

# TIPA: A System for Processing Phonetic Symbols in L<sup>A</sup>T<sub>E</sub>X

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## Introduction

TIPA<sup>1</sup> is a system for processing IPA (International Phonetic Alphabet) symbols in L<sup>A</sup>T<sub>E</sub>X. It is based on TSIPA<sup>2</sup> but both METAFONT source codes and L<sup>A</sup>T<sub>E</sub>X macros have been thoroughly rewritten so that it can be considered as a new system.

Among many features of TIPA, the following are the new features as compared with TSIPA or any other existing systems for processing IPA symbols.

- A new 256 character encoding for phonetic symbols ('T3'), which includes all the symbols and diacritics found in the recent versions of IPA and some non-IPA symbols.
- Complete support of L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>.
- Roman, slanted, bold, bold extended and sans serif font styles.
- Easy input method in the IPA environment.
- Extended macros for accents and diacritics.<sup>3</sup>
- A flexible system of macros for 'tone letters'.
- An optional package (`vowel.sty`) for drawing vowel diagrams.<sup>4</sup>
- A slightly modified set of fonts that go well when used with Times Roman and Helvetica fonts.

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<sup>1</sup> TIPA stands for *T<sub>E</sub>X IPA* or *Tokyo IPA*. The primary ftp site in which the latest version of TIPA is placed is `ftp://tooyoo.l.u-tokyo.ac.jp/pub/TeX/tipa`, and also it is mirrored onto the directory `fonts/tipa` of the CTAN archives.

<sup>2</sup> TSIPA was made in 1992 by Kobayashi Hajime, Fukui Rei and Shirakawa Shun. It is available from a CTAN archive.

One problem with TSIPA was that symbols already included in OT1, T1 or Math fonts are excluded, because of the limitation of its 128 character encoding. As a result, a string of phonetic representation had to be often composed of symbols from different fonts, disabling the possibility of automatic inter-word kerning. And also too many symbols had to be realized as macros.

<sup>3</sup> These macros are now defined in a separate file called '`exaccent.sty`' in order for the authors of other packages to be able to make use of them. The idea of separating these macros from other ones was suggested by Frank Mittelbach.

<sup>4</sup> This package (`vowel.sty`) can be used independently from the TIPA package. Documentation is also made separately in '`vowel.tex`' so that no further mention will be made here.

## TIPA Encoding

**Selection of symbols** The selection of TIPA phonetic symbols<sup>5</sup> was made based on the following works.

- *Phonetic Symbol Guide* [9] (henceforth abbreviated as *PSG*).
- The official IPA charts of '49, '79, '89 and '93 versions.
- Recent articles published in the *JIPA*<sup>6</sup>, such as "Report on the 1989 Kiel Convention" [6], "Further report on the 1989 Kiel Convention" [7], "Computer Codes for Phonetic Symbols" [3], "Council actions on revisions of the IPA" [8], etc.
- An unpublished paper by J. C. Wells: "Computer-coding the IPA: a proposed extension of SAMPA" [10].
- Popular textbooks on phonetics.

More specifically, TIPA contains all the symbols, including diacritics, defined in the '79, '89 and '93 versions of IPA. And in the case of the '49 version of IPA, which is described in the *Principles* [5], there are too many obsolete symbols and only those symbols that had had some popularity at least for some time or for some group of people are included.

Besides IPA symbols, TIPA also contains symbols that are useful for the following areas of phonetics and linguistics.

- Symbols used in the American phonetics (e.g. æ, ɛ, ɒ, λ, etc.).
- Symbols used in the historical study of Indo-European languages (e.g. ɸ, ɹ, ʌ, ʒ, ɚ, ɛ, and accents such as á, ě, etc.).
- Symbols used in the phonetic description of languages in East Asia (e.g. ɿ, ʅ, ɕ, ɲ, ʈ, etc.).
- Diacritics used in 'extIPA Symbols for Disordered Speech' [4] and 'VoQS (Voice Quality Symbols)' [1] (e.g. ɳ̂, ɸ̂, ɪ̂, etc.).

It should be also noted that TIPA includes all the necessary elements of 'tone letters', enabling

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<sup>5</sup> In the case of TSIPA, the selection of symbols was based on "Computer coding of the IPA: Supplementary Report" [2].

<sup>6</sup> *Journal of the International Phonetic Association*.

all the theoretically possible combinations of the tone letter system. In the recent publication of the International Phonetic Association tone letters are admitted as an official way of representing tones but the treatment of tone letters is quite insufficient in that only a limited number of combination is allowed. This is apparently due to the fact that there has been no ‘portable’ way of combining symbols that can be used across various computer environments. Therefore T<sub>E</sub>X’s productive system of macro is an ideal tool for handling a system like tone letters.

In the process of writing METAFONT source codes for TIPA phonetic symbols there have been many problems besides the one with the selection of symbols. One of such problems was that sometimes the exact shape of a symbol was unclear. For example, the shapes of the symbols such as ʃ (Stretched C), j (Curly-tail J) differ according to sources. This is partly due to the fact that the IPA has been continuously revised for the past few decades, and partly due to the fact that different ways of computerizing phonetic symbols on different systems have resulted in the diversity of the shapes of phonetic symbols.

Although there is no definite answer to such a problem yet, it seems to me that it is a privilege of those working with METAFONT to have a systematic way of controlling the shapes of phonetic symbols.

**Encoding** The 256 character encoding of TIPA is now officially called the ‘T3’ encoding.<sup>7</sup> In deciding this new encoding, care is taken to harmonize with existing other encodings, especially with the T1 encoding. Also the easiness of inputting phonetic symbols is taken into consideration in such a way that frequently used symbols can be input with small number of keystrokes.

Table 1 shows the layout of the T3 encoding.

The basic structure of the encoding found in the first half of the table (character codes ’000–’177) is based on normal text encodings (ASCII, OT1 and T1) in that sectioning of this area into several groups such as the section for accents and diacritics, the section for punctuation marks, the section for numerals, the sections for uppercase and lowercase letters is basically the same with these encodings.

Note also that the T3 encoding contains not only phonetic symbols but also usual punctuation marks that are used with phonetic symbols, and in such cases the same codes are assigned as the normal

<sup>7</sup> In a discussion with the L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub> team it was suggested that the 128 character encoding used in WSUIPA would be referred to as the OT3 encoding.

	'0	'1	'2	'3	'4	'5	'6	'7
'00x	Accents and diacritics							
'04x	Punctuation marks							
'06x	Basic IPA symbols I (vowels)							
'07x	Diacritics, etc.							
'10x	Basic IPA symbols II							
'13x	Diacritics, etc.							
'14x	Pct.	Basic IPA symbols III (lowercase letters)						
'17x								Diacr.
'20x	Tone letters and other suprasegmentals							
'23x	Old IPA, non-IPA symbols							
'24x	Extended IPA symbols							
'30x								Gmn.
'33x	Basic IPA symbols IV							
'37x								Gmn.

Pct. = Punctuation marks, Diacr. = Diacritics, Gmn. = Symbols for Germanic languages.

Table 1: Layout of the T3 encoding

text encodings. However it is a matter of trade-off to decide which punctuation marks are to be included. For example ‘:’ and ‘;’ might have been preserved in T3 but in this case ‘:’ has been traditionally used as a substitute for the length mark ‘ˑ’ so that I decided to exclude ‘:’ in favor of the easiness of inputting the length mark by a single keystroke.

The encoding of the section for accents and diacritics is closely related to T1 in that the accents commonly included in T1 and T3 have the same encoding.

The sections for numerals and uppercase letters are filled with phonetic symbols that are used frequently in many languages, because numerals and uppercase letters are usually not used as phonetic symbols. And the assignments made here are used as the ‘shortcut characters’, which will be explained in the section entitled “Ordinary phonetic symbols” (page 105).

