquired scale,” are introduced with their distinctions and applications explored in both musical and numerical frameworks. Additionally, the study applies computational techniques and principles of numerical analysis to investigate the primary modes of the 7 Dastgāh system in Classical Persian Music. Although the 17-note system shares interval similarities with the ancient Abjad 18-note system, it differs substantially in numerical valuation, computational methodology, structural efficiency, and systematic approach to application. The findings can be applied to music therapy and theoretical music studies as an innovative, numerically grounded method that offers deeper insights into the psychological attributes of musical scales. The results reveal a significant correlation between the psychological states induced by musical scales and their innate temperament qualities, and by identifying the zodiac constellations associated with each scale, the psychological impacts of melodies can be further discerned. For instance, analysis of the primary mode in Dastgāh-e Chāhārgāh indicates that feelings of excitement align with the psychological quality of warm and dry. Furthermore, the computational approach revealed Chāhārgāh astrological with Leo, suggesting that its melodies naturally evoke qualities of courage, exhilaration, and radiant joy.

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Keywords: 17-note numerical system, Iranian music radif, music therapy, zodiac constellation, four temperaments of music.

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1. Introduction

Scientific music is a mathematical discipline that discusses the consonance and dissonance of notes, as well as the timing of tunes, to determine how to compose music [11]. The ancient musicians of Iran and Greece tried to relate modes in music to the zodiac with astronomical information and astrological computations of the authorities [25]. Some concepts in the history of astronomy have seriously affected the development of science and culture in many regions. The concept of the zodiac is one of them. The zodiac as a band of constellations, within which visible motions of the Moon and planets occur, played an important role in the astronomy of ancient Mesopotamia, ancient Greece, and countries of Islam. The ideas associated with the zodiac had not only astronomical but also astrological and religious significance. The history of the Mesopotamian zodiac is of particular importance, since it had a direct impact on the formation of ideas about the zodiac in ancient Greece and Islamic countries, and through them in Europe [16]. The zodiac is divided into twelve equal parts called signs: Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces [2]. In different parts of the book named Behjat ol-Rooh (happiness of the soul) written by Safi al-Din Ormavi (d.1294) are pointed out the relationship between the twelve Maqāms of Iranian music with the zodiac constellations. In a diagram, he related each Maqām to the zodiac and attributes it to the ancestors [31].

The zodiac has the properties of the four elements (water, earth, wind, and fire), and they affect the body's "temperament"¹ and humors (blood, phlegm, yellow bile, black bile) [1]. It is believed that created bodies based on four humors, namely blood, phlegm, yellow bile, and black bile. Two of them are hot and two are cold. There is a difference between the two; one is warm and dry, and the other is warm and moist, one is cold and dry, and the other is cold and moist [26]. Temperament in Persian means blending, and in traditional Iranian medicine, it refers to a quality that arises from the interaction between opposing qualities of the four elements (water, earth, air, and fire) [15]. The human mood is strongly affected by mental states; Some of these conditions affect the human mood quickly, and some slowly. For example, anger releases heat suddenly while pleasure releases heat gradually. Fear pushes the heat inside suddenly (the face turns white), but sadness pushes the heat inside little by little, and in the long run, it causes black bile diseases. In Table 1, six important mental states and the quality of each are stated [24].

TABLE 1. The relation between human mood temperament [24]

Temperament quality	Psychological quality
Warm and dry	<i>Anger</i>
Warm and dry	<i>Excitement</i>
Warm and moist	<i>Worry</i>
Cold and moist	<i>Fear</i>
Cold and dry	<i>Depression</i>
Cold and dry	<i>Sorrow</i>

¹Please refer to the reference in item [28].

The results of the GLM² analysis shows that temperament type is related to neuroticism. This relationship is greater in people with a black bile temperament and those who prefer the Dastgāh-e Shūr [5]. The high-pitched voice in music is warm and dry, and warms up the temperament while softening the rough nature. The low-pitched voice in music is cold and moist and cools down the temperament, which is very good to hear for warm and dry temperaments. The music that is between bass and treble keeps all temperaments balanced [2]. Persian philosophers invented twelve modes in music according to the twelve zodiac signs, which are considered the principal bases [27]. The mentioned twelve modes (and other modes) were performed in the old Iranian music of seventeen degrees and tonalities. For example, Safi al-Din Ormavi wrote the mode of Oshshāq from each of the seventeen degrees of scale. Therefore, according to the old saying, each mode includes seventeen tonalities, and thus the total tonality of the twelve main modes will be two hundred and four ($12 \times 17 = 204$) [9].

But the present system is restricted to seven Dastgāh, subdivided into numerous tunes [29]. A historical study of the emergence of Dastgāh shows that it was originally a concept of multimodal performance with roots in the concept of the proximity of modes that was first written down briefly in the fourteenth century. In the sixteenth century, a concept of multimodal performance instruction emerged in the musical texts, which outlined four multimodal performance suites that started with a certain mode and returned to the same mode [21].

The Iranian music repertoire (Radif-e Dastgāhi) includes a collection of modes, melodies, songs, and inner voices of the Iranian plateau that have been arranged systematically to facilitate teaching authentic Iranian music to students [4]. The names of the original seven Dastgāhs are Shūr, Māhūr, Homāyun, Chāhārgāh, Segāh, Navā, and Rāst-Panjgāh [17]. A Dastgāh is a musical structure composed of various pieces referred to as 'Gushe', beginning with a central 'mode' that serves as the foundation, or 'mother mode.' As the piece progresses, it transitions through different modes in a structured sequence. These sections typically conclude with a 'Forud' (cadence), which brings the music back to the mother mode [22].

2. History of the ancient Abjad musical notation System

Numbers were used in four different ways in the history of Iranian music. Firstly, they were used to determine the degrees of a scale, for which the letters of the alphabet³ were used in the method of melody notation [13], Secondly, they were used for calculations of distances relative to each other [10], Thirdly, they were used for rhythm or Iqāāt (the system of ancient music rhythm) [12], Fourthly, the science of acoustical physics [7, 23]. But due to the use of the first case (notation method) in this article, a brief explanation of the method of the pioneers of this technique in Iran is given as follows⁴.

²The general linear model (GLM) is a statistical analysis method.

³Numerical valuation system for letters.

⁴References to the first paragraph, "History of the ancient Abjad musical notation System," are for document presentation, and the sentences are not taken from the book.

