Language Manual

American English

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1 General

This document discusses certain aspects of text-to-speech processing for the American English text-to-speech system, in particular the different types of input characters and text that are allowed.

This version of the document corresponds to four voices; the High Quality voices Heather, Laura and Ryan, and the High Density voices John and Jane. Note that there are some differences between the voices when it comes to text processing

2 Letters in orthographic text

Characters from **A-Z** and **a-z** may constitute a word. Certain other characters are also considered as letters, notably those used as letters in other European languages, i.e. "ñ, ō, å, ç, é". These letters are not pronounced as in their native languages though, they are pronounced as regular "n, o, a, c, e" etc.

Characters outside of these ranges, i.e. numbers, punctuation characters and other non-alphanumeric characters are not considered as letters.

3 Punctuation characters

Punctuation marks appearing in a text affect both rhythm and intonation of a sentence. The following punctuation characters are permitted in the normal input text string:
`, : ; " " . ? ! ( ) { } [ ]'`

3.1 Comma, colon and semicolon

Comma < , >, colon < : > and semicolon < ; > cause a brief pause to occur in a sentence, accompanied by a small rising intonation pattern just prior to the character.

3.2 Quotation marks

Quotes < " " > appearing around a single word or a group of words cause a brief pause before and after the quoted text.

3.3 Full stop

A full stop < . > is a sentence terminal punctuation mark which causes a falling end-of-sentence intonation pattern and is accompanied by a somewhat longer pause. A full stop may also be used as a decimal marker in a number (see chapter 5) and in abbreviations (see chapter 8).

3.4 Question mark

A question mark <?> ends a sentence and causes question-intonation, first rising and then falling.

3.5 Exclamation mark

The exclamation mark <!> behaves in a similar manner to the full stop, causing a falling intonation pattern followed by a pause.

3.6 Parentheses, brackets and braces

Parenthesis < ( ) >, brackets < [ ] > and braces < { } > appearing around a single word or a group of words cause a brief pause before and after the bracketed text.

4 Other non-alphanumeric characters

4.1 Non-punctuation characters

The characters listed below are processed as non-letter, non-punctuation characters. Some are pronounced at all times and others are only pronounced in certain contexts, which are described in the following sections of this chapter.

Symbol	Reading
/	slash
+	plus
$	dollars
£	pounds
€	euros
¥	yen
<	less than
>	greater than
%	percent
^	circumflex
|	pipe
~	tilde
@	at
=	equals
^{2}	see below
^{3}	see below
-	see below
*	see below

Table 1   Non-punctuation characters

4.2 The ² and ³ signs

The reading of expressions with ² and ³ is:

Expression	Reading
mm²	square millimeters
cm²	square centimeters
m²	square meters
km²	square kilometers
mm³	cubic millimeters
cm³	cubic centimeters
m³	cubic meters
km³	cubic kilometers

4.3 Symbols whose pronunciation varies depending on the context

4.3.1 Hyphen

A hyphen < - > is pronounced "minus" if followed by a digit. In certain date formats, in between days or years, the hyphen is pronounced "to". In other cases the hyphen is never pronounced.

Expression	Reading
44-3	forty-four minus three
15-20 October	fifteenth to twentieth of October
6-10 Nov	sixth to tenth of November
1998-2004	nineteen ninety-eight to two thousand four
02-02-2002	February second two thousand two
low-income	low income

4.3.2 Asterisk

Asterisk < * > is pronounced "times" if enclosed by digits. In other cases it is pronounced "asterisk".

Expression	Reading
2*3	two times three
*bc	asterisk b c

5 Number processing

Strings of digits that are sent to the text-to-speech converter are processed in several different ways, depending on the format of the string of digits and the immediately surrounding punctuation or non-numeric characters. To familiarize the user with the various types of formatted and non-formatted strings of digits that are recognized by the system, a brief description of the basic number processing is provided below, along with examples. Number processing is subdivided into the following categories:

Full number pronunciation
Leading zero
Decimal numbers
Currency amounts
Ordinal numbers
Arithmetic operators
Mixed digits and letters
Time of day
Year
Dates
Phone numbers

5.1 Full number pronunciation
Full number pronunciation is given for the whole number part of the digit string.

Example

2425	full number
2,425	full number
2 425	full number
24.25	24 is a full number, 25 is the decimal part

Numbers denoting thousands, millions and billions (numbers larger than 999) may be grouped using space or comma (not full stop). In order to achieve the right pronunciation the grouping must be done correctly.

