L2/21-190

Title: Thoughts on the Unicode sign list of Ancient Egyptian hieroglyphs
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Abstract

We argue that the identity of a code point of an Ancient Egyptian hieroglyph should be defined in terms of its functional and iconic features. Such information is gathered in the Thot Sign List. Awareness of the features of signs is also essential to guide future extensions of the repertoire of hieroglyphs in Unicode. We further articulate the open question of the desired granularity of this repertoire.

1 Introduction

The existing 1071 Ancient Egyptian hieroglyphic signs in Unicode cover most of the sign occurrences in typical hieroglyphic texts from the classical period, and a majority of sign occurrences in texts from other periods.[1] Moreover, most hieratic sign occurrences can be encoded with standardized hieroglyphic signs from this set. However, if even a single sign in a text is not covered, then this means the text as a whole cannot be properly encoded. It is therefore tempting to want to add as many hieroglyphs to Unicode as possible, to meet the practical needs of Egyptologists who are encoding texts.

However, there are a number of subtle issues that have been either misunderstood or ignored in various attempts over the years to add more hieroglyphs to Unicode, such as L2/20-068R by Michel Suignard. Various objections against such attempts were raised by Egyptologists, in spoken communication in Unicode meetings such as those in Cambridge (11-12 July 2016) and London (14-15 June 2018), and in informal email exchanges.[2] Even though the latest developments are moving away from aforementioned proposal, as discussed in L2/21-108, it is worth documenting these objections, to avoid a repeat in the future. The criticism carries over to the existing set of 1071 hieroglyphs in Unicode, which is in need of reliable documentation, and advice needs to go out against the use of some of the signs. Our arguments are grounded in two decades of experience with large corpora of encodings of hieroglyphic and hieratic texts, such as the Ramses corpus[3], and in research of the repertoire of Ancient Egyptian hieroglyphs, culminating in the creation of the Thot Sign List (TSL)[4].

The central question is: **How does one characterize a collection of occurrences of hieroglyphs as an abstract entity that deserves its own code point?** The difficulty lies in the nature of Ancient Egyptian hieroglyphic writing, in which signs never lost their original figurative dimension, no matter whether they were used as meaning signs or sound signs. Moreover, inscriptions often had secondary decorative and extralinguistic functions, and motivated by this, any number of details in the shapes of signs could be varied and are potentially significant.

The root cause of some of the problems is that proposals to add hieroglyphs to Unicode have mostly been based on lists of normalized glyphs in printed publications that have not at all been concerned with the question of what a sign really is or how to characterize it as deserving its own code point. Some such publications include glyphs that represent particular occurrences of signs in specific texts, which in reality may be superficial graphical variants of signs, or conversely the glyphs in other publications may represent abstract shapes that do not correspond to any particular occurrences of hieroglyphs. By gathering shapes from various existing lists and publications, each with different underlying objectives and methodologies, and

[1] Statistical analysis has revealed that 86% of the sign occurrences in the *Thesaurus Linguae Aegyptiae* are covered (data collected by Daniel A. Werning).

[2] Many of the problems were already pointed out more than 20 years ago by Wolfgang Schenkel in L2/99-223, as a response to L2/99-008. See also `www.unicode.org/notes/tn3/tn3-1.html`. The considerations have not changed since.

[3] `http://ramses.ulg.ac.be/`

[4] `http://thotsignlist.org/` [16]

making distinctions between shapes based purely on their visual appearance as taken from these publications, one does *not* obtain a sign list. The best one can hope for is an unassorted and unprincipled **collection of shapes**.

This criticism is of course not restricted to L2/20-068R; it can be applied to the 1071 signs already in Unicode as well. This list was mainly based on the list in Gardiner's grammar [5], plus some of its font supplements [6, 7, 8, 9], numerals from Möller's *Hieratische Paläographie* [13], and a seemingly arbitrary selection of signs from the *Griffith Insititute Topographical Bibliography* (GITB).

Although Gardiner's grammar offers detailed descriptions of signs, and thereby attempts to give them proper definitions, it is also partly a font, that is, a list of shapes. Indeed, for some signs, several graphical variants are given, some tall, some short, and the only reason for having these multiple graphical variants was to allow the limited printing technology at that time to print one and the same sign in different groupings together with other signs. The signs from Gardiner's font supplements and from GITB are even more problematic, as they came largely without full documentation or any documentation at all. For some it is unknown from which texts they were taken and for others it is not even clear what the shapes represent.

For examples of problems caused by using modern Egyptological sources for deciding on code points, one can look at certain entries in the sign lists of Borghouts [1] and Hornung & Schenkel (unpubl.). Some of their hieroglyphic signs originate from sources in the *Coffin Texts* of de Buck. However, coffin texts are only rarely written in hieroglyphs. Most are in a cursive script that is in between the hieratic and hieroglyphic scripts. In order to have uniformity in the publication, de Buck wisely chose to use an hieroglyphic script to resemble these texts. However, this entailed the creation of 'new' hieroglyphic signs, which are interpretations and standardizations of the actual cursive signs. Some of these signs are now thought to represent maces, or any other types of objects, even though they are simply dots or strokes in the original. Therefore, it could be argued that these hieroglyphic signs based on the Coffin Texts technically do not exist (although their cursive counterparts clearly do). Several other publications, like the dictionary of van der Molen [20], used these hieroglyphic representations of cursive signs as well, as did the sign lists of Borghouts [1] and Hornung & Schenkel (unpubl.). As all four publications go back to de Buck instead of the original coffins, it could be argued that they reflect only one publication, in which some signs are modern creations. Therefore, occurrence of a sign in multiple publications does not necessarily mean that it existed.

This is only one illustration of the processes of Egyptological research that complicate creating a comprehensive sign list, and there are many more modern publications where further scrutiny is required to determine whether the signs they include were actually used in Ancient Egypt, or whether they are modern creations. It is certainly appropriate to introduce additional code points for said cursive signs if they do not correspond to other hieroglyphs that already have code points, but this should be done based on a modern understanding of the identification of these signs, rather than taking the shapes in any printed publication at face value.

As mentioned before, Gardiner's sign list is partly a font, motivated by particular printing technology. The same holds for the glyphs in the Hieroglyphica [10], which was tied to two tools, viz. Glyph for Windows and MacScribe, which use a form of encoding referred to as the *Manuel de Codage*. A modern tool that uses a very similar encoding is JSesh [19]. The main purpose of such tools is to prepare printed documents, after which the encoding can be discarded [14]. It should be understood however that the considerations for preparing printed documents are very different from the considerations for the interchange of textual data, which is one of the main objectives of Unicode. For example, a font can include several shapes for what could well be argued to be the same sign, allowing the user to choose the one they prefer. Conversely, if two signs have a very similar shape, the user could choose the same shape for both, without this being noticeable by the readers of the resulting printed document. Especially the latter case is highly problematic for the interchange of encodings however, as confusion may result when one font is replaced by another in which code points are assigned slightly different glyphs. Furthermore, statistical studies of sign use become impossible if code points are used inconsistently. Hence, one should be wary to base a Unicode sign list

directly on the Hieroglyphica or JSesh fonts.

