# **1** Introduction

Although most countries in the world have had national standard encoding schemes for the characters of their own written language or languages for some time, these could differ wildly even between countries sharing the same written language. As a result, an electronic document written using a piece of software based on a particular encoding scheme could only be read by someone possessing either software based on the same encoding scheme or software for translating between the two different encoding schemes.

As the volume of international communications increased, especially the international exchange of electronic data, not least via the internet, it became clear that this situation was completely impractical and that some internationally accepted universal encoding scheme, which could form the basis for multi-lingual software, was needed. A joint technical committee (ISO/IEC JTC1) was therefore set up by the International Organization for Standardisation (ISO) and the International Electrotechnical Committee (IEC) to work on this, and, initially independently though later in collaboration with ISO/IEC, the Unicode Consortium embarked on a similar project.

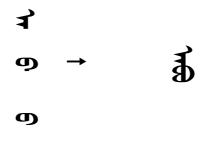
The resulting ISO/IEC international standard 10646 and the Unicode standard, which uses the identical encoding but which additionally includes information which is important for people wishing to implement computer software based on the standard, offer a universal international standard encoding scheme covering not only all the characters used in the written forms of the languages of the world but also more general symbols.

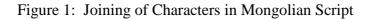
The current versions of the standards [8,2] cover the majority of the European scripts (Latin, with extensions including characters with various accents; Greek; Cyrillic; etc.), various Indian scripts, including Devanagari, Bengali and Gujarati, and several other Asian scripts, including Thai and Tibetan as well as the Chinese, Japanese and Korean ideographic scripts. New versions, which are expected to be published shortly, will extend these with the scripts that have been undergoing standardization since 1993. These include, among many others, the traditional Mongolian script which is the subject of this paper.

Traditional Mongolian script, which is properly written vertically in columns ordered from left to right, was derived around the 12th century from the Uighur script, which was in turn developed from the Sogdian Aramaic script in the 8th or 9th century. It has been in continuous use since that date, even though in 1946 in Mongolia proper it was supplanted as the official written form of the Mongolian language by a Cyrillic script, written horizontally from left to right: the traditional script continued to be used in preference to the Cyrillic in certain disciplines, including history, literature and linguistics, and beginning in 1994 it has started to be used more widely and is now being taught in schools once again.

Mongolian is a cursive script, so individual letters in a word are joined together as illustrated in Figure 1. In addition, the actual written form of each individual letter in a word generally depends on the position of the letter within a word, specifically on whether it appears as a single isolated character (isolate form; only vowels have this

form), or at the beginning (initial form), in the middle (medial form), or at the end (final form) of a word (see Figure 2). It may also depend on the preceding letter with which it can form a ligature (see Figure 3). In abstract terms, therefore, each letter has what might be called a *basic form* together with various *variant forms*, while certain combinations of letters combine to form ligatures.





Mongolian letter (transliteration)	Isolate	Initial	Medial Final	
<b>Հ</b> (A)	र उ	オ	- 1 -	<b>~</b> u
J (OE)	र्व	र्ष	१ व ब्रै	თ g
مر (L)		4	L	ব

Figure 2: Initial, Medial and Final Forms of Mongolian Script Letters

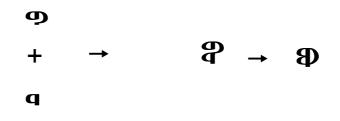


Figure 3: Mongolian Script Ligatures

The standard encoding which is to appear in the ISO/IEC and Unicode standards in fact codes only the basic character set, together with special punctuation symbols and numerals, but does not explicitly encode the variant forms or the ligatures since the correct variant form or ligature can, at least in most cases, be determined from context. Instead, control symbols are encoded which can be used to resolve ambiguities in those few cases where the context rules are inadequate and which can also be used to override the default contextual forms if so required.

In this paper, we present the basic Mongolian character set and explain the principles behind the selection of the characters which comprise it in Section 2. We also explain the use of the special characters in the character set. Section 3 then describes all the variant forms of each basic character and indicates how they are generated, and Section 4 contains a description of all the ligatures.

The final section of the paper gives some information about implementing software based on this encoding and also discusses how traditional Mongolian text can be intermixed with other scripts.

# 2 The Basic Character Set

The standard encoding covers not only traditional Mongolian script but also related scripts: Todo and Manchu, which are derivatives of Mongolian; Sibe, which is derived from Manchu; and Ali Gali, which was used for transcriptions of Tibetan and Sanskrit texts. Todo, Manchu and Sibe all share Mongolian characters.

The characters in the encoding are named according to the scripts in which they are used as follows: letters used only in traditional Mongolian and letters shared between traditional Mongolian and other scripts are named MONGOLIAN LETTER; letters used exclusively in Todo are named MONGOLIAN LETTER TODO; letters used exclusively in Sibe and those shared between Sibe and Manchu are named MONGOLIAN LETTER SIBE; and letters used exclusively in Manchu are named MONGOLIAN LETTER MANCHU. Similarly, the Ali Gali letters are named after the script with which they are associated: MONGOLIAN LETTER ALI GALI, MONGOLIAN LETTER TODO ALI GALI, and MONGOLIAN LETTER MANCHU ALI GALI for Mongolian, Todo and Manchu respectively.

The basic character set encodes the Mongolian numerals together with precisely one form of each different letter. Generally this is the isolated form for the vowels and the initial form for the consonants, with the particular variant form occurring when the consonant is followed by the letter "A" being chosen in cases where this initial form has several alternative variants.

However, the various forms that the characters can take are not all unique: in some cases one character can have the same form in different positions (e.g. the initial and medial forms of the Mongolian letter "B" look the same  $(\mathbf{\Phi})$ ), while in other cases two different characters can look the same, either in the same position (e.g. the initial form

of the Mongolian letter "O" ( $\mathbf{a}$ ) looks the same as the initial form of the Mongolian letter "U" ( $\mathbf{a}$ ) ) or in different positions (e.g. the first medial form of the Mongolian letter "TA" ( $\mathbf{a}$ ) looks the same as the second initial form of the Mongolian letter "DA" ( $\mathbf{a}$ )). And the same can also be true across the different scripts (e.g. the medial form of the Mongolian letter "ANG" ( $\mathbf{a}$ ) is the same as that of the Todo letter "ANG" ( $\mathbf{a}$ ), though their final forms are different ( $\mathbf{a}$ ,  $\mathbf{a}$ )).

This duplication can in fact lead to complete words being visually indistinguishable: for example, the Mongolian words "bodo" (to think) and "budu" (to dye) both have the same written form  $\widehat{\Theta_{v}}$  because the positional forms of the Mongolian letters "O" ( $\overrightarrow{a}$ ) and "U" ( $\overrightarrow{a}$ ) occurring in the words are identical. However, the coding must be able to distinguish between the letters in order to be able to distinguish between the words.

We therefore choose the particular variant forms of the characters of the basic character set in such a way that no two different characters in the set have the same glyph, thus allowing us to distinguish the characters of the basic character set by sight. Thus, for example, the isolated form of the Mongolian letter "O" ( $\mathbf{a}$ ) is used, but the initial form of the Mongolian letter "U" ( $\mathbf{a}$ ) is used instead of the isolated form because the isolated form looks the same as the isolated form of "O" ( $\mathbf{a}$ ). Similarly, the medial form of the Mongolian letter "ANG" ( $\mathbf{a}$ ) is used but the final form of the Todo letter "ANG" ( $\mathbf{a}$ ).

The basic character set also encodes various punctuation symbols which are specific to Mongolian, including character 1800, MONGOLIAN BIRGA ( $\lhd$ ), character 1805, MONGOLIAN FOUR DOTS ( $\div$ ), and character 180A, MONGOLIAN NIRUGU (.). The Mongolian Birga is a symbol which is used to mark the beginning of a piece of text, such as the beginning of a section, a paragraph, or a line, and the Mongolian Four Dots is similarly used to mark the end of a piece of text. The Mongolian Nirugu is basically used simply to lengthen the cursive connection between letters, as in the following examples:



Finally, the basic character set includes four control characters: three for selecting alternative variants of a given positional form (the Mongolian free variant selectors, characters 180B ( $\begin{bmatrix} V \\ S2 \end{bmatrix}$ ), 180C ( $\begin{bmatrix} V \\ S2 \end{bmatrix}$ ) and 180D ( $\begin{bmatrix} V \\ S3 \end{bmatrix}$ ), and the Mongolian vowel separator (character 180E ( $\begin{bmatrix} V \\ S3 \end{bmatrix}$ )).

The Mongolian vowel separator serves to separate the vowels "A" and "E", when they occur as the final letter in a word, from the consonant preceding them. A given sequence of characters with a connected final "A" or "E" ( $\frown$ ) and the same sequence of characters with a separated final "A" or "E" ( $\frown$ ) can both correspond to Mongolian words, though these have different meanings and are thus different words. For example, the word "xana" with a separated final "a"  $\frown$  means " the wall of a tent", while the word "xana" with the final "a" connected  $\frown$  means "the outer casing of a vein".