Kendi (801-873) represented the notes of an octave⁵ using the letters of the alphabet from “Alef” to “Kāf” and repeated them in the second octave as well. Octave was referred to as “Al-Lazi Bel-Kull” and, like ancient Greece, was based on the Minor scale, starting from La as Ut and indicated two octaves as shown in Figure1:



FIGURE 1. (a) First octave, (b) Second octave

After him, Abu Nasr Farabi (d.950), a great Iranian musician and musicologist known as the Second Master, whom in the Western world is called Alfarabius, continued to solve the problem of two octaves by extending the sequence of letters from “lam” onwards in the second octave, i.e., “mim”, “non”, “sin”, etc. However, it is obvious that with this initiative, the degrees of notes in the octave could not be distinguished because each letter of the alphabet Abjad represents a numerical value. Thus, from “alef,” which is equivalent to 1 (unit) to “ya” it continues in order and reaches 10; but “kaf” becomes equivalent to 20 while it should be the eleventh note. It was Ibn Zayla Isfahāni (d.1048) (as cited book in Al-Kafi-fel-Musiqhi, 1964), one of Ibn Sina’s distinguished students, who succeeded in solving this problem by adding two letters after the eleventh degree using the Abjad system; i.e., “ya” (ye + alef = 11) and “yab” (ye + be = 12).

Then, another Iranian artist, Safi al-Din Abd al-Mumin Ormavi (d.1294), as seen in the valuable work “Al-Adwār fi-Musiqi”, extended the above approach and arranged a method for song-writing that Iranian and other Muslim musicians followed after him. In Safi al-Din Ormavi’s scheme, the octave is formed by 18 notes (with the repetition of Ut), and since these 18 notes create 17 intervals, it has become known and named as the 17-part system as shown in Figure2, assuming the base note is “Do”⁶.



FIGURE 2. Safi al-Din Ormavi’s scheme

As the works of Abdolqāder Marāghi (d.1434) [18], the last traditional musicologist of Iran, indicate that he continued from “Yah” to “Lah” in the second octave, which he called “Zilkolo Marratein,” following the method of Safi al-Din Ormavi [30]. Table 2 illustrates the above explanations.

⁵The eighth interval between any notes of the same name is called an octave.

⁶Please refer to Appendix “I” for more information on some of the musical signs and terminology used here.

TABLE 2. Design of the 18-note Abjad table of Safi al-Din Ormavi

C	D _b	D ₇	D	E _b	E ₇	E	F	G _b	G ₇	G	A _b	A ₇	A	B _b	B ₇	B	C
ا	ب	ج	د	هـ	و	ز	ح	ط	ی	یا	یب	یج	ید	یه	یو	یز	یح
Alef	Be	Jim	Dāl	He	Vāv	Ze	Hhe	Tā	Ye	Yā	Yab	Yaj	Yad	Yah	U	Yaz	Yahh
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Research Objectives:

1. Main Objective

To introduce and examine the relationship between the four human temperaments, zodiac constellations, and musical scales within an octave based on a 17-note division through numerical computations and the establishment of scientific rules.

2. Sub-Objectives

- A. To propose new definitions, including Intrinsic Scale, Acquired Scale, and Practical Scale, for analyzing the relationship between music, temperament, and astrology.
- B. To investigate and analyze the reasons for the absence of computational methods and rules in the past to prove this relationship.
- C. To develop a scientific framework for linking music, mathematics, temperament theory, and astrology based on the 17-note system.

3. Introducing the Seventeen-note numerical system (a novel theory)

Innovative numerical orders of musical scales⁷ and their computational methods based on common intervals of different scales in an octave will be introduced in twelve, seventeen, and twenty-four notes⁸ that have been developed to determine the innate and acquired temperaments⁹ and the relationship of the celestial zodiac constellation and planets of each scale¹⁰. This article presents the first study to examine the intricate relationship between the four human temperaments and the zodiac constellations, with musical scales. While earlier scholars acknowledged this connection, they failed to establish any logical, systematic, or computational frameworks to elucidate it. Moreover, their interpretations often diverged significantly, leaving room for ambiguity. While the 17-note system is similar in intervals to the 18-note system of the ancient Abjad, it differs considerably in its approach and application.

⁷In this article, new topics such as the innate scale, the acquired scale, the practical scale, Makāni numbers, and Manzeli numbers have been discussed, and understanding them correctly will greatly help comprehend the article's subject. It is also worth mentioning that the connection of musical scale with the temperaments and constellations of the zodiac means that the melodies in the scale attract and transfer the characteristics and energies of the temperaments and constellations of the corresponding zodiac.

⁸The 17- and 24-note interval models incorporate quarter-tone intervals, which are often misunderstood as referring exclusively to either upward (Koron) or downward (Sori) adjustments. In contrast, the 12-note interval model does not include quarter-tone intervals. While this article employs the term 'Koron,' readers are encouraged to consult the appendices (I) for a more detailed explanation.

⁹The word (temperament) in this article is the four temperaments of humans referred to as warm/cold and dry/moist, taken from the four elements.

¹⁰Refer to Appendices (II), (III), and (IV) for more explanation.

The importance and current research aim to address this pivotal subject by leveraging computational methodologies, striving to deepen our understanding of these fascinating interconnections.

In a computational numerical system with 17 notes, the initial note “Do” and the final note “Si”, the ascending process (in total, 17 notes or 16 unequal consecutive intervals)¹¹ is introduced in two models: Makāni and Manzeli (place-value notation and positional), with the same ordering but different numerical values with common computational rules. As shown in Table 3, the order of notes, Makāni numbers, and as in Table 4 based on valuation, are the Manzeli numbers values.

TABLE 3. 17-note numerical Makāni Model

Note symbols	C	D _b	D _♯	D	E _b	E _♯	E	F	G _b	G _♯	G	A _b	A _♯	A	B _b	B _♯	B
Note names	Do	Re _b	Re _♯	Re	Mi _b	Mi _♯	Mi	Fa	Sol _b	Sol _♯	Sol	La _b	La _♯	La	Si _b	Si _♯	Si
Makāni numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

TABLE 4. 17-note numerical Manzeli Model

Note symbols	C	D _b	D _♯	D	E _b	E _♯	E	F	G _b	G _♯	G	A _b	A _♯	A	B _b	B _♯	B
Note names	Do	Re _b	Re _♯	Re	Mi _b	Mi _♯	Mi	Fa	Sol _b	Sol _♯	Sol	La _b	La _♯	La	Si _b	Si _♯	Si
Manzeli numbers	1	2	3	4	5	6	7	8	9	2	3	4	5	6	7	8	9

In the Makāni model, the note Sol Koron is equal to 10, and in the Manzeli model, it is equal to 2, which changes in subsequent notes based on this basis. The correspondence of note degrees with their numbers in the Makāni table is obvious, but the logic and reason for changing numbers in the Manzeli table are due to avoiding two-digit numbers. Therefore, the formula for valuing Manzeli notes is as follows:

- A) For single-digit numbered notes, the number of distances from the starting note with the number 1 should be added together.
- B) For double-digit numbered notes, the number of distances from the starting note with the number 2 should be added together, then to avoid double-digit numbers, add up the digits of the resulting number.

