Universal Multiple-Octet Coded Character Set
International Organization for Standardization
Organisation internationale de normalisation
Международная организация по стандартизации

Doc Type: **Working Group Document**
Title: **Further discussion on ordering and the proposed Duployan script**
Source: **Irish National Body**
Status: **National Body Contribution**
Action: **For consideration by JTC1/SC2/WG2 and UTC**
Date: **2010-10-03**

1. Introduction. Document N3922 "Response to Irish NB comments N3908" discusses some of the concerns raised in N3908 "On ordering and the proposed Duployan script for shorthands and Chinook" about aspects of encoding Duployan. Essentially there are two issues N3908 raises, one of which has essentially been settled by N3922.

2. Sorting by shape and ordering within shape-classes. As in N3908, we note that Mr Anderson rightly constructs an ordering based on shape. Although what might be termed "Unified Duployan" may never have had a "native" ordering either as a whole or in any of the language variants, in the context of the UCS, an ordering which has an intrinsic logic to it will certainly be of benefit to end users, whether the operating system is ordering Duployan filenames or whether the users are using word-processing or database software to sort their data.

The issues which were raised in N3908 have been resolved thus:

2.1. Long arcs re-ordered. The long arcs have been moved to after the triple of half-circle, half-circle-with-stroke, and half-circle-with-dot:

A slight error in the collation specification in the revised N3895 (which ought to have been re-numbered N3895R) should be noted; it has been underscored here:

Primary collation: Initial vowel cluster < H < X < P < B < P N < T < TH < SLOAN DH < D < DH < D S < F < V < F N < K < KK < G < SLOAN J < K M < L < HL < LH < R < RH < R S < M < M N < M WITH DOT < M S < M N S < N < N M < N WITH DOT < N S < N M S < J < J M < J WITH DOT < J WITH DOTS INSIDE AND ABOVE < J N < J S < J M S < J S WITH DOT < J N S < S < S J < S WITH DOT < S WITH DOT BELOW < S S < S J S < S T < S T R < S P < S P R < T S < T R S < W < WH < W R < S N < S M < K R S < G R S < S K < S K R < medial/final vowel cluster.

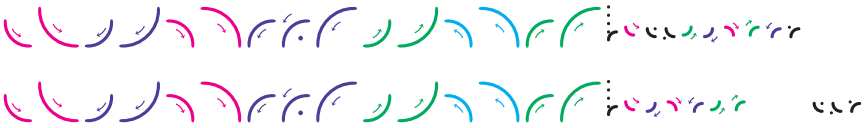
Another slight error in the collation specification should also be noted; it has been underscored here:

Vowel order: AOU < O < WO < WOW < WA < WI < WEI < OU < OW < Romanian U < OA < A < Sloan OW < I < E < Sloan EH < Romanian I < Sloan EE < IE < Short I < EE < UI < YE < Long I < U < EU < XW < U N < LONG U < UH < Sloan U < OOH < Vocalic M < Nasal U < Sloan EN < Sloan AN < Nasal O < Pernin AN < Nasal I < Nasal A < Pernin AM < Sloan ON;

2.2. Dotted half-circles re-ordered. The relative order of the SLOAN EH and ROMANIAN I has been reversed so that they follow the same pattern as S WITH DOT and S WITH DOT BELOW:

2.3. Invariant half-circle vowels re-ordered. The half-circle vowels I, EE, IE, and UI have been re-ordered so that they follow the same pattern as M, N, J and S:

2.4. Small quarter-circle vowels re-ordered. The small quarter circles have been re-ordered according to the relative order of the downward-sloping quarter-arc consonants, even where some of them are upward-sloping. This is slightly inconsistent, but since slope directionality has not been indicated for the dotted vowels it is not clear how this category should be further improved. Is directionality inherent in the dotted vowels? The top line below shows the current ordering; the second line implements the directionality but leaves the dotted vowels to the side as their directionality is uncertain. Clarification from Mr Anderson would be welcome, though we have no objection to the first line if no logical improvement can be made.



2.5. Circles re-ordered. The circle vowels have been re-ordered according to size with the internal components of the *w*- vowels ordered according to the value of the second component. Thus AOU, O, WO, WOW, WA, WI, WEI, OU, OW, U, ROMANIAN U, OA, A, SLOAN OW, with the *w*- vowels following the pattern ⍥ *wo* = ○+○ *o+o*, ⍥ *wow* = ○+⊙ *o+ow,* ⍥ *wa* = ○+◦ *o+a,* ⍥ *wi* = ○+◟ *o+i,* ⍥ *wei* = ○+◡+◟ *o+e+i*:

As stated, we believe that Mr Anderson's ordering based on shape will very likely prove to be useful to users of Duployan. It is our view that users will learn the sequence quickly and have no trouble finding things by shape. In unifying the Diployan characters used for different languages, it made good sense to devise a coherent and logical ordering for them.

The outstanding issue for the encoding of Duployan relates to the functionality of the organization of the code chart.

3. Organization of the code chart. Having determined that the collation proposed is useful, elegant, and sensible, we believe that the ordering of the characters as presented in the code chart will prove to work *against* the end user in environments where ISO/IEC 14651 and the UCA are not properly implemented. In effect, the end user *will not be able to rely on a consistent result* in instances where a binary sort is applied.

Document N3922 makes a number of claims, not all of which are supportable, in our view. In the first place, it argues that the issues raised in document N3908 had been raised previously, and had been discussed by the UTC. N3908 was published in September 2010, and so could not have been discussed in the spring of this year. If the UTC visited similar issues, they did so without our input, and in any case we do not believe that the matter has been closed. We are bringing forward our concerns for WG2 and the UTC to consider, and expect the technical issues we raise to be examined, not to be brushed aside as N3922 attempts to do.

3.1. The nature of the Duployan collation order. It is stipulated that Duployan has no "native collation". Nevertheless, a "Unified Duployan" encoding must have a collation, and Mr Anderson has devised an excellent one. It is no matter that the order was "invented" by Mr Anderson. Quite the opposite: his unique contribution in this matter is a valuable contribution to the history of the script itself. It doesn't matter that "to sort Duployan characters… could take many different forms and still be just as faithful to the source documents"—the "sorting by shape" collation proposed is excellent, and so there is no reason that it should not be present in the code table as well as in the UCA and ISO/IEC 14651. The implication in N3922 seems to be that "inventing" a collation is somehow illegitimate. The practice of the UCS has shown otherwise. The encodings for Myanmar, Vai, and Tai Tham, for instance are all "comprise" orderings involving a superset of characters that goes beyond attested orders; current work on other African scripts (Kpelle, Mende, Loma) involves devising sorting orders where none had previously existed. Current UCS practice *is* to arrange the code chart more or less according to those orderings. We do not believe that Duployan should deviate from this practice.

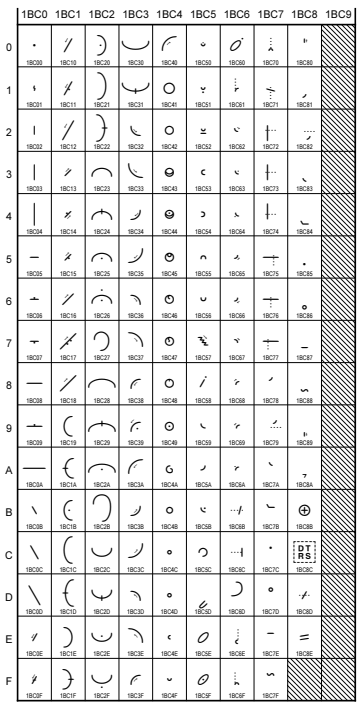
3.2 Duployan code chart organization. Mr Anderson cites Ken Whistler in defence of "the organizing principles of the current allocation":

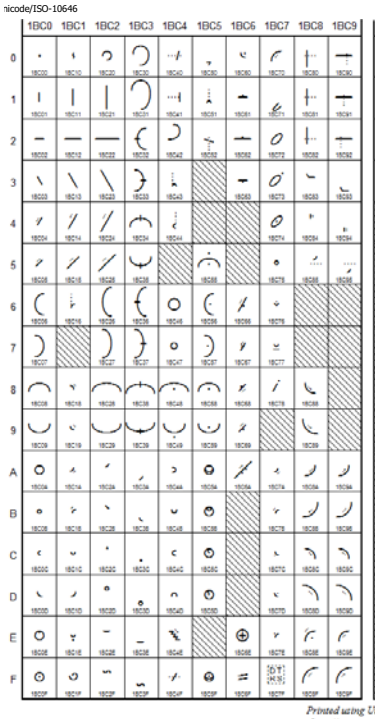
> "[the] current allocation groups letters by usage, and orders them to invite comparison and contrast, shedding light on the proper usage of the characters. A collation-based order hides the relationships between a basic letter and its variants." – UTC consensus as expressed by Ken Whistler.

