An additional case of vowel harmony in Modern Hebrew is found in loanwords (Cohen 2010). In loanword adaptation, source vowels are adapted to the phonologically closest Hebrew vowel. However, in a minority of cases, usually when the source vowel is central [ə] or when the Hebrew vowel is epenthetic, the quality of the vowel in loanwords is *optionally* determined by the quality of a neighboring vowel.

(8) Vowel harmony in borrowings

Hebrew form		Gloss
קֶנְגּוּרוּ	qeng<u>u</u>ru	'kangaroo'
פִּילִים	fil<u>i</u>m	'film'
קוֹלוֹרַבִּי	kol<u>o</u>rabi	'kohlrabi'
אִינְטְלִיגֶנְטִי	intil<u>i</u>genti	'intelligent'
פְלוֹרוֹסֶנְט	fl<u>o</u>rosent	'florescent'
סִינִימָה	sin<u>i</u>ma	'cinema'

EVAN-GARY COHEN
(Tel-Aviv University)

Vowel Length: Biblical Hebrew

The length of vowels represented by the vowel signs in Tiberian Biblical Hebrew is largely predictable from syllable structure and the placement of stress. Vowels are pronounced long when they are either (i) in a stressed syllable or (ii) in an open unstressed syllable. Elsewhere the vowel is pronounced short. Examples: מֶלֶךְ ['mɛːlɛχ] 'king', יִשְׁמַע [jiʃˈmaːʕ] 'he hears', חָכְמָה [ħɔχˈmɔː] 'wisdom', הַהוּא [haːˈhuː] 'that', מִחוּץ [miːˈħuːsˤ] 'outside'. In the orthography short [u] is predominantly represented by *qibbuṣ*, e.g., יֻקַּם [yuqˈqaːm] 'he will be avenged', but is occasionally represented by *shureq*, e.g., יוּשַׁד [juʃˈʃaːð] 'it will be destroyed' (Hos. 10.14). The lengthening of vowels in open unstressed syllables was due to the predominant prosodic tendency of syllables to have two moras (→ Syllable Structure: Biblical Hebrew). The vowels *ḥolem* and *ṣere* are invariably long and have no short variants. This also is essentially dependent on stress and syllable structure, in that they occur only in the aforementioned environments that condition vowel length, e.g., כֹּהֵן [koːˈheːn] 'priest', הֵקִים [heːˈqiːm] 'he raised', יָקֹום [jɔːˈqoːm] 'may he rise'.

Vocalic *shewa* (ְ) in the Tiberian reading tradition was pronounced as a short *a* vowel in most contexts. When occurring before a guttural consonant or the letter *yod* it was realized with a different quality through an assimilatory process. Before a guttural it was realized with the same quality as the vowel following the guttural and before consonantal *yod* it was pronounced with the quality of *ḥireq* (→ Shewa: Pre-Modern Hebrew). *Shewa* was not lengthened, since it had the status of an epenthetic vowel that was inserted on the phonetic level to break up consonantal clusters at the onset of syllables and did not constitute the nucleus of a syllable in the underlying syllabification of the word (→ Syllable Structure: Biblical Hebrew). Vowels represented by *ḥateph* signs (*ḥateph pataḥ* ֲ , *ḥateph seghol* ֱ , and *ḥateph qameṣ* ֳ) were also read as short vowels. Like *shewa*, in most cases the *ḥateph* vowels had the status of epenthetic vowels inserted on the surface phonetic level and so were not lengthened by the predominant prosodic principle of bimoricity, since they did not exist in the underlying syllable structure of the word.

The default pronunciation of vocalic *shewa* with the quality of [a] was the equivalent to that of the *ḥateph pataḥ* sign (ֲ). Both the vocalic *shewa* and the vowels expressed by *ḥateph* signs were short vowels that, in principle, had the same quantity as short vowels in closed syllables, which were represented in standard Tiberian vocalization by a simple vowel sign. So, the vocalic *shewa* in a word such as תְּדַבֵּר 'you speak' would have been read with the same quantity and quality as the *pataḥ* in the closed syllable that follows it: [taðabbeːʀ]. Likewise the *ḥateph pataḥ* in הֲמֶלֶךְ [haˈmɛːlɛχ] 'interrogative + king' would have been read with the same quantity and quality as the *pataḥ* in הַמֶּלֶךְ [hamˈmɛːlɛχ] 'the king' (Khan 1987, 37–39; 1992a) → Shewa: Pre-Modern Hebrew.