In other words, assume that x and b are natural numbers such that:

x . represents a note number in the Manzeli model table.

b . represents the number of intervals from the starting note “C” as shown in Figure 3.

¹¹Theoretically (though not in practice), it is assumed that diatonic and chromatic semitones are equal in size, and a quarter-tone represents $\frac{1}{4}$ of a whole tone. Therefore, microtonal units (Comma, Savart, Cent) are not considered here.

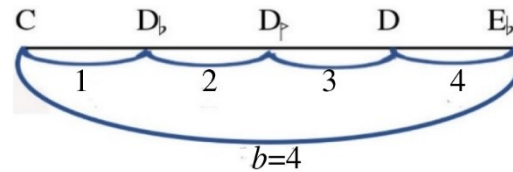


FIGURE 3. The number of intervals from the starting note

$$x = \begin{cases} b + 1, & 1 \leq b \leq 8, \\ b + 2, & 9 \leq b \leq 16. \end{cases}$$

Whenever $1 \leq b \leq 8$, the Manzeli number of the desired note will be x itself.

Whenever $9 \leq b \leq 16$ and x is a two-digit number $x = b_1b_2$ then the components are added together, $b_1 + b_2$, to obtain the desired Manzeli note number.

For example, to obtain the note number of Gd , its interval is $b = 9$, which is equal to $x = 2 + 9 = 11$, and the sum of the components is 2, i.e., $1 + 1 = 2$.

Note: The half step notes in Tables Makāni and Manzeli are displayed as chromatic intervals. But if there is a diatonic half step in a scale, one is subtracted from the number of that note. For example, the number Makāni “ $A_\flat$ ” is equal to the number 12, and Manzeli is 4 which in location “ $G^\sharp$ ” accounts for Makāni will be 11 and for Manzeli 3. This feature is also present in the Holdrian comma number of chromatic and diatonic half steps. Similarly, notes of Chromatic are 5 commas, and Diatonic 4 commas are considered.

4. Features of the table of Makāni and Manzeli models of notes

First, it should be noted that the proposed models (Makāni and Manzeli) in Iranian and Western music theories have no precedent for the purpose described. Therefore, this article is introduced as the first research in this field and which is dedicated to investigating this important issue using computational methods. Based on the experiences of this research in the structure of the 17-note system, to obtain the correct computational results, all numbers and remainders of the division by 12 must be added up and divided by 9. As indicated in Table 5,6, the sum of the numerical values of all notes in the Makāni model is equal to one hundred and fifty-three (153) with the sum of the digits equal to 9. The remainder of the sum of the number of notes divided by twelve¹² is also “9”, indicating that the Makāni model is correct. In the Manzeli model, the sum of all numbers is equal to eighty-nine (89), which is equal to the number of notes, seventeen (17). The remainder of the number 89 divided by 12 is also 5, indicating five notes with a quarter-tone (koron) interval as given in Table 6.

¹²See appendix: (VI).

TABLE 5. Calculation method for the Makāni system

The sum of numbers of nites of Makāni table	Sum of the digits
$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 + 14 + 15 + 16 + 17 = 153$	$1+5+3=9$
Quotient	Remainder
$153 \div 12 = 12$	9

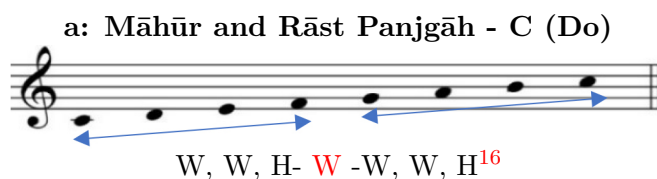
TABLE 6. Calculation method for the Manzeli system

The sum of numbers of nites of Manzeli table	Sum of the digits
$1+2+3+4+5+6+7+8+9+2+3+4+5+6+7+8+9 = 89$	$8 + 9 = 17$
Quotient	Remainder
$89 \div 12 = 7$	5

5. Review of Iranian Music Repertoire based on 17-note

Before delving further into the discussions of this topic to prove and validate the concept of Makāni and Manzeli tables, accompanied by their computational method, a brief explanation is necessary. In terms of the structure of the intervals of the notes of two tetrachords in one scale, with the “Major second” interval between them, is introduced in numerical systems in two forms, namely¹³ symmetrical and asymmetrical scales¹⁴.

5.1. Symmetrical scales. Symmetrical scales are formed by two consecutive tetrachords with identical interval patterns, separated by a whole step (major second), such as Māhūr,¹⁵ Rāst-Panjgāh, and Chāhārgāh as shown in Figure 4. However, the similarity in structure and form of the two tetrachords is not enough evidence, and the sum of the numbers of the notes in both tetrachords must also be equal to the 24-note numerical Manzeli system (which will be explained in the next article).



¹³The scales introduced according to the calculations of the numerical system are Innate scales. For more information, refer to appendix number (II).

¹⁴It is assumed that the distances of the flats note and the sharps note are the same in the ascending and descending steps of the scales.

¹⁵The first Māhūr's mode corresponds to the natural major scale.

¹⁶In old Iranian music, they used to say the Whole step: “Tanini”, and Half step: “Baghiyeh”.

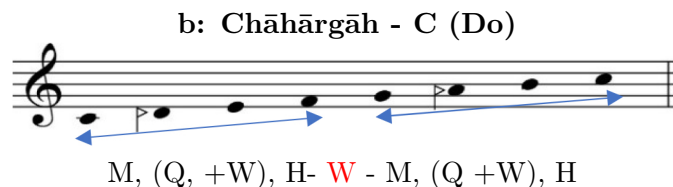


FIGURE 4. Symmetrical scales example a and b

Note1: “M” is “Mojannab = Half step $\pm$ quarter-tone (ascending or descending).

Note2: “Q” is a quarter-tone.

5.2. Asymmetrical scales. Asymmetric scales are formed by two dissimilar tetrachords separated by a whole step (major second), creating an octave with contrasting interval patterns. This creates a non-uniform pattern, as seen in musical scales such as Segāh, Shūr, Navā, Homāyun, as shown in Figure 5 (it should be noted that the numbers obtained from each tetrachord system will differ due to the 24-note system used).