The function of a code chart is not to "invite comparison and contrast". *That* functionality belongs in a *User's Guide* to the script. The function of a code chart is to provide a structure which is *technically useful*, not a structure which has educative value.

Further, it is hard to see how Ken Whistler's statement actually applies. A collation-based order which places all of the half-circle consonant next to one another

is hardly *hiding* the relationships between a basic letter and its variants. When one compares the two proposed code charts, it is clear that both of them attempt in some way to display a relationship between the shapes of characters (namely, of basic letters and their variants):

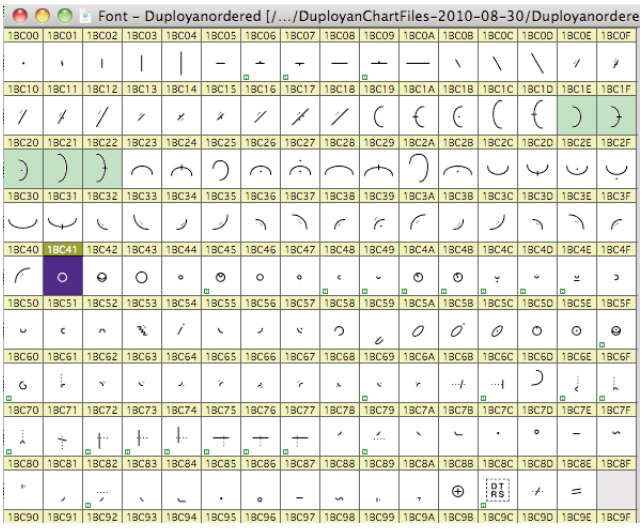


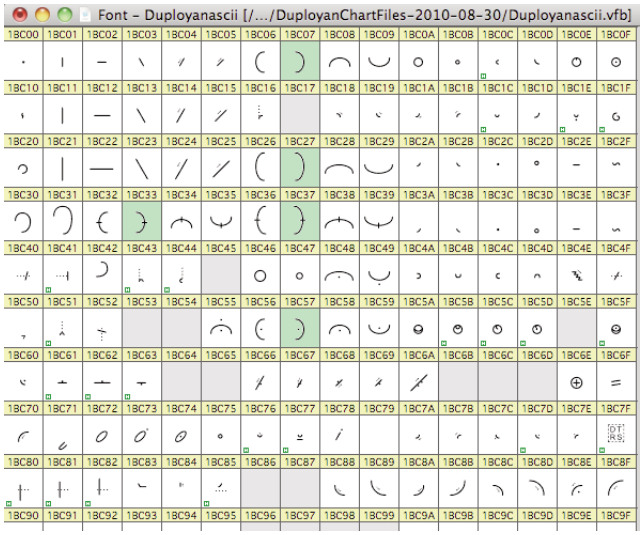


The problem is that a 16-row by 10-column display is not a constant, which renders the non-collation display unstable, since the horizontal relations are lost in other ratios.

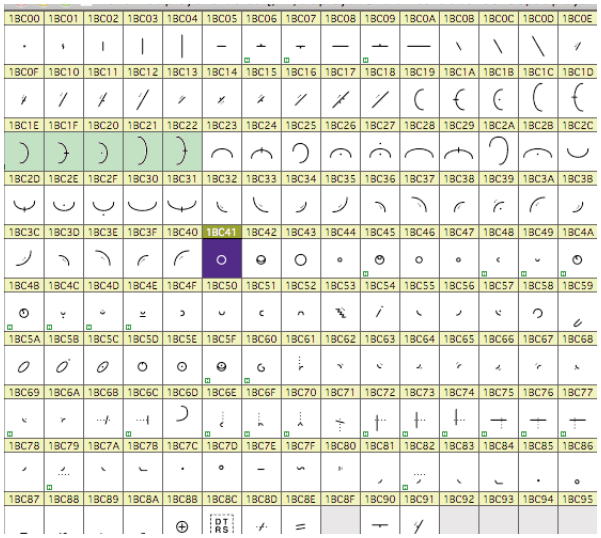
It may be true that Mr Anderson's proposed allocation divides up French Duployan, Romanian Stenographie, Chinook script, Pernin shorthand, Perrault shorthand, and Sloan-Duployan and that this in some way reflects historical developments. But again, that is a matter of paedagogy, which is a different thing from technical functionality.

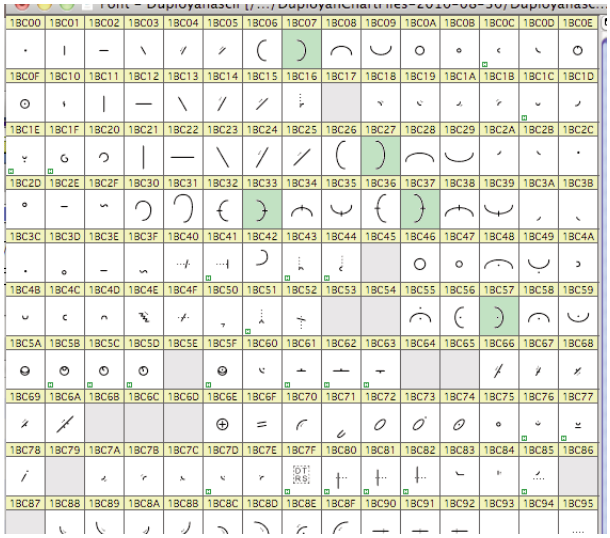
Where Mr Anderson's proposed allocation fails to provide technical functionality is in its *instability in dynamic envoronments*. In a real-world user environment, the contents of a font (which typically organizes characters in code-chart order) are displayed to the end user in a variety of ways. A font developer, for example, will use a font editor such as FontLab.



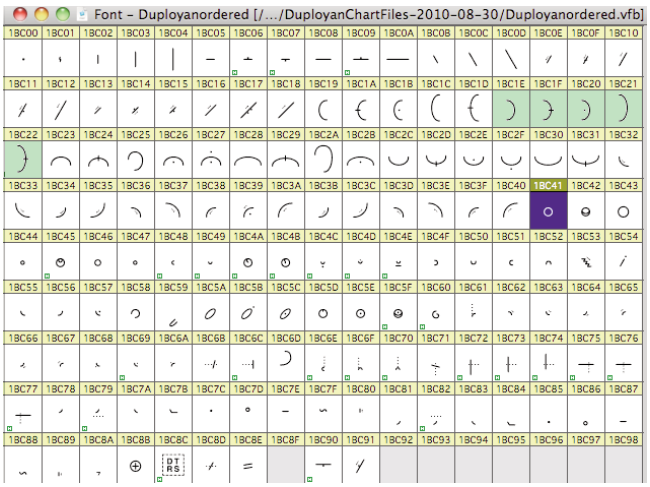


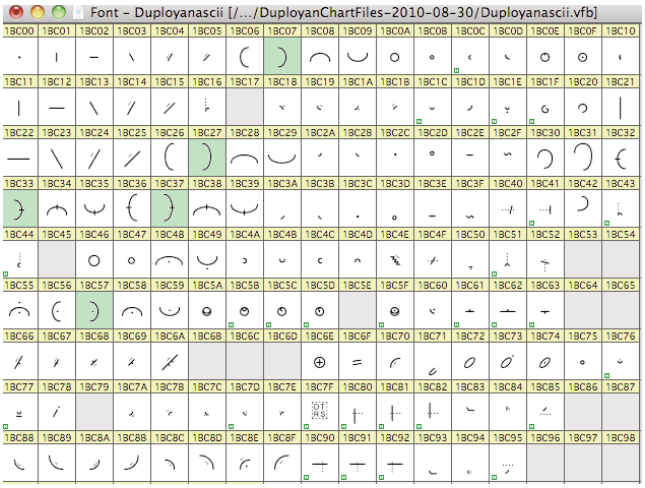
Here we see a FontLab window open to a width of sixteen characters, with five related characters highlighted in green. Unlike the UCS code charts, display is horizontal rather than vertical, but both show a similarity to the UCS code charts.