Sporadically a *ḥateph qameṣ* appears to have the status of a syllable, in which case the sign is marking a phonologically short vowel nucleus rather than an epenthetic. This applies notably to *ḥateph qameṣ* on non-guttural consonants in words such as דֳּמִי [dɔˈmiː] 'silence', צֳרִי [sˤɔˈʀiː] 'balsam', צִפֳּרִים [sˤippɔˈʀiːm] 'birds', קֳדָשִׁים [qɔðɔːˈʃiːm] 'holy things'. There are also some isolated cases of *ḥateph seghol* with this status, e.g., וּבְצֶלְצְלִים [ʔuvsˤɛlsˤɛˈliːm] 'and with cymbals' (Aleppo Codex, Codex Leningradensis reads וּבְצִלְצְלִים 1 Sam. 6.5). These syllables are exceptional, therefore, in having the weight of only one mora (CV).

Some long vowels appear to occur in closed syllables at the end of a word, e.g., יָד [yɔːð] 'hand', קוֹל [qoːl] 'voice', לָקוּם [lɔːˈquːm] 'to rise', הִשְׁמִיד [hiʃˈmiːð] 'he destroyed', בֵּית [beːθ] 'house of'. After long vowels in the middle of a word *shewa* is normally silent (→ Shewa: Pre-Modern Hebrew), so some long vowels appear to occur in closed syllables also within a word, e.g., שׁוֹמְרִים [ʃoːmˈʀiːm] 'guarding (mpl)', אָכְלָה [ʔɔːχˈlɔː] 'she ate'. Such syllables should be analyzed as containing an epenthetic before the final consonant of the same quality as that of the preceding vowel, viz. [qoːol], [ʃoːomˈʀiːim]. The most compelling evidence for this analysis is the appearance of this epenthetic as *pataḥ* before guttural consonants (the so-called furtive *pataḥ*), e.g., רוּחַ [ˈʀuːaḥ] 'spirit' (for further details see Khan 1987). Such vowels have inherent length and the syllabification accommodates this (→ Syllable Structure: Biblical Hebrew).

Many words carry a secondary stress in addition to the main stress. This is marked by an accent sign or a major *gaʿya* on a long vowel in an open syllable, e.g., הָאָדָם [ˌhɔːʔɔːˈðɔːm] 'the man' (Gen. 2.19), הָאָדָם [ˌhɔːʔɔːˈðɔːm] (Gen. 1.27). A secondary stress is marked on a short vowel in a closed syllable by a minor *gaʿya*, and the vowel is lengthened as a result, e.g., נִתְחַכְּמָה [ˌniːθħakkaˈmɔː] 'let us deal wisely' (Exod. 1.10). Occasionally *gaʿya* is marked on a *shewa* or an epenthetic *ḥateph* vowel (known as *shewa gaʿya*), as a result of which these were lengthened, e.g., תְּשַׁלְּחוּ [ˌtaːʃallaˈħuː] 'you shall let go' (Jer. 34.14), עֲלִיּוֹתָיו [ˌʕaːlijoːˈθɔːv] 'his chambers' (Ps. 104.3) (Yeivin 1980:253–254; Khan 2009).

In order to establish the synchronic phonological representation of the vowels of the Tiberian reading tradition, therefore, one must distinguish between (i) vowels which are invariably long and include length in their underlying phonological representation and (ii) vowels whose length is determined by syllable structure and stress and so are of unspecified length at a phonological level.

The long vowel phonemes include: long *qameṣ* /ɔ̄/, *ḥolem* /ō/, *ṣere* /ē/, long *shureq* /ū/, long *ḥireq* /ī/ (typically written with *yod*), e.g., יָד /yɔ̄ð/ [yɔːð] 'hand', כֹּהֵן /kōhēn/ [koːheːen] 'priest', יִירְשׁוּ /yīrˈšū/ [ˌjiːʀˈʃuː] 'they inherit'.