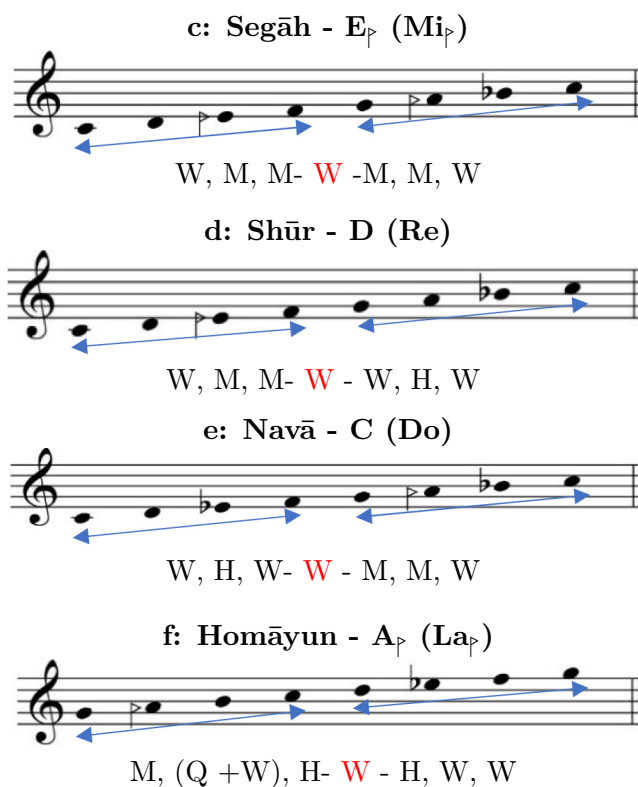


FIGURE 5. Asymmetrical scales example c to f

Since the purpose of this article is to introduce the 17-note system and its calculations, the internal esoteric qualities of scales and their variables are not discussed. But notes play a special role in a scale. One point is important to mention here:

Shāhed note: The Shāhed note is the main note around which the melody evolves, the note to which melodic passages constantly return [19]. Also, the Shāheds were introduced based on the ascending degree of the scale.

TABLE 7. Specifications of scale Modes

Number	Mode	Shāhed note
1	Māhūr	<i>Tonic</i>
2	Rāst-Panjgāh	<i>TonicthenSupertonic</i>
3	Chāhārgāh	<i>Tonic</i>
4	Segāh	<i>Mediant</i>
5	Shūr	<i>Tonic</i>
6	Navā	<i>Tonic</i>
7	Homāyun	<i>Supertonic</i>

6. Calculation notation

The notations used in this paper are presented in Table 8.

TABLE 8. Calculation notation of 17-note numerical system

Explanation	Notation
Symmetrical scale with a Shāhed note	St_1
Symmetrical scale with two Shāhed notes	St_2
Asymmetric scale with a Shāhed note	$\check{St}_1$
Sum of the notes	Sn_8
First Shāhed note	t_1
Second Shāhed note	t_2
First scale element in computational steps	es_1
Second scale element in computational steps	es_2
Extracted number	e
Answers to calculations in the first, second, and third steps	a_1, a_2, a_3
Obtained number from total calculations	TC
Final innate element of scale (temper notation)	Tes
Scale zodiac constellation	Sz

7. Computational rules of the 17-note numerical system

Through a lengthy computational process of trial and error in cases (I) and (IV), and with the assistance of the old established system in cases (II) and (III), the following rules have been established:

- (I) The result of calculations in the Makāni and Manzeli systems must be the same.
- (II) To obtain the scale element (innate temper scale), divide the last number in the total calculation by 4, and the remainder will be the scale element, i.e.,

$$TC \stackrel{4}{\equiv} Tes.$$

The notation $a \stackrel{c}{\equiv} b$ means that b is the remainder of a divided by c .

Each element is also associated with a temperament. The numerical notation of each element and its temperaments are indicated in Table 9 [3].

TABLE 9. Numerical notations of each element and their temperament [3].

Element	Fire	Wind	Water	Earth
Temper	Warm and dry	Warm and moist	Cold and moist	Cold and dry
Notation	1	2	3	0

Note: When the remainder is zero, “Tes” and “es” represent earth, but the ancient people considered the number 4 as its symbol.

- (III) Obtaining the corresponding scale zodiac constellation: the remainder of dividing the total number of calculations by the number 12 will be the corresponding scale zodiac constellation, i.e.,

$$TC \stackrel{12}{\equiv} Sz.$$

The numerical notation of each zodiac constellation is shown in Table 10.

TABLE 10. Numerical notations of zodiac constellation

Zodiac	Aries	Taurus	Gemini	Cancer	Leo	Virgo
Notation	1	2	3	4	5	6
Zodiac	Libra	Scorpio	Sagittarius	Capricorn	Aquarius	Pisces
Notation	7	8	9	10	11	12

Note: When the remainder is zero, “Sz” represents Pisces, but ancient people considered the number 12 as its symbol.

- (IV) Extracted number Instruction: This number, which is used for asymmetric scales according to Table 10, is one of the numbers 4, 8, or 12 based on computational experience. The extraction method is as follows: If the note (Shāhed) is part of the first three columns (1, 2, 3), the number is 4. If it is part of the second three columns (4, 5, 6), the number is 8. If it is part of the third three columns (7, 8, 9), the number is 12. However, since adding the number 12 does not affect the result, it can be ignored in calculations (The extracted number is necessary for accurate calculation of the corresponding scale zodiac constellation).

TABLE 11. Table of extracted number

Number	1	2	3	4	5	6	7	8	9
Note	Do	Re _b	Re _p	Re	Mi _b	Mi _p	Mi	Fa	
Note	Sol _b	Sol _p	Sol	La _b	La _p	La	Si _b	Si _p	Si

Since the 17-note system is an incomplete pattern taken from 24 notes, the above-extracted table is arranged in the order of 24 notes, then the notes not used in the 17-note system are removed, so the ninth cell of the first row remains empty.

8. Computational method of the 17-note numerical system

Before discussing the computational method, it should be noted that the author has arrived at this numerical system and computational method through trial and error and testing various methods.

Additionally, the notations defined in Table 7 of the 17-note numerical system have been used for calculations. Although the numbers of the Makāni and Manzeli value tables have equal functionality for all ethnic and national music, the following examples are specific to examining the initial scales of Iranian traditional music repertoire, and each type of music will have its computational method depending on its modal foundation.

8.1. Symmetrical scales with a Shāhed note.

- A. The sum of the scale numbers (which are eight notes) is multiplied by the Shāhed note is defined as $a_1 := Sn_8 \times t_1$, where the $:=$ notation represents a definition or an assignment.
- B. The answer to item A is divided by 4 to determine the remainder of the scale, which is the scale element (es_1). Then, the element number (es_1) is multiplied by 4 because there are four seasons in a year (symbolized by four temperaments), i.e.,

$$a_1 \stackrel{4}{\equiv} es_1, \quad a_2 := es_1 \times 4.$$

- C. The answers to steps A and B are added together, i.e., $TC = a_1 + a_2$.