Character sequence	Display	Character sequence	Display
· ™ ฬ/ŋ	! ,	· ~/~	•
🏫 🕅 📈	r/ ,	n W	-1
<u>n</u> 🕅 🖌	נייז	∩ુ √	/
<b>ŕ</b> 🕅 🔧 🖌 / / יק	Ø j	÷ √/)	F <b>I</b>
7 Ms 1/2	7,	~ ~/m	7
+ 🕅 📈/ŋ	Ν,	4 1/1	~
r 🕅 🖌	с,	$\nabla \mathcal{M}$	\ <u>_</u>
<del>,</del> Ms 🖌/ŋ	ς,	₅ √//ŋ	17
🖈 🕅 🕅 /ኀ	ς,	<u>∽</u> √/)	×1
ᢏ 🕅 🏹/ŋ	<b>е</b> ,	<ul> <li>√/ŋ</li> </ul>	$\mathbf{v}_{\mathbf{r}}$

The following examples illustrate the use of the Mongolian vowel separator  $\boxed{\mathbb{W}}$ :

The Mongolian free variant selectors are used to distinguish different variants of the same positional form of a character. They modify only the character immediately preceding them and have no effect on the character following. Basically, the three variant selectors indicate the second, third and fourth variant form of a particular positional variant respectively, the default (first) variant being obtained if no variant selector is included. The order of the different variants follows that given in the Mongolian Reference Table in the first appendix. Note that a free variant selector applied to a character for which no corresponding variant exists is assumed to have no effect.

The following examples illustrate some uses of the free variant selectors:

Character sequence	Example of use	Character sequence	Example of use
V ST	ſſ	$\mathcal{A}$	$\checkmark$
🖌 🕅	٠ آب	ฟ	<b>F</b>
<b>)</b> [ <u>SY</u> ]	$\mathcal{M}$ (traditional form)	··· ر ۲	ᡝᢒ᠇ᠰᠣ
<b>\</b> [57]	منئ	<del>`v</del>	<del>دن</del> و
ĵ [ <sup>FV</sup> ]	۲۰۰۰ (traditional form)	Ý	Jun 1
<b>γ</b> [FV]	<b>Tran</b> (traditional form)	·	ىشىر
	frind) (traditional form)	• 🕅 🖍	وبننيز أ

$\mathbf{\hat{s}}$	ಗ್	ᠥ	ᠥ
$\mathcal{T}_{\mathbf{T}}$ [V]	ᢒᡵᡐᡡᡍᠠᠯ	ᠠᢧ	ᠴᡵᡐᠦᡍ᠇ᢇᠯ
$\operatorname{reg}[s_1]$	৸ঢ়	<del>)</del> जू	40
	د منعد	<b>?</b>	בדים ז
<b>γ</b> [SV]	~m!	<b>?</b>	าฑ
e 🛐	(traditional form)	ච	ᡇ
$\mathbf{\hat{N}}$	(traditional form)	ጉ	رب
<u>ᠭ</u> [ <u>SY</u> ]	$\mathbf{M}$ (traditional form)	ij	کسن
🕺 [SY]	Ƴ: ੑੑ <b>ੑੑੑੑੑੑੑੑੑੑੑੑੑੑੑੑ</b> ₩ਗ਼ੑੑੑੑ	•!	ᡞ᠊ᢩᡧᡝᠮ᠊ᡋᡕ
<b>î</b> 🛐	4	Ĵi	4552
🌳 (FV)	$\checkmark$ (traditional form)		$\mathcal{H}$
🗣 🕅	ᠰᡐᡣᠼ	Գ	ᠰᡖᡴᠼ
	60m2	۲ ···	905152
$\cdots \boldsymbol{\nabla} \begin{bmatrix} FV \\ S1 \end{bmatrix} \cdots$	ᠬ᠇ᡖᠯᠠᡍᡆ	··· 6 ···	ᡨ᠇ᡨᠯᠠᡍ
<b>6</b> [st]	পাত	<b>v</b>	and/
<b>5</b> [FV]	$\mathbf{r}\mathbf{\Theta}$ (traditional form)	<b>7</b>	
<b>7</b> [FV]	4	5	4.22

The full basic character set is shown in the "Basic Character Set" tables on pages 7 and 8 and the names of these characters are given in the "Names of Basic Characters" tables on pages 9 and 10. The numbers in the squares beneath the characters in the "Basic Character Set" tables are the decimal identification numbers of the characters. The hexadecimal identification number of each character, which corresponds to its official code in the standards, is obtained by concatenating the numbers at the head of the column and the left of the row in which the character is located. Thus, for example, the code of the character in the top left-hand corner of the table on page 7 (Mongolian Birga; decimal identification number 0) is 1800 and the code of the character in the bottom left-hand corner of the table on page 8 (Mongolian letter Ali Gali NNA; decimal identification number 143) is 188F. Positions in these tables which are shaded contain no characters and the codes corresponding to these positions are invalid and should not be used.

	180	181	182	183	184	185	186	187
0	6	0	Ł	F	31	Ą	ዊ የ	-
	0	16	32	48	64	80	96	112
1		Ŋ	J	<b>;</b>	ব	4	Я	L.
-	•	17	33	49	65	81	97	113
2	+	ß	ろ	Ŷ	B	م	E	<b>√</b> ∘
-	2	18	• <b>)</b> 34	50	66	82	98	114
3	* *	M	đ	٥		4		1
3	◆ 3	<b>، د</b> 19	35	51	<b>₽</b> 67	83	99	<b>1</b> 15
		U	đ	ป	Т	ป	ム	•
4	•• 4	20	<b>Q</b> 36	<b></b> 52	68	<b>4</b>	100	<b>116</b>
_						01		
5	**	λ	र्षे	1	E	7	も	ሻ
	5	21	37	53	69	85	101	117
6	I	6	र्ष	М	a	6	த	イ
	6	22	38	54	70	86	102	118
7	<b>-1</b> 7	<b>റ</b> 23	<b>J</b> 39	<b>*1</b>	<b>5</b>	<b>7</b> 87	103	<b>1</b> 0
	,							113
8	$\sim$	ե	· -	1	ች	う	4	
	8	24	40	56	72	88	104	120
9	₩	G	ろ	ው	த	Z	R	
	9	25	41	57	73	89	105	121
Α			ወ	っ	Ŀ	Q	1	
	10	26	42	58	74	90	106	122
в	FV S1		ц,	つ	Ŀ	ኆ	イ	
	11	27	43	59	75	91	107	123
С	EV		ク	ዝ	ち	ม	ゔ	
•	[ <u>S2</u> ] 12	28	44	60	76	92	108	124
D	(EV)		·.)	시	ःत		n	
D	[ <u>S3</u> ] 13	29	45	61	►◀ 77	<b>9</b> 3	<b>*)</b> . 109	125
_	[M]				_	_		
Е	[ <u>VS</u> ]	20	<b>→</b> ↑ 46		•	7	<b>*</b> +	100
	14	30			78	94	110	126
F			<b>~</b> 1	P	<b>२</b>		- <b>F</b> I	
	15	31	47	63	79	95	111	127

### **Basic Character Set**

	188	189	18A
0	<b>9</b> 128	<b>1</b>	<b>1</b> 60
1	<b>8</b> 129	<b>1</b> 45	<b>1</b> 61
2	130	146	162
3	130 <b>W</b> 131	140 <b>D</b> 147	1
4	131 <b>M</b> 132	147	163
5	3	Ŷ	₽°
6	133 <b>233</b>	149	165
7	134 <b>1</b>	150 <b>C</b>	166
8	135	151	167
9	136 <b>?</b>	152	168 <b>^</b>
A	137 • <b>犬</b>	153	169
в	138 J	154	170
с	139	155	171
D	140	156	172
Е	141	157	173
	142	158	174
F	143	<b>1</b> 8 159	175