The vowel phonemes unspecified as to length include: *pataḥ* /a/, *seghol* /ɛ/, *ḥireq* /i/, *qibbuṣ*/ *shureq* /u/. In principle these are long when

they bear stress, e.g., יִשְׁמַע /jiʃˈmaʕ/ [jiʃˈmaːʕ] 'he hears', נַעַר /ˈnaʕar/ [ˈnaːʕaʀ] 'boy', כַּרְמֶל /karˈmɛl/ [kaʀˈmeːl] 'plantation', מֶלֶךְ /ˈmɛlɛχ/ [ˈmɛːlɛχ] 'king', or syllabified with two moras in open unstressed syllables, e.g., הַהוּא /haa.huu/ [haːˈhuː] 'that' and מִחוּץ /mii.ħuuṣ/ [miːˈħuːuṣ] 'outside'. In unstressed closed syllables they are short.

To the second category of vowels we should add also /e/ and /o/ without specified length. These are represented by the *ṣere* and *ḥolem* vowel signs, respectively, in the stressed syllables of certain forms. Since stressed vowels are always long, on a phonetic level these are not distinguishable from *ṣere* and *ḥolem* that represent phonemes with underlying length. This is necessary to account for apparent discrepancies in the historical development of vowels in several morphological forms, in which *pataḥ* (a vowel with no specified length feature) occurs in parallel with *ṣere* and *ḥolem* (Sarauw 1939:56–64; Khan 1994a). This applies, for example, to nouns with an originally doubled final consonant. In forms deriving from the **qall* pattern the vowel is *pataḥ*, e.g., רַב [ˈʀaːv] 'much', and in forms deriving from the **qill* and **qull* pattern, the vowel is *ṣere* and *ḥolem*, respectively, e.g., לֵב [ˈleːv] 'heart', עֹז [ˈʕoːz] 'strength'. Such words would all have a vowel of unspecified length on the phonological level, namely /ˈrav/, /ˈlev/, /ˈʕoz/, respectively, and the length would have been a consequence of stress. There is, therefore, no discrepancy in their pattern. The same applies to the underlying phonological representation of the *pataḥ*, *ṣere*, and *ḥolem* in verbal forms (קָטַל /qɔ̄ṭal/, קָטֵל /qɔ̄ṭel/, קָטֹל /qɔ̄ṭol/; יִקְטַל /yiqṭal/, יִקְטֵל /yiqṭel/, יִקְטֹל /yiqṭol/) and in segholate nouns (נַעַר /naʕar/, סֵפֶר /sefer/, קֹדֶשׁ /qoðɛš/), which would have the phonemes /a/, /e/ and /o/.

In syllables that do not have the main stress the vowels /e/ and /o/ are generally realized phonetically as [ɛ] or [ɔ], respectively, which overlap in quality with the phonemes /ɛ/ and /ɔ̄/, e.g., וַיֵּרֶד /vayˈyēreð/ [vayˈyeːʀeð] 'and he came down', קֳדָשִׁים /qoðɔ̄ˈʃīm/ [qɔðɔːˈʃiːim] 'holy things'. A secondary stress may be marked on short [ɔ] and lengthen it to [ɔː], as in קֳדָשִׁים [ˌqɔːðɔːˈʃiːim] 'holy things' (Exod. 29.37). The underlying phonemic representation of a word such as צֳרִי [ṣɔˈʀiː] 'balm' would be /ṣoˈrī/, the pausal form of which would be צֹרִי [ˈṣoːʀiː] with primary stress on the first syllable (attested in Rabbinic Hebrew).

In principle, all the phonemes /a/, /ɛ/, /i/, /u/, /e/, and /o/, which synchronically in the medieval Tiberian reading tradition should be analyzed as lacking a feature of length in their specification, correspond to vowels that were short in all contexts at an earlier historical period. With regard to the vowels that synchronically should be analyzed as having a length feature (i.e., /ɔ̄/, /ō/, /ē/, /ū/, /ī/), these mostly corresponded to historically long vowels, with the exception of /ɔ̄/, which resulted from the historical lengthening of an original short *a, and /ē/, which in some cases developed from the historical lengthening of an original short *i.

The distinction between vowels that are inherently long and those that are long through prosodic stress was already adumbrated by medieval scholars, in particular Ḥayyūj and Judah Ha-Levi (Steiner 2001).