8.2. Symmetrical scales with two Shāhed notes.

- A. The sum of the scale numbers (which are eight notes) is multiplied by the number of the first Shāhed note as $a_1 := Sn_8 \times t_1$
- B. The answer to step A is divided by 4 to determine the remainder, which is the scale element (es_1). Then, the scale element (es_1) is multiplied by 4 to obtain a_2 as

$$a_1 \stackrel{4}{\equiv} es_1, \quad a_2 := es_1 \times 4.$$

- C. The answers from steps A and B are added together, i.e., $a_3 = a_1 + a_2$.
- D. The second Shāhed note is multiplied by the element number from step C as follows:

$$a_3 \stackrel{4}{\equiv} es_2, \quad a_4 := es_2 \times t_2.$$

- E. The answers from steps C and D are added together to obtain $TC = a_3 + a_4$.

8.3. Asymmetric scales with a Shāhed note. For calculations of asymmetric scales with a Shāhed note, the same method as symmetric scales with a Shāhed note is used except in the final step of the asymmetric scale, the extracted number, e , from the previous steps, a_1 and a_2 , is added $TC = a_1 + a_2 + e$.

9. Findings

Māhūr - C (Do): Symmetrical scale with a Shāhed note as shown in tables 12 and 13.

TABLE 12. (Makāni) - The Shāhed note is Do =1

C	D	E	F	G	A	B	C	Total
1	4	7	8	11	14	17	1	63
$a_1 = 63 \times 1 = 63,$ $es_1 : 63 \stackrel{4}{\equiv} 3,$ $a_2 = 3 \times 4 = 12,$ $TC = 63 + 12 = 75.$								

A¹⁷: The remaining number is 3 and its temperament is cold and moist.

$$75 \stackrel{4}{\equiv} 3$$

B¹⁸: The remaining number 3 and the constellation scale is Gemini.

$$75 \stackrel{12}{\equiv} 3$$

TABLE 13. (Manzeli) - The Shāhed note is Do =1

C	D	E	F	G	A	B	C	Total
1	4	7	8	3	6	9	1	39
$a_1 = 39 \times 1 = 39,$ $es_1 : 39 \stackrel{4}{\equiv} 3,$ $a_2 = 3 \times 4 = 12,$ $TC = 39 + 12 = 51.$								

A . The remaining number is 3 and its temperament is cold and moist.

$$51 \stackrel{4}{\equiv} 3$$

B . The remaining number 3 and the constellation scale is Gemini.

$$51 \stackrel{12}{\equiv} 3$$

Chāhārgāh - C (Do): Symmetrical scale with a Shāhed note as given in tables 14 and 15.

TABLE 14. (Makāni) - The Shāhed note is Do =1

C	D _p	E	F	G	A _p	B	C	Total
1	3	7	8	11	13	17	1	61
$a_1 = 61 \times 1 = 61,$ $es_1 : 61 \stackrel{4}{\equiv} 1,$ $a_2 = 1 \times 4 = 4,$ $TC = 61 + 4 = 65.$								

A . The remaining number is 1 and its temperament is warm and dry.

$$65 \stackrel{4}{\equiv} 1$$

B . The remaining number 5 and the constellation scale is Leo.

$$65 \stackrel{12}{\equiv} 5$$

¹⁷Corresponding scale temper: The intended meaning is the innate temperament of the scale.

¹⁸Corresponding scale zodiac constellation: The intended meaning is zodiac constellation of the scale.

TABLE 15. (Manzeli) - The Shāhed note is Do =1

C	D _p	E	F	G	A _p	B	C	Total
1	3	7	8	3	5	9	1	37
$a_1 = 37 \times 1 = 37, \quad es_1 : 37 \stackrel{4}{\equiv} 1, \quad a_2 = 1 \times 4 = 4,$ $TC = 37 + 4 = 41.$								

A . The remaining number is 1 and its temperament is warm and dry.

$$41 \stackrel{4}{\equiv} 1$$

B . The remaining number 5 and the constellation scale is Leo.

$$41 \stackrel{12}{\equiv} 5$$

Rāst Panjgāh - C (Do): Symmetrical scale with two Shāhed notes as indicated in tables 16 and 17.

TABLE 16. (Makāni) - The Shāhed note are Do =1 and Re=4

C	D	E	F	G	A	B	C	Total
1	4	7	8	11	14	17	1	63
$a_1 = 63 \times 1 = 63, \quad es_1 : 63 \stackrel{4}{\equiv} 3, \quad a_2 = 3 \times 4 = 12,$ $a_3 = 63 + 12 = 75, \quad es_2 : 75 \stackrel{4}{\equiv} 3, \quad a_4 = 3 \times 4 = 12, \quad TC = 75 + 12 = 87.$								

A . The remaining number is 3 and its temperament is cold and moist.

$$87 \stackrel{4}{\equiv} 3$$

B . The remaining number 3 and the constellation scale is Gemini.

$$87 \stackrel{12}{\equiv} 3$$

TABLE 17. (Manzeli) - The Shāhed note are Do =1 and Re=4

C	D	E	F	G	A	B	C	Total
1	4	7	8	3	6	9	1	39
$a_1 = 39 \times 1 = 39, \quad es_1 : 39 \stackrel{4}{\equiv} 3, \quad a_2 = 3 \times 4 = 12,$ $a_3 = 39 + 12 = 51, \quad es_2 : 51 \stackrel{4}{\equiv} 3, \quad a_4 = 3 \times 4 = 12, \quad TC = 51 + 12 = 63.$								

A . The remaining number is 3 and its temperament is cold and moist.

$$63 \stackrel{4}{\equiv} 3$$

B . The remaining number 3 and the constellation scale is Gemini.

$$63 \stackrel{12}{\equiv} 3$$

Segāh - E_p (Mi_p): Asymmetric scale with a Shāhed note as shown in tables 18 and 19.

TABLE 18. (Makāni) - The Shāhed note is $Mi_{\flat} = 6$

C	D	$E_{\flat}$	F	G	$A_{\flat}$	$B_{\flat}$	C	Total
1	4	6	8	11	13	15	1	59
$a_1 = 59 \times 6 = 354, \quad es_1 : 354 \stackrel{4}{\equiv} 2, \quad a_2 = 2 \times 4 = 8,$ $TC = 354 + 8 + 8 = 370.$								

A . The remaining number is 2 and its temperament is warm and moist.

$$370 \stackrel{4}{\equiv} 2$$

B . The remaining number 10 and the constellation scale is Capricorn.

$$370 \stackrel{12}{\equiv} 10$$

TABLE 19. (Manzeli) - The Shāhed note is $Mi_{\flat} = 6$

C	D	$E_{\flat}$	F	G	$A_{\flat}$	$B_{\flat}$	C	Total
1	4	6	8	3	5	7	1	35
$a_1 = 35 \times 6 = 210, \quad es_1 : 210 \stackrel{4}{\equiv} 2, \quad a_2 = 2 \times 4 = 8,$ $TC = 210 + 8 + 8 = 226.$								

A . The remaining number is 2 and its temperament is warm and moist.

$$226 \stackrel{4}{\equiv} 2$$

B . The remaining number 10 and the constellation scale is Capricorn.

$$226 \stackrel{12}{\equiv} 10$$

Homāyun - $A_{\flat}$ ($La_{\flat}$): Asymmetric scale with a Shāhed notes as indicated in tables 20 and 21.