Case study

The availability of sign variants in an unprincipled way can be quite confusing, even for seasoned encoders. For instance, M036  has, in the *Manuel de Codage*, a few variants, among which M177A  . In Stela Cairo CGC 34504, from the time of Ramses II, the bottom of the sign seems to display a slight spike, making M177A a potential candidate. However, the graphical match is far from perfect. Further work confirms that it is in fact a very late graphical variant of the sign, and that the original M036 is a better choice. Basically, if a set of variants is proposed, the encoder will need a way to choose among them. They will be working from an original text, whose signs will almost certainly differ in shape from the glyphs available in the fonts. Without a clear typology of variants, the choice they make will be virtually random. It will give a false sense of accuracy in the sign selection, and statistical studies on usage of sign variants will be skewed. The availability of variants under these circumstances will be pointless, and even harmful.

Discussion

There are currently a number of corpora of Ancient Egyptian texts that do not use Unicode at all. If they use technology generally associated with Unicode, such as OpenType fonts, then custom hieroglyphs specific to these corpora can be positioned in the Private Use Areas. Unicode is thereby clearly not an absolute requirement for any particular such corpus. But Unicode has the potential to play an important role in Egyptology, to let different corpora and research projects with different objectives *interchange* encodings, provided the interchange format, i.e. the repertoire of code points, is chosen to be meaningful to the Egyptological community *as a whole*. Next to corpora, one may think of many more applications. Consider for example an Egyptologist involved in an excavation, who wants to send an email to a colleague with the transcription of a newly found text.

The conclusion is that although it is tempting to elevate a collection of signs used in a particular corpus to become part of the Unicode repertoire of hieroglyphs, this does not necessarily benefit the broader and longer-term role that Unicode could play in Egyptology.

2 What is a sign

How do we characterize the notion of 'sign', as an abstraction of a collection of occurrences of hieroglyphs deserving its own code point? This question should have been central in previous attempts to include hieroglyphs in Unicode. Yet, the present document is the first that even poses the question in this context.[5]

One can investigate occurrences of hieroglyphs according to (at least) three dimensions[6]

1. functional,
2. iconic,
3. palaeographic.

The functionality can be defined, in terms of paradigmatic substitution, as the ability of a hieroglyph to be part of the writing of a word, as e.g. a phonogram, a logogram, or a classifier [18]. Two hieroglyphs are

[5] Even though it has been extensively discussed in publications such as Collombert [2], Meeks [12] and Polis & Rosmorduc [17].

[6] See the distinction between 'graphemes', 'classes', and 'forms', based on these three criteria in [17, pp. 64–65]. These are the three levels acknowledged in the Thot Sign List [16].

functionally equivalent if in principle one could be substituted for the other while the writing of the word remains equivalent (even if extralinguistic factors are obviously affected).

By iconic, we here mean what a hieroglyph depicts. This can for example be a human or god, in a certain pose, possibly performing a given action or holding an object and so on, or it can be an animal or part of an animal, or it can be an object or part of a landscape. It is important to stress that the iconic components of a given sign may vary (e.g., presence vs. absence of internal details, orientation of hands, etc.) without modifying or altering its functional dimension.

Lastly, palaeography describes stylistic details of appearance of hieroglyphs beyond the iconic or figurative level, and may serve to identify the period, the region, the writing material (papyrus versus stone) and sometimes even an individual scribe. An owl G017  will have quite different palaeographical features when carved in limestone and when painted on a wall, for instance, but it remains functionally a phonogram (for *m*) and figuratively it still represents an owl without significant differences in terms of iconic features (see the discussion in [15, pp. 345–347]).[7]

One hieroglyph can have several functions, and one function can be fulfilled by two iconically distinct hieroglyphs. For example, G043  and Z007  are functionally almost entirely interchangeable (as phonograms with the value '*w*'), but markedly different from an iconic viewpoint. Note that the latter was originally the representation of a chick in hieratic but was later also used in hieroglyphic texts, with an independent iconography as 'curl', no longer recognizably depicting a chick.

It is uncontroversial that hieroglyphs with different functionality should not be merged into a single code point. For typical users of the sign list, it would furthermore be unacceptable if two hieroglyphs that visibly depict different things were merged, whether or not those hieroglyphs are functionally equivalent.

At the other extreme, palaeographic details of hieroglyphs can be of the utmost importance to Egyptologists, albeit more so in some applications than in others. However, it should be understood that palaeography is generally considered to be outside the scope of Unicode. Moreover, there is no obvious limit to the graphical distinctions that could potentially be of interest to palaeography. For these reasons, one should not allow multiple code points for hieroglyphs that are functionally equivalent and that furthermore have the same referent, with only minor differences in their appearance.

The challenge is then to delineate which differences in appearance are and which are not sufficient justification for introducing separate code points in Unicode. The difficulty comes from the fact that the boundary between iconography and palaeography as understood above is blurry. A solution may be found along the following guidelines:

- Two hieroglyphs correspond to different Unicode signs if they are functionality distinct.
- Two hieroglyphs correspond to different Unicode signs if there is a *discrete* difference in *simple* descriptions of what the hieroglyphs represent.
- In other cases, hieroglyphs will be called 'graphical variants'. These ought to correspond to the same code point.

By 'discrete differences' we exclude in particular any continuous scales, such as 'width', 'height' or 'angle' (except if rotation by 45, 90 or 180 degrees can turn a sign into a functionally distinct sign). In the typical case, there is a graphical feature that is clearly present or absent in most representative hieroglyphs of a sign.

Whole numbers are by definition discrete, but deliberately counting how often a certain graphical feature occurs can lead to a contrived and unnatural description of what a sign represents. For example, one could

[7] In semiotics, palaeography may refer to both iconic/figurative aspects and plastic aspects (textures, colors, materials, etc.). To simplify the current discussion, we restrict the meaning of palaeography to '*how* something is represented', to distinguish it from iconography, in the meaning of '*what* is represented'.