As has been remarked, a vowel in an unstressed closed syllable was, in principle, short. If, however, it was followed by a series of contiguous consonants of relatively weak articulation (e.g., any of the consonants אהעחינל *ʾhḥynl*), then the vowel was sometimes lengthened, even when not stressed. This occurs in certain prefixes of the verbs היה *hyh* 'be' and חיה *ḥyh* 'live', namely the *ḥireq* of prefixes before *he* or *ḥet*, e.g., יִהְיֶה [jiːhˈjɛː] 'he will be', and the *pataḥ* of the conjunctive prefix -וַ *wa-* before *yod*, e.g., וַיְהִי [vaːjˈhiː] 'and it was' (Khan 1994b). Such lengthening is occasionally found elsewhere and is marked by the *ga'ya* sign (Yeivin 1980:262), e.g., הֲשָׁמַע עָם [haˈʃɔːmaːʕ ˈʕɔːm] 'did any people hear?' (Deut. 4.33), שְׁמַע־נָא [ˈʃamaːʕˈnɔː] 'listen' (1 Sam. 28.22), וּפְתַחְיָה [ufθaːħˈjɔː] 'and Pethahiah' (Neh. 11.24). The purpose of the lengthening of the unstressed vowel in such contexts was, it seems, to ensure that adjacent weak letters were not elided in the reading.

The phonetic duration of long vowels varied considerably. From the medieval sources we are able to infer the existence of several different degrees in the relative duration of long vowels. Most of these were conditioned by differences in stress, vowel height, or consonant strength. We shall mention here some of the known cases of differences in relative duration of long vowels (for these variations see Khan 1987; 1989; 1994b; 1996):

Stressed long vowels were longer than unstressed long vowels, e.g., in the word הַהוּא [haːˈhuː] 'that' the [uː] was longer than the [aː].

A long vowel with secondary stress was longer than a long vowel in an unstressed syllable, e.g., in the word הָאָדָם [ˌhɔːˈʔɔːˈdɔːm] 'the man' (Gen. 2.19) the second [ɔː] was shorter than the other two.

Long vowels in open syllables that took secondary stress marked by major *ga'ya*, e.g., הָאָדָם [ˌhɔːˈʔɔːˈdɔːm] 'man' (Gen. 1.27), were of greater duration than vowels in closed syllables lengthened by secondary stress and marked by minor *ga'ya*, e.g., נִתְחַכְּמָה [ˌniːθħakkaˈmɔː] 'let us deal wisely' (Exod. 1.10). This difference in duration is reflected in the medieval terminology: געיה גדולה *ga'ya gedola* ('major *ga'ya*') vs. געיה קטנה *ga'ya qeṭanna* ('minor *ga'ya*') (Khan 1992b). A *shewa* lengthened by *shewa ga'ya* corresponds in duration to a vowel lengthened by minor *ga'ya* (Khan 2009).

A high vowel, e.g., [iː], [uː], in a closed syllable with secondary stress marked by minor *ga'ya* was shorter than a low vowel [aː] in the same conditions, e.g., in the words נִתְחַכְּמָה [ˌniːθħakkaˈmɔː] 'let us deal wisely' (Exod. 1.10) and וַתִּצְפְּנֵהוּ [vaːttisˤpaˈneːhuː] 'and she hid him' (Exod. 2.2), the [iː] vowel of the first was shorter than the [aː] vowel of the second. The same applies to a *shewa* lengthened by *shewa ga'ya* (Khan 2009).

The high vowel [iː] of prefixes of the verbs היה and חיה was shorter than the low vowel [aː] in prefixes of these verbs, e.g., in the forms יִהְיֶה [jiːhˈjɛː] 'he will be' and וַיְהִי [vaːjˈhiː] 'and it was', the [iː] of the first was shorter than the [aː] of the second.

The high vowel [iː] of the prefixes of the verbs היה and חיה was shorter than [iː] in a stressed syllable or an unstressed open syllable, but longer than [iː] in a closed syllable with secondary stress marked by minor *ga'ya*, e.g., in the words אִם [ˈʔiːm] 'if', יִהְיֶה [jiːhˈjɛː] 'he will be', and נִתְחַכְּמָה [ˌniːθħakkaˈmɔː] 'let us deal wisely' (Exod. 1.10), the three [iː] vowels were of decreasing degrees of length.