TABLE 20. (Makāni) - The Shāhed note is $La_{\flat} = 13$

G	$A_{\flat}$	B	C	D	$E_{\flat}$	F	G	Total
11	13	17	1	4	5	8	11	70
$a_1 = 70 \times 13 = 910, \quad es_1 : 910 \stackrel{4}{\equiv} 2, \quad a_2 = 2 \times 4 = 8,$ $TC = 910 + 8 + 8 = 926.$								

A . The remaining number is 2 and its temperament is warm and moist.

$$926 \stackrel{4}{\equiv} 2$$

B . The remaining number 10 and the constellation scale is Taurus.

$$926 \stackrel{12}{\equiv} 2$$

TABLE 21. (Manzeli) - The Shāhed note is $\text{La}_{\text{p}} = 5$

G	A_{p}	B	C	D	$\text{E}_{\flat}$	F	G	Total
3	5	9	1	4	5	8	3	38
$a_1 = 38 \times 5 = 190, \quad es_1 : 190 \stackrel{4}{\equiv} 2, \quad a_2 = 2 \times 4 = 8,$ $TC = 190 + 8 + 8 = 206.$								

A . The remaining number is 2 and its temperament is warm and moist.

$$206 \stackrel{4}{\equiv} 2$$

B . The remaining number 10 and the constellation scale is Taurus.

$$206 \stackrel{12}{\equiv} 2$$

Navā - C (Do): Asymmetric scale with a Shāhed note as given in tables 22 and 23.

TABLE 22. (Makāni) - The Shāhed note is $\text{DO} = 1$

C	D	$\text{E}_{\flat}$	F	G	A_{p}	$\text{B}_{\flat}$	C	Total
1	4	5	8	11	13	15	1	58
$a_1 = 58 \times 1 = 58, \quad es_1 : 58 \stackrel{4}{\equiv} 2, \quad a_2 = 2 \times 4 = 8,$ $TC = 58 + 8 + 4 = 70.$								

A . The remaining number is 2 and its temperament is warm and moist.

$$70 \stackrel{4}{\equiv} 2$$

B . The remaining number 10 and the constellation scale is Capricorn.

$$70 \stackrel{12}{\equiv} 10$$

TABLE 23. (Manzeli) - The Shāhed note is $\text{DO} = 1$

C	D	$\text{E}_{\flat}$	F	G	A_{p}	$\text{B}_{\flat}$	C	Total
1	4	5	8	3	5	7	1	34
$a_1 = 34 \times 1 = 34, \quad es_1 : 34 \stackrel{4}{\equiv} 2, \quad a_2 = 2 \times 4 = 8,$ $TC = 34 + 8 + 4 = 46.$								

A . The remaining number is 2 and its temperament is warm and moist.

$$46 \stackrel{4}{\equiv} 2$$

B . The remaining number 10 and the constellation scale is Capricorn.

$$46 \stackrel{12}{\equiv} 10$$

Shūr - D (Re): Asymmetric scale with a Shāhed note as indicated in tables 24 and 25.

TABLE 24. (Makāni) - The Shāhed note is Re =4

C	D	E _p	F	G	A	B _b	C	Total
1	4	6	8	11	14	15	1	60
$a_1 = 60 \times 4 = 240, \quad es_1 : 240 \stackrel{4}{\equiv} 4, \quad a_2 = 4 \times 4 = 16,$ $TC = 240 + 16 + 8 = 264.$								

A . The remaining number is 0 and its temperament is cold and dry.

$$264 \stackrel{4}{\equiv} 0$$

B . The remaining number 0 and the constellation scale is Pisces.

$$264 \stackrel{12}{\equiv} 0$$

TABLE 25. (Manzeli) - The Shāhed note is Re =4

C	D	E _p	F	G	A	B _b	C	Total
1	4	6	8	3	6	7	1	36
$a_1 = 36 \times 4 = 144, \quad es_1 : 144 \stackrel{4}{\equiv} 4, \quad a_2 = 4 \times 4 = 16,$ $TC = 144 + 16 + 8 = 168.$								

A . The remaining number is 0 and its temperament is cold and dry.

$$168 \stackrel{4}{\equiv} 0$$

B . The remaining number 0 and the constellation scale is Pisces.

$$168 \stackrel{12}{\equiv} 0$$

The results of calculation steps for seven Dastgāhs in two Makāni and Manzeli models are shown in Tables 26 to 31, and their temperament and zodiac constellations are also presented in Table 32.

TABLE 26. Symmetrical scale Makāni model to a Shāhed note

Mode	Sn_8	t_1	a_1	es_1	a_2	TC	Tes	Sz
Māhūr	63	1	63	3	12	75	3	3
Chāhārgāh	61	1	61	1	4	65	1	5

TABLE 27. Symmetrical scale Manzeli model to a Shāhed note

Mode	Sn_8	t_1	a_1	es_1	a_2	TC	Tes	Sz
Māhūr	39	1	39	3	12	51	3	3
Chāhārgāh	37	1	37	1	4	41	1	5

TABLE 28. Symmetrical scale Makāni model with two Shāheds note

Mode	Sn_8	t_1	a_1	es_1	a_2	a_3	t_2	es_2	a_4	TC	Tes	Sz
Rāst-Panjgāh	63	1	63	3	12	75	4	3	12	87	3	3

TABLE 29. Symmetrical scale Manzeli model with two Shāheds note

Mode	Sn_8	t_1	a_1	es_1	a_2	a_3	t_2	es_2	a_4	TC	Tes	Sz
Rāst-Panjgāh	39	1	39	3	12	51	4	3	12	63	3	3

TABLE 30. Asymmetric scale Makāni model to a Shāhed note)

Mode	Sn_8	t_1	a_1	es_1	a_2	TC	Tes	Sz
Segāh	59	6	354	2	8	370	2	10
Homāyun	70	13	910	2	8	926	2	2
Navā	58	1	58	2	8	70	2	10
Shūr	60	4	240	4	16	264	0	0

TABLE 31. Asymmetric scale Manzeli model to a Shāhed note)

