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Tamar Zewi



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the letters indicating thousands are usually omitted. Hence, the more common method to note the year is $\text{תשע"א} = (5)771 = 2011$.

The following are a few examples of the common usage of numerals in Rabbinic literature, which continues to the present day. The letter-numerals are pronounced as ordinary words: רמ"ח *ramah* '248' refers in Rabbinic Hebrew to the number of members of the body, as well as to the number of the Commandments that a Jew must fulfil (Tosefot Shabbat 92.1); שס"ה *šasa* '365' refers to the number of sinews in the body, the number of days in a year, and the actions that a Jew is prohibited from doing (Babylonian Talmud Keritot 6.1) (the above numbers appear in the common idiom $\text{בכל רמ"ח אבריו ושס"ה גידיו}$ *be-kol ramah avraw we-šasa gidaw* 'wholeheartedly [lit. 'with all his 248 members and 365 sinews']'); ט"ו בשבט *tu bi-šbat* 'the 15th day of the month of Shevat, a Jewish festival (Rashi, Yevamot 15.1); ל"ג בעמר *lag ba-omer* 'the 33rd day of the Omer, a Jewish festival' (Shulḥan 'Aruḳ, Oraḥ ḥayyim 493.3); ק"ץ טעמים *qan te'amim* 'too many excuses (lit. '150 reasons')', which is used principally in the idiom $\text{לטהר את השרץ בק"ץ טעמים}$ *leṭaḥer et ha-šeres be-qan te'amim* 'to justify, to cite 150 reasons to condone wrong doing (lit. 'to purify the insect with 150 reasons')'; תרי"ג מצוות *taryag mišbot* '613 commandments, i.e., the total number of positive and negative commandments mentioned above (Genesis Rabbah 24.5).

Finally, the use of letters as numerals gave birth to a popular method of commentary, which, with the calculation of the arithmetical value of the letters, has sometimes enabled Rabbinic scholars and commentators to explain or link texts. This method is called גימטרייה *gematria* (the word has its origin in Greek, where two etymologies have been suggested (a) from 'geometry' and (b) 'grammateria' (play on letters)). Thus, e.g., the values of the Hebrew word יין *yayin* 'wine' and the Hebrew word סוד *sod* 'secret' are both 70. Hence, the Talmudic dictum $\text{סוד יצא סוד נכנס יין יצא סוד}$ *niknas yayin yaša sod 'in vino veritas* (lit. 'when wine comes in, a secret goes out')' (Babylonian Talmud Eruvin 68.1).

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AVIHAI SHIVTIEL
(University of Leeds, Emeritus)

Numerals: Modern Hebrew

The system of numerals in Modern Hebrew involves a marked schism between normative statements and actual colloquial use. From a normative perspective, the current system is very similar to that of earlier periods of Hebrew. But in colloquial use, two major tendencies are observed: a tendency towards neutralization of gender distinctions in cardinal numerals, and a change in the way definite distinctions are expressed in noun phrases containing cardinal numerals. These changes have received much attention from both normativists and descriptivists. The former try to undo the change; the latter, to exploit them as an interesting test-case for studying on-going language change.

The discussion below begins with a brief general description of the system of cardinal numerals in Modern Hebrew. Next, the changes in the system are described, and analyses and explanations are offered. Since the changes apply principally to cardinal numerals, the focus is on this system, and not on ordinal numerals, whose form and structure are very similar to those of earlier periods of Hebrew.

1. A BASIC DESCRIPTION OF THE SYSTEM

Cardinal numerals from one to nineteen are marked for gender distinction. Cardinal numerals from three to ten encode definiteness distinction as well, whereby numerals modifying an indefinite noun take the independent (or free) form and those modifying a definite noun take the dependent (or bound) form. Therefore, the numerals one, two, and eleven to nineteen have two forms (masculine and feminine), and the numerals three to ten have four forms (dependent and independent forms of masculine and feminine), although in the feminine paradigm,

the distinction between the dependent and independent forms is visible only in the case of the numeral ‘three’. All other numerals (tens, hundreds, thousands, etc.) have one form. In complex numbers, that is, numbers that include thousands, hundred, tens, and units, the order of the constituent is from the highest number to the lowest, e.g., 5,653 *חמשת אלפים שש* *šamešet ’alafim šeš me’ot xamišim ve-šaloš* ‘five thousand, six hundred, fifty and three’.