<i>ASCII</i>	:	;	"							
<i>TIPA</i>	:	˙	˘							
<i>ASCII</i>	0	1	2	3	4	5	6	7	8	9
<i>TIPA</i>	h	i	l	z	q	e	v	y	o	e
<i>ASCII</i>	@	A	B	C	D	E	F	G	H	I
<i>TIPA</i>	ə	ɑ	β	ç	ð	ε	ϕ	γ	h	i
<i>ASCII</i>	J	K	L	M	N	O	P	Q	R	S
<i>TIPA</i>	j	ʋ	ʌ	ŋ	ŋ	ɔ	ʔ	ʃ	r	ʃ
<i>ASCII</i>	T	U	V	W	X	Y	Z			
<i>TIPA</i>	θ	ʊ	ʊ	ʉ	χ	ʏ	ʒ			

Table 2: TIPA shortcut characters

As for the section for uppercase letters in the usual text encoding, a series of discussion among the members of the `ling-tex` mailing list revealed that there seem to be a certain amount of consensus on what symbols are to be assigned to each code. For example they were almost unanimous for the assignments such as  $\alpha$  for A,  $\beta$  for B,  $\delta$  for D,  $\jmath$  for S,  $\theta$  for T, etc. For more details, see table 2.

The encoding of the section for numerals was more difficult than the above case. One of the possibilities was to assign symbols based on the resemblance of shapes. One can easily think of assignments such as  $\mathfrak{z}$  for 3  $\mathfrak{b}$  for 6, etc. But the resemblance of shape alone does not serve as a criteria for all the assignments. So I decided to assign basic vowel symbols to this section.<sup>8</sup> Fortunately the resemblance of shape is to some extent maintained as is shown in table 2.

The encoding of the section for lowercase letters poses no problem since they are all used as phonetic symbols. Only one symbol, namely ‘g’, needs some attention because its shape should be ‘g’, rather than ‘g’, as a phonetic symbol.<sup>9</sup>

The second half of the table (character codes ‘200–’377) is divided into four sections. The first section is devoted to the elements of tone letters and other suprasegmental symbols.

Among the remaining three sections the last section ‘340–’377 contains more basic symbols than the other two sections. This is a result of assigning the same character codes as latin-1 (ISO8859-1) and T1 encodings to the symbols that are commonly included in TIPA, latin-1 and T1 encoded fonts.<sup>10</sup> These are the cases of  $\text{æ}$ ,  $\text{ø}$ ,  $\text{œ}$ ,  $\text{ç}$  and  $\text{þ}$ . And within each section symbols are arranged largely in alphabetical order.

<sup>8</sup> This idea was influenced by the above mentioned article by J. C. Wells [10].

<sup>9</sup> But the alternative shape ‘g’ is preserved in other section and can be used as `\textg`.

<sup>10</sup> This is based on a suggestion by Jörg Knappen.

For a table of the T3 encoding, see Appendix C (page 114).

### TIPA fonts

This version of TIPA includes two families of IPA fonts, `tipa` and `xipa`. The former family of fonts is for normal use with L<sup>A</sup>T<sub>E</sub>X, and the latter family is intended to be used with ‘`times.sty`’(PSNFSS). They all have the same T3 encoding as explained in the previous section.

- `tipa`
  - Roman:** `tipa8`, `tipa9`, `tipa10`, `tipa12`, `tipa17`
  - Slanted:** `tipas18`, `tipas19`, `tipas110`, `tipas112`
  - Bold extended:** `tipabx8`, `tipabx9`, `tipabx10`, `tipabx12`
  - Sans serif:** `tipass8`, `tipass9`, `tipass10`, `tipass12`, `tipass17`
  - Bold:** `tipab10`
- `xipa`
  - Roman:** `xipa10`
  - Slanted:** `xipas110`
  - Bold:** `xipab10`
  - Sans serif:** `xipass10`

All these fonts are made by METAFONT, based on the Computer Modern font series. In the case of the `xipa` series, parameters are adjusted so as to look fine when used with Times Roman (in the cases of `xipa10`, `xipas110`, `xipab10`) and Helvetica (in the case of `xipass10`).

### Usage

**Declaration of TIPA package** In order to use TIPA, first declare TIPA package at the preamble of a document.

```
\documentclass{article}
\usepackage{tipa}
```

**Encoding options** The above declaration uses OT1 as the default text encoding. If you want to use TIPA symbols with T1, specify the option ‘T1’.

```
\documentclass{article}
\usepackage[T1]{tipa}
```

If you want to use a more complex form of encoding, declare the use of `fontenc` package by yourself and specify the option ‘`noenc`’. In this case the option ‘T3’, which represents the TIPA encoding, must be included as an option to the `fontenc` package. For example, if you want to use TIPA and the University Washington Cyrillic (OT2) with the T1 text encoding, the following command will do this.

```
\documentclass{article}
\usepackage[T3,OT2,T1]{fontenc}
\usepackage{noenc}{tipa}
```

By default, TIPA includes the `fontenc` package internally but the option `noenc` suppresses this.

**Using TIPA with PSNFSS** In order to use TIPA with `times.sty`, declare the use of `times.sty` before declaring `tipa` packages.

```
\documentclass{article}
\usepackage{times}
\usepackage{tipa}
```

Font description files `T3ptm.fd` and `T3phv.fd` are automatically loaded by the above declaration.

**Other options** TIPA can be extended by the options `tone`, `extra`.

If you want to use the optional package for ‘tone letters’, add ‘`tone`’ option to the `\usepackage` command that declares `tipa` package.

```
\usepackage[tone]{tipa}
```

And if you want to use diacritics for extIPA and VoQS, specify ‘`extra`’ option.

```
\usepackage[extra]{tipa}
```

Finally there is one more option called ‘`safe`’, which is used to suppress definitions of some possibly ‘dangerous’ commands of TIPA.

```
\usepackage[safe]{tipa}
```

More specifically, the following commands are suppressed by declaring the `safe` option. Explanation on the function of each command will be given later.

- `\s` (equivalent to `\textsyllabic`)
- `\*` (already defined in plain T<sub>E</sub>X)
- `\|`, `\:`, `\;`, `\!` (already defined in L<sup>A</sup>T<sub>E</sub>X)

## Input Commands for Phonetic Symbols

**Ordinary phonetic symbols** TIPA phonetic symbols can be input by the following two ways.

1. Input macro names in the normal text environment.
2. Input macro names or *shortcut characters* within the following groups or environment.
  - `\textipa{...}`<sup>11</sup>
  - `{\tipaencoding ...}`
  - `\begin{IPA} ... \end{IPA}`

(These groups and environment will be henceforth referred to as the *IPA environment*.)

<sup>11</sup> I personally prefer a slightly shorter name like `\ipa` rather than `\textipa` but this command was named after the general convention of L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>. The same can be said to all the symbol names beginning with `\text`.

A shortcut character refers to a single character that is assigned to a specific phonetic symbol and that can be directly input by an ordinary keyboard. In TIPA fonts, the character codes for numerals and uppercase letters in the normal ASCII encoding are assigned to such shortcut characters, because numerals and uppercase letters are usually not used as phonetic symbols. And additional shortcut characters for symbols such as *æ*, *œ*, *ø* may also be used if you are using a T1 encoded font and an appropriate input system for it.