Mode	Sn_8	t_1	a_1	es_1	a_2	TC	Tes	Sz
Segāh	35	6	210	2	8	226	2	10
Homāyun	38	5	190	2	8	206	2	2
Navā	34	1	34	2	8	46	2	10
Shūr	36	4	144	4	16	168	0	0

10. Discussion

In this article, the initial scales of 7 Dastgāh Iranian music are evaluated. The following points are worthy of attention for ease and clarity of the content:

- 1 . The temperament of musical scales is divided into innate and acquired temperaments. The innate temperament is calculated numerically from the intervals of the scale, while the acquired temperament is created by factors that cause a change in the primary temperament. Therefore, the effects of the innate temperament of each note remain more or less intact despite acquiring an acquired temperament. For example, a person with a certain innate temperament¹⁹ and its structural characteristics (such as body parts and bones relative to other innate temperaments) will almost preserve the effects of their innate temperament throughout their life, even if they acquire an acquired temperament. For this reason, the similarity of acquired temperaments in each scale is related to factors such as season quality, zodiac constellation, corresponding planet, and tonality of the related system. For example, as shown in the table of innate temperaments seven Dastgāh in the traditional music of Iran Dastgāh-e Māhūr has a cool and moist nature, but it is dominated by the warm and moist qualities of the Gemini sign²⁰.
- 2 . To ensure the correct results for innate and zodiac scales, one must reach the same results using four computational tables (two models of the 17-note numerical system, a Manzeli model of the 24-note numerical system, for scales containing quarter-tone intervals, and a Manzeli

¹⁹See appendix: (VII).

²⁰For referring to the temperamental characteristics of the elements from the perspective of Iranian traditional medicine, see references [24].

model of the 12-note for equal-tempered scales without quarter-tones, which will be explained in the future articles). In the first step, the answer must be the same in two models (Makāni and Manzeli) of 17-notes, then the same result should be obtained in the 24-note system. For example, the Māhūr scale of “Do” in both models of 17-note and 24-note Manzeli systems is introduced with a cold and moist temperament with the zodiac sign of Gemini, but if the scale is not innate, the results in the computational model of the systems will not be the same, such as in the Māhūr scale of “Fa” in the Makāni model, it has a cold and dry temperament with the zodiac sign of Cancer, and in the Manzeli model, it has a cold and dry temperament with the zodiac sign of Scorpio, and in the 24-note system it has a warm and dry temperament with the zodiac sign of Sagittarius²¹. Therefore, the Māhūr scale of Fa is not an innate scale. In other words, the calculations of the positions or scales mentioned in this article are examined from each of the seventeen degrees²², and only one consistent scale is presented in the 3 mentioned tables (two tables from the 17 notes system and one table from the 24 notes system), which will be the innate scale.

- 3 . In the table of innate temperament and the zodiac constellation of seven Dastgāh presented in the findings, some Dastgāh share a common element and zodiac sign but have different characteristics for various reasons. For example, the modes of Segāh and Navā are in the Capricorn, but their intervals are distinct, which can be compared to genetic differences where individuals born under a common zodiac sign may have different traits due to genetic variation. It is important to know these issues in the science of music therapy. For example, two foods that have two different tastes but have similar properties. Just as people have different favorites in the taste of food, psychological taste is also different in choosing the type of music. Similarly, Māhūr and Rāst-Panjgāh from Gemini are members of the same family with the same behavior but different spirits.

Finally, the fundamental difference between the 17-note (16-intervals) numerical system and the ancient Abjad-based 18-note (17-intervals) system can be explained as follows:

- 1 . Structural difference: The ancient model is an 18-note (17-interval) system, while the current model is a 17-note (16-interval) system. In the 17-note system, the initial note “C” and the octave “C” are both equivalent to the number “1”, as it returns to the starting point of its movement like a circle; but in the 18-note system, which is indicated by the symbol “Yahh”, it is equivalent to “18” (the Abjad letters of “Ye” (10) and “hhe” (8), which add up to 18), meaning that a position has also been assigned for the octave like other notes.
- 2 . The difference in numerical valuation: In the Abjad system, in addition to the numerical difference between the note “C” in different octaves, the note “G” with the symbol of the letter “Ye” is equal to the number 11, but in the seventeen-note system, the numerical value of the

²¹In the 12-note system, “F major” is cold and dry with the zodiac sign of Pisces.

²²See the introduction of reference [9].

note “C” in different octaves remains unchanged and in the Manzeli model, the note “G” is equal to number 3, and similarly, other subsequent notes are also different.

- 3 . Difference in computational method: Abjad-based 18-note calculations are based on determining the degrees and ratios of the distances between notes, while the computational method of the 17-note system is based on algebraic calculations and numerical systems.
- 4 . Difference in systematic efficiency: The structure of the 18-note system is based on Abjad alphabetical letters and is used for the method of writing and extracting modal cycles and positions of notes; whereas the 17-note numerical system is a computational system for achieving temperamental qualities, the effects of constellations on music, and mathematical reasoning relationships in theory.

At first glance, the 17-note numerical system and its associated calculations may appear similar to the 18-part Abjad division theory; however, in reality, these two systems represent distinct and separate concepts. Regarding the connection between temperaments and zodiac constellations, with the primary modes of Iranian musical scales, although past scholars did not establish specific criteria or computational rules to explain this relationship, findings suggest that this perspective may indeed hold validity. Unfortunately, the names of scales in contemporary music have diverged from those used by ancient Iranian scholars, making it challenging to accurately interpret the insights of past musicians. Nevertheless, the speculation by some contemporary musicians that the ancient mode of ‘Oshshāq’²³ corresponds to the primary mode of the Dastgāh-e Māhūr aligns with the findings of this study²⁴. Despite the lack of explicit formulas or calculations from ancient musicians, it seems their insights were largely intuitive, passed down orally or as personal opinions to subsequent generations. This article represents the first research to explore such a relationship by introducing the 17-note numerical system and its computational method.

11. Conclusion

The computational results confirm that, despite differences in the valuation of notes between the Makāni and Manzeli models, the formulation of the 17-note numerical system consistently and reliably evaluates the primary scales within the seven Dastgāh of contemporary traditional Persian music. A significant relationship is established between these numerical evaluations and the psychological qualities attributed to each mode.

Furthermore, the computational findings show that the psychological states of each scale²⁵ correspond significantly to the innate temperament quality of the primary scale of mode. For example, excitement

²³In this regard, some people have associated Oshshāq with the zodiac sign Scorpio, see Reference [8], while others have associated them with the zodiac sign Gemini. See Reference [2, 27].

²⁴In ancient Iranian music, the Oshshāq is the first of the twelve main Maqāms, and its intervals correspond to the Maqām-e Māhūr in the musical Radif.