The rules for grouping of numbers are the following:
- Numbers are grouped in groups of three starting at the end.
- The first group in a number may consist of one, two, or three digits.
- If a group, other than the first, does not contain exactly three digits, the sequence of digits is not interpreted as a full number.
- The highest number read is 99999999999 (eleven digits). Numbers higher than this are read as separate digits.

Number	Reading
2580	two thousand five hundred and eighty
2 580	"
2,580	"
25800	twenty-five thousand eight hundred
25 800	"
25,800	"
2580350	two million five hundred eighty thousand three hundred and fifty
2 580 350	"
2,580,350	"
1000000000	one billion
123456789012	one two three four five six seven eight nine zero one two
23 456 789 012	twenty-three billion four hundred fifty-six million seven hundred eighty-nine thousand and twelve

5.2 Leading zero

Numbers that begin with 0 (zero) are read digit by digit.

Number	Reading
09253	zero nine two five three
020	zero two zero

5.3 Decimal numbers

Comma or full stop may be used when writing decimal numbers.

The full number part of the decimal number (the part before comma or full stop) is read according to the rules in 5.1. The decimals (the part after comma or full stop) are read as separate digits. Note: A number containing a comma followed by exactly three digits is not read as a decimal number but as a full number, following the rules in 5.1.

Number	Reading
16.234	sixteen point two three four
3.1415	three point one four one five
1251.04	one thousand two hundred and fifty-one point zero four
1,251.04	one thousand two hundred and fifty-one point zero four
2.50	two comma five zero
2,50	two point five zero
3,141	three thousand one hundred and forty-one

5.4 Monetary amounts

The following principles are followed for monetary amounts:

- Numbers with zero or two decimal places preceded or followed by the currency markers £, $, ¥ or € are read as monetary amounts.
- Numbers with zero or two decimal places followed by the words "pounds", "dollars", "yen" or "euros" (singular or plural) are read as monetary amounts.
- Accepted decimal markers are comma and full stop.
- No spaces are allowed in the number.
- The decimal part (consisting of two digits) in monetary amounts is read as "and nn pence" and "and nn cents".
- If the decimal part is "00" it will not be read.

Example	Reading
$15.00.	fifteen dollars
15.00£.	fifteen pounds
15.00 euros.	fifteen euros
€ 200.50	two hundred euros and fifty cents
1,000,000 ¥	one million yen

There is also the possibility of writing large amounts as follows:

$ 1 million	one million dollars

5.5 Ordinal numbers

Numbers are read as ordinals in the following cases:

- The number is followed by a month name or one of the month name abbreviations and the number is smaller or equal to 31. The number may be preceded by a day or an abbreviation for a day. Examples: 3 January, 3 Jan, Tuesday 3 Jan.
- The number consists of a day interval followed by a month name/abbreviation. Example 15-16 January
- The number is followed by "st, nd, rd, th, d". Examples: 1st, 2nd, 3rd, 4th, 23d.

Valid abbreviations for months: Jan, Feb, Mar, Apr, Jun, Jul, Aug, Sept, Oct, Nov and Dec.

Valid abbreviations for days: Mon, Tue, Wed, Thu, Thurs, Fri, Sat and Sun.

The abbreviations above are only expanded to names of months and days when appearing in correct date contexts.

5.6 Arithmetic operators

Numbers together with arithmetical operators are read according to the examples below.