All cardinal numerals except for ‘one’ precede the noun they quantify. The head noun usually appears in the plural, though some nouns, usually those denoting periods of time and units of measure, appear in the singular as well. The gender of the head noun determines the form of the numeral for those numerals marked for gender, and the definiteness status of the head noun determines whether the numeral is in the dependent or independent form, for those numerals marked for the distinction. A dependent numeral and the definite head noun take the form of a construct state (*smixut*) construction (→ Construct State), and the definite article is attached to the final member of the construction, i.e., the head noun. The difference in structure between noun phrases with dependent and independent numerals has led to a controversy in the generative school of linguistics as to the syntactic position of the numerals in both types of noun phrases. Some researchers (Ritter 1991; Shlonsky 2004) argue that in both cases the numeral is a head that takes as its complement an extended projection of the noun. Others (e.g., Danon 1997), maintain that the syntactic position of independent and dependent numerals is different; dependent numerals are heads of their phrase, while independent numerals occupy the Specifier position of the phrase, that is, the structural position of the element modifying the constituent which contains the head and its complement.

2. CHANGES IN THE SYSTEM

As noted above, the system of cardinal numerals is undergoing various changes.

- (a) Phonological changes: A few changes occur in the pronunciation of certain numerals: the feminine independent forms of the numerals

ארבע *’arba* ‘four’ and *שמונה* *šmone* ‘eight’ usually receive penultimate stress rather than the prescriptive ultimate stress; the feminine form of *עשרה* *šmone esre* ‘eighteen’ is very often pronounced *šmona esre*; and the conjunction *ו* *ve-* ‘and’, used in numerals consisting of tens and ones, does not vary in spoken Hebrew, in contrast with the normativist demand to use the *u-* variant before a consonantal cluster, and the *va-* variant before a stressed syllable (Coffin and Bolozky 2005:179).

- (b) The grammatical form of the head noun: There is a growing tendency in spoken Hebrew to use the singular form of head nouns denoting monetary units and other units of measure (e.g., distance and weight) and the noun *איש* *iš* ‘man, person’, even with numerals smaller than ten: *שני שקל* *šne šeqel* ‘two shekels’, *חמישה דולר* *xamiša dolar* ‘five dollars’, *שמונה מטר* *šmona meter* ‘eight meters’, *שישה קילו* *šiša kilo* ‘six kilos’, *חמישה איש* *xamiša iš* ‘five people’.
- (c) Loss of gender distinctions: Loss of gender distinction is attested in both the independent and the dependent forms. In the independent forms, the distinction between masculine and feminine forms is neutralized, and native speakers of Hebrew tend to use the (shorter) feminine forms of the numerals, irrespective of the gender of the head noun, e.g., *חמש שקל* *xameš šeqel* ‘five (f.) shekels (m.)’, *שמונה ספרים* *šmone sfarim* ‘eight (f.) books (m.)’ (Bolozky 1982; Bolozky and Haydar 1986; Glinert 1989; 2005; Ravid 1995). In the dependent forms, a different change is attested: in some numerals the masculine forms become more wide-spread than the feminine forms, and in others the reverse obtains, e.g., *שלושת הבנות* *šlošet ha-banot* ‘the three girls (lit. ‘three [m.] the-girls [f.]’), *ששת הערוגות* *šešet ha-’arugot* ‘the six flower beds (lit. ‘six [m.] the-flower beds [f.]’), versus *תשע הספרים* *teša ha-sfarim* ‘the nine books (lit. ‘nine [f.] the-books [m.]’). Glinert (2005:140) points out that in the dependent forms of the numerals three, four, five, six, and ten, there is a tendency to use the masculine forms even with feminine nouns, and Coffin and Bolozky (2005:184) make a similar observation regarding the numeral

Table 1: Bound and free forms of cardinal numerals (1–10) in Modern Hebrew

Numeral	Feminine				Masculine			
	Independent		Dependent		Independent		Dependent	
1	אחת	<i>'axat</i>	אחת	<i>'axat-</i>	אחד	<i>'exad</i>	-אחד	<i>'axad-</i>
2	שתי	<i>šte</i>	שתי-	<i>šte-</i>	שני	<i>šne</i>	-שני-	<i>šne-</i>
3	שלוש	<i>šaloš</i>	שלוש\שלוש-	<i>šloš-/šaloš-</i>	שלושה	<i>šloša</i>	-שלושת-	<i>šlošet-</i>
4	ארבע	<i>'arba</i>	-ארבע-	<i>'arba-</i>	ארבעה	<i>'arba'a</i>	-ארבעת-	<i>'arba'at-</i>
5	חמש	<i>xameš</i>	-חמש-	<i>xameš</i>	חמשה	<i>xamiša</i>	-חמשת-	<i>xamešet-</i>
6	שש	<i>šeš</i>	-שש-	<i>šeš-</i>	ששה	<i>šiša</i>	-ששת-	<i>šešet-</i>
7	שבע	<i>ševa'</i>	-שבע-	<i>ševa'-</i>	שבעה	<i>šiv'a</i>	-שבעת-	<i>šiv'at-</i>
8	שמונה	<i>šmone</i>	-שמונה-	<i>šmone</i>	שמונה	<i>šmona</i>	-שמונת-	<i>šmonat</i>
9	תשע	<i>teša</i>	-תשע-	<i>teša-</i>	תשעה	<i>tiš'a</i>	-תשעת-	<i>tiš'at-</i>
10	עשר	<i>'eser</i>	-עשר-	<i>'eser-</i>	עשרה	<i>'asara</i>	-עשרת-	<i>'aseret-</i>