The following pair of examples show the same phonetic transcription of a English word that are input by the above mentioned two input methods.

```
Input1: [\textsecstress\textepsilon kspl
\textschwa\textprimstress ne
\textsci\textesh\textschwa n]
```

```
Output1: [ɛksplə'neɪʃən]
```

```
Input2: \textipa{["Eksp1@"neIS@n]}
```

```
Output2: [ɛksplə'neɪʃən]
```

It is apparent that inputting in the IPA environment is far easier than in the normal text environment. Moreover, although the outputs of the above examples look almost the same, they are *not* identical, exactly speaking. This is because in the IPA environment automatic kerning between symbols is enabled, as is illustrated by the following pair of examples.

```
Input1: v\textturnv v w\textscaw
y\textturny y [\textesh]
```

```
Output1: vAv wAw yAy [ʃ]
```

```
Input2: \textipa{v2v w\textscaw yLy [S]}
```

```
Output2: vAv wAw yAy [ʃ]
```

Table 2 shows most of the shortcut characters together with the corresponding characters in the ASCII encoding.

**Naming of phonetic symbols** Every TIPA phonetic symbol has a unique symbol name, such as *Turned A*, *Hooktop B*, *Schwa*.<sup>12</sup> Also each symbol has a corresponding control sequence name, such as `\textturna`, `\texthtb`, `\textschwa`. The name used as a control sequence is usually an abbreviated form of the corresponding symbol name with a prefix `\text`. The conventions used in the abbreviation are as follows.

- Suffixes and endings such as ‘-ive’, ‘-al’, ‘-ed’ are omitted.

<sup>12</sup> The naming was made based on the literature listed in the section entitled “Selection of Symbols” (page 102). And users of TSIPA should be careful because TIPA’s naming is slightly modified from that of TSIPA.

<i>Symbol name</i>	<i>Macro name</i>	<i>Symbol</i>
Turned A	<code>\textturna</code>	ɐ
Glottal Stop	<code>\textglotstop</code>	ʔ
Right-tail D	<code>\textrightaild</code>	ɖ
Small Capital G	<code>\textscg</code>	ɡ
Hooktop B	<code>\texthtb</code>	ɸ
Curly-tail C	<code>\textctc</code>	ç
Crossed H	<code>\textcrh</code>	ħ
Old L-Yogh Ligature	<code>\textOlyoghlig</code>	ɮ
Beta	<code>\textbeta</code>	β

Table 3: Naming of TIPA symbols

- ‘right’, ‘left’ are abbreviated to `r`, `l` respectively.
- For ‘small capital’ symbols, prefix `sc` is added.
- A symbol with a hooktop is abbreviated as `ht...`
- A symbol with a curly-tail is abbreviated as `ct...`
- A ‘crossed’ symbol is abbreviated as `cr...`
- A ligature is abbreviated as `...lig`.
- For an old version of a symbol, prefix `O` is added.

Note that the prefix `O` (old) should be given in uppercase letter.

Table 3 shows some examples of correspondence between symbol names and control sequence names.

**Ligatures** Just like the symbols such as “, ”, —, —, fi, ff are realized as ligatures by inputting ‘‘, ’’, --, ---, `fi`, `ff` in  $\TeX$ , two of the TIPA symbols, namely *Secondary Stress* and *Double Pipe*, and double quotation marks<sup>13</sup> can be input as ligatures in the IPA environment.

*Input:* `\textipa{" " | || ‘ ‘ ’ ’}`

*Output:* ‘ , | || “ ”

**Special macros `\*`, `\;`, `\:` and `\!`** TIPA defines `\*`, `\;`, `\:` and `\!` as special macros in order to easily input phonetic symbols that do not have a shortcut character explained above. Before explaining how to use these macros, it is necessary to note that these macros are primarily intended to be used by linguists who usually do not care about things in math mode. And they can be ‘dangerous’ in that they override existing  $\LaTeX$  commands used in the math mode. So if you want to preserve the original meaning of these commands, declare the option ‘safe’ at the preamble.

<sup>13</sup> Although TIPA fonts do not include the symbols “ and ”, a negative value of kerning is automatically inserted between ‘ and ‘, ’ and ’, so that the same results can be obtained as in the case of the normal text font.

The macro `\*` is used in three different ways. First, when this macro is followed by one of the letters `f`, `k`, `r`, `t` or `w`, it results in a turned symbol.<sup>14</sup>

*Input:* `\textipa{\*f \*k \*r \*t \*w}`

*Output:* ɸ ɸ ɸ ɸ ɸ

Secondly, when this macro is followed by one of the letters `j`, `n`, `h`, `l` or `z`, it results in a frequently used symbol that has otherwise no easy way to input.

*Input:* `\textipa{\*j \*n \*h \*l \*z}`

*Output:* ɟ ɟ ħ † ʒ

Thirdly, when this macro is followed by letters other than the above cases, they are turned into the symbols of the default text font. This is useful in the IPA environment to select symbols temporarily from the normal text font.

*Input:* `\textipa{\*A dOg, \*B k\ae{t}, ma\super{\*{214}}}`

*Output:* A dɔg, B kæt, ma<sup>214</sup>

The remaining macros `\;`, `\:` and `\!` are used to make small capital symbols, retroflex symbols, and implosives or clicks, respectively.

*Input:* `\textipa{\;B \;E \;A \;H \;L \;R}`

*Output:* B E A H L R

*Input:* `\textipa{\:d \:l \:n \:r \:s \:z}`

*Output:* ɖ ɖ ɖ ɖ ɖ

*Input:* `\textipa{\!b \!d \!g \!j \!G \!o}`

*Output:* ɓ ɖ ɡ ʄ ɠ ɔ

**Punctuation marks** The following punctuation marks and text symbols that are normally included in the text encoding are also included in the T3 encoding so that they can be directly input in the IPA environment.

*Input:* `\textipa{! ' ( ) * + , - . \ / = ? [ ] ‘ ’}`

*Output:* ! ' ( ) \* + , - . / = ? [ ] ‘ ’

All the other punctuation marks and text symbols that are not included in T3 need to be input with a prefix `\*` explained in the last section when they appear in the IPA environment.

*Input:* `\textipa{\*; \*: \*@ \*\# \*\$ \*\& \*\% \*\{ \*\}}`

*Output:* ; : @ # \$ & % { }

**Accents and diacritics** Table 4 shows how to input accents and diacritics in TIPA with some examples. Here again, there are two kinds of input methods; one for the normal text environment, and the other for the IPA environment.

In the IPA environment, most of the accents and diacritics can be input more easily than in the

<sup>14</sup> This idea was pointed out by Jörg Knappen.

<i>Input in the normal text environment</i>	<i>Input in the IPA environment</i>	<i>Output</i>
<code>\'a</code>	<code>\'a</code>	á
<code>\"a</code>	<code>\"a</code>	ä
<code>\ a</code>	<code>\~a</code>	ã
<code>\r{a}</code>	<code>\r{a}</code>	â
<code>\textsyllabic{m}</code>	<code>\s{m}</code>	ɱ
<code>\textsubumlaut{a}</code>	<code>\"*a</code>	â
<code>\textsubtilde{a}</code>	<code>\~*a</code>	ã
<code>\textsubring{a}</code>	<code>\r*a</code>	â
<code>\textdotacute{e}</code>	<code>\.'e</code>	é
<code>\textgravedot{e}</code>	<code>\'e</code>	è
<code>\textacutemacron{a}</code>	<code>\'=a</code>	â
<code>\textcircumdot{a}</code>	<code>\^a</code>	â
<code>\texttildedot{a}</code>	<code>\~a</code>	ã
<code>\textbreve macron{a}</code>	<code>\u=a</code>	â

Table 4: Examples of inputting accents

normal text environment, especially in the cases of subscript symbols that are normally placed over a symbol and in the cases of combined accents, as shown in the table.

As can be seen by the above examples, most of the accents that are normally placed over a symbol can be placed under a symbol by adding an `*` to the corresponding accent command in the IPA environment.