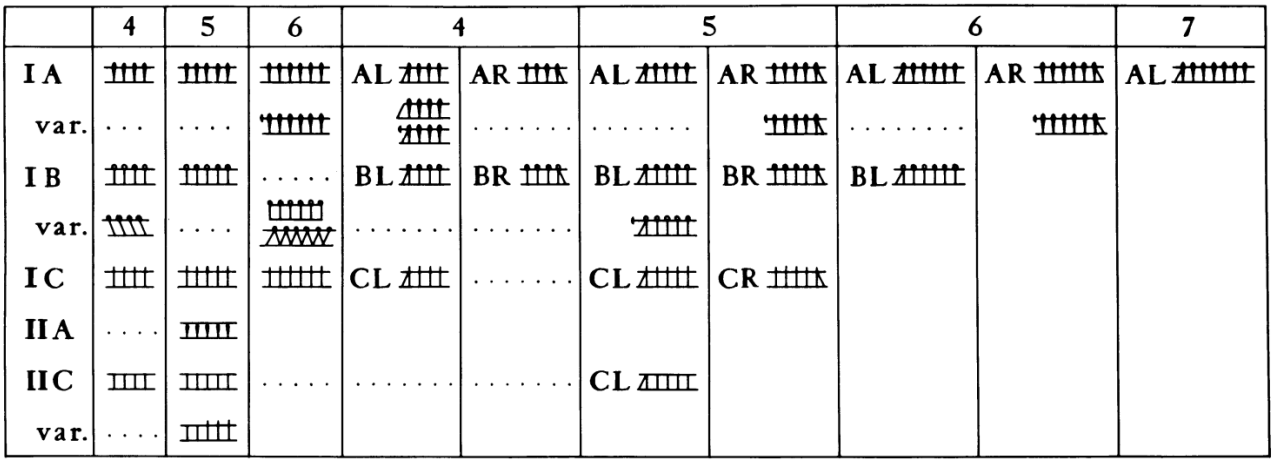

Table 1: Graphical variants of O042 in the Pyramid Texts [4, fig. 1].

count the number of ripples in an occurrence of N035, but it would clearly be undesirable to distinguish between multiple signs described as '6 ripples of water', '7 ripples of water', '8 ripples of water', ... More appropriate is simply 'ripples of water', considering that a scribe could vary the width of the sign and as a result the number of ripples depending on e.g. space constraints. It is not obvious whether one would wish to distinguish variants of V028 (a wick) with 2 or 3 or 4 loops (and in rare cases more than 4 loops). Somewhat clearer is the distinction between W017 and W018, as 'three water jars in rack' and 'four water jars in rack', respectively. Here the distinction is immediately perceived by the average reader without needing to spend unreasonable visual effort counting its parts.

More generally, the term 'simple description' is to be interpreted in the context of a variety of considerations, among which are the need to avoid an explosion of trivial graphical variants, and the added value of preserving certain distinctions of interest. Consider for example the three dozen variants of O042 in the Pyramid Texts alone (Table 1). Contrast this with R001, for which any number of graphical variants can be found, with different combinations of objects on the offering table. Unlike O042, the choice of the graphical variant is here sometimes motivated by the context, in particular, offered objects that are listed in the text.

Overall, there is much freedom how to interpret the above guidelines, in the context of various additional considerations, resulting in more signs, each with finer graphical distinctions, or fewer signs, each of which abstracts away more from a larger collection of occurrences. We further discuss some possibilities in Section 4.

It should moreover be pointed out that application of the proposed guidelines ultimately relies on value judgements by specialists, about the functionality and iconography of hieroglyphs. The untrained eye cannot determine which graphical features of normalized printed hieroglyphs matter and which do not. For example, A037 and A038 look iconographically very similar, but are in fact functionally distinct, so these should be seen as separate signs. Also A048 and A049 look very similar, but they are functionally distinct. The same holds for A053 and A054 and A055; there is little overlap, if any, between the functionalities of these three signs.

Discussion

A characterization of the notion of 'sign' without referring to specific functional and iconic features is unlikely to be meaningful. In particular, if one holds the position that any distinct hieroglyphic shape in a printed book ought to become a separate code point, then there is no limit to how many code points would be needed. Many dozens of hieroglyphic fonts are or have been used, not to mention different handwritings in older publications. To give an analogue from an alphabetic script: one would not wish to have one code point for an Helvetica 'a', for a Garamond 'a', for an Arial 'a', etc.

3 Requirements

A sign list of Ancient Egyptian hieroglyphs should satisfy the needs of at least four groups of people. First, there are obviously the encoders of texts, who need to know which signs to use for which purposes. Second, there are the font designers, who need to know what graphical aspects of a shape are essential, and what aspects can be varied. Third, there are future generations of Egyptologists who will discover and study new texts, and need to be able to determine whether the sign occurrences in these texts are covered by the existing signs in Unicode, or require new code points, to be proposed to the Unicode community for addition. Fourth, there are the developers of search engines. Unicode is often touted with the argument that it allows web search of character strings. Finding relevant hieroglyphic encodings will not be effective however unless search engines are designed to recognize that certain code points are equivalent for the purposes of search.

These considerations imply that each code point must be accompanied by at least the following information, which can be seen as *defining* the sign:

- A list of the most common meaning or sound values.
- Where necessary further clarification for which purposes to use the sign.
- A description of the iconic features that are essential to the sign.
- Where appropriate, links to other signs that are functionally equivalent.
- Photographic evidence of the existence of a sign in at least one, but preferably two or three inscriptions.
- Associated bibliographic information.

The Thot Sign List (TSL)[8], introduced to the wider Egyptological community at ICE XII (Cairo, 3-8 November 2019), provides these types of information for most of the existing 1071 signs in Unicode, as well as for many additional signs. It is therefore the most appropriate tool to remedy the lack of proper definitions of the existing signs, as well as to provide the necessary infrastructure to create a meaningful extension of the Unicode sign list.

Note that it is essential that new signs are analyzed and documented in the TSL *before* they are added to Unicode. This contrasts with what has been proposed in the recent past, namely that a suitable sign list can be obtained by first adding an overly large set of shapes to Unicode, and subsequently weeding out the 'wrong' ones. This idea seems to rest on the assumptions that a shape is either a sign or a non-sign, and that a non-sign does not hold any relation to an actually occurring sign and thereby cannot be confused with an actually occurring sign. However, such *ghost signs*, if they arise at all, are generally not the biggest problem. It is much more likely that a sign list created by a non-expert will contain many instances of one of the following three problems:

[8] `http://thotsignlist.org/` [16]

1. Two or more variant shapes of the same sign are introduced, none of which is clearly the best representative of the majority of occurrences of the sign.

2. One code point is introduced that turns out to represent two different signs, as a result of the non-expert being unaware that a graphical detail is important enough to distinguish them.

3. A code point is introduced for a sign that does exist, but with a shape that is not representative of the majority of occurrences of the sign.

The reason why (1) is a problem for users is because the choice between the graphical variants becomes arbitrary, and search and statistical studies of sign use become difficult. It should be clear that also (2) causes difficulties for corpus studies. A fix whereby a new code point is introduced later and the old code point is reinterpreted to mean just one of the two signs creates obvious problems for existing encodings. For (3), a fix that introduces a new code point leads to problems similar to those of (1) and a change of the glyph in the code charts will cause problems for users, who see the meaning of their encodings change overnight.