Expression	Reading
-12	minus twelve
+24	plus twenty-four
2*3	two times three
2/3	two divided by three
25%	twenty-five percent
3.4%	three point four percent

5.7 Mixed digits and letters

If a letter appears within a sequence of digits, the groups of digits will be read as numbers according to the rules above. The letter marks the boundary between the numbers. The letter will also be read. Examples:

Expression	Reading
77B84Z3	seventy-seven B eighty-four Z three
0092B87-B	zero zero nine two B eighty-seven B

5.8 Time of day

The colon is used to separate hours, minutes and seconds. Abbreviations such as "A.M." and "P.M." (possible variants: a.m., am, AM, p.m., pm, PM) may follow or precede the time, with a space inserted between the time and the abbreviation.

Example: 9 A.M.

4 pm

Possible patterns are:

a) **hh:mm (or h:mm)**

b) **hh:mm:ss (or h:mm:ss)**

c) **hh:mm'ss" (or h:mm'ss")**   ex 12:30'45"

h = hour, m = minute, s = second.

In pattern a): If the "mm"-part is equal to "00", this part will not be read. Instead, "o'clock" will be added if the hours are less than 13, or "hundred hours" will be added if the hours are greater than or equal to 13.

Example: 9:00   nine o'clock
          13:00   thirteen hundred hours

In pattern b): An "and" will be inserted before the "ss"-part, and "seconds" will be added after it. If the "ss"-part is equal to "00", this part will not be read.

Pattern (c) follows the rules for pattern (b).

5.9 Years

Numbers between 1100 and 2000 are always read as hundreds (year reading) with the exception of numbers containing decimals.
Years (2 or 4 digits) can also be followed by "s" or " 's" to indicate decades.

Expression	Reading
1988	nineteen eighty-eight
1939-45	nineteen thirty-nine to forty-five
1088	one thousand eighty-eight
1988.0	one thousand nine hundred and eighty-eight point zero
1988.32	one thousand nine hundred and eighty-eight point three two
September 1999	September nineteen ninety-nine
1980s	nineteen eighties
70's	seventies
1980's	nineteen eighties

5.10 Dates

The valid formats for dates are:

1.mm-dd-yyyy, mm.dd.yyyy, and mm/dd/yyyy
2.mm-dd-yy, mm.dd.yy, and mm/dd/yy

"**yyyy**" is a four-digit number, "**yy**" is a two-digit number, "**mm**" is a month number between 1 and 12 and "**dd**" a day number between 1 and 31.

Hyphen, full stop and slash may be used as delimiters.

In all formats, one or two digits may be used in the "mm" and "dd" part. Zeros may be used in front of numbers below 10.

Examples of valid formats and their readings:

Type 1:   mm-dd-yyyy, mm.dd.yyyy, and mm/dd/yyyy

10-02-2003	or	10-2-2003	October second two thousand three
10.02.2003	or	10.2.2003	"
10/02/2003	or	10/2/2003	"

Type 2:   mm-dd-yy, mm.dd.yy, and mm/dd/yy

10-02-03	or	10-2-03	October second two thousand three
10.02.03	or	10.2.03	"
10/02/03	or	10/2/03	"

Ranges of days and years are also supported.

Examples:

1998-1999	nineteen ninety-eight to nineteen ninety-nine
1939-45	nineteen thirty-nine to forty-five
2002/3	two thousand two to three
14-15 January	fourteenth to fifteenth of January
October 19-20	October nineteenth to twentieth

Other possible formats include :

- Monday, 15 January   (with or without the comma)
- Mon, January 15   (with or without the comma)
- 30 April 1999
- April 30 1999
- May 1953
- 3 May

5.11 Phone numbers

In this section the patterns of digits that are recognised as phone numbers are described. In the pronunciation of phone numbers, all numbers are read out digit by digit with pauses between groups of numbers.

5.11.1 Ordinary phone numbers

Sequences of digits in the following formats are treated as phone numbers.

The following sequences of digits can be separated by a space, a period, or a hyphen:

- xxx xx xx xx
- xxx xxxx
- xx (xx) xxx xx xx
- (xx) xx xx xx xx xx
- xx (x)x xx xx xx xx
- xx (x) x xx xx xx xx
- xx x xx xx xx xx

The following sequences can only appear in these formats:

- (xx)-xxxx-xxx-xxx
- (xx).xxxx.xxx.xxx
- xx xxx xx xx
- x-xxx-xxx-xxxx

Other formats are preceded by an area code that can consist of 1-3 numbers, either surrounded by parentheses or not. The groups of digits can be separated by a space, slash, hyphen or period. If the area code is surrounded by parentheses, it can be grouped with the other digits.