### **Basic Character Set (continued)**

000	hex	Name	dec	hex	Name
		MONGOLIAN BIRGA	064	40	MONGOLIAN LETTER LHA
001		MONGOLIAN ELLIPSIS	065	41	MONGOLIAN LETTER ZHI
002		MONGOLIAN COMMA	066	42	MONGOLIAN LETTER CHI
003		MONGOLIAN FULL STOP	067	43	MONGOLIAN LETTER TODO LONG VOWEL SIGN
004 005		MONGOLIAN COLON MONGOLIAN FOUR DOTS	068 069	44 45	MONGOLIAN LETTER TODO E
005		MONGOLIAN FOUR DOTS MONGOLIAN TODO SOFT HYPHEN	069	45 46	MONGOLIAN LETTER TODO I MONGOLIAN LETTER TODO O
008		MONGOLIAN TODO SOFT HYPHEN MONGOLIAN SIBE SYLLABLE BOUNDARY MARKER	070	40	MONGOLIAN LETTER TODO U
008	-	MONGOLIAN MANCHU COMMA	071	48	MONGOLIAN LETTER TODO OE
009		MONGOLIAN MANCHU FULL STOP	072	49	MONGOLIAN LETTER TODO UE
010		MONGOLIAN NIRUGU	074	4A	MONGOLIAN LETTER TODO ANG
011		MONGOLIAN FREE VARIATION SELECTOR ONE	075	4B	MONGOLIAN LETTER TODO BA
012	0C	MONGOLIAN FREE VARIATION SELECTOR TWO	076	4C	MONGOLIAN LETTER TODO PA
013	0D	MONGOLIAN FREE VARIATION SELECTOR THREE	077	4D	MONGOLIAN LETTER TODO QA
014	0E	MONGOLIAN VOWEL SEPARATOR	078	4E	MONGOLIAN LETTER TODO GA
015	0F	( THIS POSITION SHALL NOT BE USED )	079	4F	MONGOLIAN LETTER TODO MA
016	10	MONGOLIAN DIGIT ZERO	080	50	MONGOLIAN LETTER TODO TA
017	11	MONGOLIAN DIGIT ONE	081	51	MONGOLIAN LETTER TODO DA
018		MONGOLIAN DIGIT TWO	082	52	MONGOLIAN LETTER TODO CHA
019	-	MONGOLIAN DIGIT THREE	083	53	MONGOLIAN LETTER TODO JA
020		MONGOLIAN DIGIT FOUR	084	54	MONGOLIAN LETTER TODO TSA
021		MONGOLIAN DIGIT FIVE	085	55	MONGOLIAN LETTER TODO YA
022		MONGOLIAN DIGIT SIX	086	56	MONGOLIAN LETTER TODO WA
023		MONGOLIAN DIGIT SEVEN	087	57	MONGOLIAN LETTER TODO KA
024 025		MONGOLIAN DIGIT EIGHT MONGOLIAN DIGIT NINE	088 089	58 59	MONGOLIAN LETTER TODO GAA MONGOLIAN LETTER TODO HAA
025	-	(THIS POSITION SHALL NOT BE USED )	089	59 5A	MONGOLIAN LETTER TODO HAA MONGOLIAN LETTER TODO JIA
020		(THIS POSITION SHALL NOT BE USED)	090	5B	MONGOLIAN LETTER TODO NIA
028		(THIS POSITION SHALL NOT BE USED)	092	5D 5C	MONGOLIAN LETTER TODO DZA
029		(THIS POSITION SHALL NOT BE USED)	093	5D	MONGOLIAN LETTER SIBE E
030		(THIS POSITION SHALL NOT BE USED )	094	5E	MONGOLIAN LETTER SIBE I
031	1F	(THIS POSITION SHALL NOT BE USED )	095	5F	MONGOLIAN LETTER SIBE IY
032	20	MONGOLIAN LETTER A	096	60	MONGOLIAN LETTER SIBE UE
033	21	MONGOLIAN LETTER E	097	61	MONGOLIAN LETTER SIBE U
034	22	MONGOLIAN LETTER I	098	62	MONGOLIAN LETTER SIBE ANG
035	23	MONGOLIAN LETTER O	099	63	MONGOLIAN LETTER SIBE KA
036		MONGOLIAN LETTER U	100	64	MONGOLIAN LETTER SIBE GA
037		MONGOLIAN LETTER OE	101	65	MONGOLIAN LETTER SIBE HA
038		MONGOLIAN LETTER UE	102	66	MONGOLIAN LETTER SIBE PA
039			103	67	MONGOLIAN LETTER SIBE SHA
040		MONGOLIAN LETTER NA	104	68	
041		MONGOLIAN LETTER ANG	105	69 CA	
042 043		MONGOLIAN LETTER BA MONGOLIAN LETTER PA	106 107	6A 6B	MONGOLIAN LETTER SIBE JA MONGOLIAN LETTER SIBE FA
043		MONGOLIAN LETTER QA	107	6C	MONGOLIAN LETTER SIBE GAA
044		MONGOLIAN LETTER GA	108	6D	MONGOLIAN LETTER SIBE HAA
046		MONGOLIAN LETTER MA	110	6E	MONGOLIAN LETTER SIBE TSA
047		MONGOLIAN LETTER LA	111	6F	MONGOLIAN LETTER SIBE ZA
048		MONGOLIAN LETTER SA	112	70	MONGOLIAN LETTER SIBE RAA
049		MONGOLIAN LETTER SHA	113	71	MONGOLIAN LETTER SIBE CHA
050		MONGOLIAN LETTER TA	114	72	MONGOLIAN LETTER SIBE ZHA
051		MONGOLIAN LETTER DA	115	73	MONGOLIAN LETTER MANCHU I
052	34	MONGOLIAN LETTER CHA	116	74	MONGOLIAN LETTER MANCHU KA
053	35	MONGOLIAN LETTER JA	117	75	MONGOLIAN LETTER MANCHU RA
054	36	MONGOLIAN LETTER YA	118	76	MONGOLIAN LETTER MANCHU FA
055		MONGOLIAN LETTER RA	119	77	MONGOLIAN LETTER MANCHU ZHA
056		MONGOLIAN LETTER WA	120	78	(THIS POSITION SHALL NOT BE USED)
057		MONGOLIAN LETTER FA	121	79	(THIS POSITION SHALL NOT BE USED)
058		MONGOLIAN LETTER KA	122	7A	(THIS POSITION SHALL NOT BE USED)
059		MONGOLIAN LETTER KHA	123	7B	(THIS POSITION SHALL NOT BE USED)
060		MONGOLIAN LETTER TSA	124	7C	(THIS POSITION SHALL NOT BE USED)
061		MONGOLIAN LETTER ZA	125	7D	(THIS POSITION SHALL NOT BE USED)
062 063		MONGOLIAN LETTER HAA	126	7E 7F	(THIS POSITION SHALL NOT BE USED)
003	J۳	MONGOLIAN LETTER ZRA	127	7	( THIS POSITION SHALL NOT BE USED )

#### Names of Basic Characters

dec	hex	Name
128	80	MONGOLIAN LETTER ALI GALI ANUSVARA ONE
129	81	MONGOLIAN LETTER ALI GALI VISARGA ONE
130	82	MONGOLIAN LETTER ALI GALI DAMARU
131	83	MONGOLIAN LETTER ALI GALI UBADAMA
132	84	MONGOLIAN LETTER ALI GALI INVERTED UBADAMA
133	85	MONGOLIAN LETTER ALI GALI BALUDA
134	86	MONGOLIAN LETTER ALI GALI THREE BALUDA
135	87	MONGOLIAN LETTER ALI GALI A
136	88	MONGOLIAN LETTER ALI GALI I
137	89	MONGOLIAN LETTER ALI GALI KA
138	8A	MONGOLIAN LETTER ALI GALI NGA
139	8B	MONGOLIAN LETTER ALI GALI CA
140	8C	MONGOLIAN LETTER ALI GALI TTA
141	8D	MONGOLIAN LETTER ALI GALI TTHA
142	8E	MONGOLIAN LETTER ALI GALI DDA
143	8F	MONGOLIAN LETTER ALI GALI NNA
144	90	MONGOLIAN LETTER ALI GALI TA
145	91	MONGOLIAN LETTER ALI GALI DA
146	92	MONGOLIAN LETTER ALI GALI PA
147	93	MONGOLIAN LETTER ALI GALI PHA
148	94	MONGOLIAN LETTER ALI GALI SSA
149	95	MONGOLIAN LETTER ALI GALI ZHA
150	96	MONGOLIAN LETTER ALI GALI ZA
151	97	MONGOLIAN LETTER ALI GALI AH
152	98	MONGOLIAN LETTER TODO ALI GALI TA
153	99	MONGOLIAN LETTER TODO ALI GALI ZHA
154	9A	MONGOLIAN LETTER MANCHU ALI GALI GHA
155	9B	MONGOLIAN LETTER MANCHU ALI GALI NGA
156	9C	MONGOLIAN LETTER MANCHU ALI GALI CA
157	9D	MONGOLIAN LETTER MANCHU ALI GALI JHA
158	9E	MONGOLIAN LETTER MANCHU ALI GALI TTA
159	9F	MONGOLIAN LETTER MANCHU ALI GALI DDHA
160	A0	MONGOLIAN LETTER MANCHU ALI GALI TA
161	A1	MONGOLIAN LETTER MANCHU ALI GALI DHA
162	A2	MONGOLIAN LETTER MANCHU ALI GALI SSA
163	A3	MONGOLIAN LETTER MANCHU ALI GALI CYA
164	A4	MONGOLIAN LETTER MANCHU ALI GALI ZHA
165	A5	MONGOLIAN LETTER MANCHU ALI GALI ZA
166	A6	MONGOLIAN LETTER ALI GALI HALF U
167	A7	MONGOLIAN LETTER ALI GALI HALF YA
168	A8	MONGOLIAN LETTER MANCHU ALI GALIBHA
169	A9	MONGOLIAN LETTER ALI GALI DAGALGA
170	AA	(THIS POSITION SHALL NOT BE USED)
171	AB	(THIS POSITION SHALL NOT BE USED)
172	AC	(THIS POSITION SHALL NOT BE USED)
173	AD	(THIS POSITION SHALL NOT BE USED)
174	AE	(THIS POSITION SHALL NOT BE USED)
175	AF	( THIS POSITION SHALL NOT BE USED )

Names of Basic Characters (continued)

#### 2.1 Other basic Mongolian characters

The basic Mongolian character set described above only includes characters which are peculiar to Mongolian and its related scripts. Other symbols which are used not only in the Mongolian scripts but also in other scripts are encoded as general punctuation symbols in the General Punctuation block of the standards. These include the two combination symbols "?!" and "!?" and the Mongolian space.

The combination symbols "?!" and "!?" are represented by characters 2048, QUESTION EXCLAMATION MARK, and 2049, EXCLAMATION QUESTION MARK, respectively.

The Mongolian space is not coded explicitly in the standards, but its functionality is provided by character 202F, NARROW NO-BREAK SPACE (E). The Mongolian space occurs frequently in Mongolian: many words are formed by the addition of one or more suffixes (which indicate for example different case endings of nouns and pronouns, ownership, and negation) to a basic stem word, and each individual suffix is separated from the stem or from the preceding suffix by the Mongolian space. Visually, this appears as a small white space, though it also affects the forms of the letters preceding and following it, the preceding character adopting its final form. However, it

does not mark a break between words, the stem word together with all its suffixes being considered to form a single word.

Note that the functionality of character 202F, NARROW NO-BREAK SPACE, is different from that of character 00A0, NO-BREAK SPACE, which does mark a division between words but which forbids a line of text to be broken at that division.