Discussion

Some have argued that a sign is defined by its occurrence in a printed book. It is true that Gardiner's grammar satisfies the minimum requirements for definitions of signs that we listed above, even though some of this information is now a little outdated. But many other sources list shapes of sign occurrences without even making the claim that these shapes represent independent signs, let alone characterizing the identities of those signs by proper definitions. A case in point is the series of font supplements to Gardiner's grammar, which contain various shapes many of which came without any documentation whatsoever.

A related misconception is that a sign is defined by its appearance, or in other words, Egyptologists know what sign is meant by what it looks like. For some signs, this may be true, but for others, it may not be.

To start with a few obvious examples, there are various circles among the existing signs, such as D012 (pupil of eye), D067 (1 heqat; a unit of volume), N005 (sun), N009 and N010 (moon), N033 (grain), O048 (enclosed mound), O050 (threshing floor), S021 (ring), X006A (round loaf), Z013 (circle), AA001 (basket from above). Similarly, there are various rectangular shapes, with sharp or with rounded corners, such as N017 (land), N018 (sandy tract), N037 (pool), O039 (stone), Q003 (stool), S026A (apron), X004B (roll of bread), Z008 (oval), AA012 (platform). Triangle-shaped signs are M044 (thorn), O024 (pyramid), X008 (conical loaf), X008A (hieratic conical loaf), and N029 (slope of hill), X007 (half-loaf). Only with the help of context and documentation, where available, do we know which signs to use for which purposes.

Gardiner does not associate Z013 with any particular object. Because [9] placed it in the 'Z' category, which includes the geometrical figures, one is free to claim that he wanted to reserve this sign for abstract circles that do not represent anything in particular, like a sun or grain. The examples from [5] further suggest it can act as phonetic determinative *qd*. This still leaves doubt when exactly to use Z013 and when to use any of the other circular signs.

There are further signs that [9] introduced without any documentation. The shape of D048A  seems to match writings of *ḥnt*, 'basin', and D064  seems to match writings of *kp*, 'chopped-off hand', but there is no ground truth to confirm this. It is plausible, but not verifiable, that Gardiner intended D065  to depict a lock of hair.

In [8], F001A  is suggested to be used in words related to 'rejoice, breathe, nose', which would make it largely interchangeable with D019  , and there are attested sign occurrences that support this. However, there are also attested sign occurrences that look like F001A  , some in a variant without the ear, and that are used like F001  in the meaning of 'bull'. It is unclear whether Gardiner intended F001A  to cover such cases as well.

Perhaps O024A  is meant to represent a mastaba with a surrounding wall, or it could represent a pedestal of a sun temple, considering the use suggested by [8]. It is well possible that there are two distinct signs, one depicting a mastaba and another depicting a pedestal. Until it is fixed whether O024A  is supposed to represent one or the other (or both), font designers will have difficulty determining what exact glyphs are allowable for this sign.

As stated by [8], M031A  can be used in the writing of *srd*, 'make to grow'. This suggests that it is functionally equivalent to M031  , which represents a rhizome. However, M031A  more likely represents a tree in a pot [3, pp. 5–8]. Explicitly making this identification would prevent font designers from incorrectly shaping the sign as rhizome.

Case studies

Signs D034  and D034A  are functionally equivalent. The difference in the shape of the shield can be explained by the different periods in which these two signs were used; it is open to debate whether this distinction should be encoded. There may also be a difference in the weapon held in the other hand, which one may guess (!) to be a battle-axe in the first case and a mace in the other. In this respect a clear distinction between the two weapons is visible in Gardiner's grammar and in Unicode proposal L2/06-354, but no such distinction is visible in the Unicode code tables (Table 2). In order to resolve this confusion, and to decide whether these are two different signs or two graphical variants of one another, the appearance must be defined in words. Gardiner [5] in fact suggests that the distinction between battle-axe and mace is not worth making, at least for the purposes of the sign list in his grammar. If one were to follow the same view for the purposes of Unicode, one could define the appearance as 'arms holding a shield and *either* a battle-axe *or* a mace', by which two slightly different shapes can be covered by a single code point. Either way, there is currently no "ground truth". The issue can only be resolved by adding new information to what is presently in Unicode, which underspecifies the identities of code points.

Another example is L008  , which turns out to represent a click beetle with its legs omitted. Many users of the sign list have been wondering for over a decade what this sign represents, as the shape is not immediately suggestive of a beetle. The entry in GITB from which this sign was taken does little to clarify the matter, and it took a specialist to eventually recognize the shape for what it is. During the 2018 meeting in London, Mark-Jan Nederhof and Jorke Grotenhuis raised this issue to illustrate why a sign cannot be defined merely by its shape, and why it is essential that definitions of signs include, among others, descriptions of what signs represent and how they are to be used, and that such a definition must

	A022	A048	B007	C011	D034	E034	E034A	W003	W003A
2009									
2020									

Table 2: A selection of the errors introduced into the code charts since 2009 (L2/07-322R).

exist *before* it is decided that a sign deserves to be given its own permanent code point. Regrettably, the discussion following the meeting (cf. L2/19-315) argued about the shape that should be associated with this code point, and thereby completely missed the point we were trying to make.

Other problematic signs added due to GITB are A069  and A070  , but neither actually occurs in the GITB at the indicated entries. It is reasonable to assume that A069  was meant to be the same sign that is used as classifier in personal names. However, it is not clear that A070 was meant to be the same sign that is used in the writing of *ḥḥ*. The issue is that all attestations for *ḥḥ* have the palms of the hands directed inward, whereas the original code tables have the palms directed outward. This may mean that the shape in the original code tables was wrong, or it may mean that the two shapes represent different signs with distinct functions.

At the time of writing, there are several issues with the code charts on the Unicode site (Table 2), which:

- seem to depict A022  holding a mace, whereas Gardiner [5] describes the sign as holding a sceptre,
- depict A048  with a beard, whereas Gardiner [5] specifically states 'beardless man',
- depict B007  with a beard, even though it is meant to represent a queen,
- depict C011  as a man without any of the usual iconic features of gods (long hair and beard), whereas Gardiner [5] specifies this sign as depicting a god,
- seem to have a shape for E034A  that is identical to that of E034  , but uniformly scaled down, whereas Gardiner [6] explains by examples that it is supposed to be scaled down only vertically, to appear above or beneath other signs,
- similarly has G036A  as a uniformly scaled down version of G036  , whereas the scaling down should be only vertically, as Gardiner [6] specifies 'Lower form of last', similarly G037A  versus G037  , V030A  versus V030  , and W003A versus W003  .

Some of these mistakes are currently in the process of being corrected. This does not address the core issue however, as the original code charts from 2009 were correct. Mistakes apparently sneaked in over the years, when code charts were iteratively 'improved' by non-experts. No doubt they had the best intentions, and they are not to blame, because in the absence of proper definitions of what code points of hieroglyphs are meant to represent, there is no way for them to avoid such mistakes. Unless Unicode is willing to drastically

alter its course with regard to Ancient Egyptian, such mistakes will continue to appear and reappear in the future, in existing signs and in signs to be added in the future.

