Lengthening in the Quranic Recitation: Duration and pitch contours

Mohamed YEOU
Chouaib Doukkali University, El-Jadida, Morocco
E-mail: m_yeou@yahoo.com

ABSTRACT

The present paper considers the realization of vowel lengthening in the Quranic recitation by six professional reciters: three Egyptians and three Saudis. The study is focused on two types of lengthening: 4-beat obligatory lengthening and 6-beat compulsory lengthening. The two groups of reciters displayed several important differences in the production of lengthening: duration values and the use of F0 contours.

1. INTRODUCTION

The Quran is recited according to the rules of *Tajwīd* (science of recitation). These are a set of written regulations, which govern many of the parameters of sound production such as duration, segment quality and single-breath phrase. There exists an abundant literature that describes these rules, which constitutes an invaluable source of information on a number of questions relating to the phonetics of quranic recitation (e.g., [1]). This information is all the more important because it still has a physical realization through the practice of professionally trained reciters. Unfortunately, too little scholarly work has been conducted in describing the sound of recitation by linking the rules of *Tajwīd* to actual performance practice.

Modern quranic recitation broadly consists of two styles: *murattal* and *mujawwad*. *Mujawwad* is an embellished form of recitation developed for public performance and intended to produce an emotional effect on listeners. It is characterized by the use of some aspects of music such as modulation, register, ornamentation, and vocal quality. *Murattal*, on the other hand, is a straightforward, speech-bound style of recitation. Its intent is the clear rendering of the text whether practised for instructional or devotional purposes [2]. The present study is part of a research program that aims at investigating how the sound of Quranic recitation is realized. The study considers the realization of vowel lengthening by representative professional reciters. Classical Arabic has a phonemic distinction between the short vowels /a, i, u/ and the long vowels /aː, iː, uː/. Vowel lengthening (or *madd*), which is codified according to the rules of recitation, involves the long vowels /aː, iː, uː/. There are two basic categories of lengthening: primary lengthening and secondary lengthening. Primary lengthening refers to the fixed duration of two beats (*ḥarakāt*) characterizing the long vowels. Secondary lengthening, which is conditioned by phonetic environment, refers to a variable duration ranging from two to six beats. The study focuses on two types of secondary lengthening: 4-beat obligatory lengthening (4OL) and 6-beat compulsory lengthening (6CL). The first type occurs if a long vowel is followed by a glottal stop (e.g. *jāʔa*). The second type occurs in two cases: (a) if a long vowel is followed by a geminate consonant (e.g. *ḥāqqah, dābbah*); (b) if a long vowel is followed by an intrinsically uninflected syllable-final consonant. The second case mainly occurs in names of the letters of the alphabet which introduce some of the chapters of the Quranic text (e.g. *ḥāmmīm, yāsīn*). The primary purpose of this study is to investigate how reciters realize the two types of secondary lengthening. The parameters considered are duration values and pitch contours.

2. METHOD

The study uses the recordings of six well-known professional reciters: three from Egypt and three from Saudi Arabia. The Egyptians are Maḥmūd Xalīl al-Ḥuṣari (Hs), ʼAbd al-Bāsiṭ ʼabd al-Ṣamad (Ab) and Muḥammad Ṣiddīq al-Minšāwī (Ma). The Saudis are ʼAbd al-Raḥman al-Ḥudhayfi (Hu), Muḥammad Ayoub (Ay) and Saʼd al-Ghāmidī (Gh). All of these recordings are performed in the *murattal* style and according to the Reading of *Ḥafṣ*.

Data consists of words containing the long vowels /aː/ and /iː/ and which are repeated five times in the Quran (see below for their position by chapter and verse number). For comparison purposes words containing the corresponding short vowels are also included in the data.

(i) **6-CL**: ʔalif laːmmiːm (2:1; 3:1; 29:2; 30:1; 31:1), ħaːmmiːm (40:1; 41:1; 43:1; 44:1; 45:1), daːbbatin (11:6; 11:56;16:49; 42:29;45:4); ʒaːnnun (27:10; 28:31; 55:39; 55:56; 55:74).