The advantage of IPA environment is further exemplified by the all-purpose accent `\|`, which is used as a macro prefix to provide shortcut inputs for the diacritics that otherwise have to be input by lengthy macro names. Table 5 shows examples of such accents. Note that the macro `\|` is also ‘dangerous’ in that it has been already defined as a math symbol of L<sup>A</sup>T<sub>E</sub>X. So if you want to preserve the original meaning of this macro, declare ‘safe’ option at the preamble.

Finally, examples of words with complex accents that are input in the IPA environment are shown below.

*Input:* `\textipaf{*}\|c{k}\r*mt\'om`  
`*bhr\'=at\=er}`

*Output:* \*k̂mtóm \*bhrátēr

For a full list of accents and diacritics, see Appendix A

**Superscript symbols** In the normal text environment, superscript symbols can be input by a macro called `\textsuperscript`, which has been newly introduced in the recent version of L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>. This macro takes one argument which can be either a symbol or a string of symbols, and can be nested.

<i>Input in the normal text environment</i>	<i>Input in the IPA environment</i>	<i>Output</i>
<code>\textsubbridge{t}</code>	<code>\ [t</code>	t̄
<code>\textinvsubbridge{t}</code>	<code>\ ]t</code>	t̄
<code>\textsublhalfring{a}</code>	<code>\ (a</code>	ạ
<code>\textsubrhalfring{a}</code>	<code>\ )a</code>	ạ
<code>\textroundcap{k}</code>	<code>\ c{k}</code>	k̂
<code>\textsubplus{o}</code>	<code>\ +o</code>	o <sup>+</sup>
<code>\textraising{e}</code>	<code>\ 'e</code>	e <sup>+</sup>
<code>\textlowering{e}</code>	<code>\ 'e</code>	e <sup>-</sup>
<code>\textadvancing{o}</code>	<code>\ &lt;o</code>	o <sup>+</sup>
<code>\textretracting{a}</code>	<code>\ &gt;a</code>	a <sup>-</sup>
<code>\textovercross{e}</code>	<code>\ x{e}</code>	ē
<code>\textsubw{k}</code>	<code>\ w{k}</code>	k̂
<code>\textseagull{t}</code>	<code>\ m{t}</code>	t̄

Table 5: Examples of the accent prefix `\|`

Since the name of this macro is too long, TIPA provides an abbreviated form of this macro called `\super`.

*Input1:* `t\textsuperscript h`  
`k\textsuperscript w`  
`a\textsuperscript{bc}`  
`a\textsuperscript{b%}`  
`\textsuperscript{c}}`

*Output1:* t<sup>h</sup> k<sup>w</sup> a<sup>bc</sup> a<sup>b<sup>c</sup></sup>

*Input2:* `\textipaf{t\super{h} k\super{w}`  
`a\super{bc} a\super{b\super{c}}}`

*Output2:* t<sup>h</sup> k<sup>w</sup> a<sup>bc</sup> a<sup>b<sup>c</sup></sup>

These macros automatically select the correct size of superscript font no matter what size of the text font is used.

**Tone letters** TIPA provides a flexible system of macros for ‘tone letters’. A tone letter is represented by a macro called ‘`\tone`’, which takes one argument consisting of a string of numbers ranging from 1 to 5. These numbers denote pitch levels, 1 being the lowest and 5 the highest. Within this range, any combination is allowed and there is no limit in the length of combination.

As an example of the usage of tone letter macro, the four tones of Chinese are show below.

*Input:* `\tone{55}ma` ‘mother’,  
`\tone{35}ma` ‘hemp’,  
`\tone{214}ma` ‘horse’,  
`\tone{51}ma` ‘scold’

*Output:* ˥ma “mother”, ˨ma “hemp”,  
˨˨ma “horse”, ˥ma “scold”

<i>Roman</i>	
<code>\textipa{f@"nEtIks}</code>	fə'netɪks
<i>Slanted</i>	
<code>\textipa{\slshape f@"nEtIks}</code>	fə'netɪks or
<code>\textipa{\textsl{f@"nEtIks}}</code>	fə'netɪks or
<code>\textsl{\textipa{f@"nEtIks}}</code>	fə'netɪks
<i>Bold extended</i>	
<code>\textipa{\bfseries f@"nEtIks}</code>	fə'netɪks or
<code>\textipa{\textbf{f@"nEtIks}}</code>	fə'netɪks or
<code>\textbf{\textipa{f@"nEtIks}}</code>	fə'netɪks
<i>Sans Serif</i>	
<code>\textipa{\sffamily f@"nEtIks}</code>	fə'netɪks or
<code>\textipa{\textsf{f@"nEtIks}}</code>	fə'netɪks or
<code>\textsf{\textipa{f@"nEtIks}}</code>	fə'netɪks

Table 6: Examples of font switching

### How easy to input phonetic symbols?

Let us briefly estimate here how much easy (or difficult) to input phonetic symbols with TIPA in terms of the number of keystrokes.

The following table shows statistics for all the phonetic symbols that appear in the '93 version of IPA chart (diacritics and symbols for suprasegmentals excluded). It is assumed here that each symbol is input within the IPA environment and the `safe` option is not specified.

<i>keystrokes</i>	<i>number</i>	<i>examples</i>
1	65	a, b, ə, ɑ, β, etc.
2	2	ø, ll
3	30	æ, t, B, β, etc.
5	1	ç
more than 5	7	ø, ʔ, †, ʉ, etc.

As is shown in the table, about 92% of the symbols can be input within three keystrokes.

### Changing font styles

This version of TIPA includes five styles of fonts, i.e. roman, slanted, bold, bold extended and sans serif. These styles can be switched in much the same way as in the normal text fonts (see table 6).

The bold fonts are usually not used within the standard L<sup>A</sup>T<sub>E</sub>X class packages so that if you want to use them, it is necessary to use low-level font selection commands of L<sup>A</sup>T<sub>E</sub>X 2<sub>ε</sub>.

*Input:* `{\fontseries{b}\selectfont abcdefg \textipa{ABCDEFGF}}`

*Output:* abcdefg aβεδϵϕγ

Note also that slanting of TIPA symbols should correctly work even in the cases of combined accents and in the cases of symbols made up by macros.

*Input:* `\textsl{\textipa{\'{"{\u*{e}}}}}`

*Output:*  $\acute{e}$

*Input:* `\textsl{\textdoublebaresh}`

*Output:* ‡ (This symbol is composed by a macro.)

### Internal commands

Some of the internal commands of TIPA are defined without the letter @ in order to allow a user to extend the capability of TIPA.

`\ipabar` Some TIPA symbols such as `\textbarb` b̄, `\textcrtwo` 2̄ are defined by using an internal macro command `\ipabar`. This command is useful when you want to make barred or crossed symbols not defined in TIPA.

This command requires the following five parameters to control the position of the bar.

- #1 the symbol to be barred
- #2 the height of the bar (in dimen)
- #3 bar width
- #4 left kern added to the bar
- #5 right kern added to the bar

Parameters #3, #4, #5 are to be given in a scaling factor to the width of the symbol, which is equal to 1 if the bar has the same width with the symbol in question. For example, the following command states a barred b (b̄) of which the bar position in the y-coordinate is `.5ex` and the width of the bar is slightly larger than that of the letter b.

```
% Barred B
\newcommand\textbarb{%
\ipabar{{\tipaencoding b}}%
{.5ex}{1.1}{}}

```

Note that the parameters #4 and #5 can be left blank if the value is equal to 0.

And the next example declares a barred c (c̄) of which the bar width is a little more than half as large as the letter c and it has the same size of kerning at the right.

```
% Barred C
\newcommand\textbarc{%
\ipabar{{\tipaencoding c}}%
{.5ex}{.55}{.55}}

```

More complex examples with the `\ipabar` command are found in `T3enc.def`.