Alternatively, some may argue that the code charts are right and Gardiner was wrong. But this then only reinforces our earlier argument that code points cannot be defined by merely referring to a printed publication.

4 Granularity of encoding

It may be tempting to think that building a sign list of Ancient Egyptian hieroglyphs is like collecting stamps. Each stamp one encounters can be compared to the stamps that one already has. If it differs, one may add it to one's collection, and otherwise one may trade it in for another stamp. However, the comparison quickly breaks down. Due to the variability of the shapes of hieroglyphs, the question is not whether two occurrences are the same, but whether their functional and iconic features are 'similar enough' to be encoded by the same code point, or equivalently, how to define code points to cover a range of potential occurrences.

The TSL distinguishes between *signs* and *classes*. A *sign* is an abstract entity that is determined by functional and coarse iconic properties, roughly corresponding to the notions of 'grapheme' and 'character', while a *class* represents a distinct graphical realization of a sign. An example of a sign is  , 'guinea-fowl', with phonetic value *nḥ*. The sign can have different graphical realizations, represented by four classes, depending on presence/absence of the lappet and the extending feathers on the head. The representative class of the sign has the lappet and extending feathers, which can be considered to be the more complete representation of the guinea-fowl, but the other three forms have been attested as well. Here one may question whether distinguishing all four forms is consistent with the traditions and aims of Unicode.

Another example of a sign is  , a seated god with long, curved beard and straight wig. Its classes include variants such as A040A  , with different objects held in the hands. The scientific aims of the TSL justify gathering such classes under one sign. For the purpose of Unicode and its typical users however, one may consider assigning an individual code point to each such class, motivated by the iconic distinctions of the different objects held in the hands.

The existing sign list in Unicode was not obtained after any deliberate choices were articulated about the most appropriate granularity of encoding of graphical details, and its creation was mostly done in the spirit of collecting stamps. It is informative however to analyze this set relative to the signs/classes in the TSL; see Appendix A. There are 73 cases where Unicode contains two or more classes for the same sign. These can be broken down into the following:

- There are 3 cases where one of the classes represents an hieratic form, or a hieroglyph derived from an hieratic form. Examples are D019  versus D020  and H006  versus H006A  . It seems reasonable to distinguish these in Unicode.

- There are 8 cases where the classes are determined by a secondary object that is absent or present, such as objects held by gods or kings. Further examples are A041  versus A042  versus A042A  and C010 versus C010A .

- There are 11 cases where the orientation of the sign (by rotation and/or mirroring) or the arrangement of its parts differs. Examples are F023 versus F024  , Y001 versus Y001A  , and Z002 

versus Z002C versus Z002D . One would presently not wish these variants to be represented by additional code points, but rather to use the prospective mirroring/rotating control characters, as well as control characters to compose signs into groups.

- There are 3 cases where the only distinction is vertical scaling. Examples are D027  versus D027A and U004 versus U005 . There are further cases of scaled variants in Unicode, but these are understandably not distinguished in the TSL. One may well argue that scaled variants do not deserve their own code points, as the differences are not discrete.
- There are approximately 23 cases where most clear occurrences of the sign could be unambiguously assigned to one of the classes. Examples are A014  versus A014A , D061 versus D062 versus D063 , G023 versus G024 , and U026 versus U027 .
- In the remaining 25 cases, it could be hard to know for sure which class to pick for many occurrences of the sign. Examples are E010 versus E011 (the latter without a clearly distinguishable beard), T008 versus T008A (rounded tip versus pointed tip), T026 versus T027 (more or fewer details), V022 versus V023 (more or fewer internal details). It is debatable whether introducing this level of graphical detail in Unicode was appropriate. There are further slight graphical variants, such as O020A versus O020 and V007A versus V007 , that are not even distinguished by the TSL.

This document does not intend to commit to a precise level of granularity for future extensions of the Unicode sign list, but we can enumerate a few possibilities:

1. Introduction of most TSL signs, and possibly a few special cases of TSL classes.
2. Introduction of most TSL classes, especially where it concerns semograms. (Distinctions in shapes of phonograms are often regarded to be less important.)
3. Prioritization of TSL signs for now, and further consideration of TSL classes in a few years.
4. Representation of TSL signs using code points and TSL classes using variation selectors.

The last option explicitly offers a two-tiered system, allowing a choice of coarse-grained and fine-grained encoding, omitting variation selectors in the former case. Also for the second and third options, a two-tiered system could be offered, by distinguishing the representative class of each sign. For example, one of the four classes for guinea-fowl could be the one that users should choose for a coarse-grained encoding, leaving the other three unused. Note that the corresponding code point would then have one of two meanings, depending on the desired granularity of encoding, e.g. either "(any form of) guinea-fowl" or "guinea-fowl with lappet and with extending feathers".

If Unicode is to systematically include code points of hieroglyphs at the granularity of TSL classes, then one may question whether there is enough established research on which such a sign list could be based. For sign A001  alone, there are many potential classes, such as those in Table 3. Locating, verifying and documenting a comprehensive repertoire of classes will require a significant investment in future research, and it may be many more years before this research is completed. In the mean time, the most common signs and classes may be explored, guided by statistical analysis of a number of digital corpora.

Table 3: Some variants of A001 [12, p. 42].

Discussion

One could define the term *coverage* (of a sign list) to mean the percentage of Ancient Egyptian texts that can be completely encoded. The expectation that adding many thousands of hieroglyphs to Unicode will significantly increase coverage is understandable, but not necessarily correct. It is true that, mutatis mutandis, the more signs are available, the greater the probability that all sign occurrences in any given text are covered. However, the frequency distribution of signs in for example L2/20-068R is certain to be very unbalanced, as a consequence of the disparate nature of the publications on which it is based. Many shapes are undoubtedly hapax, that is, they occur in only one text. In contrast, it is likely that adding just a few hundred well-chosen, well-defined, frequent signs will do at least as much to enhance the usefulness of Unicode for digitizing Ancient Egyptian texts.

Furthermore, the paradoxical situation can occur whereby adding more signs representing a finer level of graphical detail can lead to *decreased* coverage. For example, if one wishes to have two code points for a guinea-fowl, one with lappet and with extending feathers and one without lappet and without extending feathers, then there is no appropriate code point for a guinea-fowl with lappet and without extending feathers, nor for a guinea-fowl without lappet and with extending feathers. From a different perspective, introducing more graphical variants can be a slippery slope towards needing to introduce even more to compensate for the loss of coverage.

A related example is that of the 'lake' signs, N037 , N037A , N038 and N039 , which are functionally equivalent. Many occurrences of the 'lake' can be identified as one of these four forms, but many others are further variants and intermediate forms (see for example [11, pp. 143–144]). It seems inevitable moreover that given any collection of narrowly defined variants of the 'lake', more variants will be found later that are not covered by any existing ones (or that could be argued to be covered by more than one, in the case of intermediate forms), resulting in a never ending series of additions to the sign list.