The following examples illustrate how narrow no-break space 🕎 is used to generate the most commonly occurring case endings in Mongolian:

Case - ending	Character sequence	Case - ending	Character sequence
TRADITION	IAL MONGOLIAN :		
177	SPE 5 X Y	<del>.</del> .	SP to i / SP tor i
ଟ	NNB To / NNB Tor	ರ್	<u>ਆ ਨ</u> ਹ ਹਿ / <u>ਆ</u> ਨ ਹਿ
<del>କ</del> ଟ	NNB 수 1 / NNB 수 1 ~		י ר יי ד ר ש
9mm	י ר זי די ר	ᡐᠣᠺ	אופ אים אים אים אים אים אים אים אים אים אים
ಕರ್ಗ	אוש ק אס ג / אוש ק אע ג	C	
۲	SP 7 X		NP
ರ್ಗ	፮₱ ፁᠠ ᠷ / ፮₱ ፁን ᠷ	্য	\$\$\$ <b>♀ √</b> 𝔨 / \$\$\$\$ ♀ ·ϧ 𝔅
ر <u>انمر</u>	🕎 ኁ ኈ ኁ 🕅 🗸	ᡏᠣᢉᡍ	ر ب ب س الله الله
<del>, 20</del>	ਲਿਊ <b>`ਚ ਫ</b> / ਲਿਊ <b>`ਚ</b> ਫ	୶	빨 6 ✔ 갸/ ﷺ 6 ヵ 갸
ᠵᡕ᠇ᠷ	᠉᠉᠋ᡔᡳᠶ᠊ᡳ᠆ᠵ᠋᠉᠉᠋ᠵᠶᠶᡵ	$\mathfrak{r}$	sp γ √ ≂
TODO :			
ل <del>ن.</del>	NPB 7 10	(m/	<u>אש</u> זי זע זע זי
<u> হ্</u>	NP 7 7	<b>9</b> 0	
ᡞᡗᠧ	M み み)	ᠧᡃᠴᡄ	איז <del>א</del> א י ד א
ᠵᡄᡃᠷ	אוש גי אר אי ג	ಕಿ-್	<sup>ነም</sup> 6 ኊ
ᠱ <del>ᠸᡎᡃ</del> /	NP 두 · · · · · · · · · · · · · · · · · ·	ᡏᠣᢉᡄᡃ	🕎 ፑ ᠣ ᡎ ᠧ ·
SIBE and M	IANCHU :		
ç	SP: T	ì	۱ <u>۷</u> ۱ ۱
<i>с</i> н/	spe of V	л Г	
θη	NP 6 ≠	ᡤ᠇ᡵᠶ	<sup>NNB</sup> ↔ ₩ ᢏ ᢏ

## **3** The Variant Forms

As indicated in Section 1, the actual written form of any given letter in Mongolian generally depends on its position within a word: the letter assumes its initial form when it is the first letter in the word, its final form when it is the last letter in the word, and its medial form when it occurs somewhere in the middle of the word. However, there can also be a number of possible variations of a given positional form, and these variations can depend on a number of factors including the preceding and following letters, the syllable which contains the letter, and the gender of the word. In fact, a given positional form may have as many as four different variants, while a letter may have as many as nine different variant forms altogether. The complete set of variants of each letter are shown in the Mongolian Reference Table, which forms the first appendix to the document and which is described in Section 3.2.

Taking account of the fact that different variants may look the same as discussed in Section 2, a set of presentation forms is defined, all of which are visually distinct not only from each other but also from all the characters in the basic character set. These are shown in the "Presentation Character Set" tables on pages 13 and 14, and their names are given in the following tables on pages 15 and 16. The set of all possible character shapes in Mongolian is therefore represented by the basic character set together with the set of presentation forms.

These presentation forms are not encoded explicitly in the ISO/IEC 10646 standard. Instead, the appropriate positional form of a character is determined directly from its position in a word and the first (which is the most commonly occurring) variant of this is taken as the default form. Then a different (non-default) variant of that positional form is obtained by appending one of the Mongolian free variant selectors (characters 180B, 180C and 180D ([SI], [S2], [S3]) in the basic character set) to the code for the basic character. Thus, for example, the Mongolian word "dug" means "deep sleep" ( $( \neg \neg n')$ ) when spelt with the first (default) variant of the initial form of the letter "D" ( $( \circ )$ ) (when the actual sequence of characters would be  $\nabla \neg \nabla$  ( ) but means "to put in check using the bishop in the game of chess" ( $\nabla \neg n'$ ) when spelt using the second variant (when the actual sequence of characters would include the first free variant selector:  $\nabla [SI] \neg \nabla ( )$ .

	F30	F31	F32	F33	F34	F35	F36	F37
0	° •		<b>•</b> •• 32	<b>J</b> 48	<b>A</b> 64	<b>ď</b> 80	<b>-</b> 96	112
1	6	g	Ŷ	Ч	z	ď	Т	وار
2	1 -33	17 7	33	49 <b>Y</b>	65	81 5	97 <b>1</b>	113
3	2 -333	18	34	50	66 <b>2</b>	82 •	98	114
5	3	19	35	51	67	83	_ <b>_</b> 99	115
4	4	20	<b>★</b> 36	<b>9</b> 52	<b>)</b> 68	<b>ا</b> لح 84	<b>K</b> 100	<b>&gt;</b> 116
5	◄ 5	• <b>•</b>	<b>*</b> 37	<b>೨</b> 53	<b>a</b> 69	ب <b>ح</b> 85	<b>ک</b>	<b>1</b> 17
6	1	<b>14</b>	4	٢	4	Ĵ	P	<b>&gt;</b> I
7	6	22 3	38	54	70	86 ¶	102 ന	118 <b>Ц</b> о
	7	23	39	55	71	87	103	119
8	8	<b>9</b>	40	<b>لل</b> 56	<b>A</b> 72	<b>P</b> 88	<b>≭</b> ◀ 104	<b>‡つ</b> 120
9	ے ۹	<b>ک</b> 25	41	म <sup>57</sup>	а 73	<b>പ</b> <sup>89</sup>	<b>1</b> 05	<b>2</b>
A	<b>1</b> 0	<b>2</b> 6	<b>4</b> 2	<b>ب</b> 58	<b>ک</b>	<b>4</b> 90	<b>२</b> 106	<b>122</b>
в	<b>1</b> 1	<b>بل</b> 27	43	<b>ک</b> 59	<b>م</b> 75	<b>و</b> ا 1	<b>a</b> . 107	<b>L</b> o 123
С	P	I,	đ	£	Ā	Q	3	0
D	12 <b>đ</b>	28 : <b>`</b>	44 <b>L</b>	60 2	76	92 S	108	124 <b>&amp;</b>
	13	29	45	61	77	93	109	125
Е	<b>D</b> 14	<b>つ</b> 30	<b>م</b> 46	<b>ل</b> 62	<b>4</b> 78	<b>山</b> 94	110	<b>7</b>
F	<b>G</b> 15	<b>7</b> 31	Ц 47	<b>A</b> 63	<b>4</b> 79	<b>பு</b> 95	<b>Л</b> 111	<b>J</b> 127

### **Presentation Character Set**

	F38	F39
0	<b>1</b> 28	<b>\</b> 144
1	129	<b>1</b> 45
2	<b>J</b> 130	<b>₩</b> 146
3	<b>റ</b> 131	<b>1</b> 47
4	<b>?</b> 132	<b>1</b> 48
5	• <b>X</b> 133	149
6	<b>*3</b> 134	150
7	<b>↑ ▲</b> 135	151
8	<b>Ц</b> 136	152
9	+ <b>()</b> 137	153
Α	<b>لا</b> 138	154
В	<b>1</b> 39	155
С	<b>1</b> 40	156
D	<b>*</b> 141	157
Е	<b>1</b> 42	158
F	<b>Ч</b> • 143	159