(ii) **4-OL**: χatˤiːʔat- (2:81; 4:112; 7:161; 26:82; 71:25), maːʔin (10:24; 13:4; 18:29; 18:45; 54:11), ʃaːʔa (1:20; 4:90; 5:48; 6:35;10:16), ħaniːʔan (4:4; 52:19; 69:24; 77:43).

(iii) **Long vowel**: ʔinnaː (2:14; 6:158; 9:52; 11:122; 15:52), ʔanniː (8:9; 8:12; 21:83; 9:52; 38:41; 54:10), ʔalχabiːtu (2:267; 3:179; 4:2; 5:100; 8:37), ttˤajjibaːtu (2:57; 2:172; 5:4; 5:5; 7: 160).

(iv) **Short vowel**: biʔsa (14:29; 18:29; 49:11; 57:15; 62:5), baʔsa (4:84; 6:65; 6:148; 40:84; 40:85), baʃarun (21:3; 23:33; 30:20; 36:15; 41:6), rabbikumaː (55:13; 55:16; 55:18; 55:21; 55:23).

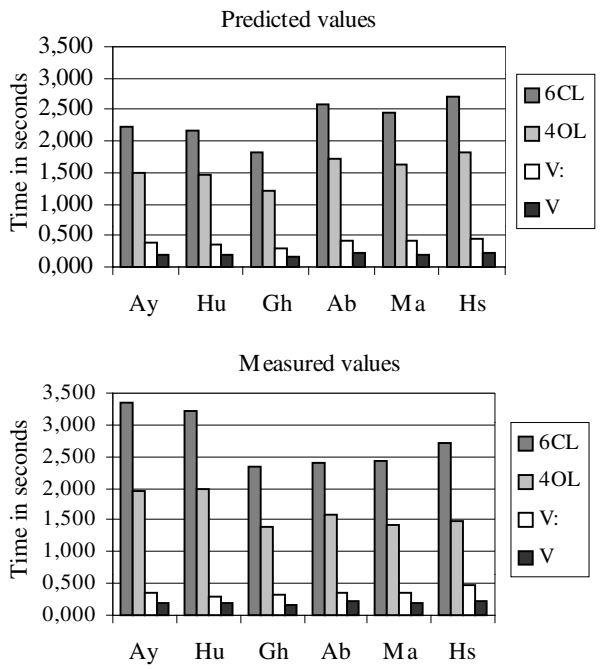
ISBN 1-876346-48-5 © 2003 UAB

The Quran recitation recordings used are readily available on CDs. They were converted to sound files at a sampling frequency of 11025 Hz (16 bit), using Soundforge. Analysis was carried out using Praat software [3]. Vowel duration measurements were made from synchronous waveform and spectrographic displays of each syllable, expanded to provide the most optimal resolution. The autocorrelation subroutine of Praat was used for the fundamental frequency (F0). To assess the accuracy of the *madd* realization (6CL and 4OL), the number of counts was derived on the basis of both the short and long vowel duration data for each reciter.

3. RESULTS

3.1. Duration

Figures 1 & 2 show the measured average vowel durations and the corresponding predicted ones in all conditions of the present experiment. It was found that the predicted vowel durations give a better match to the measured ones if the underlying pulse is considered to be set by the duration of the short vowel (one beat) rather than that of the long vowel (two beats). Consequently, the timing of 6CL and 4OL amounts in fact to 12 and 8 single beats, respectively. For discussion purposes, however, the calculated durations of 6CL and 4OL are divided by two to be considered as multiples of the two-beat unit (see Figure 3).



Figures 1 & 2: Average duration values (predicted and measured) in seconds. V=short vowel; V:=long vowel.

Results summarized in Figures 1, 2 and 3 indicate that reciters exhibit different patterns of lengthening. For the Egyptians (Ab, Ma, Hs) the distribution of the obtained vowel durations are quite similar to the predicted ones. However, for the Saudis the fit is quite small even if an acceptable error margin is allowed for (±0.5 count). The timing of 6CL is overextended by Ay, Hu, and Gh to 10.3, 10.2 and 7.8 counts, respectively. In the same way, the timing of 4OL does not correspond to the usual prescribed 4-beat unit. Reciters Ay and Hu overextend it to 6.1 and 6.3 counts, respectively. Prescriptive rules of Quranic recitation based on the Reading of *Ḥafṣ* do not allow overextension in 6CL; however, they accept variable extension in 4OL. The accepted durational options for 4OL are 3, 4, 5 or 6 counts [2]. Calculation of the 6CL/4OL ratio indicate that both groups of reciters have approximately the same range (from 1.6 to 1.8). Thus it seems that the Saudis maintain the distinction between 6CL and 4OL, though with longer durations.