²⁵There is no record of knowing the psychological states of music through numbers, and in Iranian books, musicians’ opinions are expressed through the feelings they receive. That is why there is no common agreement in some opinions. For information with such sentimental comments, see reference [14].

with psychological quality of warmth and dryness²⁶ corresponds to the Dastgāh-e Chāhārgāh, anxiety with warm and moist psychological quality corresponds to the Dastgāh-e Segāh, love, and reflection with warm and moist psychological quality corresponds to the Dastgāh-e Homāyun, dignity and calmness with cold and moist psychological quality correspond to the Dastgāh-e Māhūr and Dastgāh-e Rāst-Panjgāh, while sadness with cold and dry psychological quality corresponds to the Dastgāh-e Shūr. The quality of warm and moist psychological stability is also significantly related to the Dastgāh-e Navā. This result is consistent with the findings of Aslani and Karimi (2018), who noted that individuals with warm and moist temperament have the greatest interest in Dastgāh-e Navā, the warm and dry temperament in Dastgāh-e Chāhārgāh, and the cold and moist temperament in Dastgāh-e Māhūr [6].

The results demonstrate that, through calculations based on the 17-note numerical system, the innate temperament of each scale and its connections to the zodiac signs are identified. As illustrated in Table 31, each zodiac sign possesses a distinct temperament, and a scale's innate temperament may differ from its associated zodiac sign. This discrepancy creates unique interactions between the zodiac sign and the scale's temperament. The scale's innate temperament influences the psychological states evoked by the melody, while the zodiac sign's temperament conveys additional effects. When the zodiac sign's temperament aligns with the scale's innate temperament, the combined impact on the overall temperament is amplified, resulting in harmonized mental states and temperamental influences²⁷.

TABLE 32. Innate temperament and zodiac constellation table 7-Dastgāh classical Persian music.

Mode	Innate temperament	Zodiac sign	zodiac temperament
Homāyun	Warm and moist	Taurus	Cold and dry
Māhūr	Cold and moist	Gemin	Warm and moisti
Rāst-Panjgāh	Cold and moist	Gemini	Warm and moist
Chāhārgāh	Warm and dry	Leo	Warm and dry
Segāh	Warm and moist	Capricorn	Cold and dry
Navā	Warm and moist	Capricorn	Cold and dry
Shūr	Cold and dry	Pisces	Cold and moist

The calculations of the Zodiac constellations at each stage not only identify temperamental qualities but also determine the transmitted psychological influences and characteristics. For instance, the computations revealed that the primary mode of the Dastgāh-e Chāhārgāh is influenced by the Leo constellation; thus, its melodies naturally embody traits such as courage, vibrancy, and radiant joy²⁸.

The results obtained from the calculations of the primary patterns (primary mode) of each Dastgāh indicate that, contrary to the belief of some musicians who consider Navā to belong to Shūr, this mode

²⁶See Reference [24].

²⁷The meaning of 'temperament' in musical scales is the influence these melodies have on a person's psychological and emotional state states.

²⁸For referring to the characteristics of the zodiac, see references [1].

is independent. This is because by considering Dastgāh-e Shūr as the mother scale for the Navā, the result of the calculations is inconsistent, and there is no significant relationship. Moreover, the doubt that some musicians have about attributing the primary mode of Dastgāh-e Rāst-Panjgāh is considered a derivative of Māhūr. While Māhūr and Rāst-Panjgāh share a common musical lineage, they evoke markedly distinct psychological and emotional responses, a key reason for Rāst-Panjgāh's classification as an independent mode.

Correct identification of the initial note of each scale is of particular importance for theoretical analysis and can be accessed through numerical computational rules. In other words, the start of an innate scale is different from the start of the practical scale²⁹. For example, the computations of the primary mode of the Shūr Māqam in the three calculation tables of the numerical system are the same from note “Do”, but in terms of implementation, it can be considered from note Shāhed “Re”. So, the scale doesn't need to start with the Shāhed note, like Hodayun “La- Koron”, in which the starting note of the innate scale is of the “Sol”.

The limitation and weakness of the present study are that it has three calculation tables (two models of 17-numerical notes and a Manzeli model of 24-numerical notes). Without these, the method for calculating scales with quarter-tone intervals may be prone to errors. Therefore, in the 24-note study, the accuracy of the results will be verified, and the findings will be applied to Iranian musical Dastgāh's using the 17-note numerical system.

Interestingly, solving some difficult scientific problems can be done with simple calculation methods. These numerical systems and their rules are a modern way of understanding and recognizing the theoretical relationships in music therapy, and they benefit from logical and numerical reasoning and calculations. In this method, numbers and calculations are used to express the result of the problem. Therefore, many subjective and taste-related topics can be edited.

The reasoning and logic behind the presented topics are based on trial-and-error calculations. However, further practical field investigations are recommended to finalize the current proposal.

12. Appendices

I. A- A Natural note (♮) neutralizes other signs and indicates that the note is in its natural state.

B- A flat note (♭) lowers the sound of the note by a half step (semitone).

C- A Koron (♭) lowers the sound of the note by approximately a quarter tone (not a quarter of a whole step).

II. Innate scale: A scale that, in terms of structure, has a consecutive interval of notes from a specific degree to an octave compared to other scales of the same form or reference. Therefore, in the 17-note system, one scale can be written in 17 combinations, but only one scale from 17 pattern types will be the reference.

²⁹See Appendices: IV.

III. Acquired scale: A scale that starts with the same structure as the innate scale from a different degree, such as the Māhūr -“Fa” played with the distance pattern of the Māhūr -“DO”.

IV. Practical scale: It is a scale whose performing from a certain note determines the personality and state of that Māqam. For example, the scale of Natural minor “La” minor is derived from the major scale of Natural major “Do”, but the practical scale starts from the ascending sixth degree of the scale.

V. Zodiac Constellation and corresponding planet: Each of the twelve regions of the zodiac Constellation, where the Sun is located in one of them each month, and is roughly equivalent to our solar months. Each of the zodiac signs has a constellation (planet) as follows: 1- Aries: Mars 2- Taurus: Venus 3- Gemini: Mercury 4- Cancer: Moon 5- Leo: Sun 6- Virgo: Mercury 7- Libra: Venus 8- Scorpio: Mars 9- Sagittarius: Jupiter 10- Capricorn: Saturn 11- Aquarius: Saturn 12- Pisces: Jupiter.

VI. Twelve is a complete cycle or the end of a repetition, and its footprint can be found in everything, such as 12 months in a year, 12 hours for a day, 12 hours for a night, 12 modes in ancient Iranian music, 12 half steps in the intervals of a 12-note scale, etc.

VII. Each person at birth has a temperament based on the instinctive heat and moisture inherited from their parents, which is called the primary, innate temperament. Various factors can affect a person’s temperament and change it [20].

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