# **Presentation Character Set (continued)**

00         0.         MONGOLIAN LETTER I INITIAL FORM         074         4.4         MONGOLIAN LETTER TOD U INITIAL FORM           011         00         MONGOLIAN LETTER I FORM         075         4.5         MONGOLIAN LETTER TOD U SECON DEDIAL FORM           012         00         MONGOLIAN LETTER O FIRST MEDIAL FORM         075         4.6         MONGOLIAN LETTER TOD U FIRST FINAL FORM           014         00         MONGOLIAN LETTER O SECOND MEDIAL FORM         075         4.6         MONGOLIAN LETTER TOD U FIRST FINAL FORM           015         07         MONGOLIAN LETTER O SECOND FINAL FORM         073         4.7         MONGOLIAN LETTER TOD O FIRST MEDIAL FORM           016         10         MONGOLIAN LETTER O SECOND FINAL FORM         081         51         MONGOLIAN LETTER TOD O FIRAL FORM           017         11         MONGOLIAN LETTER NA THER MEDIAL FORM         083         53         MONGOLIAN LETTER NA HERM EDIAL FORM           020         14         MONGOLIAN LETTER NA HERM EDIAL FORM         085         55         MONGOLIAN LETTER TOD O FA FINAL FORM           021         15         MONGOLIAN LETTER NA HERM EDIAL FORM         085         55         MONGOLIAN LETTER TOD O FA FINAL FORM           022         16         MONGOLIAN LETTER NA HERM EDIAL FORM         086         56         MONGOLIAN LET			hex	dec	Name	hex	dec
002         Q2         MONGOLAN         BIRGA THERD FORM         066         42         MONGOLAN         LETTER TODO 1         FREDAL FORM           003         Q3         MONGOLAN         LETTER A INTAL FORM         067         44         MONGOLAN         LETTER A FIRST FREDAL FORM         067         44         MONGOLAN         LETTER A FIRST FREDAL FORM         070         46         MONGOLAN         LETTER A FIRST FREDAL FORM         071         46         MONGOLAN         LETTER TODO 0         FIRST FREDAL FORM         072         48         MONGOLAN         LETTER TODO 0         FIRST FREDAL FORM         073         44         MONGOLAN         LETTER TODO 0         FIRST FREDAL FORM         073         44         MONGOLAN         LETTER TODO 0         FIRST FREDAL FORM         073         46         MONGOLAN LETTER TODO 0         FIRST FREDAL FORM         073         46         MONGOLAN LETTER TODO 0         FIRST FREDAL FORM         073         46         MONGOLAN LETTER TODO 0         FIRST FREDAL FORM         073         46         MONGOLAN LETTER TODO 0         FIRST FREDAL FORM         073	RM		-				
03         INONGOLAN BIRGA FOURTH FORM         067         43         MONGOLAN LETTER A INTUL FORM           06         MONGOLAN LETTER A SECOND FORM         068         44         MONGOLAN LETTER A SECOND FORM         070           07         MONGOLAN LETTER A SECOND FORM         071         47         MONGOLAN LETTER TARD MEDAL FORM         071         47         MONGOLAN LETTER TARD MEDAL FORM         071         47         MONGOLAN LETTER A FIRST FMAIL FORM         072         48         MONGOLAN LETTER A FIRST FMAIL FORM         072         44         MONGOLAN LETTER TODO O FIRAL FORM         072         44         MONGOLAN LETTER TODO U SECOND FALL FORM         072         44         MONGOLAN LETTER TODO U SECOND FALL FORM         073         44         MONGOLAN LETTER TODO U SECOND FALL FORM         073         44         MONGOLAN LETTER TODO U SECOND FALL FORM         074         44         MONGOLAN LETTER TODO U HIRD MEDAL FORM         074         44         MONGOLAN LETTER TODO U HIRD MEDAL FORM         076         42         MONGOLAN LETTER TODO U HIRD MEDAL FORM         076         44         MONGOLAN LETTER TODO U HIRD MEDAL FORM         076         44         MONGOLAN LETTER TODO U HIRD MEDAL FORM         076         44         MONGOLAN LETTER TODO U HIRD MEDAL FORM         076         44         MONGOLAN LETTER TODO U HIRD MEDAL FORM         077         44         MONGOLAN LETTER TODO						• •	
04         MONGOLAN LETTER A FIRST MENL FORM         056         44         MONGOLAN LETTER A SECOND MEDIAL FORM         067         45         MONGOLAN LETTER A FIRST MENL FORM         068         44         MONGOLAN LETTER A SECOND MEDIAL FORM         070         45         MONGOLAN LETTER A THRO MEDIAL FORM         071         45         MONGOLAN LETTER A SECOND MEDIAL FORM         071         45         MONGOLAN LETTER TODO U SECOND MEDIAL FORM         071         46         MONGOLAN LETTER TODO U JECOND MEDIAL FORM         071         46         MONGOLAN LETTER TODO U JECOND MEDIAL FORM         071         46         MONGOLAN LETTER TODO U JECOND MEDIAL FORM         071         46         MONGOLAN LETTER TODO U JECOND MEDIAL FORM         077         46         MONGOLAN LETTER TODO U JECOND MEDIAL FORM         071         40         MONGOLAN LETTER TODO U FINST FINAL FORM         073         47         MONGOLAN LETTER TODO U FINST FINAL FORM         073         45         MONGOLAN LETTER TODO U FINST FINAL FORM         074         47         MONGOLAN LETTER TODO U FINST FINAL FORM         075         45         MONGOLAN LETTER TODO U FINST FINAL FORM         075         45         MONGOLAN LETTER TODO U FINST FINAL FORM         076	•••					-	
005         005 <td>IVI</td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td>	IVI		-				
006         66         MONQOLAN LETTER A THIRD MEDIAL FORM         070         46         MONQOLAN LETTER TO DO O FIRST MEDIAL FORM           008         08         MONQOLAN LETTER A THIRD MEDIAL FORM         071         48         MONQOLAN LETTER TO DO O FIRST MEDIAL FORM           019         09         MONQOLAN LETTER A SECOND FINAL FORM         072         48         MONQOLAN LETTER TO DO O J SECOND IOLATE FORM           011         08         MONQOLAN LETTER A SECOND FINAL FORM         074         44         MONQOLAN LETTER TO DO U SECOND IOLATE FORM           012         06         MONQOLAN LETTER O FIRST MEDIAL FORM         076         45         MONQOLAN LETTER TO DO U FIRST MEDIAL FORM           014         06         MONQOLAN LETTER O FIRST MEDIAL FORM         076         46         MONQOLAN LETTER TO DO U FIRST MEDIAL FORM           016         00         MONQOLAN LETTER O FIRST MEDIAL FORM         077         40         MONQOLAN LETTER TO DO O FIRST MEDIAL FORM           016         00         MONQOLAN LETTER O TO FIRST MEDIAL FORM         071         47         MONQOLAN LETTER TO DO O FIRST MEDIAL FORM           017         11         MONSOLAN LETTER O TO FIRST MEDIAL FORM         081         51         MONQOLAN LETTER TO FIRST MEDIAL FORM           021         14         MONSOLAN LETTER NA THEOLEGAN         081						-	
08         MONGOLAN LETTER A SECOND FINAL FORM         072         48         MONGOLAN LETTER TODO O FINAL FORM           011         08         MONGOLAN LETTER A SECOND SIDLATE FORM         074         44         MONGOLAN LETTER TODO U FINAL FORM           011         08         MONGOLAN LETTER 1 FINAL FORM         075         48         MONGOLAN LETTER TODO U FIRST FINAL FORM           012         0C         MONGOLAN LETTER 0 FIRST MEDIAL FORM         076         48         MONGOLAN LETTER TODO U FIRST FINAL FORM           013         0D         MONGOLAN LETTER 0 FIRST FINAL FORM         077         40         MONGOLAN LETTER TODO U FIRST FINAL FORM           014         0E         MONGOLAN LETTER 0 FIRST FINAL FORM         078         47         MONGOLAN LETTER TODO O FIRST FINAL FORM           015         0F         MONGOLAN LETTER 0 FIRST FINAL FORM         081         51         MONGOLAN LETTER TODO O FIRST FINAL FORM           014         1MONGOLAN LETTER N A FIRST FINAL FORM         083         53         MONGOLAN LETTER TODO O FIRST FINAL FORM           015         13         MONGOLAN LETTER N A FIRST FIRAL FORM         085         55         MONGOLAN LETTER N A FIRAL FORM           021         14         MONGOLAN LETTER N A FIRAL FORM         085         55         MONGOLAN LETTER N A FIRAL FORM	I.		-				
09         90         MONGOLIAN LETTER I INTALFORM         073         49         MONGOLIAN LETTER I INTALFORM           011         08         MONGOLIAN LETTER I INTALFORM         076         48         MONGOLIAN LETTER TODO U SECOND MEDIALFORM           012         0C         MONGOLIAN LETTER I OFINALFORM         076         48         MONGOLIAN LETTER TODO U THIRD MEDIALFORM           013         0D         MONGOLIAN LETTER O SECOND MEDIALFORM         077         44         MONGOLIAN LETTER TODO U THIRD MEDIALFORM           014         0E         MONGOLIAN LETTER O SECOND FINALFORM         077         47         MONGOLIAN LETTER TODO O SECOND MEDIALFORM           015         0F         MONGOLIAN LETTER O SECOND FINALFORM         081         50         MONGOLIAN LETTER TODO O SECOND MEDIALFORM           016         10         MONSOLIAN LETTER O SECOND FINALFORM         082         52         MONGOLIAN LETTER TODO O SECOND MEDIALFORM           019         13         MONSOLIAN LETTER NA THROB MEDIALFORM         083         54         MONGOLIAN LETTER NA THROB MEDIALFORM           021         16         MONSOLIAN LETTER NA THROB MEDIALFORM         084         54         MONGOLIAN LETTER NA THROB MEDIALFORM           022         16         MONSOLIAN LETTER NA THROB MEDIALFORM         084         54         MONGOLIAN LET			47	071		07	007
010         0.4         MONGOLIAN LETTER I INITIAL FORM         074         4.4         MONGOLIAN LETTER TODO U INITIAL FORM           011         08         MONGOLIAN LETTER I FIALA FORM         075         48         MONGOLIAN LETTER TODO U SECON DIVEDIAL FORM           012         0C         MONGOLIAN LETTER O FIRST MEDIAL FORM         076         40         MONGOLIAN LETTER TODO U THIRD MEDIAL FORM           014         0E         MONGOLIAN LETTER O FIRST FINAL FORM         077         40         MONGOLIAN LETTER TODO U THIRD MEDIAL FORM           015         0F         MONGOLIAN LETTER O FIRST FINAL FORM         077         44         MONGOLIAN LETTER TODO U FIRST MEDIAL FORM           016         10         MONGOLIAN LETTER O FIRST MEDIAL FORM         081         51         MONGOLIAN LETTER TODO PA FINAL FORM           017         11         MONGOLIAN LETTER NA THIRD MEDIAL FORM         081         51         MONGOLIAN LETTER TODO PA FINAL FORM           021         15         MONGOLIAN LETTER NA THIRD MEDIAL FORM         085         56         MONGOLIAN LETTER TODO PA FINAL FORM           022         16         MONGOLIAN LETTER NA THIRD MEDIAL FORM         086         56         MONGOLIAN LETTER TODO PA FINAL FORM           023         17         MONGOLIAN LETTER NA THIRD MEDIAL FORM         086         56		MONGOLIAN LETTER TODO O FINAL FORM	48	072	MONGOLIAN LETTER A FIRST FINAL FORM	08	008
011         08         MONGOLIAN LETTER 1 FINAL FORM         075         48         MONGOLIAN LETTER 10 FIRST BEDIAL FORM           012         00         MONGOLIAN LETTER 0 O FIRST FINAL FORM         076         40         MONGOLIAN LETTER 100 U FIRST FINAL FORM           014         0E         MONGOLIAN LETTER 0 O FIRST FINAL FORM         077         40         MONGOLIAN LETTER 100 U FIRST FINAL FORM           015         0F         MONGOLIAN LETTER 0 O SECOND FINAL FORM         078         4F         MONGOLIAN LETTER 100 U FIRST FINAL FORM           016         10         MONGOLIAN LETTER 0 O SECOND FINAL FORM         080         50         MONGOLIAN LETTER 100 C FIRST FINAL FORM           017         11         MONGOLIAN LETTER 0 E FIRAL FORM         082         52         MONGOLIAN LETTER 100 C G A FIRST MEDIAL FORM           018         12         MONGOLIAN LETTER NA FIRST MEDIAL FORM         084         54         MONGOLIAN LETTER 100 G A FIRAL FORM           021         15         MONGOLIAN LETTER NA FIRST MEDIAL FORM         085         55         MONGOLIAN LETTER 100 G A FIRAL FORM           022         16         MONGOLIAN LETTER A FIRAL FORM         085         55         MONGOLIAN LETTER TOD C FIRAL FORM           023         17         MONGOLIAN LETTER A FIRAL FORM         085         56         MONGOLIA	)RM	MONGOLIAN LETTER TODO U SECOND ISOLATE FORM	49	073	MONGOLIAN LETTER A SECOND FINAL FORM	09	009
012         0C         MONSOLIAN LETTER O SECOND MEDIAL FORM         076         4C         MONSOLIAN LETTER TO DO U THIED MEDIAL FORM           013         0D         MONGOLIAN LETTER O SECOND FINAL FORM         077         4E         MONSOLIAN LETTER TOD O E INITIAL FORM           014         0E         MONGOLIAN LETTER O SECOND FINAL FORM         078         4E         MONSOLIAN LETTER TOD O E INITIAL FORM           016         10         MONSOLIAN LETTER O TIER MEDIAL FORM         080         50         MONSOLIAN LETTER TOD D FINAL FORM           017         11         MONSOLIAN LETTER O E TIER MEDIAL FORM         081         51         MONSOLIAN LETTER TOD P FINAL FORM           018         12         MONSOLIAN LETTER NO FINAL FORM         083         53         MONSOLIAN LETTER NO FINAL FORM           020         14         MONSOLIAN LETTER NA FINAL FORM         085         55         MONSOLIAN LETTER NO FINAL FORM           021         15         MONSOLIAN LETTER NA FINAL FORM         085         56         MONSOLIAN LETTER TOD OT A FINAL FORM           024         18         MONSOLIAN LETTER NA FINAL FORM         087         57         MONSOLIAN LETTER TOD OT A FINAL FORM           024         18         MONSOLIAN LETTER A THINAL FORM         086         56         MONSOLIAN LETTER TOD O A FINAL FORM		MONGOLIAN LETTER TODO U INITIAL FORM	4A	074	MONGOLIAN LETTER I INITIAL FORM	0A	010
013       00       MONGOLIAN LETTER 0 SECOND MEDIAL FORM       077       40       MONGOLIAN LETTER TOD U FIRST FINAL FORM         014       02       MONGOLIAN LETTER 0 SECOND FINAL FORM       079       4F       MONGOLIAN LETTER TOD OC FIRST MEDIAL FORM         015       07       MONGOLIAN LETTER 0 SECOND FINAL FORM       080       50       MONGOLIAN LETTER TOD OC SECOND MEDIAL FORM         016       10       MONGOLIAN LETTER 0 SECOND FINAL FORM       081       51       MONGOLIAN LETTER TOD OC SECOND MEDIAL FORM         017       11       MONGOLIAN LETTER N SERST MEDIAL FORM       081       53       MONGOLIAN LETTER NA FIRST MEDIAL FORM         021       14       MONGOLIAN LETTER NA FIRST MEDIAL FORM       084       54       MONGOLIAN LETTER NA FIRST MEDIAL FORM         021       15       MONGOLIAN LETTER NA FIRST MEDIAL FORM       085       55       MONGOLIAN LETTER NA FIRST MEDIAL FORM         022       16       MONGOLIAN LETTER NA FIRST MEDIAL FORM       085       55       MONGOLIAN LETTER TOD CA FIRAL FORM         023       17       MONGOLIAN LETTER NA FIRST MEDIAL FORM       085       59       MONGOLIAN LETTER OA SECOND MEDIALFORM         024       18       MONGOLIAN LETTER OA SECOND MEDIALFORM       085       59       MONGOLIAN LETTER OA SECOND MEDIALFORM       086       50 <t< td=""><td></td><td></td><td>4B</td><td></td><td></td><td>-</td><td>011</td></t<>			4B			-	011
014         0F         MONGOLIAN LETTER O FIRST FINAL FORM         078         4E         MONGOLIAN LETTER TOD O CE NITIAL FORM           015         0F         MONGOLIAN LETTER O SECOND FINAL FORM         079         4F         MONGOLIAN LETTER TOD O CE SECOND MEDIAL FORM           016         10         MONGOLIAN LETTER O E TINRD MEDIAL FORM         081         51         MONGOLIAN LETTER TOD O E FINAL FORM           017         11         MONGOLIAN LETTER E E FINAL FORM         081         53         MONGOLIAN LETTER TOD O A FINAL FORM           019         13         MONGOLIAN LETTER NA THIRD MEDIAL FORM         083         53         MONGOLIAN LETTER NA THIRD MEDIAL FORM           021         15         MONGOLIAN LETTER NA THIRD MEDIAL FORM         085         55         MONGOLIAN LETTER NA THIRD MEDIAL FORM           021         15         MONGOLIAN LETTER NA THIRD MEDIAL FORM         085         56         MONGOLIAN LETTER TO TOD CA A FINAL FORM           022         16         MONGOLIAN LETTER NA THIRD MEDIAL FORM         085         58         MONGOLIAN LETTER NA THIRD MEDIAL FORM           023         17         MONGOLIAN LETTER A THIRD MEDIAL FORM         085         54         MONGOLIAN LETTER NA THIRD MEDIAL FORM           024         18         MONGOLIAN LETTER A THIRD MEDIAL FORM         085         54	i -		-				
015         0.F         MONGOLIAN LETTER         0.5 ENCOND FINAL FORM         079         4.F         MONGOLIAN LETTER TOD OCE FIRST MEDIAL FORM           016         10         MONGOLIAN LETTER         0.5 ENCOND FINAL FORM         080         50         MONGOLIAN LETTER TOD OCE FIRST MEDIAL FORM           018         12         MONGOLIAN LETTER         ETTER E E INITIAL FORM         082         52         MONGOLIAN LETTER TOD OC A FIRST MEDIAL FORM           021         14         MONGOLIAN LETTER         NA FIRST MEDIAL FORM         084         53         MONGOLIAN LETTER TOD CA FIRST MEDIAL FORM           021         15         MONGOLIAN LETTER NA FIRST MEDIAL FORM         085         55         MONGOLIAN LETTER TAS FIRAL FORM         085         55         MONGOLIAN LETTER TAS FIRAL FORM         087         7         MONGOLIAN LETTER A STRAL FORM         087         7         MONGOLIAN LETTER A STRAL FORM         085         59         MONGOLIAN LETTER A STRAL FORM         086         50         MONGOLIAN LETTER A STRAL FORM         086         50         MONGOLIAN LETTER A STRAL FORM         081         58         MONGOLIAN LETTER A STRAL FORM         091         58         MONGOLIAN LETTER A STRAL FORM         091         58         MONGOLIAN LETTER A STRAL FORM         092         50         MONGOLIAN LETTER A STRAL FORM         091 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>							
016         10         MONGOLIAN LETTER 0E THIRD MEDIAL FORM         081         50         MONGOLIAN LETTER TODO DE SECOND MEDIAL FORM           017         11         MONGOLIAN LETTER 0E SECOND FINAL FORM         081         51         MONGOLIAN LETTER TODO DE SECOND FINAL FORM           018         12         MONGOLIAN LETTER 1000 CA FINAL FORM         082         52         MONGOLIAN LETTER NON FINAL FORM           020         14         MONGOLIAN LETTER NA THIRD MEDIAL FORM         083         53         MONGOLIAN LETTER NON FINAL FORM           021         15         MONGOLIAN LETTER NA THIRD MEDIAL FORM         085         55         MONGOLIAN LETTER NON FINAL FORM           022         16         MONGOLIAN LETTER A THIRD MEDIAL FORM         087         57         MONGOLIAN LETTER A THIRD MEDIAL FORM           023         17         MONGOLIAN LETTER A THIRD MEDIAL FORM         086         58         MONGOLIAN LETTER A THIRD FORM           024         18         MONGOLIAN LETTER A THIRD MEDIAL FORM         087         57         MONGOLIAN LETTER A THIRD MEDIAL FORM           026         1A         MONGOLIAN LETTER A THIRD MEDIAL FORM         085         56         MONGOLIAN LETTER A THIRD MEDIAL FORM           026         1D         MONGOLIAN LETTER A THERAL FORM         093         50         MONGOLIAN LETTER T						-	
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		MONGOLIAN LETTER MANCHURA FEMININE SECOND MEDIA	78	120		39	050
		MONGOLIAN LETTER MANCHU KA FEMININE FIRST FIR					
059 38 MONGOLIAN LETTER HAA FINAL FORM 123 78 MONGOLIAN LETTER MANCHU ZHA MEDIAL FORM							
	OND FORM	MONGOLIAN LETTER ALI GALI ANUSVARA ONE SECOND				-	
		MONGOLIAN LETTER ALI GALI VISARGA ONE SECOND F	-				
		MONGOLIAN LETTER ALI GALI A SECOND ISOLATE FOR					
		MONGOLIAN LETTER ALI GALI A FIRST FINAL FORM	7F	127	MONGOLIAN LETTER TODO E FIRST MEDIAL FORM	3F	063