`\tipaloweraccent`, `\tipaupperaccent` These two commands are used in the definitions of TIPA accents and diacritics. They are special forms of the commands `\loweraccent` and `\upperaccent` that are defined in `exaccent.sty`. The difference between the commands with the prefix `tipa` and the ones without it is that the former commands select

accents from a T3 encoded font while the latter ones do so from the current text font.

These commands take two parameters, the code of the accent (in decimal, octal or hexadecimal number) and the symbol to be accented, as shown below.

*Input:* `\tipaupperaccent{0}{a}`

*Output:*  $\grave{a}$

Optionally, these commands can take a extra parameter to adjust the vertical position of the accent. Such an adjustment is sometimes necessary in the definition of a nested accent. The next example shows TIPA's definition of the 'Circumflex Dot Accent' (e.g.  $\hat{\acute{a}}$ ).

```
% Circumflex Dot Accent
\newcommand\textcircumdot[1]%
{\tipaupperaccent[-.2ex]{2}%
{\tipaupperaccent[-.1ex]{10}{#1}}}
```

This definition states that a dot accent is placed over a symbol thereby reducing the vertical distance between the symbol and the dot by `.1ex` and a circumflex accent is placed over the dot and the distance between the two accents is reduced by `.2ex`.

If you want to make a combined accent not included in TIPA, you can do so fairly easily by using these two commands together with the optional parameter. For more examples of these commands, see `tipa.sty` and `extraipa.sty`.

`\tipaLoweraccent`, `\tipaUpperaccent` These two commands differ from the two commands explained above in that the first parameter should be a symbol (or any other things, typically an `\hbox`), rather than the code of the accent. They are special cases of the commands `\Loweraccent` and `\Upperaccent` and the difference between the two pairs of commands is the same as before.

The next example makes a schwa an accent.

*Input:* `\tipaUpperaccent[.2ex]%  
{\lower.8ex\hbox{%  
 \textipa{\super@}}}{a}`

*Output:*  $\overset{\cdot}{\underset{\cdot}{a}}$

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## Appendix

### A A List of TIPA Symbols

For each symbol the following information is shown: (1) the symbol, (2) input method in the normal text environment (and a shortcut method that can be used within the IPA environment in parenthesis), (3) the name of the symbol.

#### Vowels and Consonants

a a

Lower-case A



e	\textturna (5)	Turned A	f	f	Lower-case F
ɑ	\textscripta (A)	Script A	g	\textg (g)	Lower-case G
ɒ	\textturnscripta (6)	Turned Script A	ƒ	\textbarg	Barred G
æ	\ae	Ash	ɡ	\textcrg	Crossed G
Λ	\textscA (\;A)	Small Capital A <sup>15</sup>	ǰ	\texthtg (\!g)	Hooktop G
Λ	\textturnv (2)	Turned V <sup>16</sup>	g	g (\textg)	Text G
b	b	Lower-case B	ǧ	\textscg (\;G)	Small Capital G
ʙ	\textsoftsign	Soft Sign	ǧ	\texthtscg (\!G)	Hooktop Small Capital G
ʙ	\texthardsign	Hard Sign	γ	\textgamma (G)	Gamma
β	\texthtb (\!b)	Hooktop B	ɣ	\textbabygamma	Baby Gamma
B	\textscb (\;B)	Small Capital B	γ	\extramshorns (7)	Ram's Horns
ɓ	\textcrb	Crossed B	h	h	Lower-case H
ɔ̄	\textbarb	Barred B	hv	\texthvlig	H-V Ligature
β	\textbeta (B)	Beta	ħ	\textcrh	Crossed H
c	c	Lower-case C	fi	\texthth (H)	Hooktop H
ε	\textbarc	Barred C	fj	\texththeng	Hooktop Heng
ç	\texthtc	Hooktop C	ɥ	\textturnh (4)	Turned H
č	\v{c}	C Wedge	н	\textsch (\;H)	Small Capital H
ç	\c{c}	C Cedilla	i	i	Lower-case I
ç	\textctc (C)	Curly-tail C	ı	\i	Undotted I
Ċ	\textstretchc	Stretched C <sup>17</sup>	ı̄	\textbari (1)	Barred I
d	d	Lower-case D	ι	\textiota	Iota
đ	\textcrd	Crossed D	ı̇	\textlhti	Left-hooktop I <sup>18</sup>
ɖ	\textbard	Barred D	ı̈	\textlhtlongi	Left-hooktop Long I
ɗ	\texthtd (\!d)	Hooktop D	ı̉	\textvibyi	Viby I <sup>19</sup>
ɗ	\extrtaild (\;d)	Right-tail D	ı̊	\extraisevibyi	Raised Viby I
ɗ	\textctd	Curly-tail D	ı̋	\textsci (I)	Small Capital I
ɗz	\textdzlig	D-Z Ligature	j	j	Lower-case J
ɗz	\textdctzlig	D-Curly-tail Z Ligature	J	\j	Undotted J
ɗʝ	\textdyoghlig	D-Yogh Ligature	j	\textctj (J)	Curly-tail J <sup>20</sup>
ɗz	\textctdctzlig	Curly-tail D-Curly-tail Z Ligature	J	\textscj (\;J)	Small Capital J
ð	\dh (D)	Eth	j	\v{\j}	J Wedge
e	e	Lower-case E	j	\textbardotlessj	Barred Dotless J
ə	\textschwa (@)	Schwa	J	\text0bardotlessj	Old Barred Dotless J
ɛ̃	\extrhookschwa	Right-hook Schwa	ƒ	\texthtbardotlessj (\!j)	Hooktop Barred Dotless J <sup>21</sup>
ɛ̃	\textreve (9)	Reversed E	k	k	Lower-case K
E	\textscE (\;E)	Small Capital E	ƀ	\texthtk	Hooktop K
ε	\textepsilon (E)	Epsilon	ɣ	\textturnk (\*k)	Turned K
ɛ̃	\textcloseepsilon	Closed Epsilon	l	l	Lower-case L
ɛ̃	\textreversible (3)	Reversed Epsilon			
ɛ̃	\extrhookreversible	Right-hook Reversed Epsilon			
ɛ̃	\textclosereversible	Closed Reversed Epsilon			

<sup>15</sup> This symbol is fairly common among Chinese phoneticians.

<sup>16</sup> In *PSG* this symbol is called ‘Inverted V’ but it is apparently a mistake.

<sup>17</sup> The shape of this symbol differs according to the sources. In *PSG* and recent articles in *JIPA*, it is ‘stretched’ toward both the ascender and descender regions and the whole shape looks like a thick staple. In the old days, however, it was stretched only toward the ascender and the whole shape looked more like a stretched c.

<sup>18</sup> The four symbols ı̇, ı̈, ı̉ and ı̊ are mainly used among Chinese linguists. These symbols are based on “det svenska landsmålsalfabetet” and introduced to China by Bernhard Karlgren. The original shapes of these symbols were in italic as was always the case with “det svenska landsmålsalfabetet”. It seems that the Chinese linguists who wanted to continue to use these symbols in IPA changed their shapes upright.

<sup>19</sup> I call this symbol ‘Viby I’, based on the following description by Bernhard Karlgren: “Une voyelle très analogue à ı̇ se rencontre dans certains dial. suédois; on l’appelle ‘ı̇ de Viby’.” (*Études sur la phonologie chinoise*, 1915–26, p. 295)

<sup>20</sup> In the official IPA charts of ’89 and ’93, this symbol has a dish serif on top of the stem, rather than the normal sloped serif found in the letter j. I found no reason why it should have a dish serif here, so I changed it to a normal sloped serif.

<sup>21</sup> In *PSG* the shape of this symbol slightly differs. Here I followed the shape found in IPA ’89, ’93.