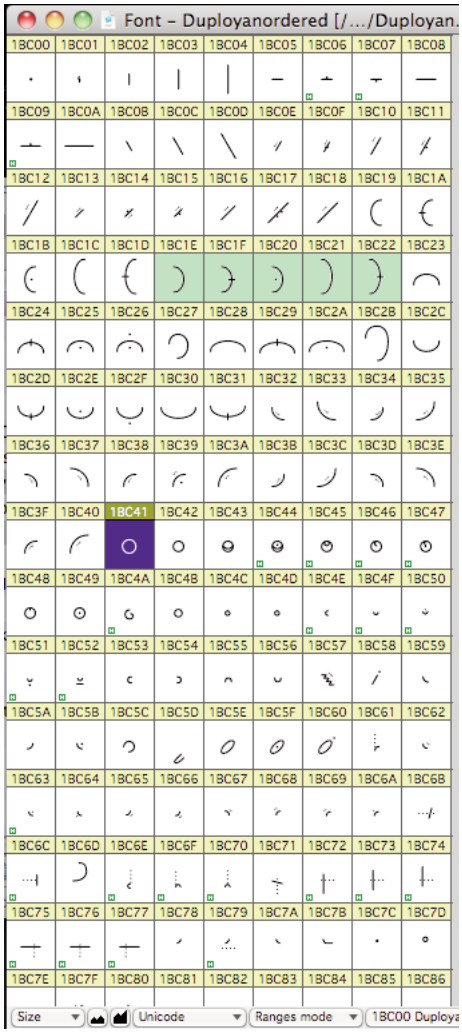


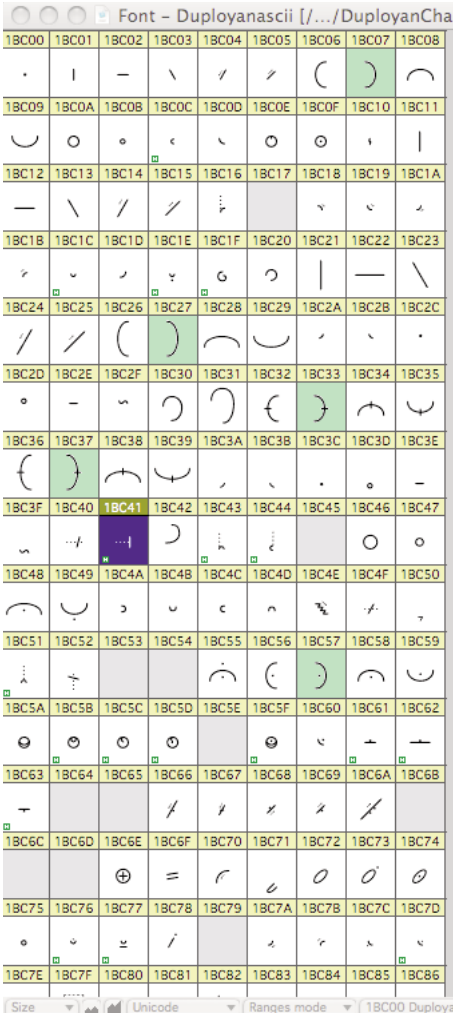
Here we see a FontLab window open to a width of fifteen characters, with the same five related characters highlighted in green. Here, the characters in the collation-based code chart are still right next to each other, but the linear relationship of the characters in the non-collation-based code chart are now scattered and more difficult to find at a glance.





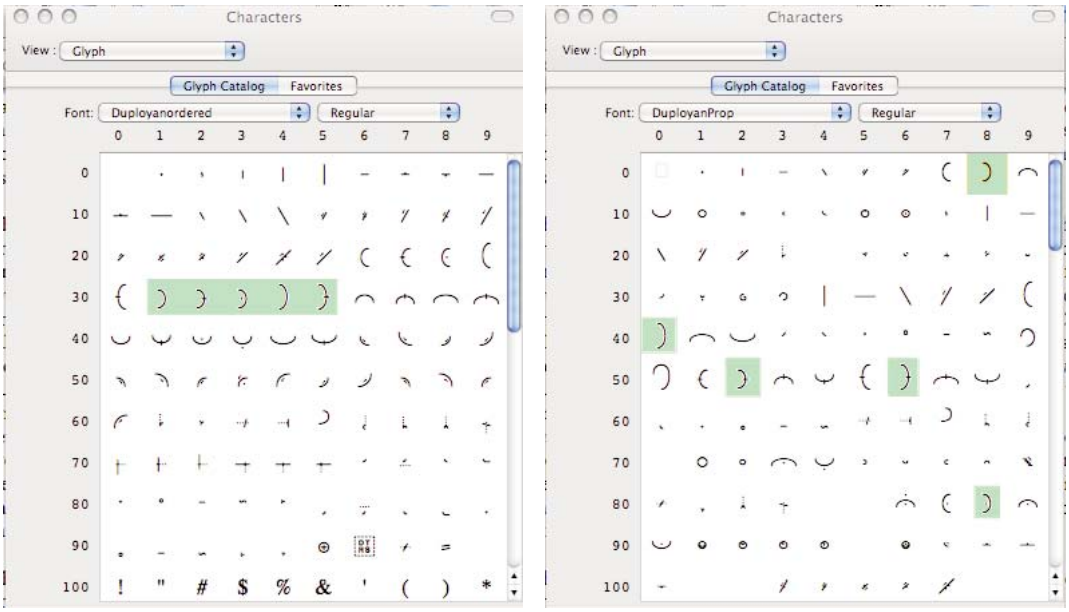
Here we see a FontLab window open to a width of seventeen characters, with the same five related characters highlighted in green. As above the linear relationship of the characters in the non-collation-based code chart are now scattered and more difficult to find at a glance.



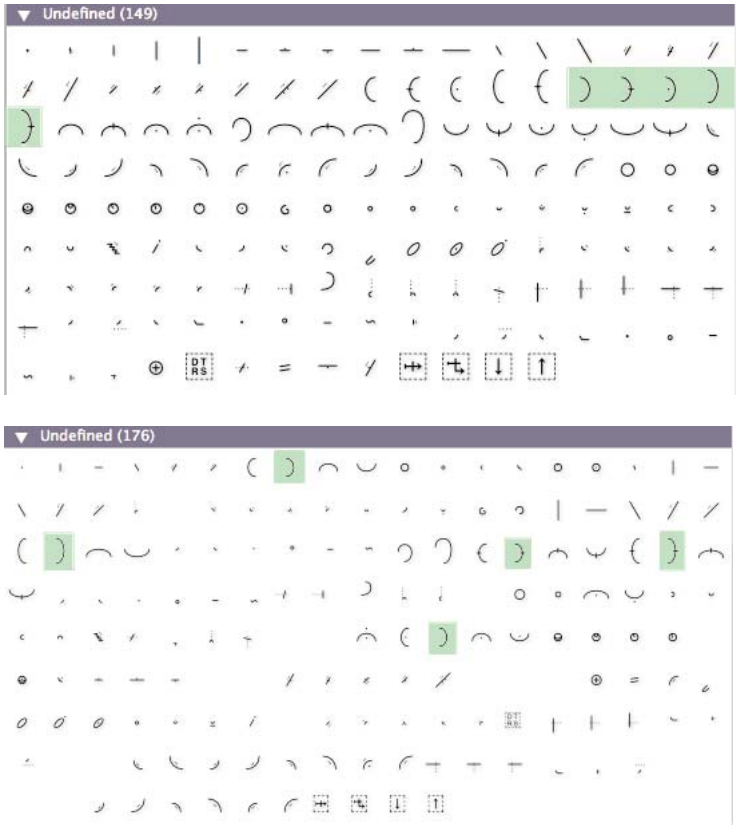


And here we see a FontLab window open to a width of only eight characters, with the same five related characters highlighted in green. Here, the scattering is even more pronounced. We do not believe that this arrangement can be considered “user-friendly”, particularly when the users will quickly become familiar with shape-based ordering in other contexts. What *advantage* is there for having two disparate orders—one which is stable in a dynamic environment and one which is not?