- area code+ xxx xxxx
- area code+ xxx xxx

5.11.2 International phone numbers

International phone numbers follow the pattern below:
International Prefix + Country code + space or hyphen + Local number

International prefix: "00" or "+"
Country code: 1-3 digits
Local number: 6-12 digits

All formats included above can be preceded by an international prefix and a country code

Examples:

001-12-456-7894
001-12 578 21 56
0032 (71).4521.521.843

6 How to change pronunciation errors

Words that are not pronounced correctly by the text-to-speech converter can be entered in the user lexicon (see User's guide). In this lexicon, the user enters a phonetic transcription of the word (see chapter 7). Phonetic translations can also be entered directly in the text, using a PRN-tag (see User's guide).

7 American English Phonetic Text

The American English text-to-speech system uses the American English subset of the SAMPA phonetic alphabet (Speech Assessment Methods Phonetic Alphabet), with a few exceptions. The symbol /o/ was replaced by /@U/ (ex. nose), /e/ was replaced by /EI/ (ex. hate), /aI/ was replaced by /AI/ (ex. light), and /3`/ and /@`/ were replaced by /r=/ (ex. furs, corner). The symbol /4/ was also introduced to represent a flapped 't' (ex. better). The symbols are written with a space between each phoneme.

Only SAMPA may be used in phonetic transcriptions. Symbols not listed here are not valid in phonetic transcriptions and will be ignored if included in the user lexicon or in a PRN tag.

7.1 Consonants

7.1.1 Symbols for the American English consonants

Symbol	Word	Phonetic text	Comment
b	bad	b {1 d	
t	stone	s t @U1 n	
t_h	tab	t_h {1 b	
4	better	b E1 4 r=	flapped t
p	spot	s p A1 t	
p_h	pipe	p_h AI1 p	
d	date	d EI1 t	
k	skin	s k I1 n	
k_h	cone	k_h @U1 n	
g	gag	g {1 g	
m	man	m {1 n	
n	nose	n @U1 z	
r	rose	r @U1 z	
l	let	l E1 t	
N	ring	r I1 N	
f	fat	f {1 t	
v	vote	v @U1 t	
s	sat	s {1 t	
z	zoo	z u1	
S	shin	S I1 n	
tS	chin	tS I1 n	
Z	measure	m E1 Z r=	
dZ	gin	dZ I1 n	
D	this	D I1 s	
T	thin	T I1 n	
w	wait	w EI1 t	glide
j	yacht	j A1 t	glide
h	hit	h I1 t	glide

Table 2   American English consonants

7.2 Vowels

7.2.1 Symbols for the American English vowels

Symbol	Word	Phonetic text	Comment
r=	corner	k O1 r n r=	
A	pot	p A1 t	
O	thought	T O1 t	
I	lit	l I1 t	
i	neat	n i1 t	
u	zoo	z u1	
V	hut	h V1 t	
U	put	p U1 t	
{	pat	p {1 t	
E	net	n E1 t	
@	allow	@ l aU1	
EI	main	m EI1 n	
AI	high	h AI1	
OI	boy	b OI1	
@U	nose	n @U1 z	
aU	pout	p aU1 t	

Table 3   American English vowels

7.3 Lexical stress

In words with more than one syllable, one (and normally only one) of the syllables is more prominent than the others. This is referred to as word stress, or lexical stress. Words of one syllable also have word stress when spoken in isolation, although many may lose the stress in certain contexts. For the correct pronunciation of a word, it is important to include the symbol marking the word stress.

In the phonetic transcriptions the word stress is indicated by the symbol "1" placed directly after the stressed vowel (with no space between the vowel symbol and the stress symbol).