ł	\textltilde (\ ~l)	L with Tilde	Ŕ	\textscR (\;R)	Small Capital R
ł̄	\textbarl	Barred L	Ɔ	\textinvscr (K)	Inverted Small Capital R
ł̂	\textbeltl	Belted L	s	s	Lower-case S
ł̄	\textrtail (\:l)	Right-tail L	š	\v{s}	S Wedge
ļ	\textlyoghlig	L-Yogh Ligature	ș	\textrtails (\:s)	Right-tail S (at left)
ļ̄	\textlyoghlig	Old L-Yogh Ligature	ʃ	\textesh (S)	Esh
Ł	\textscL (\;L)	Small Capital L	ʄ	\textdoublebaresh	Double-barred Esh
λ	\textlambda	Lambda	ʃ̄	\textctesh	Curly-tail Esh
λ̄	\textcrlambda	Crossed Lambda	t	t	Lower-case T
m	m	Lower-case M	ʈ	\texthtt	Hooktop T
ɱ	\textltailm (M)	Left-tail M (at right)	ʉ	\textlhookt	Left-hook T
ɱ̄	\textturnm (W)	Turned M	ʈ̄	\textrtailt (\:t)	Right-tail T
ɱ̄	\textturnmleg	Turned M, Right Leg	ʈ̄	\texttctclig	T-Curly-tail C Ligature
n	n	Lower-case N	ʈ̄s	\textttslig	T-S Ligature
ɳ	\textnrleg	N, Right Leg	ʈ̄ʃ	\texttteshlig	T-Esh Ligature
ñ	~n	N with Tilde	ʈ̄	\textturnt (\*t)	Turned T
ɲ	\textltailn	Left-tail N (at left)	ʈ̄	\textctt	Curly-tail T
ɳ̄	\ng (N)	Eng	ʈ̄	\textcttctclig	Curly-tail T-Curly-tail C Ligature
ɳ̄	\textrtailn (\:n)	Right-tail N	θ	\texttheta (T)	Theta
ɳ̄	\textctn	Curly-tail N	u	u	Lower-case U
N	\textscN (\;N)	Small Capital N	ū	\textbaru (O)	Barred U
o	o	Lower-case O	υ	\textupsilon (U)	Upsilon
⊙	\textbullseye (\!o)	Bull's Eye	U	\textscU (\;U)	Small Capital U
ø	\textbaro (8)	Barred O	v	v	Lower-case V
ø̄	\o	Slashed O	υ	\textscriptv (V)	Script V
œ	\oe	O-E Ligature	w	w	Lower-case W
œ̄	\textscœlig (\OE)	Small Capital O-E Ligature	ʍ	\textturnw (\*w)	Turned W
ɔ	\textopeno (O)	Open O	x	x	Lower-case X
œ̄	\textturnœlig	Turned C(Open O)-E Ligature	χ	\textchi (X)	Chi
ω	\textomega	Omega	y	y	Lower-case Y
Ω	\textscomega	Small Capital Omega	ʎ	\textturny (L)	Turned Y
ω̄	\textcloseomega	Closed Omega	Ƴ	\textscy (Y)	Small Capital Y
p	p	Lower-case P	Ƴ̄	\textvibyy	Viby Y <sup>23</sup>
p̄	\textwynn	Wynn	z	z	Lower-case Z
þ	\textthorn (\th)	Thorn	z̄	\textcommatailz	Comma-tail Z
þ̄	\texthtp	Hooktop P	ž	\v{z}	Z Wedge
ϕ	\textphi (F)	Phi	z̄	\textctz	Curly-tail Z
q	q	Lower-case Q	z̄	\textrevyogh	Reversed Yogh
q̄	\texthtq	Hooktop Q	z̄	\textrtailz (\:z)	Right-tail Z
Q	\textscq (\;Q)	Small Capital Q <sup>22</sup>	ʒ	\textyogh (Z)	Yogh
r	r	Lower-case R	ʒ̄	\textctyogh	Curly-tail Yogh
r̄	\textfishhookr (R)	Fish-hook R	ʒ̄	\textcrtwo	Crossed 2
ɹ	\textlonglegr	Long-leg R	ʔ	\textglotstop (P)	Glottal Stop
ɹ̄	\textrtailr (\:r)	Right-tail R	ʔ̄	\textraiseglotstop	Superscript Glottal Stop
ɹ̄	\textturnr (\*r)	Turned R	ʔ̄	\textbarglotstop	Barred Glottal Stop
ɹ̄	\textturnrrtail (\:R)	Turned R, Right Tail	ʔ̄	\textinvglotstop	Inverted Glottal Stop
ɹ̄	\textturnlonglegr	Turned Long-leg R	ʔ̄	\textcrinvglotstop	Crossed Inverted Glottal Stop
			ʔ̄	\textrevglotstop (Q)	Reversed Glottal Stop
			ʔ̄	\textbarrevglotstop	Barred Reversed Glottal Stop

<sup>22</sup> Suggested by Prof S. Tsuchida for Austronesian languages in Taiwan. In *PSG* 'Female Sign' and 'Uncrossed Female Sign' (pp. 110-111) are noted for pharyngeal stops, as proposed by Trager (1964). Also I'm not sure about the difference between an epiglottal plosive and a pharyngeal stop.

<sup>23</sup> See explanations in footnote 19.

	<code>\textpipe{}</code>	Pipe
≠	<code>\textdoublebarpipe</code>	Double-barred Pipe
≠	<code>\textdoublebarslash</code>	Double-barred Slash
	<code>\textdoublepipe{  }</code>	Double Pipe
!	!	Exclamation Point

**Suprasegmentals**

ˊ	<code>\textprimstress{"}</code>	Vertical Stroke (Superior)
ˋ	<code>\textsecstress{"}</code>	Vertical Stroke (Inferior)
:	<code>\textlengthmark{:}</code>	Length Mark
˙	<code>\texthalflength{;}</code>	Half-length Mark
	<code>\textvertline</code>	Vertical Line
	<code>\textdoublevertline</code>	Double Vertical Line
⏟	<code>\textbottomtiebar{\t*{}}</code>	Bottom Tie Bar
↘	<code>\textglobfall</code>	Downward Diagonal Arrow
↗	<code>\textglobrise</code>	Upward Diagonal Arrow
↓	<code>\textdownstep</code>	Down Arrow <sup>24</sup>
↑	<code>\textupstep</code>	Up Arrow

**Accents and Diacritics**

è	<code>\'e</code>	Grave Accent
é	<code>\'e</code>	Acute Accent
ê	<code>\^e</code>	Circumflex Accent
ë	<code>\~e</code>	Tilde
ë	<code>\"e</code>	Umlaut
ë	<code>\H{e}</code>	Double Acute Accent
ê	<code>\r{e}</code>	Ring
ë	<code>\v{e}</code>	Wedge
ë	<code>\u{e}</code>	Breve
ē	<code>\=e</code>	Macron
è	<code>\.e</code>	Dot
ç	<code>\c{e}</code>	Cedille
ç	<code>\textpolhook{e}{\k{e}}</code>	Polish Hook (Ogonek Accent)
ë	<code>\textdoublegrave{e}{\H*e}</code>	Double Grave Accent
è	<code>\textsubgrave{e}{\^*e}</code>	Subscript Grave Accent
è	<code>\textsubacute{e}{\'*e}</code>	Subscript Acute Accent
è	<code>\textsubcircum{e}{\~*e}</code>	Subscript Circumflex Accent
ĝ	<code>\textroundcap{g}{\ c{g}}</code>	Round Cap
â	<code>\textacutemacron{a}{\^'a}</code>	Acute Accent with Macron
á	<code>\textvbaraccent{a}</code>	Vertical Bar Accent
ä	<code>\textdoublevbaraccent{a}</code>	Double Vertical Bar Accent
ë	<code>\textgravedot{e}{\^'.e}</code>	Grave Dot Accent
ë	<code>\textdotacute{e}{\^'.e}</code>	Dot Acute Accent
â	<code>\textcircumdot{a}{\^'.a}</code>	Circumflex Dot Accent

<sup>24</sup> The shapes of `\textdownstep` and `\textupstep` differ according to sources. Here I followed the shapes found in the recent IPA charts.