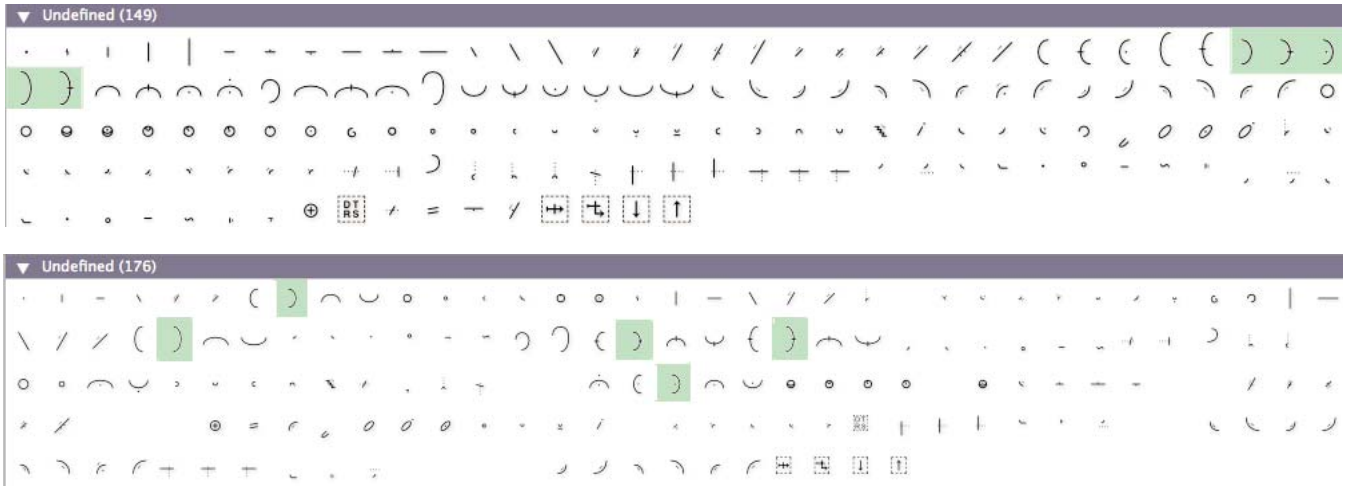
Another common usage environment is the “character picker”. A variety of these are available. One use would be the kind of use to which Mr Anderson refers in N3922, where an amateur developer of keyboards has to actually find the characters he or she wishes to insert. Any *User Guide to the Duployan Script* can list the characters needed for French Duployan or Chinook. They can be listed by name and code position, or by graphically highlighting them in a chart. But when actually finding them in a character picker, a collation-based code table has more stability and enables easier identification and selection of the desired characters.



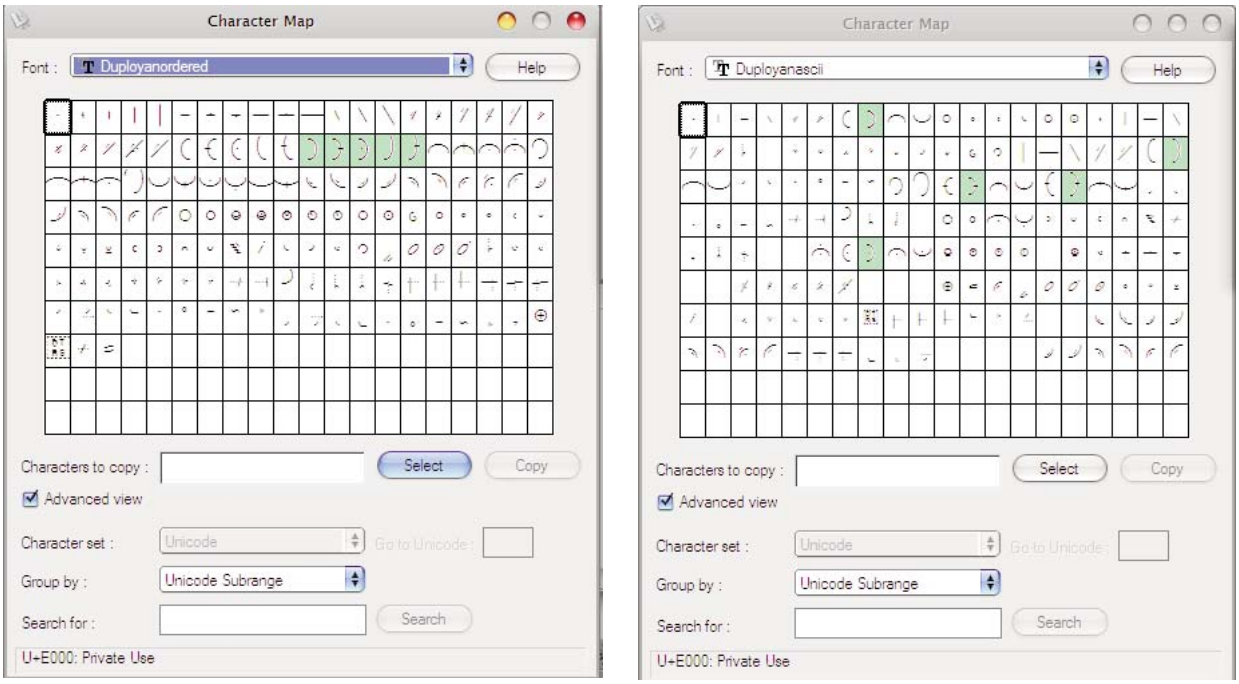
Here we see the glyph palette in Apple’s Character Viewer, which seems to be hard-coded to display in rows of ten glyphs.



Here we see the glyph palette in PopChar, which can be re-sized to various widths. The width here is 17 characters. On the top is the collation-based ordering; on the bottom the non-collation-based ordering.



Here we see the glyph palette in PopChar, re-sized to 35 characters. Again, a stable ordering above, a chaotic ordering below.



Here we see the Character Map in Windows XP, which is hard-coded to 20 characters. Glyphs are easy to find on the left, and not so easy to find on the right.

Now in order to actually make a keyboard layout, or to insert the occasional character into text when a Duployan keyboard is not being used, software applications such as Character Viewer or PopChar or Character Map are routinely used. *Finding* characters in such applications is a *key functionality* which benefits from a collation-based ordering in the code table.

4. "Advantages". Document N3922 suggests that there are three advantages to the non-collation-based allocation.

4.1. The 128-character block "rule". It is true that the Principles and Procedures mention that all things being equal it's reasonable to put higher-frequency characters toward the front of a block with more than 128 characters in it. A number of things should be noted, however. First, the Principles and Procedures are *guidelines*, not *laws*. They are there to help standardizers, not to tie their hands. Second, that rule was approved in 1997; computer processing power is much greater now than it was at that time. Third, it appears that Mr Anderson is citing only part of P&P D.2.1, which reads in full:

> When allocating code space to a block requiring fewer than 128 positions, these positions should not cross a 128-code position (half row) boundary. Wherever possible, if the number of positions is close to 128, it is preferable to start the collection at the half-row boundary. For blocks slightly larger than 128 positions the highest frequency characters should all be allocated within the first 128 positions. *This highest frequency allocation principle may be overridden when there is justification to do otherwise. The purpose of this guideline is to insure greater compression ratios for run-length compression techniques*. (See resolution M33.11). Further, for blocks requiring closer to 128 positions it is desirable to start at a half-row boundary.

Note the sentences which we have italicized. With regard to Duployan, the first of these sentences leaves us *free* to choose to prefer a collation-based ordering if there are good, functional, technical reasons to do so (which there are). D.2.1 does not prevent us from doing so. The second sentence gives the explanation for the recommendation, and here it seems that the recommendation is of little consequence given the very small user community and relatively small amount of data in Duployan.

Many script blocks are greater than 8 columns and have common letters after the block end. Myanmar, for instance. Cyrillic, Greek, Latin, Canadian Syllabics, and Coptic have characters all over the place in the UCS. It would be one thing if Duployan were a national script used in massive databases handling personal names and addresses for the purposes of taxation and social insurance. In such a scenario such compression might well be valuable. But Duployan is in a minority of minority scripts, and it is our view that the value such optimization might have does not outweigh the functional advantages of a collation based code-chart order.

Only eleven characters would be affected by this, all of them affixes or punctuation:

DUPLOYAN AFFIX LOW ACUTE
DUPLOYAN AFFIX LOW GRAVE
DUPLOYAN AFFIX LOW DOT
DUPLOYAN AFFIX LOW CIRCLE
DUPLOYAN AFFIX LOW LINE
DUPLOYAN AFFIX LOW WAVE
DUPLOYAN AFFIX LOW ARROW
DUPLOYAN SIGN O WITH CROSS
DUPLOYAN THICK LETTER SELECTOR
DUPLOYAN DOUBLE MARK
DUPLOYAN PUNCTUATION CHINOOK FULL STOP

4.2. Helping amateur developers to select language subsets. As we have indicated above, we do not believe that Mr Anderson's assertions about this advantage stand up to scrutiny. In the first place, how many keyboard layouts would one need? French Duployan, Romanian Stenographie, Chinook script, Pernin shorthand, Perrault shorthand, and Sloan-Duployan, that's 6, multiplied by three platforms (Keyman, MSKLC, Apple) is just 9. Double that, and it's still 18. It simply does not make sense to suggest that this rarified activity should be considered to be more technically functional than an ordering based on a new (and excellent) collation sequence which users of all varieties of Duployan will be encountering anyway.