Table 2: Teen cardinal numerals (11–19) in Modern Hebrew

Numeral	Feminine		Masculine	
	11	אחת עשרה	<i>'axat 'esre</i>	אחד עשר
12	שתיים עשרה	<i>štem 'esre</i>	שנים עשר	<i>šnem 'asar</i>
13	שלוש עשרה	<i>šloš 'esre</i>	שלושה עשר	<i>šloša 'asar</i>
14	ארבע עשרה	<i>'arba' 'esre</i>	ארבעה עשר	<i>'arba'a 'asar</i>
15	חמש עשרה	<i>xameš 'esre</i>	חמשה עשר	<i>xamiša 'asar</i>
16	שש עשרה	<i>šeš 'esre</i>	ששה עשר	<i>šiša 'asar</i>
17	שבע עשרה	<i>šva' 'esre</i>	שבעה עשר	<i>šiv'a 'asar</i>
18	שמונה עשרה	<i>šmone 'esre</i>	שמונה עשר	<i>šmona 'asar</i>
19	תשע עשרה	<i>tša 'esre</i>	תשעה עשר	<i>tiš'a 'asar</i>

Table 3: Numerals 20–100 (tens) in Modern Hebrew

20	עשרים	<i>'esrim</i>
30	שלושים	<i>šlošim</i>
40	ארבעים	<i>'arba'im</i>
50	חמשים	<i>xamišim</i>
60	ששים	<i>šišim</i>
70	שבעים	<i>šiv'im</i>
80	שמונים	<i>šmonim</i>
90	תשעים	<i>tiš'im</i>
100	מאה	<i>me'a</i>

three. In an experiment that included both production and grammaticality judgments of the dependent forms of the numerals three to ten, Meir (2008) found that in the production task, the masculine forms were preferred with the numerals three and six, the feminine forms were preferred with the numerals five, seven, eight, and nine, and in the case of the numerals four and ten there was only a slight preference for the feminine forms. In the grammaticality judgment task, however, there was a tendency to judge as grammatical noun phrases with

the masculine dependent forms assigned to feminine nouns more often than equivalent noun phrases with the feminine forms. Regarding the numerals eleven to nineteen, there seems to be a general tendency to prefer the feminine forms (Glinert 2005:24), though no study has been conducted yet to assess this inclination.

- (d) Change in the expression of definiteness: As described above, when the head noun is definite, the numeral takes the dependent form, and the entire noun phrase has the form of the construct (*smixut*) state: the

numeral is formally the head, and the head noun is formally the modifier, which also carries the definite article, as in normal in construct formations. The form of the phrase ‘the three boys’ is *שלושת הילדים* *šlošet ha-yeladim*, which is formally similar to the construct state, e.g., *ממשלת המדינה* *memšelet ha-medina* ‘the country’s government’. However, in current colloquial use, a different structure is often used, one in which the numeral appears in the independent form, and the definite article precedes the entire phrase. Avineri (1964:427) referred to this structure as a ‘vulgar use’ more than four decades ago, which suggest that the structure is not particularly recent. Glinert (1989:84) reports that this often happens when the noun indicates a unit of measure, e.g., *שקל השלושים* *ha-šlošim šekel* ‘the thirty shekels’. However, this construction is used with other nouns as well, as in the following attested example from the Internet: *החמישה אנשים שנכנסים עכשיו למירק* *ha-xamiša ’anašim še-nixnasim ’axšav le-mirq*, ‘The five people who are entering Mirk now’. This change in the position of the definite article is part of a wider change in the expression of definiteness in colloquial use of the construct state construction in general, according to which the definite article precedes the entire construction, that is, is attached to the first member (the *nomen regens*, *nismax*) rather than to the final member (the *nomen rectum*, *somex*) (→ Construct State: Modern Hebrew).