ã	<code>\texttildedot{a}{\^'.a}</code>	Tilde Dot Accent
ä	<code>\textbrevemacron{a}{\u=a}</code>	Breve Macron Accent
ä	<code>\textringmacron{a}{\r=a}</code>	Ring Macron Accent
¿	<code>\textacutewedge{s}{\v's}</code>	Acute Wedge Accent
ä	<code>\textdotbreve{a}</code>	Dot Breve Accent
t	<code>\textsubbridge{t}{\ [t]}</code>	Subscript Bridge
d	<code>\textinvsubbridge{d}{\ }t</code>	Inverted Subscript Bridge
n	<code>\textsubsquare{n}</code>	Subscript Square
o	<code>\textsubrhalfring{o}{\ }o</code>	Subscript Right Half-ring <sup>25</sup>
o	<code>\textsublhalfring{o}{\ }o</code>	Subscript Left Half-ring
k	<code>\textsubw{k}{\ w{k}}</code>	Subscript W
g	<code>\textoverw{g}</code>	Over W
t	<code>\textseagull{t}{\ m{t}}</code>	Seagull
è	<code>\textovercross{e}{\ x{e}}</code>	Over-cross
¿	<code>\textsubplus{\textopeno}{\ +0}</code>	Subscript Plus <sup>26</sup>
ε	<code>\textraising{\textepsilon}{\ 'E}</code>	Raising Sign
e	<code>\textlowering{e}{\ 'e}</code>	Lowering Sign
u	<code>\textadvancing{u}{\ &lt;u}</code>	Advancing Sign
ø	<code>\textretracting{\textschwa}{\ &gt;@}</code>	Retracting Sign
e	<code>\textsubtilde{e}{\~*e}</code>	Subscript Tilde
e	<code>\textsubumlaut{e}{\~"e}</code>	Subscript Umlaut
u	<code>\textsubring{u}{\r*u}</code>	Subscript Ring
e	<code>\textsubwedge{e}{\v*e}</code>	Subscript Wedge
e	<code>\textsubbar{e}{\=*e}</code>	Subscript Bar
e	<code>\textsubdot{e}{\.*e}</code>	Subscript Dot
e	<code>\textsubarch{e}</code>	Subscript Arch
m	<code>\textsyllabic{m}{\s{m}}</code>	Syllabicity Mark
†	<code>\textsuperimposetilde{t}{\ ~{t}}</code>	Superimposed Tilde
t <sup>†</sup>	<code>t\textcorner</code>	Corner
t <sup>r</sup>	<code>t\textopencorner</code>	Open Corner
ø	<code>\textschwa\rhoticity</code>	Rhoticity
b <sup>v</sup>	<code>b\textceltpal</code>	Celtic Palatalization Mark
k <sup>&lt;</sup>	<code>k\textlptr</code>	Left Pointer
k <sup>&gt;</sup>	<code>k\textrptr</code>	Right Pointer
p	<code>p\textrectangle</code>	Rectangle <sup>27</sup>

<sup>25</sup> Diacritics `\textsubrhalfring` and `\textsublhalfring` can be placed after a symbol by inputting, for example, `[e\textsubrhalfring{}]` [e].

<sup>26</sup> The diacritics such as `\textsubplus`, `\textraising`, `\textlowering`, `\textadvancing` and `\textretracting` can be placed after a symbol by inputting `[e\textsubplus{}]` [e], for example.

<sup>27</sup> This symbol is used among Japanese linguists as a diacritical symbol indicating no audible release (IPA ʼ), because the symbol ʼ is used to indicate pitch accent in Japanese.

$\widehat{b}$	<code>\texttoptiebar{gb}</code> ( <code>\t{gb}</code> )	Top Tie Bar	$\theta_s$	<code>\sliding{\ipa{T}s}</code>	Right Arrow
'		Apostrophe	$\underset{\sim}{m}$	<code>\crtilde{m}</code>	Crossed tilde
˘	<code>\textrevapostrophe</code>	Reversed Apostrophe	$\underset{\cdot}{a}$	<code>\dottedtilde{a}</code>	Dotted Tilde
.		Period	$\underset{\sim}{s}$	<code>\doubletilde{s}</code>	Double Tilde
ˆ	<code>\texthooktop</code>	Hooktop	$\overset{\circ}{n}$	<code>\partvoiceless{n}</code>	Parenthesis + Ring
ˆ	<code>\texttrhook</code>	Right Hook	$\overset{\circ}{n}$	<code>\inipartvoiceless{n}</code>	Parenthesis + Ring
ˆ	<code>\textpalhook</code>	Palatalization Hook	$\overset{\circ}{n}$	<code>\finpartvoiceless{n}</code>	Parenthesis + Ring
$p^h$	<code>p\textsuperscript{h}</code> ( <code>p\super h</code> )	Superscript H	$\overset{\circ}{s}$	<code>\partvoice{s}</code>	Parenthesis + Subwedge
$k^w$	<code>k\textsuperscript{w}</code> ( <code>k\super w</code> )	Superscript W	$\overset{\circ}{s}$	<code>\inipartvoice{s}</code>	Parenthesis + Subwedge
$t^j$	<code>t\textsuperscript{j}</code> ( <code>t\super j</code> )	Superscript J	$\overset{\circ}{s}$	<code>\finpartvoice{s}</code>	Parenthesis + Subwedge
$t^\gamma$	<code>t\textsuperscript{\textgamma}</code> ( <code>t\super G</code> )	Superscript Gamma	$\underset{\sim}{J}$	<code>\sublptr{J}</code>	Subscript Left Pointer
$d^{\text{f}}$	<code>d\textsuperscript{\textrevglotstop}</code> ( <code>d\super Q</code> )	Superscript Reversed Glottal Stop	$\underset{\sim}{J}$	<code>\subrptr{J}</code>	Subscript Right Pointer
$d^n$	<code>d\textsuperscript{n}</code> ( <code>d\super n</code> )	Superscript N			
$d^l$	<code>d\textsuperscript{l}</code> ( <code>d\super l</code> )	Superscript L			

### Tone letters

The tones illustrated here are only a representative sample of what is possible. For more details see the section entitled “Tone Letters” (page 107).

$\uparrow$	<code>\tone{55}</code>	Extra High Tone
$\uparrow$	<code>\tone{44}</code>	High Tone
$\updownarrow$	<code>\tone{33}</code>	Mid Tone
$\downarrow$	<code>\tone{22}</code>	Low Tone
$\downarrow$	<code>\tone{11}</code>	Extra Low Tone
$\searrow$	<code>\tone{51}</code>	Falling Tone
$\nearrow$	<code>\tone{15}</code>	Rising Tone
$\uparrow$	<code>\tone{45}</code>	High Rising Tone
$\downarrow$	<code>\tone{12}</code>	Low Rising Tone
$\uparrow$	<code>\tone{454}</code>	High Rising Falling Tone

### Diacritics for extIPA, VoQS

In order to use diacritics listed in this section, it is necessary to specify the option ‘extra’ at the preamble (See the section entitled “Other options” on page 105). Note also that some of the diacritics are defined by using symbols from fonts other than TIPA so that they may not look quite satisfactory and/or may not be slanted (e.g. `\whistle{s}`  $\text{\textasciitilde}$ ).