We suggest that the environments of font design, or of using character pickers to find characters, are more likely to be seen by more users than the environment of amateur keyboard layout creation. Moreover, we do not believe that the annotated names list of Mr Anderson's proposal is in fact sufficient to help anybody to accurately create a language-specific subset. The only way of doing that is to give a

complete specification outside of the code chart, which would also include combining diacritics and any other characters that might be used in a particular Duployan orthography.

We do not believe that there are grounds for the allegation that a collation-based allocation "obfuscates the classes of character variants, and jumbles the characters necessary to each orthography, inviting mistaken identities, resulting in non-conformant documents". Once again, the code chart is not the place for the specification of which characters are to be used in which orthography. A proper *User's Guide to the Duployan Script*, whether a a Unicode Technical Note or as some other sort of monograph, is the proper place for such information; the names list simply could not give it comprehensively, and so this argument too does not convince us that there are any advantages to a non-collation-based allocation.

4.3. "Inherent properties of characters from the source document". Unfortunately there is little that can be said about this "advantage", as there is no description given about what "properties" are "inherent" in Duployan characters. Is a usage scenario intended? The Latin letter *eð* is used in Icelandic; does this mean that "Icelandicness" is an "inherent property" of this letter? If so, it is shared by the properties "Faroeseness" and "Old-Englishness" and "International-Phonetic-Alphabetness". It is true that the source materials do not, by and large, offer a rigorous shape-based ordering such as that which Mr Anderson has "invented and imposed" upon Duployan. But this is no fault. Unified Duployan as a member of the UCS *requires* such an ordering, for the benefit of the end users of the script. The fact that no such order is found in the sources means only that the sources were unconcerned about sorting Duployan, since in their glossaries words are normally sorted according to their Latin transcriptions, not their Duployan constituent parts.

4.4. "Imposing a collation-based allocation order". Neither the UTC nor WG2 makes any formal recommendation regarding the "imposition" of order in the code chart, but it is certainly the case that *in practice* a binary order which is isomorphic to the more formal collation order is usually the order which is adopted.

Getting back to functionality,

Here is the alphabetical order specified for collation (simple consonants only):

H X P B T D F V K G L R M N J S

That is what users of Duplyan will get in an application that implements the UCA/14651. Here is the alphabetical order of a binary sort of the non-collation-based order:

H P T F K L M N J S X B D V G R

This is a lot of change. It is like expecting an order like

A B C D E F G H I J K L O M N P

and getting a sort based on:

A C E G I K O M N P B D F H J L

We believe that this will lead to a confusing and undesirable ambiguity for the end user of Duployan, who will learn to expect one sort order but in many environments will get another. There is no advantage to the end user here. Nor, given the usage scenario we have shown above, would there be any advantage to abandoning the shape-based ordering (which is very good) in favour of the "paedagogical" ordering.

Mr Anderson concludes with the following statement:

> I reiterate that imposition of the complex collation specification onto the allocation order is inappropriate and cannot be justified by the source documents on which the Duployan proposal is based.

Why is it inappropriate, just because the source materials were not interested in collating Duployan charcters? That was not a technical requirement for those who devised the various Duployan orthographies. But those intrepid innovators are long dead, and could not anticipate modern usage environments. Duployan is to be used by people *today*, on computers which will sort their data. The only sort which makes sense for the modern user is the shape-based one which Mr Anderson has expertly devised. There is therefore no advantage to the end user for having the code chart be in any *other* order, as this will simply result in a binary order which conflicts with the superior order proposed for the UCA and ISO/IEC 14651.

5. Issue: Expansion. In Mr Anderson's proposal some blanks are left here and there within the code chart, evidently for potential additions. For instance, between U+1BC63 and U+1BC66 two spaces are left. One might surmise that the following two characters are envisaged:

1BC63

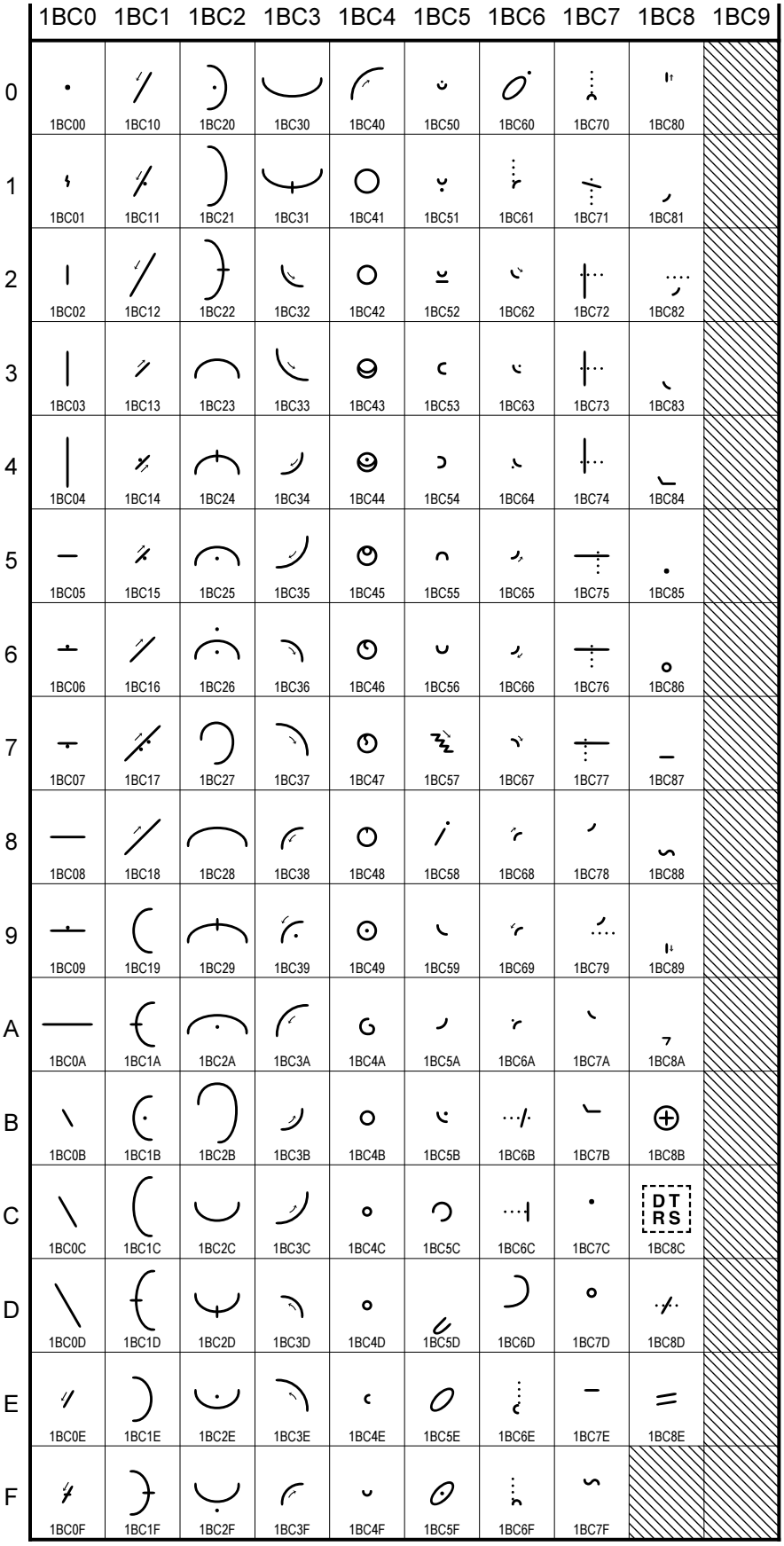
1BC64

1BC65 

1BC66 

We would have no issue with re-inserting such gaps in the re-ordered chart and would welcome Mr Anderson's advice on this point, should it be agreed that a collation-based code-chart order be adopted.

The Irish National Body favours the encoding of Mr Anderson's Duployan character set, but after considerable reflection, would prefer to see an agreed reorganization of the code chart to follow the collation order *before* and *as a precondition to* a new ballot being sent out after the Busan meeting of WG2. We have attached a draft to this document.