The [aː] vowel in prefixes of the verbs היה and חיה (e.g., וַיְהִי [vaːjˈhiː]) and other words before two weak consonants (e.g., הֲשָׁמַע עָם [haˈʃɔːmaːʕ ˈʕɔːm] 'did any people hear?' [Deut. 4.33]) was longer than an [aː] vowel in a closed syllable with secondary stress marked by minor *ga'ya* (e.g., וַתִּצְפְּנֵהוּ [vaːttisˤpaˈneːhuː] 'and she hid him' [Exod. 2.2]).

A final unstressed long vowel underwent particular reduction in duration in the construction known as *deḥiq*, i.e., where *dagesh*

occurs on the initial letter of a word when the preceding word ends in a long vowel and has a conjunctive accent on the penultimate syllable (Yeivin 1980: 289–292). The Masoretic treatise *Hidāyat al-Qāriʾ* 'Guide for the Reader' (→ Masoretic Treatises) describes the phenomenon of *deḥiq* as the 'compression' of the final vowel: "The vowel that follows the accent in וְאָעִידָה בָּם [vɔʔɔːˈiː.ð̟ɔː bbˈɔːm] 'I shall cause to witness against them' (Deut. 31.28) is not extended but is considerably compressed" (Eldar 1984:7). According to this source the compression also takes place in short words that are connected by *maqqef* to a following word when the initial consonant of the second word has *dagesh*: "The compression may take place in a word without an accent if it is a short word as in מַה־תֹּאמַר [maː-ttoːˈmaːʀ] 'what [your soul] says' (1 Sam. 20.4), זֶה־בְּנִי [zɛː-bbaˈniː] 'this is my son' (1 Kgs 3.23), מַה־בְּרִי [maː-bbaˈʀiː] 'what, my son' (Prov. 31.2), וּמַה־תַּעֲשֶׂה [ʔumaː-ttaˈʕaˈsɛː] 'and what will you do?' (Josh. 7.9) and the like". This implies that the *pataḥ* in the word מַה־ before *dagesh* was long, though of decreased duration. The pronunciation of the *pataḥ* as a long vowel is confirmed by the Karaite transcriptions into Arabic script, which represent it by the *mater lectionis* ʾalif, e.g., ما تتن لی 'what will you give me' מַה־תִּתֶּן־לִי [maː-ttitteːn-ˈliː] Gen. 15.2) (Khan 1989).

In the medieval Babylonian pronunciation of Hebrew the basic distribution of vowel length was essentially equivalent to what is found in Tiberian. This is marked explicitly in the so-called 'compound system' of Babylonian vocalization, which distinguished between long and short vowels, in that it marked short vowels in open and closed syllables by the use of different signs from those used to indicate long vowels (→ Vocalization, Babylonian).

Unlike in Tiberian, the /e/ and /o/ phonemes retain their quality when pronounced short in unstressed syllables. Short unstressed /o/ is found, for example, in רֹנִּי *ronnī* 'rejoice!' (Tiberian רָנִּי *rånnī* Zeph. 3.14), וַיֹּמֹת *way-yåmot* 'and he died' (Tiberian וַיָּמָת *way-yåmåt* 2 Sam. 12.18). In prefix conjugation forms with suffixes, such as. יִשְׁמוֹרֵנִי *yišmorēnī* 'he guards me' (Tiberian יִשְׁמְרֵנִי *yišmərēnī*) and אֶשְׁמוֹרָה *ʾišmorå̄* 'I guard' (Tiberian אֶשְׁמְרָה *ʾešmərå̄*). The /o/ has usually been reduced to *shewa* in such forms in Tiberian, but note

אֶשְׁתָּלֶנּוּ *ʾeštå̄lennū* 'I will plant it' (Ezek. 17.23) and וָאֶשְׁקֳלָה *wå̄-ʾešqå̄lå̄* 'and I weighed' (Ezra 8.25), where the quality is [ɔ].