One should also bear in mind the difficulties of implementing the control characters in OpenType, which is at present the most widely promoted font technology. An OpenType font can only contain up to 65,535 characters. Because dynamic scaling is not possible, each sign has to be represented several times, in different scalings. To render left-to-right as well as right-to-left text, a mirrored copy is needed of each scaling of each sign. Having, say, seven scalings for 5,000 signs would therefore already surpass the limits of OpenType technology. In reality, the situation is even worse, as the process of scaling and positioning requires internal code points that need to come out of the above-mentioned 65,535 characters. In addition, we wish to introduce control characters for rotation and shading (hatching), which will require further characters. Consequently, prospects of creating a sign list of considerably more than 3,000 (graphical variants of) signs may at first delight some users who hope to use Unicode for palaeographic purposes, but later disappoint them if it turns out no font can be implemented that includes that many signs.

The limitations of OpenType technology also mean that, for example, fine-tuning of scaling and positioning cannot be realized within Unicode, nor can custom glyphs be introduced on the fly. Thereby,

it is unrealistic to expect that Unicode can replace specialized tools such as JSesh for the publication of texts, and it may be more fruitful to focus on tasks that can more realistically be performed on the basis of Unicode, such as interchange of textual resources, especially for grammatical, historical, or literary studies.

Case studies

If a code point is 'defined' by a glyph, then changing this glyph in the code charts is inherently problematic, and as illustrated by Table 2 can have very harmful consequences. If instead code points are defined in terms of their iconic and functional features, for a certain granularity of encoding, then this opens up the possibility of replacing one glyph by another without affecting correctness.

For example, no attestations of B007  have been found with a uraeus attached to the diadem, even though it was introduced in Unicode with a uraeus. If the code point is defined in the vein of 'sitting woman wearing diadem and holding flower, used in the writing of names of queens', then this opens the possibility of removing the uraeus from the representative glyph if we find that this is the more common form.

Similarly, the kilt in A067  appears to be a mistake, as no clothes are visible in attested occurrences. If the sign is defined in the vein of 'dwarf, used as classifier in the writing of *nmw* and *dng* ('dwarf')', then one may consider correcting the representative glyph, as long as it remains consistent with that definition. For another example, Section 3 discussed the (likely) incorrect orientation of the hands in A070  .

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A The 1071 hieroglyphs from Unicode 5.2 mapped to the Thot Sign List

A sign in the TSL is identified by a sequence of digits. If this sequence is followed by an underscore and a sequence of two digits, then this represents a class within a sign.

Signs tagged with **composition** can be formed from other signs by control characters, and would therefore not be expected to be found in the TSL. Similarly, signs tagged with **mirroring** or **rotation** can be formed using prospective control characters for mirroring or rotation.

Signs tagged with **variant** are graphical variants of other signs in Unicode, which may or may not be added to the TSL as class at some point.

Code points tagged by **typographical** do not have an independent meaning as signs, but are used to form enclosures, and would therefore not be in the TSL.

This is the PDF version of `https://mjn.host.cs.st-andrews.ac.uk/egyptian/unicode/tabletsl.html`

A001 𓀀 : seated man.
TSL 82

A002 𓀁 : seated man with hand to mouth.
TSL 290

A003 𓀂 : man sitting on heel.
TSL 459

A004 𓀃 : seated man with hands raised.
TSL 630

A005 𓀄 : crouching man hiding behind wall.
TSL 848_01

A005A 𓀅 : seated man hiding behind wall.
TSL 848_00

A006 𓀆 : seated man under vase from which water flows.
TSL 851

A006A 𓀇 : seated man reaching for libation stone, under vase from which water flows.
Has reading sꜣṯ , "make libation". Not related to A6 at all.

A006B 𓀈 : seated man reaching down, under vase from which water flows.
Has reading sꜣṯ , "make libation". Not related to A6 at all. Not clearly attested; may not exist.

A007 𓀉 : fatigued man.

TSL 879

A008  : man performing hnw -rite.
TSL 895

A009  : seated man with  W010 on head.
TSL 912

A010  : seated man holding oar.
TSL 83

A011  : seated man holding  S042 and  S039.
TSL 114

A012  : soldier holding bow and quiver.
TSL 132

A013  : man with arms tied behind his back.
TSL 149

A014  : falling man with blood streaming from his head.
TSL 189_00

A014A  : man whose head is hit with an axe.
TSL 189_01

A015  : man falling.
TSL 214

A016  : man bowing down.
TSL 234

A017  : child sitting with hand to mouth.
TSL 245

A017A  : child sitting with arms hanging down.
TSL 256

A018  : child wearing  S003.
TSL 261

A019  : bent man leaning on staff.
TSL 274

A020  : man leaning on forked staff.
TSL 291

A021  : man holding staff and handkerchief.
TSL 303

A022  : statue of man holding staff and  S042.
TSL 329

A023  : king holding staff and  T003.
TSL 341

A024  : man striking with both hands.
TSL 361

A025  : man striking, with left arm hanging behind back.
TSL 383

A026  : man with one arm pointing forward.
TSL 396

A027  : hastening man.
TSL 407

A028  : man with hands raised on either side.
TSL 422

A029  : man upside down.
TSL 436

A030  : man with hands raised in front.
TSL 460

A031  : man with hands raised behind him.
TSL 492

A032  : man dancing with arms to the back.
TSL 516

A032A  : man dancing with arms to the front.
variant
Only attested in hieratic.

A033  : man with stick and bundle on shoulder.
TSL 7041

A034  : man pounding in a mortar.
TSL 549

A035  : man building wall.
TSL 563

A036  : man kneading into vessel.
TSL 580

A037  : man in vessel.
TSL 594

A038  : man holding necks of two emblematic animals with panther heads.
TSL 606

A039  : man on two giraffes.
TSL 617

A040  : seated god.
TSL 631_00

A040A  : seated god holding  S040.
TSL 631_01

A041  : king with uraeus.
TSL 651_00

A042  : king with uraeus and holding  S045.
TSL 651_01

A042A  : king with uraeus and holding  S045 and  S038.
TSL 651_03

A043  : king wearing  S001.
TSL 679_02

A043A  : king wearing  S001 and holding  S040.
Provisionally TSL 702. No clear attestation found.

A044  : king wearing  S001 and holding  S045.
TSL 679_03

A045  : king wearing  S003.
TSL 714_00

A045A  : king wearing  S003 and holding  S040.
Provisionally TSL 726. No clear attestation found.