dec	hex	Name
128	80	MONGOLIAN LETTER ALI GALI A SECOND FINAL FORM
129	81	MONGOLIAN LETTER ALI GALI A THIRD FINAL FORM
130	82	MONGOLIAN LETTER ALI GALI A FOURTH FINAL FORM
131	83	
132	84	MONGOLIAN LETTER ALI GALI KA INITIAL FORM
133	85	MONGOLIAN LETTER ALI GALI NGA SECOND INITIAL FORM
133	86	MONGOLIAN LETTER ALI GALI NGA SECOND INITIAL FORM
134	87	MONGOLIAN LETTER ALI GALI NGA FIRST MEDIAL FORM
	÷.	
136	88	MONGOLIAN LETTER ALI GALI CA MEDIAL FORM
137	89	MONGOLIAN LETTER ALI GALI SSA MEDIAL FORM
138	8A	MONGOLIAN LETTER ALI GALI ZA MEDIAL FORM
139	8B	MONGOLIAN LETTER MANCHU ALI GALI GHA MEDIAL FORM
140	8C	MONGOLIAN LETTER MANCHU ALI GALI NGA MEDIAL FORM
141	8D	MONGOLIAN LETTER MANCHU ALI GALI CA MEDIAL FORM
142	8E	MONGOLIAN LETTER MANCHU ALI GALI JHA MEDIAL FORM
143	8F	MONGOLIAN LETTER MANCHU ALI GALI TTA MEDIAL FORM
144	90	MONGOLIAN LETTER MANCHU ALI GALI DDHA MEDIAL FORM
145	91	MONGOLIAN LETTER MANCHU ALI GALI DHA MEDIAL FORM
146	92	MONGOLIAN LETTER MANCHU ALI GALI CYA MEDIAL FORM
147	93	MONGOLIAN LETTER MANCHU ALI GALI ZHA MEDIAL FORM
148	94	MONGOLIAN LETTER MANCHU ALI GALI ZA MEDIAL FORM