Examples of short *ṣere* in unstressed syllables include בֶּן ראובן *ben-rəʾūḇēn* 'the son of Reuben' (Tiberian בֶּן־רְאוּבֵן *ben-rəʾūḇēn* Josh. 15.6), וַיֹּרֶד *way-yēred* 'and he went down' (Tiberian וַיֵּרֶד *way-yēred* Jer. 36.12). אֱנֹשׁ *ʾenōš* 'man' (Tiberian אֱנוֹשׁ *ʾĕnōš* Job 5.17). In manuscripts with compound vocalization these vowels are represented by *ṣere* combined with the *ḥiṭpa* sign, demonstrating that they were short, e.g., בֶּן מנשה (Tiberian בֶּן־מְנַשֶּׁה *ben-mənaššē* Num. 32.41), וַיִּבֶן *way-yiḇen* 'and he built' (Tiberian וַיִּבֶן *way-yiḇen* Exod. 1.11), אֱנֹשׁ *ʾenōš* 'man' (Tiberian אֱנוֹשׁ *ʾĕnōš* Ps. 10.18).

In *deḥiq* constructions, where the Tiberian Masoretic sources state that the final long vowel of a word is compressed, Babylonian compound vocalization often explicitly marks the vowel as short, e.g., הִשָּׁבְעָה לִי *hiššå̄ḇə̄å lli* (Tiberian הִשָּׁבְעָה לִּי *hiššå̄ḇə̄å lli* 'swear to me' Gen. 21.23) (Yeivin 1985:338–339).

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GEOFFREY KHAN
(University of Cambridge)

Vowel Length: Modern Hebrew

Israeli Hebrew possesses the following vowel phonemes: *a, e, i, o, u*. Vowel length is environmentally determined and not phonemic; it tends to be affected by degree of stress, and pretonic lengthening may also occur, mostly in open syllables (→ Pretonic Lengthening: Modern Hebrew). In one class of cases, however, vowel length may be argued to have re-emerged as a semi-distinctive feature. When a glottal (א ʾ or ה *h*) or pharyngeal (ע ʿ) consonant is lost, a two-vowel sequence arises; if the two vowels are identical, they merge into a single long vowel:

> תעבוד *taʿavod* 'you will work' > *taavod* > *ta:vod* (> *tavod*)
>
> תהרוג *taharog* 'you will kill' > *taarog* > *ta:rog* (> *tarog*)
>
> לצערי *le-ṣaʿari* 'unfortunately (lit. 'to my regret') > *leṣaari* > *leṣa:ri* (> *ʔleṣari*)
>
> אני מאמין *ʾani maʾamin* 'I believe' > *ani maamin* > *ani ma:min* (> *ʔani mamin*)

As Rabin (1972) and Rosén (1955; 1977) point out, the resulting differences in length may give rise to minimal pairs, such as:

> נתתי *natáti* 'I gave' versus נטעתי *nataʿti* > *natá:ti* 'I planted'
>
> כך *kax* 'thus' versus כעך *kaʿax* > *ka:x* 'bagel'
>
> שר *šar* 'sing' versus שער *šaʿar* > *ša:r* 'gate'

In some cases length serves as a morphological marker, as in:

> בא *ba* 'come (ms)' versus באה *baʾa* > *ba:* 'come (fs)'
>
> תביא *tavi* '(you will) bring (ms)' versus תביאי *taviʾi* > *tavi:* '(you will) bring (fs)'

The 'pre-merger' vowels do not have to be identical, e.g.,

> שעונים *šeʿonim* 'watches' > *šeonim* > *šoonim* > *šo:nim* (> *šonim*)
>
> סערה *seʿara* 'storm' > *seará* > *saara* > *sa:ra* (> *sara*)
>
> להסביר *le(h)asbir* 'explain' > *laasbir* > *la:sbir* (> *lasbir*)
>
> להכניס *le(h)axnis* 'bring in' > *laaxnis* > *la:xnis* > *laxnis*
>
> שייכנס *še-(y)ikanes* 'let him enter' > *šiikanes* > *ši:kanes* (> *šikanes*)
>
> שיתלבש *še-(y)itlabeš* 'let him get dressed' > *šiitlabeš* > *ši:tlabeš* (>*šitlabeš*)

In some cases the vowel may end up short, but this is typical of non-native speech (e.g., אני מאמין *ʾani maʾamin* > *ani mamin* or לצערי < *iraʿaṣ-el le-ṣari* are rarely found in native speech).

A long vowel thus often signals a lost consonantal slot, and captures relationships with regular patterns (with all their syntactic and semantic implications), as well as deviations from expected vowel configurations (Bolozky 1997).

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SHMUEL BOLOZKY
(University of Massachusetts Amherst)