$\overleftrightarrow{s}$	<code>\spreadlips{s}</code>	Left Right Arrow
$\overv{v}$	<code>\overbridge{v}</code>	Overbridge
$\overn{n}$	<code>\bibridge{n}</code>	Bibridge
$\underline{\underline{t}}$	<code>\subdoublebar{t}</code>	Subscript Double Bar
$\underset{\text{f}}{\text{f}}$	<code>\subdoublevert{f}</code>	Subscript Double Vertical Line
$\underset{\text{v}}{\text{v}}$	<code>\subcorner{v}</code>	Subscript Corner
$\underset{\uparrow}{s}$	<code>\whistle{s}</code>	Up Arrow

### B B Symbols not included in TIPA

There are about 40 symbols that appear in *PSG* but are not included or defined in TIPA (ordinary capital letters, Greek letters and punctuation marks excluded). Most of such symbols are the ones that have been proposed by someone but never or rarely been followed by other people.

Some of such symbols can be realized by writing appropriate macros, while some others cannot be realized without resorting to the Metafont.

This section discusses these problems by classifying such symbols into three categories, as shown below.

1. Symbols that can be realized by T<sub>E</sub>X’s macro level and/or by using symbols from other fonts.
2. Symbols that can be imitated by T<sub>E</sub>X’s macro level and/or by using symbols from other fonts (but may not look quite satisfactory).
3. Symbols that cannot be realized at all, without creating a new font.

The following table shows symbols that belong to the first category. For each symbol, an example of input method and its output is also given. Note that barred or crossed symbols can be easily made by TIPA’s `\ipabar` macro.

Script Lowe-case F	<code>{\itshape f}</code>	$f$
Barred Small Capital I	<code>\ipabar{\textsci}{.5ex}{1.1}{\textasciitilde}</code>	$\text{\textasciitilde}$
Barred J	<code>\ipabar{j}{.5ex}{1.1}{\textasciitilde}</code>	$\text{\textasciitilde}$
Crossed K	<code>\ipabar{k}{1.2ex}{.6}{\textasciitilde}{.4}</code>	$\text{\textasciitilde}$
Barred Open O	<code>\ipabar{\textopeno}{.5ex}{.6}{.4}{\textasciitilde}</code>	$\text{\textasciitilde}$
Barred Small Capital Omega	<code>\ipabar{\textscomega}{.5ex}{1.1}{\textasciitilde}</code>	$\text{\textasciitilde}$
Barred P		

<code>\ipabar{p}{.5ex}{1.1}{}</code>	Ⓟ
Half-barred U	
<code>\ipabar{u}{.5ex}{.5}{.5}</code>	Ⓡ
Barred Small Capital U	
<code>\ipabar{\textscu}{.5ex}{1.1}{}</code>	Ⓢ
Null Sign	
<code>\$\emptyset\$</code>	∅
Double Slash	
<code>/\kern-.25em/</code>	//
Triple Slash	
<code>/\kern-.25em/\kern-.25em/</code>	///
Pointer (Upward)	
<code>k\super{\tiny\$\wedge\$}</code>	k <sup>^</sup>
Pointer (Downward)	
<code>k\super{\tiny\$\vee\$}</code>	k <sup>v</sup>
Superscript Arrow	
<code>k\super{\super{\\$}\leftarrow\$}</code>	k <sup>←</sup>

Symbols that belong to the second category are shown below. Note that slashed symbols can be in fact easily made by a macro. For example, a slashd b i.e. Ⓟ can be made by `\ipaclap{b}{/}`. The reason why slashed symbols are not included in TIPA is as follows: first, a simple overlapping of a symbol and a slash does not always result in a good shape, and secondly, it doesn't seem significant to devise fine-tuned macros for symbols which were created essentially for typewriters.

Right-hook A	Ⓜ
Slashed B	Ⓝ
Slashed C	Ⓞ
Slashed D	Ⓟ
Small Capital Delta	Ⓠ
Right-hook E	Ⓡ
Right-hook Epsilon	Ⓢ
Small Capital F	Ⓣ
Female Sign	
Uncrossed Female Sign	
Right-hook Open O	
Slashed U	Ⓤ
Slashed W	Ⓥ

And finally, symbols that cannot be realized at all are as follows.

- Reversed Turned Script A
- A-O Ligature
- Inverted Small Capital A
- Small Capital A-O Ligature
- D with Upper-left Hook
- Hooktop H with Rightward Tail
- Heng
- Hooktop J
- Front-bar N

- Inverted Lower-case Omega
- Reversed Esh with Top Loop
- T with Upper Left Hook
- Turned Small Capital U
- Bent-tail Yogh
- Turned 2
- Turned 3

**C C TIPA encoding (T3)**

	'0	'1	'2	'3	'4	'5	'6	'7
'00x	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ
'01x	˘	˘	˘	˘	˘	˘	˘	˘
'02x	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ
'03x	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ
'04x	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ
'05x	(	)	*	+	,	-	.	/
'06x	Ⓜ	Ⓝ	Ⓞ	Ⓟ	Ⓠ	Ⓡ	Ⓢ	Ⓣ
'07x	Ⓤ	Ⓥ	Ⓦ	Ⓧ	Ⓨ	Ⓩ	ⓐ	ⓑ
'10x	Ⓝ	Ⓞ	Ⓟ	Ⓠ	Ⓡ	Ⓢ	Ⓣ	Ⓤ
'11x	Ⓡ	Ⓢ	Ⓣ	Ⓤ	Ⓥ	Ⓦ	Ⓧ	Ⓨ
'12x	Ⓣ	Ⓤ	Ⓥ	Ⓦ	Ⓧ	Ⓨ	Ⓩ	ⓐ
'13x	Ⓩ	ⓐ	ⓑ	Ⓝ	Ⓞ	Ⓟ	Ⓠ	Ⓡ
'14x	ˆ	a	b	c	d	e	f	g
'15x	h	i	j	k	l	m	n	o
'16x	p	q	r	s	t	u	v	w
'17x	x	y	z			≠	~	,
'20x	-	\	\	\	\	/	/	/
'21x	/	-	\	\	\	/	/	/
'22x	/	/			↓	↑	↗	↘
'23x	˘	˘	˘	˘	˘	˘	˘	˘
'24x	Ⓝ	Ⓞ	Ⓟ	Ⓠ	Ⓡ	Ⓢ	Ⓣ	Ⓤ
'25x	Ⓤ	Ⓥ	Ⓦ	Ⓧ	Ⓨ	Ⓩ	ⓐ	ⓑ
'26x	Ⓝ	Ⓞ	Ⓟ	Ⓠ	Ⓡ	Ⓢ	Ⓣ	Ⓤ
'27x	Ⓣ	Ⓤ	Ⓥ	Ⓦ	Ⓧ	<	>	
'30x	Ⓜ	Ⓝ	Ⓞ	Ⓟ	Ⓠ	Ⓡ	Ⓢ	Ⓣ
'31x	Ⓤ	Ⓥ	Ⓦ	Ⓧ	Ⓨ	Ⓩ	ⓐ	ⓑ
'32x	Ⓝ	Ⓞ	Ⓟ	Ⓠ	Ⓡ	Ⓢ	Ⓣ	Ⓤ
'33x	Ⓡ	Ⓢ	Ⓣ	Ⓤ	Ⓥ	Ⓦ	Ⓧ	Ⓨ
'34x	Ⓣ	Ⓤ	Ⓥ	Ⓦ	Ⓧ	Ⓨ	Ⓩ	ⓐ
'35x	Ⓝ	Ⓞ	Ⓟ	Ⓠ	Ⓡ	Ⓢ	Ⓣ	Ⓤ
'36x	Ⓤ	Ⓥ	Ⓦ	Ⓧ	Ⓨ	Ⓩ	ⓐ	ⓑ
'37x	∅	§	Ⓣ	Ⓜ	Ⓩ	Ⓩ	Ⓝ	Ⓝ