1BC0 1BC1 1BC2 1BC3 1BC4 1BC5 1BC6 1BC7 1BC8 1BC9
0 1BC00 1BC10 1BC20 1BC30 1BC40 1BC50 1BC60 1BC70 1BC80
1 1BC01 1BC11 1BC21 1BC31 1BC41 1BC51 1BC61 1BC71 1BC81
2 1BC02 1BC12 1BC22 1BC32 1BC42 1BC52 1BC62 1BC72 1BC82
3 1BC03 1BC13 1BC23 1BC33 1BC43 1BC53 1BC63 1BC73 1BC83
4 1BC04 1BC14 1BC24 1BC34 1BC44 1BC54 1BC64 1BC74 1BC84
5 1BC05 1BC15 1BC25 1BC35 1BC45 1BC55 1BC65 1BC75 1BC85
6 1BC06 1BC16 1BC26 1BC36 1BC46 1BC56 1BC66 1BC76 1BC86
7 1BC07 1BC17 1BC27 1BC37 1BC47 1BC57 1BC67 1BC77 1BC87
8 1BC08 1BC18 1BC28 1BC38 1BC48 1BC58 1BC68 1BC78 1BC88
9 1BC09 1BC19 1BC29 1BC39 1BC49 1BC59 1BC69 1BC79 1BC89
A 1BC0A 1BC1A 1BC2A 1BC3A 1BC4A 1BC5A 1BC6A 1BC7A 1BC8A
B 1BC0B 1BC1B 1BC2B 1BC3B 1BC4B 1BC5B 1BC6B 1BC7B 1BC8B
C 1BC0C 1BC1C 1BC2C 1BC3C 1BC4C 1BC5C 1BC6C 1BC7C 1BC8C
D 1BC0D 1BC1D 1BC2D 1BC3D 1BC4D 1BC5D 1BC6D 1BC7D 1BC8D
E 1BC0E 1BC1E 1BC2E 1BC3E 1BC4E 1BC5E 1BC6E 1BC7E 1BC8E
F 1BC0F 1BC1F 1BC2F 1BC3F 1BC4F 1BC5F 1BC6F 1BC7F
DT RS

Dot consonants

1BC00 · DUPLOYAN LETTER H
- Chinook, Pernin, Sloan, Perrault
- non-joining character

1BC01 ◦ DUPLOYAN LETTER X
- Salishan
- non-joining character

Vertical-line consonants

1BC02 ı DUPLOYAN LETTER P
- Chinook number 1

1BC03 | DUPLOYAN LETTER B
→ 1BC72 ◌𞽲 duployan affix low vertical secant
→ 1BC73 ◌𞽳 duployan affix mid vertical secant
→ 1BC74 ◌𞽴 duployan affix high vertical secant

1BC04 ‖ DUPLOYAN LETTER P N
= Sloan B B
→ 1BC1E) duployan letter n

Horizontal-line consonants

1BC05 – DUPLOYAN LETTER T
- Chinook number 2

1BC06 ‑ DUPLOYAN LETTER TH
- Chinook, Sloan, Pernin, Perrault

1BC07 ‒ DUPLOYAN LETTER SLOAN DH

1BC08 — DUPLOYAN LETTER D
→ 1BC75 ◌𞽵 duployan affix left horizontal secant
→ 1BC76 ◌𞽶 duployan affix mid horizontal secant
→ 1BC77 ◌𞽷 duployan affix right horizontal secant

1BC09 ⸺ DUPLOYAN LETTER DH
- Chinook

→ 1BC08 — duployan letter d

1BC0A ⸻ DUPLOYAN LETTER D S
= Sloan D D
→ 1BC2C ◡ duployan letter s

Northwest-to-southeast diagonal-line consonants

1BC0B \ DUPLOYAN LETTER F
- Chinook number 3

1BC0C \ DUPLOYAN LETTER V

1BC0D \ DUPLOYAN LETTER F N
= Sloan V V
→ 1BC1E) duployan letter n

Northeast-to-southwest diagonal-line consonants

1BC0E / DUPLOYAN LETTER K
- Chinook number 4
- written down and to the left

1BC0F / DUPLOYAN LETTER KK
- Chinook
- written down and to the left

1BC10 / DUPLOYAN LETTER G
- written down and to the left

1BC11 / DUPLOYAN LETTER SLOAN J
- written down and to the left

1BC12 / DUPLOYAN LETTER K M
- written down and to the left

= Sloan G G
→ 1BC19 (duployan letter m

Southwest-to-northeast diagonal-line consonants

1BC13 / DUPLOYAN LETTER L
- written up and to the right

= Pernin letter R

1BC14 / DUPLOYAN LETTER HL
- Chinook
- written up and to the right

1BC15 / DUPLOYAN LETTER LH
- Chinook
- written up and to the right

1BC16 / DUPLOYAN LETTER R
- Chinook number 5
- French number milliards
- written up and to the right

= Pernin letter L
= Pernin Reporters word repeat sign

1BC17 / DUPLOYAN LETTER RH
- Chinook
- written up and to the right

1BC18 / DUPLOYAN LETTER R S
- written up and to the right

= Sloan R R
→ 1BC2C ◡ duployan letter s

Left half-circle consonants

1BC19 (DUPLOYAN LETTER M
- Chinook Number 6

1BC1A (DUPLOYAN LETTER M N
- Romanian Mai mult, not Romanian Mult mai shorthand sign

→ 1BC1E) duployan letter n

1BC1B (DUPLOYAN SIGN M WITH DOT
= Romanian sign Mijloc)

1BC1C (DUPLOYAN LETTER M S
= Sloan shorthand letter M M
→ 1BC2C ◡ duployan letter s

1BC1D (DUPLOYAN LETTER M N S
→ 1BC1E) duployan letter n
→ 1BC2C ◡ duployan letter s

Right half-circle consonants

1BC1E) DUPLOYAN LETTER N
- Chinook number 7

1BC1F) DUPLOYAN LETTER N M
- not Romanian nu nu shorthand sign

→ 1BC19 (duployan letter m

1BC20) DUPLOYAN LETTER N WITH DOT
= Chinook NG
= Romanian sign Nici

1BC21) DUPLOYAN LETTER N S
= Pernin, Sloan, Perrault letter NG
→ 1BC2C ◡ duployan letter s

1BC22) DUPLOYAN LETTER N M S
→ 1BC19 (duployan letter m
→ 1BC2C ◡ duployan letter s

Top half-circle consonants

1BC23 ◠ DUPLOYAN LETTER J
• Chinook number 8
= Chinook letter SH
= Pernin letter SH

1BC24 ◠ DUPLOYAN LETTER J M
• not Romanian ceea ce shorthand sign
→ 1BC19 (duployan letter m

1BC25 ◠ DUPLOYAN LETTER J WITH DOT
= Chinook, Romanian CH
= Sloan ZH
= Chinook, Perrault J

1BC26 ◠ DUPLOYAN SIGN J WITH DOTS INSIDE AND ABOVE
= Romanian sign Ici

1BC27 ◠ DUPLOYAN LETTER J N
→ 1BC1E) duployan letter n

1BC28 ◠ DUPLOYAN LETTER J S
= Romanian stenographic letter Ge
= Pernin, Perrault letter ZH
= Sloan letter CH
→ 1BC2C ◡ duployan letter s

1BC29 ◠ DUPLOYAN LETTER J M S
→ 1BC19 (duployan letter m
→ 1BC2C ◡ duployan letter s

1BC2A ◠ DUPLOYAN LETTER J S WITH DOT
= Sloan letter hard CH
= Pernin, Perrault letter Ch

1BC2B ◠ DUPLOYAN LETTER J N S
→ 1BC1E) duployan letter n
→ 1BC2C ◡ duployan letter s

Bottom half-circle consonants

1BC2C ◡ DUPLOYAN LETTER S
• Chinook number 9
• French Hundreds

1BC2D ◡ DUPLOYAN LETTER S J
• not Romanian sa se shorthand sign
→ 1BC23 ◠ duployan letter j

1BC2E ◡ DUPLOYAN LETTER S WITH DOT
= Chinook TS
= Chinook, Romanian, Sloan Z

1BC2F ◡ DUPLOYAN LETTER S WITH DOT BELOW
= Romanian Sh

1BC30 ◡ DUPLOYAN LETTER S S
• French, Sloan
= Romanian stenographic letter Ts
= Pernin, Perrault letter Z
→ 1BC2C ◡ duployan letter s