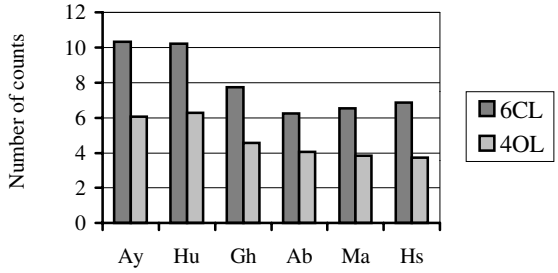


Figure 3: The number of counts derived on the basis of the short vowel duration data for each reciter.

3.2. Pitch contours

3.2.1. Level F0 contours vs. complex F0 contours

The intonation of lengthening is investigated by describing patterns of pitch in two levels. Gross descriptions in terms of F0 variability are firstly given. Then, F0 patterns are more finely described in terms of deviation from perfect periodicity and extent of variation. Characterization of the different ornamentation kinds corresponding to F0 modulation is also discussed at this level.

Table 1 summarizes the distribution of the intonational patterns produced by both groups of reciters. The level flat contour is the prevalent F0 contour in the Egyptians for both types of lengthening: 4CL and 6OL. However, for the Saudis the level contour does not occur with the same frequency in both types of lengthening: 64% on 6OL, but only 32% on 4CL.

	4 OL		6 CL	
	flat	complex	flat	complex
Egyptians	99%	1%	100%	0%
Saudis	32%	68%	64%	36%

Table 1: Distribution of the different types of pitch contours for both groups of reciters.

This F0 pattern distribution indicates that the Egyptians constantly produce flat pitch contours, whereas the Saudis have much variation in pitch movements. In some cases they produce purely flat contours, and in other cases, they produce complex contours having different phases. A flat contour corresponds to a constant F0 spreading on the same level throughout the lengthened vowel. In contrast, a complex contour consists of two different phases. Generally, the first phase involves several kinds of F0

modulation, while the second phase is usually held on a level pitch. To determine the distribution of these two phases over time, the duration of each phase was separately measured. Results indicate that the mean spanning range of the modulated component is in the order of 21-27% for 6CL, but it is in the order of 36-48% for 4OL.

3.2.2. F0 modulation in complex contours

The F0 undulation component in complex F0 contours actually corresponds to melismatic ornamentation if we consider the Quranic lengthening as a form of vocalizing or melodizing. The vowel extension gives the possibility of melodic play to a reciter so as to individualize his interpretation. He may either keep the tone as straight as possible or add some kind of ornamentation to it. The investigation of the details of the ornamentation phase produced by the Saudi reciters shows that it involves different melody aspects, which are derived from the singing tradition. The vocal ornamentation types include trills, slides, turns, vibrato, mordent and appoggiaturas.

(i) *Trill*: is the alternation back and forth between a given base note, and the note either a half-step or a whole-step above it.

(ii) *Appoggiatura*: consists of a nonharmonic note preceding the main melody note.

(iii) *Turn or gruppetto*: consists of the expected melody note, the note above, then the original note again, then the note below, and finishing back on the original note.

(iv) *Slide or portamento*: a short glide from one note to an adjacent one, or a very smooth uninterrupted change from one note to the next.

(v) *Mordent*: consists of the rapid alternation of a note with a note one degree upper or lower than it.

(vi) *Vibrato*: an artistic F0 fluctuation that involves changes in pitch of 1-3%, occurring 4-7 cycles per second.