3. EXPLAINING GENDER NEUTRALIZATION

Of these changes, it is the neutralization in gender distinction in the cardinal numerals three to ten that has received the most attention, and various explanations have been suggested. With respect to the independent forms, Ravid (1995) conducted an experiment whose results indicate a general preference for the use of the feminine forms. Ravid explains this direction of change in terms of two basic tenets of analogical change proposed by Kuryłowicz (1949) and Manczak (1980). Kuryłowicz suggests that contrasts of marginal significance tend to be abandoned in favor of maintaining major contrasts

in the language. Gender marking in Hebrew numerals is the reverse of gender marking in all other morphological systems in the language (final *-a* for masculine in numerals, but for feminine in nouns and adjectives); therefore, the abandonment of gender in numerals maintains the more general gender marking system in the language. Manczak (1980:284) further proposes that in analogical changes, shorter morphemes or words tend to be preserved more often than longer ones, with re-formation of the latter more frequent than re-formation of the former. In the case of Hebrew numerals, we find that the two independent forms collapse into the morphologically shorter, unmarked feminine form.

Bolozky (1982) suggests a different approach, arguing that the preference for feminine forms is prosodic in nature, i.e., the result of an attempt to avoid a clash between two adjacent stressed syllables. Numerals in Hebrew form a prosodic constituent with the noun they modify. A stress clash may occur if the numeral is stressed on the final syllable and the following noun on the first syllable. A numeral with penultimate stress, in contrast, will never cause a stress clash, whatever the stress pattern of the following noun. All the masculine free forms have final stress. In the feminine forms, in contrast, only three forms have final stress (*שלוש* *šaloš* ‘three’, *חמש* *xameš* ‘five’, *שש* *šeš* ‘six’); the other five forms are stressed on the penultimate (*ארבע* *’arba* ‘four’ [colloquially], *שבע* *ševa* ‘seven’, *שמונה* *šmóne* ‘eight’, *תשע* *téša* ‘nine’, *עשר* *’éser* ‘ten’). Hence, feminine numerals are preferred because they contribute to a more regular rhythmic pattern in the language.

Meir (2005) further suggests that the system of gender marking in numerals is a very marked system, and it is this markedness that makes the system prone to change. This markedness is observed on several linguistic levels. First, the morphological marking of gender in numerals is the reverse of gender marking in all other systems in the language. The marking of definiteness is also different from that of other noun modifiers. Second, the position of cardinal numerals also differs from that of adjectives and demonstratives (→ Adjective; Demonstrative Pronouns). Numerals precede the nouns they modify, while adjectives and demonstratives follow the head noun. In their syntactic position, then, numerals resemble other quanti-

fiers and measure phrases in Hebrew, and not adjectives. Moreover, quantifiers in Hebrew do not inflect for gender (→ Quantifier). Numerals, therefore, are the only pre-head modifiers that are marked for gender in the language, thus exhibiting backwards agreement: the agreement controller (the noun) follows the agreement target (the numeral). Backward agreement is psycho-linguistically more challenging than forward agreement, and often results in neutralization of agreement (Berman 1992).

Hebrew numerals show yet another peculiarity: there is non-isomorphism in markedness between the morphological level and the semantic level. Morphologically, the feminine form is unmarked, while the masculine form is the derived, marked form. Furthermore, from a general normative perspective, the masculine form is unmarked semantically, in that it can refer to both a group of masculine nouns as well as to a mixed group, whereas the feminine form can refer only to a group consisting of feminine nouns. In addition, the masculine numeral form has two allomorphs, the dependent and the independent forms, while the feminine numerals have only one form; the dependent and independent forms are isomorphic except for the numeral three, but the form *שלוש* *šloš* 'three' (the feminine dependent form) is almost entirely obsolete (Bolzky and Coffin 2005:184). Allomorphy is characteristic of the unmarked element in the paradigm. Thus, from the semantic and allomorphic points of view, the masculine is unmarked, but from a morphological point of view (i.e., the point of view of word formation), the masculine is the marked form, as it is derived from the feminine form by suffixation. Waugh and Lafford (2000:273) point out that such non-isomorphism between different linguistic levels is quite rare, and causes instability in the system, as is indeed attested in the Hebrew numeral system.

In the dependent forms, a different change is attested, as pointed out in section (c) above: in some numerals the masculine forms are preferred; in others, the feminine forms. The motivation for this change may be prosodic (Glinert 1989:82; Meir 2008): there is preference for forms with penultimate stress over those with ultimate stress. Therefore, the emerging paradigm combines the penultimate stressed masculine forms (three, five, six) and the penultimate stressed feminine forms (seven, eight, nine).