A046  : king wearing  S003 and holding  S045.
TSL 714_01

A047  : shepherd seated and wrapped in mantle, holding stick.
TSL 748

A048  : beardless man seated and holding knife.
TSL 764

A049  : seated Syrian holding stick.
TSL 777

A050  : noble on chair.
TSL 794

A051  : noble on chair holding  S045.
TSL 811

A052  : noble squatting holding  S045.
TSL 821

A053  : standing mummy.
TSL 832

A054  : lying mummy.
TSL 834

A055  : mummy on bed.
TSL 835

A056  : seated man holding stick.
Provisionally TSL 837. Attested from cursive.

A057  : man holding  R004.
Provisionally TSL 838.

A058  : man applying hoe to ground.
Provisionally TSL 845. Is just variant of TSL 843?

A059  : man threatening with stick.
TSL 846

A060  : man sowing seeds.
Provisionally TSL 852.

A061  : man looking over his shoulder.
Provisionally TSL 857. Not clearly attested.

A062  : Asiatic.
Likely variant of TSL 858.

A063  : king on throne holding staff.
Provisionally TSL 860. Attestation not found.

A064  : man sitting on heels holding forward  W010.
Attested from facsimile.

A065  : man wearing tunic with fringes and holding mace.
Provisionally TSL 747.

A066  : man holding  Y008.
TSL 348

A067  : dwarf.
TSL 425
Prototype should not wear kilt.

A068  : man holding up knife.
Provisionally TSL 286. May need adjustment of shape of knife.

A069  : seated man with raised right arm and left arm hanging down.
TSL 880

A070  : seated man with raised arms.

TSL 883
The hands facing outward in the Unicode code charts appears to be a mistake.

B001  : seated woman.
TSL 1070

B002  : pregnant woman.
TSL 1104

B003  : woman giving birth.
TSL 1130_00

B004  : combination of  B003 and  F031.
TSL 1130_01

B005  : woman suckling child.
TSL 1164

B005A  : woman suckling child (simplified).
variant

B006  : woman on chair with child on lap.
TSL 1182

B007  : queen wearing diadem and holding flower.
TSL 1197
The uraeus in the prototype may be an error.

B008  : woman holding  M009.
Provisionally TSL 1219.

B009  : woman holding  Y008.
Provisionally TSL 1159.

C001  : god with  N006.
TSL 1251

C002  : god with head of falcon with sun on head and holding  S034 .
TSL 1500

C002A  : god with head of falcon with sun on head.
TSL 1660

C002B  :  C002A reversed.
mirroring

C002C  :  C002 reversed.
mirroring

C003  : god with head of ibis.
TSL 1669

C004  : god with head of ram.
TSL 1710_00

C005  : god with head of ram holding  S034.
TSL 1710_01

C006  : god with head of jackal.
TSL 1775

C007  : god with head of Seth-animal.
TSL 1797

C008  : ithyphallic god wearing  S009 and with uplifted arm holding  S045.
TSL 1832

C009  : goddess with sun and horns.
TSL 7042

C010  : goddess with feather on head.
TSL 1252_00

C010A  : goddess with feather on head and holding  S034.
TSL 1252_01

C011  : god with arms supporting (the sky) and  M004 on head.
TSL 1292

C012  : god wearing  S009 and holding  S040.
TSL 1324

C013  :  C012 reversed.
mirroring

C014  : god wearing  S009 and holding  T016A.
Provisionally TSL 1365.

C015  :  C014 reversed.
mirroring

C016  : god wearing  S003 and holding  S034.
Attested but status as independent sign and desired prototype are unclear.

C017  : god with head of falcon wearing  S009 and holding  S034.
TSL 1423

C018  : squatting god.
TSL 1441

C019  : mummy-shaped god.
TSL 1473

C020  : mummy-shaped god in shrine.
TSL 1501

C021  : Bes.
Provisionally TSL 1688.

C022  : god with head of falcon and moon disk.
TSL 1740

C023  : goddess with head of feline and  N006.
Provisionally TSL 1413. Attestation not confirmed.

C024  : god wearing  S003 and holding  S040.
Provisionally TSL 1456. Attestation not confirmed.

D001  : head in profile.
TSL 1870

D002  : face.
TSL 2008

D003  : hair.
TSL 2134

D004  : eye.
TSL 2269

D005  : eye touched up with paint.
TSL 2306_00

D006  : eye with painted upper lid.
TSL 2306_01

D007  : eye with painted lower lid.
TSL 2355

D008  : eye enclosed in  N018.
TSL 2370_00

D008A  : eye with painted lower lid enclosed in  N018.
TSL 2370_01

D009  : eye with flowing tears.
TSL 2385

D010  : wḏꜣt -eye.
TSL 1871

D011  : left part of white of  D010.
TSL 1885

D012  : pupil of eye.
TSL 1896

D013 : eye-brow.
TSL 1908

D014  : right part of white of  D010.
TSL 1920

D015  : diagonal marking of  D010.
TSL 1936

D016  : vertical marking of  D010.
TSL 1952

D017  : combination of  D016 and  D015.
TSL 1964

D018  : ear.
TSL 1982

D019  : nose, eye and cheek.
TSL 1996_00

D020  : nose, eye and cheek in semi-cursive form.
TSL 1996_01

D021  : mouth.
TSL 2020

D022  : mouth with two strokes.
TSL 2033

D023  : mouth with three strokes.
TSL 2047

D024 : upper lip with teeth.
TSL 2061

D025  : lips with teeth.
TSL 2072

D026  : liquid issuing from lips.
TSL 2083

D027  : small breast.
TSL 2096_00

D027A  : large breast.
TSL 2096_01

D028  : arms in k3 -posture.
TSL 2110

D029  : combination of  D028 and  R012.
TSL 2122

D030  :  D028 with tail.
TSL 2135

D031  : combination of  D032 and U036.
TSL 2145

D031A  : combination of  D028 and  U036.
TSL 7044

D032  : arms embracing.
TSL 2156

D033  : arms rowing.
TSL 2177

D034  : arms holding shield and battle-axe.
TSL 2193_00
Attested occurrences seem to have mace rather than axe.

D034A  : arms holding shield and mace.
TSL 2193_01

D035  : arms in gesture of negation.
TSL 2208

D036  : forearm.
TSL 2222

D037  : forearm with  X008.
TSL 2233

D038  : forearm with rounded loaf.
TSL 2245

D039  : forearm with  W024.
TSL 2256

D040  : forearm with stick.
TSL 2270

D041  : forearm with palm down and bent upper arm.
TSL 2280

D042  : forearm with palm down and straight upper arm.
TSL 2290

D043  : forearm with  S045.
TSL 2291

D044  : forearm with  S042.
TSL 2292

D045  : arm with nḥbt -wand.
TSL 2293

D046  : hand.
TSL 2295

D046A  : liquid falling from hand.
TSL 2298

D047  : hand with palm up.
TSL 2301

D048  : hand without thumb.
TSL 2303

D048A  : hand holding an egg.