1BC31 ◡ DUPLOYAN LETTER S J S
→ 1BC23 ◠ duployan letter j

Downward-sloping quarter-arc consonants

1BC32 ◟ DUPLOYAN LETTER S T
• Pernin, Perrault
• written down
= Sloan SM

1BC33 ◟ DUPLOYAN LETTER S T R
• Pernin, Perrault
• written down
= Sloan SN

1BC34 ◞ DUPLOYAN LETTER S P
• Pernin, Perrault
• written down
= Sloan KW

1BC35 ◞ DUPLOYAN LETTER S P R
• Pernin, Perrault
• written down
= Sloan SKW

1BC36 ◝ DUPLOYAN LETTER T S
• written down
• Perrault
= Sloan STD

1BC37 ◝ DUPLOYAN LETTER T R S
• written down
• Perrault
= Sloan SST

1BC38 ◜ DUPLOYAN LETTER W
• Sloan, Perrault, Pernin
• written down
• takes form of a hook or wave after K and G

1BC39 ◜ DUPLOYAN LETTER WH
• written down

1BC3A ◜ DUPLOYAN LETTER W R
• written down
• Perrault
= Sloan SW

Upward-sloping quarter-arc consonants

1BC3B ◞ DUPLOYAN LETTER S N
• written up
• Perrault
= Pernin KRS
= Sloan SP

1BC3C ◞ DUPLOYAN LETTER S M
• written up
• Perrault
= Pernin GRS
= Sloan SL

1BC3D ◝ DUPLOYAN LETTER K R S
• written up
• Perrault

1BC3E ◝ DUPLOYAN LETTER G R S
• written up
• Perrault

1BC3F ◜ DUPLOYAN LETTER S K
• written up
• Perrault, Pernin
= Sloan TS

1BC40 ◜ DUPLOYAN LETTER S K R
• written up
• Perrault, Pernin
= Sloan DS

Circle vowels

1BC41 ○ DUPLOYAN LETTER AOU

1BC42 ○ DUPLOYAN LETTER O
• Chinook number 0

1BC43 ⊖ DUPLOYAN LETTER WO
• Chinook

1BC44 ⊖ DUPLOYAN LETTER WOW
• Salishan

1BC45 DUPLOYAN LETTER WA
• Chinook
• Not Romanian O+A
= Perrault letter OY
• Chinook number 100s

1BC46 DUPLOYAN LETTER WI
• Chinook

1BC47 DUPLOYAN LETTER WEI
• Salishan

1BC48 DUPLOYAN LETTER OU
• should not be used for Perrault Ow
≈ <initial, final> 1BC49
= Chinook letter oo
→ 1BC5E duployan letter uh
→ 1BC5F duployan letter sloan u
→ 1BC60 duployan letter ooh

1BC49 DUPLOYAN LETTER OW
• should not be used for Romanian U
≈ <medial> 1BC4A

1BC4A DUPLOYAN LETTER ROMANIAN U

1BC4B DUPLOYAN LETTER OA
= Pernin letter AW
= Perrault letter AW

1BC4C DUPLOYAN LETTER A
• Chinook number 10s

1BC4D DUPLOYAN LETTER SLOAN OW
• reverse circle vowel

Orienting half-circle vowels

1BC4E DUPLOYAN LETTER I
• character rotates to match entry angle of preceding consonant
• character has primary orientation (right and up)
= Perrault letter long A, short E (with accents)
→ 1BC53 duployan letter ie
→ 1BC54 duployan letter short i
→ 1BC55 duployan letter ee
→ 1BC56 duployan letter ui
→ 1BC6E duployan affix attached i hook
→ 1BC6F duployan affix attached e hook

1BC4F DUPLOYAN LETTER E
• character rotates to match entry angle of preceding consonant
• character has secondary orientation (left and down)
= Sloan letter long A
= Perrault letter short I, long E (with dot accent)
→ 1BC6F duployan affix attached e hook

1BC50 DUPLOYAN LETTER SLOAN EH

1BC51 DUPLOYAN LETTER ROMANIAN I
• character rotates to match entry angle of preceding consonant, with dot maintaining relative position
• secondary orienting (left and down)

1BC52 DUPLOYAN LETTER SLOAN EE

Invariant half-circle vowels

1BC53 DUPLOYAN LETTER IE
• Duployan shorthand
• used as an invariant vowel and for orienting word abbreviations consisting of only vowels
→ 1BC4E duployan letter i
= Pernin letter A

1BC54 DUPLOYAN LETTER SHORT I
• Pernin, Duployan shorthand
• used as an invariant vowel and for orienting word abbreviations consisting of only vowels
→ 1BC4E duployan letter i
= Consolidated Duployan letter R T R

1BC55 DUPLOYAN LETTER EE
• Pernin, Duployan shorthand
• used as an invariant vowel and for orienting word abbreviations consisting of only vowels
→ 1BC4E duployan letter i

1BC56 DUPLOYAN LETTER UI
• Duployan shorthand
• used as an invariant vowel and for orienting word abbreviations consisting of only vowels
→ 1BC4E duployan letter i
= Pernin letter E

Diagonal-line vowels

1BC57 DUPLOYAN LETTER YE

1BC58 DUPLOYAN LETTER LONG I
• Pernin
• angles like an “F” when adjacent a K-type consonant

Quarter-circle vowels

1BC59 DUPLOYAN LETTER U
• character rotates to match entry angle of preceding consonant
• character has primary orientation (right and up)
= Romanian stenographic letter EN
→ 1BC38 duployan letter w
→ 1BC4A duployan letter romanian u
→ 1BC5D duployan letter long u

1BC5A DUPLOYAN LETTER EU
• character rotates to match entry angle of preceding consonant
• character has secondary orientation (left and down)
• in French usage, may be rendered with a dot contextually
= Romanian stenographic letter AN

1BC5B DUPLOYAN LETTER XW
= Perrault Uh
• not French Eu

1BC5C DUPLOYAN LETTER U N
→ 1BC1E duployan letter n

Oblong circle vowels

1BC5D DUPLOYAN LETTER LONG U
• Pernin, Perrault
• this vowel does not rotate to match entry angle of preceding consonant
→ 1BC48 duployan letter ou

1BC5E DUPLOYAN LETTER UH
• Sloan
→ 1BC48 ○ duployan letter ou

1BC5F DUPLOYAN LETTER SLOAN U
→ 1BC48 ○ duployan letter ou

1BC60 DUPLOYAN LETTER OOH
• Sloan
→ 1BC48 ○ duployan letter ou

Small quarter-circle vowels

1BC61 DUPLOYAN LETTER VOCALIC M
• primary orienting vowel
= Perrault letters Am, Em, Im, Um (with accents)

1BC62 DUPLOYAN LETTER NASAL U
• character positions diacritically, as an orienting vowel, or as an invariant vowel
• secondary orientation
• invariant direction down
• French number 1
= Pernin letter IN
= Consolidated Duployan affix INT-R-

1BC63 DUPLOYAN LETTER SLOAN EN

1BC64 DUPLOYAN LETTER SLOAN AN

1BC65 DUPLOYAN LETTER NASAL O
• character positions diacritically, as an orienting vowel, or as an invariant vowel
• neutral nasal vowel for transcription of an ambiguous secondary orienting nasal vowel
• secondary orientation
• invariant direction up
= Pernin letter OM
= Perrault letters An, En, In, Un (with accents)
= Pernin letter IM
= Consolidated Duployan affix INT-R-

1BC66 DUPLOYAN LETTER PERNIN AN
• written down

1BC67 DUPLOYAN LETTER NASAL I
• character positions diacritically, as an orienting vowel, or as an invariant vowel
• primary orientation
• invariant direction down
• Romanian multiplicative number prefix
= Pernin letter IM
= Consolidated Duployan affix INT-R-

1BC68 DUPLOYAN LETTER NASAL A
• Perrault vocalic N - An, En, In, Un (with accents)
• character positions diacritically, as an orienting vowel, or as an invariant vowel
• neutral nasal vowel for transcription of an ambiguous primary orienting nasal vowel
• primary orientation
• invariant direction up
= Pernin letter ON
= Romanian stenographic letter YN

1BC69 DUPLOYAN LETTER PERNIN AM
• written down

1BC6A DUPLOYAN LETTER SLOAN ON

Attached affixes

1BC6B DUPLOYAN AFFIX ATTACHED SECANT
• dots show position on and relative orientation to base glyph and are not rendered
• as a prefix, takes opposite relative position to following glyph
• generally crosses adjacent character at perpendicular, but has a bias towards SW/NE angle to contrast 1BC71
• default neutral secant affix
= French suffix -anse
= Pernin prefix Pre-
= Sloan affix Ax-/-ext

1BC6C DUPLOYAN AFFIX ATTACHED TANGENT
• dots show position on and relative orientation to base glyph and are not rendered
• as a prefix, takes opposite relative position to following glyph
= French suffix -tan
= Romanian shorthand letter Str-/-str

1BC6D DUPLOYAN AFFIX ATTACHED TAIL
• orienting character
= French suffix -sionaire