The numerals four and ten have penultimate stress in both masculine and feminine dependent forms in colloquial use: ארבע—ארבעת *'árba—'arbâ'at*, עשר—עשרת *'éser—'aséret*; in these cases there is no clear preference for one form over the other.

Zewi (2006) argues that markedness considerations cannot explain the preference for the shorter forms in the independent paradigm, since in some other Semitic languages changes in the cardinal numeral systems took a different form. For example, in Amharic and Tigrinya all cardinal numerals end with *-t*, that is, they originate from the masculine forms, whereas in Tigré the existing paradigm consists of forms without *-t*, that is, of the originally feminine forms. In various dialects of Arabic a different change is found: the short forms occur when the numeral precedes a noun, and the longer forms when they appear in isolation (Bolzky and Haydar 1986). However, in the dialect of Mecca, only the longer forms are in use, irrespective of whether the noun they precede is feminine or masculine (Fischer and Jastrow 2000:90).

What is apparent from Zewi's survey is that although the specific direction of change varies across languages, gender marking in the Semitic cardinal numerals is a very unstable system, which seems to be disappearing in many languages and dialects.

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IRIT MEIR
(University of Haifa)

Numerical Value of Letters

Hebrew letters are assigned numerical value in accordance with a decimal system. The first nine letters stand for the digits 1-9, thus א = 1, ב = 2, ג = 3, and so on. The tens are indicated by the next nine letters, י = 10, כ = 20, ל = 30, and so on. The hundreds from 100 to 400 are indicated by the last four letters of the alphabet, thus ק = 100, ר = 200, ש = 300, and ת = 400. Non-round numbers above ten are expressed by a combination of letters, in descending order of magnitude. The letters which denote the larger numbers are placed before (to the right of) those denoting smaller numbers, and the values are added, e.g., יא = 11, כב = 22, קלג = 133. There are two ways of indicating the numbers 500-1000. One is with appropriate combinations of the last four letters of the alphabet, always using the letter ת (= 400) and letters representing the largest possible values for the remaining hundreds; thus the Hebrew year (5)769 (≈ 2009 C.E.) is represented by the letters תשס"ט, where תש = 700 (millennia are usually omitted in year numbers). The second

100	ק	19	ט"ט	10	י	1	א
200	ר	20	כ	11	יא	2	ב
300	ש	30	ל	12	יב	3	ג
400	ת	40	מ	13	יג	4	ד
500	ת"ק	50	נ	14	יד	5	ה
600	ת"ק	60	ס	15	ט"ו	6	ו
700	ת"ק	70	ע	16	ט"ז	7	ז
800	ת"ק	80	פ	17	י"ז	8	ח
900	ת"ק	90	צ	18	י"ח	9	ט

way is to use the orthographically final letters in the order in which they occur in the alphabet: ט = 500, ס = 600, ע = 700, פ = 800, צ = 900. The thousand units are indicated by a mark (a slash, or a dot or two) over the letter starting with the first letter of the alphabet, e.g., א̇ = 1000, ב̇ = 2000, ג̇ = 3000, and so on. In deference to the fact that the numbers י"ה 15 and י"ז 17 contain letters that are used as abbreviations for the name of the Deity (יהוה), it became customary to write the number 15 as טו (9 and 6), and the number 17 as טז (9 and 7).

There is no evidence in Hebrew inscriptions or in the Hebrew Bible that Hebrew letters were used as numbers before the Common Era. The earliest evidence for the use of letters as numbers is in the coinage of the Jewish War (66-70 C.E.) which have inscriptions such as שקל ישראל *šql ysr'el* 'shekel of Israel' with the abbreviated dates 'א' ש' for 1 שנת *šnt* 1 'year 1' and 'ב' ש' for 2 שנת *šnt* 2 'year 2'. The Talmud has a system of numerology based on the numerical value of the letters, called *gematria* (from Greek γεωμετρία 'geometry'). It is used as an aggadic hermeneutical method for interpreting the Torah and for finding hidden meanings. For example, in the phrase עִם-לָבָן גָּרְתִּי *im-lābān gartī* 'I sojourned with Laban' (Gen. 32.5), the *gematria* value of גָּרְתִּי *gartī* 'I sojourned' is 613, leading to the interpretation that although Jacob lived with Laban for twenty years, nevertheless he still observed the 613 precepts which the Torah contains, according to rabbinic tradition. The use of Hebrew letters as numbers