In order to exemplify some of the vocal ornamentation used by the Saudi reciters, pitch contours and the corresponding music notations are given below. Figure 4 illustrates the use of a trill on the first part of the lengthened vowel /aː/ in the word *maːʔin* produced by reciter Ay. The reciter alternates between an A4 note and a G#4 note. Note that just before holding the second phase on a level tone (F#4), reciter Ay employs a short appoggiatura on a G4 note.

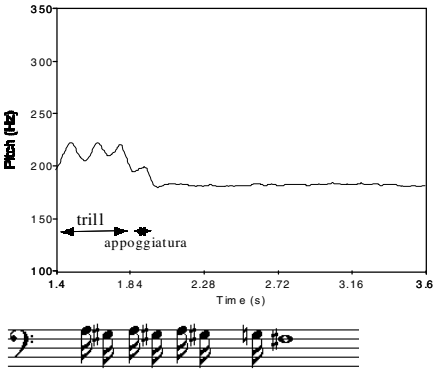


Figure 4: an F0 complex contour produced by Ay during the vowel /aː/ extension in the word *maːʔin*.

Figure 5 shows the use of a trill followed by a turn by reciter Gh. The sequence of the turn is as follows: a B4 note, a flat B4 note, a flat A4 note, and the flat B4 again. Note that the reciter's vocalization on the final note is not purely straight. A vibrato-like ornament seems to be added on it.

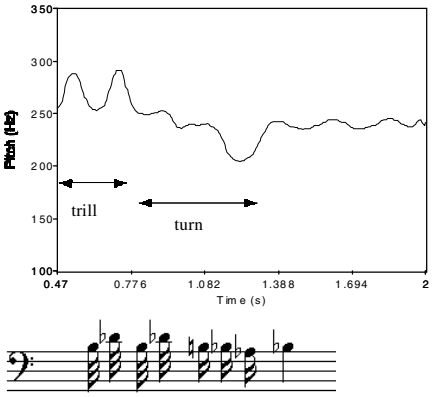


Figure 5: F0 tracking of a trill followed by a turn produced by Gh on the extended vowel /aː/ in *maːʔin*.

An example of a pitch slide is shown in Figure 6. Before holding the intended straight level tone on a C#5, reciter Ay produces a smooth pitch rising movement. This sliding movement seems to be used for avoiding exaggerated melodic leaps.

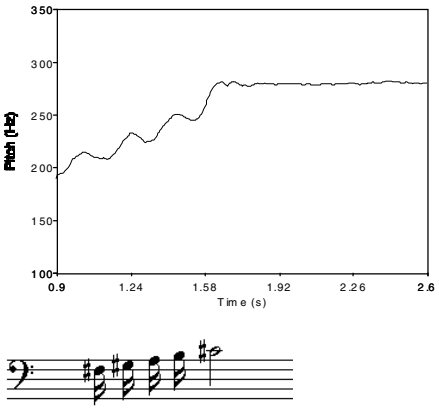


Figure 6 : F0 tracking of a slide followed by a flat line produced by Ay over the extended vowel /aː/ in *maːʔin*.

The above description does not imply that the Saudi reciters employ these ornaments in an exclusive and perfect way. In fact their use of ornamentation is very irregular and doesn't exactly correspond all the time to one ornament type. It seems that the intonation of lengthening is characterized more by free improvisation than by fixed framing. In other words, ornamentation choices are not predefined in advance, but are made on the spot during a public performance.

3.2.3. Small Fo fluctuations and level contours

Small F0 fluctuations are present at all times in human voices due to the inability to hold pitch constant. When the F0 variations are very small and rapid, *jitter* or *flutter* is

ISBN 1-876346-48-5 © 2003 UAB

produced. When the modulation frequency is lower than 5 Hz, *drift* or *wow* is produced. An intentional and artistic F0 modulation called *vibrato* is perceived if the frequency rate is in the range of 5-7 Hz [4].

All the level pitch contours produced by the reciters were analyzed to investigate the presence of these three kinds of F0 fluctuations (*viz.* jitter, drift and vibrato). Table 2 shows the percent of occurrence of these F0 fluctuations for each reciter. The Egyptian reciters produced jitter in approximately all the cases, while the Saudis showed much greater variance in the production of F0 modulations. The Saudis exhibited preferences for particular modulation components: vibrato by Gh, 67%; drift by Ay, 60%; and jitter by Hu, 50%.