7.4 Glottal stops

A glottal stop, represented by the phonetic symbol /?/, is a small sound which is often used to separate two words when the second word starts with a stressed vowel. This sound can be inserted in a transcription in order to improve the pronunciation.

7.5 Pause

An underscore < _ > in a phonetic transcription generates a small pause.

8 Abbreviations

In the current version of the American English text-to-speech system, the abbreviations in table 4 below are recognized in all contexts. These abbreviations are mostly case-insensitive (except for those indicated below by "*") and require no full stop in order to be recognized as an abbreviation.

As previously mentioned, there are also abbreviations for the days of the week and the months.

Abbreviation	Reading
kg	kilogram
°C	degrees Celsius
°F	degrees Fahrenheit
°K	degrees Kelvin
asap	as soon as possible
b/f	before
blvd	boulevard
cm	centimeters
corp	corporation
dB*	decibel
DM*	Deutschmark (only expanded after numbers)
eg	for example
etc	et cetera
ft	feet
gal	gallon
gov	governor
hr	hour
hrs	hours
ie	that is
jr	junior
km	kilometers
Km/h	kilometers per hour
mg	milligram
ml	milliliters
mm	millimeters
mph	miles per hour
mr	mister
mrs	missis
ms	miss
mt	mount
prof	professor
sgt	sergeant
sr	senior
tsp	teaspoon
vs	versus
gen	general
ltd	limited
dept	department
ct	court
rd	road
av	avenue
ctrl	control
lb	pounds
sec	seconds (Note: SEC is another abbreviation, it is spelled out)
sen	senator

Table 4   Abbreviations

Some abbreviations are expanded differently depending on their position in the sentence. For example, "dr" and "st" are expanded into "drive" and "street" if they appear after a capitalized noun. They are expanded into "doctor" and "saint" when they appear before a capitalized noun.

Examples	Readings
Main st.	Main street
St John.	Saint John
Bayview dr.	Bayview drive
Dr. Jones.	Doctor Jones

"m, g" and "in." are expanded only when appearing after a number.

Examples	Readings	
25 m	twenty-five meters	
30 in.	thirty inches	(note that the period is mandatory here)
45 g	forty-five grams	

The following state abbreviations are recognized in the American English system:

AK	Alaska	NC	North Carolina
AL	Alabama	ND	North Dakota
AZ	Arizona	OH	Ohia
AR	Arkansas	OR	Oregon
CA	California	PA	Pennsylvania
CO	Colorado	PR	Puerto Rico
CT	Connecticut	RI	Rhode Island
DE	Delaware	SC	South Carolina
FL	Florida	SD	South Dakota
GA	Georgia	TN	Tennessee
IA	Iowa	TX	Texas
IL	Illinois	VT	Vermont
KS	Kansas	VA	Virginia
KY	Kentucky	WA	Washington
LA	Louisiana	WI	Wisconsin
MA	Massachusetts	WV	West Virginia
MD	Maryland	WY	Wyoming
ME	Maine		
MI	Michigan		
MN	Minnesota		
MO	Missouri		
MS	Mississippi		
MT	Montana		
NC	North Carolina		
ND	North Dakota		
NE	Nebraska		
NV	Nevada		
NH	New Hampshire		
NJ	New Jersey		
NM	New Mexico		
NV	Nevada		
NY	New York		

9 Web-addresses and email

Web-addresses and email-addresses are read as follows:
- "www" is read as three w's spelled letter by letter.
- Full stops are read as "dot", hyphens as "dash", underscore ("_") as "underscore", slash ("/") as "slash".
- "us, uk, fr" and all the other abbreviations for countries are spelled out letter by letter.
- The "@" is read "at" .
- Words/strings (including "org", "com" and "edu") are pronounced according to the normal rules of pronunciation in the system and in accordance with the lexicon.

String	Reading
www.babeltech.com	w w w dot babeltech dot com
http://www.babeltech.com	h t t p colon slash slash w w w dot babeltech dot com
smith@yahoo.us	smith at yahoo dot u s
jane_smith@yahoo.us	jane underscore smith at yahoo dot u s