Names	of Presentation	forms	(continued)
			(commaca)

In normal Mongolian text, the correct variant of any given positional form of a letter can in most cases be determined unambiguously from the context using a set of rules involving the preceding and following letters, the syllable in the word, and the gender of the word. In these cases, software supporting Mongolian could generate the appropriate variant form of each letter automatically on input.

In a few situations, however, the rules are not sufficient to determine the correct variant form uniquely, and there can be an essentially arbitrary choice between two or more possible alternatives. Then a software system could at best generate one of the possible alternatives automatically as a default, the other possible alternatives being obtained by manually overriding this default as described in Section 3.1.

### **3.1** Overriding the Defaults

The default positional form of a Mongolian letter can be overridden using the zero width joiner  $(\underline{\mathbb{F}}_{\text{M}})$  and non-joiner  $(\underline{\mathbb{F}}_{\text{M}})$  (characters 200D and 200C in the General Puntuation block respectively): in the rules for determining the correct positional form the non-joiner effectively acts as an invisible space while the joiner acts as an invisible letter.

Thus, for example, the initial, medial and final forms of any character can be printed as a single character surrounded by white space as follows:

*initial form:* space + character + zero-width joiner + space
 *medial form:* space + zero-width joiner + character + zero-width joiner + space
 *final form:* space + zero-width joiner + character + space

More generally, appending a zero-width joiner to the beginning of a sequence of two or more letters converts the first letter in the sequence from initial form to medial form, while appending it to the end of such a sequence converts the last letter in the sequence from final form to medial form. Inserting a zero-width joiner into the middle of such a sequence has no effect. Thus, for example, the Mongolian word  $4 \sqrt{2} \sqrt{2} \sqrt{2}$  (school) can be split into its separate syllables  $4 \sqrt{2} \sqrt{2}$  using the zero-width joiner as follows:

+ で ≂ Join Join Join Join Join fr で そ か

and the Todo word  $\sqrt{\sqrt{2}}$  (school) can similarly be split into its syllables  $\sqrt{\sqrt{2}}$ 

મે રુદ્ર ઉંગો ડેગો ગ્રે રુપ્ર ઉંગો ડેગો તે મી.

The zero-width non-joiner only produces a visible effect when it is inserted between two letters. In such a situation, it has the effect of breaking the cursive connection between the two letters, thus effectively splitting the sequence into two at that position. The letter immediately preceding the non-joiner is thus treated as if it were the end of one sequence, and hence would default to final form (assuming there were some other letters preceding it; isolate form if not), while the letter immediately following the nonjoiner is treated as if it were the beginning of another sequence, and hence would default to initial form (assuming there were some other letters following it; again, isolate form if not).

A combination of one zero-width joiner and one zero-width non-joiner, in either order, also has a visible effect when inserted into the middle of a sequence of letters. If the joiner precedes the non-joiner, the cursive connection is only broken on the right, so the letter to the left of the break retains its original default positional form while the one on the right becomes initial form (or isolate form if it is a single letter). If, on the other hand, the joiner follows the non-joiner, the cursive connection is only broken on the left, so the letter on the left of the break becomes final form (again isolate form if it is a single letter) while the letter on the right retains its original default positional form.

Two adjacent joiners have the same effect as a single joiner, and similarly two adjacent non-joiners have the same effect as a single non-joiner.

Finally, two joiners separated by a non-joiner and two non-joiners separated by a joiner have the same effect as a single joiner or a single non-joiner respectively. Any sequence consisting of three or more joiners and non-joiners in any order can therefore be reduced to either a single joiner, a single non-joiner or a joiner/non-joiner pair, the effects of each of which have been specified above.

The default or correct variant forms can simply be overridden by inserting the appropriate Mongolian free variant selector after the letter to be changed.

Display	Character sequence	Display	Character sequence
ᠡᡟᡍᠺ ᡗᡍᠺ	W IZWIIZWI Ĥ W K Join W IZWIIZWI Ĥ K	ᡝᡍ᠇ᠷ	ન
ᠴ᠋ᠴᠺ	Zwi√ZwiFViZwi î V ⊼		
᠕ᡎ᠇᠊ᠺ	₩ <sup>12₩1</sup> 2₩1γ ₩ <b>-</b> <del>-</del>	ᡝ᠇ᡎ᠇ᡃᡗ	᠕ᡎ᠕᠂ᠵ
<del>76-</del> 1	Front Intellizioni J	ñor/	र्ने फर्रे
ᡏᠥᡟ	F Join NJ For Y		
ño-1			
<del>~~</del>			
	ŕ		
Fred	ና 🕅 ኈ ን	~ <b>~</b> /	ᠮᡈᠨ
Vrról	두 [Z:W] ZWI 사 가 즉 시	í <del>mó</del> /	₹ √
erji		ଗ୍ୟ	e v 1.
ᡋ᠇ᡎ	ଚ ✔ 🕅 î. j. j. j.	ଚନ୍ଦୁ	ବ√ <u>ନ</u>
ᡣᠰᡝ	ft in the <u>zero in in in</u> in	(+++1)	ᠬᡝᡝ᠋ᠲᡝ᠋
್ರಾ	う <sup>(ZW) ZW)</sup> で	ᠣ	ר ני

The following examples illustrate the use of the zero-width joiner and zero-width non-joiner:

### **3.2 The Mongolian Reference Table**

The Mongolian Reference Table, which forms the first appendix to this document, shows all the different variant forms of each of the basic Mongolian characters.

The basic characters, together with their (decimal) codes and glyphs, are listed in the first column of the table (headed "Basic Characters"). The next column (headed "Variant Forms") shows the glyphs and the names of all the variant forms of each character.

The particular variant form which occurs on the same horizontal line as the name of the basic character in the first column is the variant which belongs to the basic character set. All other variant forms are numbered as follows: if the glyph of the variant has the same shape as that of one of the basic characters, the (decimal) number of that basic character is shown in the left-hand column under the heading "No."; if, on the other hand, the glyph of the variant corresponds to one of the presentation forms, the (decimal) number of that presentation form is shown in the right-hand column under the heading "No."; if other wards the same of the presentation forms is shown in the right-hand column under the heading "No.", the other heading "No.", if the presentation form is shown in the right-hand column under the heading "No.", the other heading "No.", if the presentation form is shown in the right-hand column under the heading "No.", if the presentation form is shown in the right-hand column under the heading "No.", if the presentation form is shown in the right-hand column under the heading "No.", if the presentation form is shown in the right-hand column under the heading "No.", if the presentation form is shown in the right-hand column under the heading "No.", if the presentation form is shown in the right-hand column under the heading "No.", if the presentation form is shown in the right-hand column under the heading "No.", if the presentation form is shown in the right-hand column under the heading "No.", if the presentation form is shown in the right column under the heading "No.", if the presentation form is shown in the right column under the heading "No.", if the presentation form is shown is the presentation form is shown in the right column under the heading "No.", if the presentation form is shown is the presentation form is shown in the right column under the heading "No.", if the presentation form is shown is the presentation form is shown in the right column under the heading "No.", if the present

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this number being shown on a shaded background where a particular presentation form occurs for the first time in the table. The final column (headed "Rule") of this section of the table shows the sequence of basic characters (including zero-width joiners and non-joiners where necessary) which can be used to generate the particular variant in isolation (that is, as a single character surrounded by white space).

Note that not all positional variants are defined for all characters: for example, only medial and final forms are given for character 1829, MONGOLIAN LETTER ANG (3). This means that the particular character is not found at all positions in words in normal Mongolian text: in the case of the letter "ANG" it is never found as the first character of a Mongolian word. However, this does not mean that such a character can never occur in one of these "impossible" positions – it is, of course, quite possible to use the zero-width joiner to build an arbitrary string of characters with the letter "ANG" at the beginning even though this would not correspond to a real Mongolian word.

The last column (headed "Usage") in the table shows, for each of the four scripts, the letter in that script to which each particular variant corresponds. A blank space in this column indicates that the particular letter is not used in that script.