	Gh	Ay	Hu	Hs	Ab	Ma
jitter	33%	36%	50%	100%	96%	90%
vibrato	67%	4%	22%	0%	4%	10%
drift	0%	60%	28%	0%	0%	0%

Table 2: Distribution of the different types of F0 fluctuation for each individual reciter.

The production of jitter is generally known to be an involuntary process caused by normal physiological mechanisms. In contrast, drift is considered to be consciously controllable by means of an auditory feedback loop, though it is not easy to eliminate it at will [4]. The drifts produced by Hu and Ay occur at very low frequencies, which suggests that their drift may be related to intentional or unintentional corrections in pitch.

Unlike jitter and drift, vibrato is an important artistic component of vocal performance. It is usually introduced purposefully by singers to give a pleasing flexibility and richness to tones. The addition of vibrato is also motivated by physiological reasons. In vibrato, the laryngeal musculature is constantly working and resting; but in the production of straight tone, the musculature is constantly working. Measured values of vibrato characteristics produced by reciters Gh and Hu are within the range of typical values [5, 6]. Mean vibrato rates for Gh and Hu were found to be comparable: 5 ±0.4 Hz and 5.6 ±0.8 Hz, respectively. However, mean excursion values differed between the two reciters: 53 ±17 and 34 ±11 cents, respectively.

Figure 7 shows an example of vibrato undulations occurring over an extended vowel produced by Gh. Note that the reciter's melodic line is characterized by a three-semitone leap from a flat D5 to a flat B4. The vibrato undulations on these two tones look different. The first undulations have fairly higher frequency but lower extent rates than the second ones.

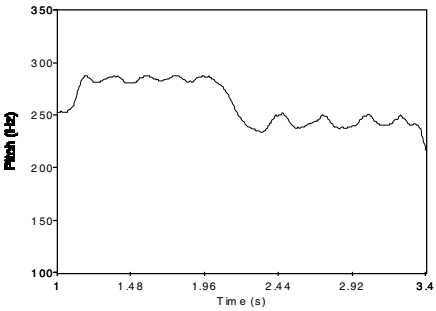


Figure 7: F0 tracking of vibrato undulations produced by Gh on the extended vowel /aː/ in the word *ʃaːʔa*.

4. CONCLUSIONS

The experiment described above showed how two groups of Quran reciters differed in the realization of vowel lengthening in two respects: (1) The Egyptians are consistent with the timing of the extensions realizing the required 4 and 6-beat distinctions, while the Saudis extend the duration of lengthening beyond the required 4 and 6 counts. (2) The Egyptians constantly produce flat pitch contours, whereas the Saudis have much variation in pitch movements. These range from purely flat contours to modulated components combined with flat ones. The improvisational use of melodic ornamentation by the Saudis is an interesting finding which is incompatible with the general distinction made between the *murattal* and the *mujawwad* styles of Quranic recitation. The *murattal* style used by the Saudis wasn't found to be just a simple straightforward form of recitation. It rather shares with the *mujawwad* style the use of musical elements with an intent to produce an emotional effect on listeners. This presence of musicality explains in part why the *murattal* style is becoming more and more popular among the Quran listeners.

REFERENCES

[1] A. al-Tawīl, *Fannu al-Tartīl wa 'Ulumuhu*, Mujamma' al-Malik Fahd, Medina, 1999.

[2] X. Nelson , *The Art of Reciting the Qur'an*, 1987.

[3] P. Boersma and D. Weenink, http://www.praat.org, Version 4.0.34, 2002.

[4] P. Cook, "An investigation of singer pitch deviation as a function of pitch and dynamics," *Proc. of the 13th ICPHS*, **I**, pp. 202-05, 1995.

[5] E. Prame, "Measures of vibrato rate in 10 singers", *J Acoust Soc Am*, **96** (**04**), pp.1979-1984, 1994.

[6] J. Bretos and J. Sundberg, "Measurements of vibrato parameters in long sustained crescendo notes as sung by ten sopranos", *TMH-QPSR*, *KTH*, **43**, pp.37-44, 2002.