1BC6E DUPLOYAN AFFIX ATTACHED I HOOK
• glyph is retrograde and opens left or right, dependent on preceding letter
• dots show position of preceding glyph and are not rendered
→ 1BC4E duployan letter i
= French suffix -tou
= Sloan affix Irre-/-ary

1BC6F DUPLOYAN AFFIX ATTACHED E HOOK
• glyph is retrograde and opens up or down, dependent on preceding letter
• dots show position of preceding glyph and are not rendered
→ 1BC4F duployan letter e
= French suffix -te

1BC70 DUPLOYAN AFFIX ATTACHED TANGENT HOOK
• attached affix
• dots show position on and relative orientation to base glyph and are not rendered
= Romanian affix Ist-/-ism
= Consolidated Duployan prefix T-R-

1BC71 DUPLOYAN AFFIX ATTACHED LEFT-TO-RIGHT SECANT
• dots show position on and relative orientation to base glyph and are not rendered
• generally crosses adjacent character at perpendicular, but has a bias towards NW/SE angle to contrast 1BC6B
• as a suffix, takes opposite relative position to following glyph
= Pernin prefix Per-

Vertical affixes

1BC72 DUPLOYAN AFFIX LOW VERTICAL SECANT
= Pernin Reporters Sub-
• dots show position on base glyph and are not rendered
→ 1BC03 | duployan letter b

1BC73 𛰳 DUPLOYAN AFFIX MID VERTICAL SECANT
= Pernin Reporters Trans-
• dots show position on base glyph and are not rendered
→ 1BC03 𛰃 duployan letter b

1BC74 𛰴 DUPLOYAN AFFIX HIGH VERTICAL SECANT
= Pernin Reporters Super-
• dots show position on base glyph and are not rendered
→ 1BC03 𛰃 duployan letter b

Horizontal affixes

1BC75 𛰵 DUPLOYAN AFFIX LEFT HORIZONTAL SECANT
= Pernin Reporters Extra-
• dots show position on base glyph and are not rendered
→ 1BC08 𛰈 duployan letter d

1BC76 𛰶 DUPLOYAN AFFIX MID HORIZONTAL SECANT
= Pernin Reporters Inter-
• dots show position on base glyph and are not rendered
→ 1BC08 𛰈 duployan letter d

1BC77 𛰷 DUPLOYAN AFFIX RIGHT HORIZONTAL SECANT
= Pernin Reporters Contra-
• dots show position on base glyph and are not rendered
→ 1BC08 𛰈 duployan letter d

High affixes

1BC78 𛰸 DUPLOYAN AFFIX HIGH ACUTE
= French suffix -ment
= Romanian suffix -mant
= Pernin Sub-
= Pernin Reporters' suffix Pro-
→ 02CA ˊ modifier letter acute accent

1BC79 𛰹 DUPLOYAN AFFIX HIGH TIGHT ACUTE
= Pernin Pro-
• as a suffix, placed above and to the right of the following letter

1BC7A 𛰺 DUPLOYAN AFFIX HIGH GRAVE
= French suffix -ien
= Pernin suffix Con-
→ 02CB ˋ modifier letter grave accent

1BC7B 𛰻 DUPLOYAN AFFIX HIGH LONG GRAVE
= Pernin Contra-

1BC7C 𛰼 DUPLOYAN AFFIX HIGH DOT
• not Romanian hundreds - use U+0307 ◌̇ combining dot above and U+0308 ◌̈ combining diaeresis
• French number thousands
= French suffix -eur
= Romanian shorthand affix trans-/-lui
→ 02D9 ˙ dot above

1BC7D 𛰽 DUPLOYAN AFFIX HIGH CIRCLE
• Not Romanian number grade or percent suffix
• French ordinal number
= French suffix -euse
→ 00B0 ° degree sign
→ 02DA ˚ ring above

1BC7E 𛰾 DUPLOYAN AFFIX HIGH LINE
= French suffix -iste
= Romanian shorthand affix -tor
= Pernin affix Dis-
→ 02C9 ˉ modifier letter macron

1BC7F 𛰿 DUPLOYAN AFFIX HIGH WAVE
= French suffix -ificatif
→ 02DC ˜ small tilde

1BC80 𛱀 DUPLOYAN AFFIX HIGH VERTICAL
• also functions as attached affix vertical up with ZWJ
• this affix is about half as long as Duployan Letter P
• as a prefix, has falling stroke direction
= Pernin ZWJ + -ime
= Sloan Tele-
→ 1BC02 𛰂 duployan letter p

Low affixes

1BC81 𛱁 DUPLOYAN AFFIX LOW ACUTE
= French suffix -cion
= Pernin prefix ex-
→ 02CF ˏ modifier letter low acute accent

1BC82 𛱂 DUPLOYAN AFFIX LOW TIGHT ACUTE
= Pernin Suf-, Sug-
• as a suffix, placed under and to the right of the following letter

1BC83 𛱃 DUPLOYAN AFFIX LOW GRAVE
= French suffix -ion
• French number millions
→ 02CE ˎ modifier letter low grave accent

1BC84 𛱄 DUPLOYAN AFFIX LOW LONG GRAVE
= Pernin Extra-

1BC85 𛱅 DUPLOYAN AFFIX LOW DOT
= French suffix -ie
• French iterative number
= Romanian shorthand affix Inter-
• not Romanian millions - see U+0323 ◌̣ combining dot below and U+0324 ◌̤ combining diaeresis below

1BC86 𛱆 DUPLOYAN AFFIX LOW CIRCLE
= French suffix -iere
• French percent
→ 02F3 ˳ modifier letter low ring

1BC87 𛱇 DUPLOYAN AFFIX LOW LINE
= French suffix -isme
= Pernin affix Mis-
→ 02D7 ˗ modifier letter minus sign

1BC88 𛱈 DUPLOYAN AFFIX LOW WAVE
= French suffix -ification
→ 02F7 ˷ modifier letter low tilde

1BC89 𛱉 DUPLOYAN AFFIX LOW VERTICAL
• functions as attached affix vertical down with ZWJ
• this affix is about half as long as Duployan the letter P
• as a prefix, has rising stroke direction
= Pernin ZWJ + -ine
→ 1BC02 𛰂 duployan letter p

1BC8A 𛱊 DUPLOYAN AFFIX LOW ARROW
= Romanian prefix Sub-
• low affix

Chinook sign

1BC8B ⊕ DUPLOYAN SIGN O WITH CROSS
- Chinook Likalisti

Sloan R-form selector

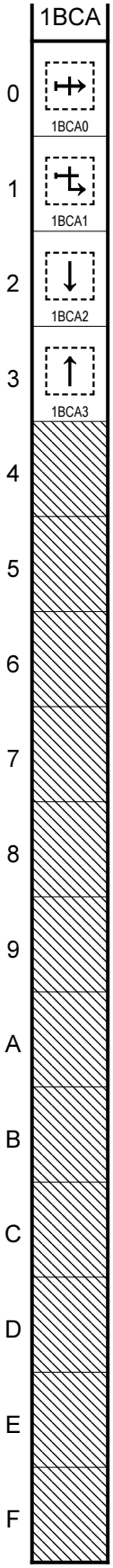
1BC8C DTRS DUPLOYAN THICK LETTER SELECTOR
- commonly abbreviated DTLS
- Sloan R-flavored letters
- Shape shown is arbitrary and is not visibly rendered
- Causes previous Duployan character to be rendered bold

Shorthand double mark

1BC8D ◌ DUPLOYAN DOUBLE MARK
- Dots show position on and relative orientation to base glyph and are not rendered
- Romanian, Sloan shorthands
- Should be used with M, N, J, and S for the Romanian word signs Mai mult, Nu nu, Ceea ce, and Sa se
- Can be doubled and tripled

Chinook punctuation

1BC8E = DUPLOYAN PUNCTUATION CHINOOK FULL STOP



Shorthand Format Controls

1BCA0 SHORTHAND FORMAT LETTER OVERLAP
- shape shown is arbitrary and is not visibly rendered

1BCA1 SHORTHAND FORMAT CONTINUING OVERLAP
- shape shown is arbitrary and is not visibly rendered

1BCA2 SHORTHAND FORMAT DOWN STEP
= Romanian shorthand affix -tsion-
= Sloan contracted ending oo/o + ZWSP
- shape shown is arbitrary and is not visibly rendered

1BCA3 SHORTHAND FORMAT UP STEP
= Sloan contracted ending uh/au/aui + ZWSP
- shape shown is arbitrary and is not visibly rendered