# 4 The Ligatures

In Mongolian script, a pair of letters consisting of a "bowed" consonant (that is a consonant without a trailing vertical stem, for example characters 182A MONGOLIAN LETTER BA ((9), 183A MONGOLIAN LETTER KA ((7)), and 183B MONGOLIAN LETTER KHA ((7)) followed by a vowel generally combine to form a ligature. These ligatures are standard in Mongolian script and the set of all different ligatures of this type is shown in the "Ligature Set" tables on pages 21 and 22.

As for the basic characters and the presentation forms, all ligatures in the table have visually distinct forms, though one such form may in fact correspond to more than one different combination of letters.

The "Mongolian Ligatures" table, which forms the second appendix to the document, gives information about each of these ligatures. Each ligature is assigned a (decimal) identification number, which appears in the first column of the table, and this is followed by the ligature's glyph and its (unique) name. The remainder of the table shows, for each of the different scripts, to which combinations of letters at which positions the ligature corresponds: isolate (column headed "ISO"); initial (column headed "INI"); medial (column headed "MED"); and final column headed "FIN"). Finally, the column headed "RULE" shows sequences of characters which generate the versions of each ligature corresponding to its different possible spellings as a stand-alone symbol.

Combinations of characters in which a "fat" ligature, for example  $\boldsymbol{\Phi}$ , is preceded by the medial form of character 182E (-,), Mongolian letter M, or followed by the medial or final forms of character 182F (-,), Mongolian letter L, as well as combinations in which the medial form of M is followed by the medial or final form of L, either directly or with an intervening small vowel (either character 1820 (-), Mongolian letter A, or character 1821 (-), Mongolian letter E), can also form ligatures. This is basically because the normal printed forms of these characters can either overlap or come very close to each in these combinations, especially in some fonts, which can make the text

difficult to read, as, for example, in the words "nomlo"  $\gamma = 1$  and "bolox"  $\Theta = 1$ . These ligatures generally involve some sort of modification or distortion of the tails of the characters so as to remove the overlap or to increase the separation between the characters, but they are not standard so are omitted from this paper. Software supporting Mongolian script should make provision for them, however.

	F40	F41	F42	F43	F44	F45	F46	F47
0	°		<b>?</b>	<b>9</b> 48	<b>a</b> 64		<b>ð</b> 96	<b>?</b>
1	J	ъ	Ÿ	<u>و</u> ر	Ð	Ż	ð	z
2	1 P	17 P	33 33	49 <b>?</b>	es P	81 <b>क</b>	97 <b>?</b>	113 🏹
3	2 P	18 P	34 <b>:බ</b>	50 3	66 P	82 <b>ठ</b>	<sup>98</sup>	114 <b>D</b>
	3	19	35	51	67	83	99	115
4	<b>4</b>	<b>२</b> 20	ې سې	<b>२</b> 52	<b>२</b> 68	<b>क</b> 84	<b>a</b> 100	<b>?.</b> 116
5	B	3	ъ.	?	z	ā	а	<b>J</b> °
	5	21	37	53	69	85	101	117
6	<b>ڳ</b>	<b>?</b>	38	<b>a</b> 54	<b>P</b> 70	<b>ð</b> . 86	<b>A</b> 102	<b>?</b> 118
7	<b>9</b> 7	<b>?</b>	یگ ۳	<b>ð</b> 55	<b>P</b>	<b>ð</b> . 87	<b>Ю</b>	<b>?</b> 119
8		a a	Ŷ	چ ا	ያ	<sub>،</sub>	<b>?</b>	<b>a</b> .
	8	24	40	56	72	88	104	120
9	<b>ع</b>	<b>a</b> 25	<b>9</b> 41	<b>P</b> 57	<b>A</b> 73	289	<b>3</b>	<b>a</b> . 121
A	Ŷ	P		Ş	<b>B</b> ,	2	Ð	ድ
	10	26	42	58	74	90	106	122
В	<b>3</b>	<b>P</b> 27	<b>9</b> 43	<b>?</b> 59	<b>P</b> - <sup>75</sup>	<b>9</b> 1	<b>ð</b> 107	<b>9</b>
с		S	<b>B</b>	Ŷ	<b>B</b>	Ð	<b></b>	Ð
	12	28	44	60	76	92	108	124
D	<b>위</b>	<b>?</b>	<b>9</b> 45	J <sub>61</sub>	<b>う</b> "	<b>२</b> 93	<b>1</b> 09	<b>B</b> ` 125
Е	B	; <b>?</b>	₽	<b>२</b>	Ĵ	2	Ŷ	\$
F	14 <b>D</b> 15	30 31	46 <b>P</b> 47	62 <b>?</b>	78 <b>7</b> 9	94 <b>?</b> 95	110 <b>3</b>	126 <b>9</b> 127

Ligature Set

	F48	F49	F4A	F4B	F4C
0	Р,	Ъ°		Ş	Ð
	128	144	160	176	192
1	Ĵ	<b>Ð</b> .	ዳ	Ş	<b>B</b> :
	129	145	161	177	193
2	<b>P</b> 130	<b>9</b>	<b>P</b> 162	<b>A</b> 178	194
				<b>B</b>	
3	9	ያ	<b>B</b>		
	131	147	163	179	195
4	8	Ŷ	<b>B</b>	æ	
	132	148	164	180	196
5	8	Ĵ	Ş	æ	
	133	149	165	181	197
6	₿ŷ		£	æ	
	134	150	166	182	198
7	₿,	ግ		æ	
	135	151	167	183	199
8	<b>P</b>	B	ን	<b>P</b> .	200
	136	152	168	184	200
9	<b>\$</b>	<b>B</b>	<b>A</b>	<b>9</b> 185	201
	137	153	169		201
Α	Ĵ.	Ð,	B	Ŷ	
	138	154	170	186	202
в	<b>.</b> ?	Ð,	भ्र	<b>.</b> ?	
-	139	155	171	187	203
С	Ð	P	B	ቆ	
	140	156	172	188	204
D	ወ	Ø	ን	ኇ	
	141	157	173	189	205
Е	<b>?</b> .	<b>P</b> 158	<b>7</b>	189 <b>Đ</b> ° 190	206
_	142 <b>3</b> °	اتە م	<b>7</b>	<b>B</b> °	200
F	<b>J</b> ° 143	<b>J</b> 159	<b>۲</b>	<b>1</b> 91	207

# Ligature Set (continued)

A text processing system supporting Mongolian requires a font containing all the characters of the basic Mongolian character set as well as their variant presentation forms and the ligatures. To conform to the standards, the characters in the basic character sets must be situated at the coding positions given in this paper since these are the official coding positions defined by the standards. However, the presentation forms and the ligatures are not explicitly part of the standards so they have no fixed coding positions; they should instead be coded at some point within what is known as the "private use area". Interchange of documents which include characters outside the basic character set is then only guaranteed to respect the sense of the document if the various parties have all agreed on the coding positions of the presentation forms and the ligatures within the private use area.

The tables given in this paper make a specific choice for the coding positions within the private use area and in fact code the presentation forms at positions F300 to F395 and the ligatures at positions F400 to F4C1.

The mechanism of inputting characters is not specified by the standard, so any keyboard driver capable of generating the appropriate 16-bit character encodings can be used. However, the input mechanism should ideally generate the correct positional forms, variants and ligatures on input by analysis of the context of each letter, at least where possible.

The standard also does not specify how traditional Mongolian should be intermixed with other scripts. This is an important question because the traditional Mongolian script is correctly written vertically in columns progressing from left to right while most other scripts in the world are written in a different orientation: for example, the Cyrillic script, which frequently appears together with traditional Mongolian script on official documents in Mongolia, is properly written in horizontal lines which are read from left to right.

To be absolutely correct, when Mongolian script is intermixed with a script having horizontal, left-to-right orientation like the Cyrillic script each script should retain in its own individual orientation. However, in cases where this correct bidirectionality cannot be achieved, one of the scripts can lose its natural orientation and instead adopt the orientation of the other. In such cases, it is often written with its characters rotated through 90 degrees. Thus, for example, if the Mongolian script adopts the horizontal, left-to-right orientation of the Cyrillic script, its characters are rotated by 90 degrees anticlockwise, and the columns are transcribed to the equivalent lines (first column becomes first line, etc.), while if the Cyrillic script adopts the vertical, left-to-right orientation of the Mongolian script (though this is much less common) its characters are rotated by 90 degrees are rotated by 90 degrees and the lines are transcribed to columns in the opposite order (last line becomes first column, etc.). Examples of the rotation of traditional Mongolian script to bring it into alignment with English text can in fact be found throughout this paper.

Mixing traditional Mongolian with scripts which have other orientations is also possible in a similar way: if the two scripts cannot both retain their correct orientation one can adopt that of the other, usually rotating its characters when one script is horizontally oriented and the other vertical. The basic rule to follow is that the text of the modified script should be readable normally if the whole "page" is rotated in such a way as to return it to its original orientation.

Since the standardisation of traditional Mongolian is comparatively recent, most of the software supporting traditional Mongolian does not conform fully, if at all, to the standard. The prototype software system being designed and built under UNU/IIST's Multiscript project is one exception: it not only supports traditional Mongolian in its correct orientation, it also supports more general multi-directional multi-lingual documents. It is compatible with the ISO/IEC 10646 and Unicode standards, and it supports traditional Mongolian script basically as described here, including supporting all the presentation forms and ligatures: in fact the traditional Mongolian font which has been used in the preparation of this paper (and which is available from UNU/IIST) has been created as part of the implementation of the Multiscript prototype. More information about the Multiscript system can be found in the range of reports and papers [1,3,4,5,6,7,9] or can be obtained direct from the authors.

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