D049  : fist.
TSL 2304

D050  : finger vertically.
TSL 2307

D050A 
composition

D050B 
composition

D050C 
composition

D050D 

composition

D050E 
composition

D050F 
composition

D050G 
composition

D050H 
composition

D050I 
composition

D051  : finger horizontally.
TSL 2318

D052  : phallus.
TSL 2324

D052A  : combination of  D052 and  S029.
composition
Provisionally TSL 5531.

D053  : liquid issuing from phallus.
TSL 2326

D054  : legs walking.
TSL 2328

D054A  : hieratic legs walking.
variant

D055  : legs walking backwards.
TSL 2329

D056  : leg.
TSL 2330

D057  : combination of  D056 and  T030.
TSL 2331

D058  : foot.
TSL 2336

D059  : combination of  D058 and  D036.
TSL 2337

D060  :  D058 under vase from which water flows.
TSL 2339

D061  : three toes oriented leftward.
TSL 2340_00

D062  : three toes oriented rightward.
TSL 2340_01

D063  : two toes oriented leftward.
TSL 2340_02

D064  : hand with palm down.
Provisionally TSL 2098.

D065  : lock of hair.
Provisionally TSL 1912.

D066  : arm with reed pen.
Provisionally TSL 2067.

D067  : dot.
Candidate for TSL?

D067A 
composition

D067B 
composition

D067C 
composition

D067D 
composition

D067E 
composition

D067F 
composition

D067G 
composition

D067H 
composition

E001  : bull.
TSL 2397

E002  : bull charging.
TSL 2586

E003  : calf.
TSL 2740

E004  : sacred ḥsꜣt -cow.
TSL 2771

E005  : cow suckling calf.
TSL 2783

E006  : horse.
TSL 2798

E007  : donkey.
TSL 2814

E008  : kid.
TSL 2833

E008A  : kid jumping.
TSL 2847

E009  : newborn bubalis or hartebeest.
TSL 2850

E009A  : mature bovine lying down.
Provisionally TSL 2399.

E010  : ram.
TSL 2398_00

E011  : ram.
TSL 2398_01

E012  : pig.
TSL 2432

E013  : cat.
TSL 2446

E014  : dog (saluki).
TSL 2466

E015  : lying canine.
TSL 2499

E016  : lying canine on shrine.
TSL 2524_00

E016A  : lying canine on shrine with  S045.
TSL 2524_01

E017  : jackal.
TSL 2538

E017A  : jackal looking back.
Provisionally TSL 2468.

E018  : wolf on  R012 with šdšd .
TSL 2557_00

E019  : combination of  E019 and  T003.
TSL 2557_01

E020  : Seth-animal.
TSL 2587

E020A  : combination of  E020 and  V030.
Provisionally TSL 2479. Not clearly attested.

E021  : lying Seth-animal.
TSL 2605

E022  : lion.
TSL 2646

E023  : lying lion.
TSL 2658

E024  : panther.
TSL 2670

E025  : hippopotamus.
TSL 2685

E026  : elephant.
TSL 2700

E027  : giraffe.
TSL 2712

E028  : oryx.
TSL 2723

E028A  : combination of  E028,  N024 and some type of jar.
Not attested in this exact form.

E029  : gazelle.
TSL 2734

E030  : ibex.
TSL 2741

E031  : goat with collar.
TSL 2755

E032  : baboon.
TSL 2758

E033  : monkey.
TSL 2759

E034  : hare.
TSL 2760

E034A  : hare (low).
variant

E036  : baboon.
TSL 2763

E037  : combination of  E036,  V036 and  V030 .
Provisionally TSL 2777.

E038  : long-horned bull.
Provisionally TSL 2853.

F001  : head of ox.
TSL 2871

F001A  : head of bovine.
TSL 3125
Or TSL 3126?

F002  : head of charging ox.
TSL 3001

F003  : head of hippopotamus.
TSL 3038

F004  : forepart of lion.
TSL 3077

F005  : head of bubalis or hartebeest.
TSL 3103

F006  : forepart of bubalis or hartebeest.
TSL 3121

F007  : head of ram.
TSL 3140

F008  : forepart of ram.
TSL 3164

F009  : head of leopard.
TSL 3177

F010  : head and neck of animal.
TSL 2872_00

F011  : head and neck of animal.
TSL 2872_01

F012  : head and neck of canine.
TSL 2900

F013  : horns.
TSL 2913

F013A  : horns (low).
variant

F014  : combination of  F013 and  M004.
TSL 2930

F015  : combination of  F014 and  N005.
TSL 2948

F016  : horn.
TSL 2961

F017  : combination of  F016 with vase from which water flows.
TSL 2976

F018  : tusk.
TSL 2987

F019  : lower jaw-bone of ox.
TSL 2995

F020  : tongue.
TSL 3002

F021  : ear of bovine.
TSL 3015

F021A  : hieratic ear of bovine.
variant

F022  : hind-quarters of lion.
TSL 3022

F023  : foreleg of ox.
TSL 3023_00

F024  :  F023 reversed.
TSL 3023_01

F025  : leg of ox.
TSL 3025

F026  : skin of goat.
TSL 3027

F027  : skin of cow with bent tail.
TSL 3028

F028  : skin of cow with straight tail.
TSL 3031

F029  : cow's skin pierced by arrow.
TSL 3032

F030  : water-skin.
TSL 3039

F031  : three skins tied together.
TSL 3042

F031A  : three skins tied together (simplified).
variant

F032  : animal's belly.
TSL 3044

F033  : tail.
TSL 3045

F034  : heart.
TSL 3048

F035  : heart and windpipe.
TSL 3049

F036  : lung and windpipe.
TSL 3051

F037  : backbone and ribs and spinal cord.
TSL 3055

F037A  : backbone and ribs.
TSL 3057

F038  : backbone and ribs.
TSL 7046

F038A  : backbone and ribs and spinal cord.
variant
Not attested.

F039  : backbone and spinal cord.
TSL 3073

F040  : backbone and spinal cords.
TSL 3078

F041  : vertebrae.
TSL 3084

F042  : rib.
TSL 3088

F043  : ribs.
TSL 3091

F044  : leg-bone with meat.
TSL 3092

F045  : uterus.
TSL 3093

F045A  : uterus (simplified).
variant

F046  : intestine.
TSL 3094_00

F046A  : intestine.
TSL 3094_02

F047  : intestine.
TSL 3094_01

F047A  : intestine.
TSL 3094_03

F048  : intestine.
TSL 3100_00

F049  : intestine.
TSL 3100_01

F050  : combination of  F046 and  S029.
TSL 3104

F051  : piece of flesh.
TSL 3106

F051A  : three pieces of flesh horizontally.
composition

F051B  : three pieces of flesh vertically.
composition

F051C  :  F051 reversed.
rotation

F052  : excrement.
TSL 3111

F053  : divine rod with  F007.
Provisionally TSL 3119.

G001  : Egyptian vulture.
TSL 3195

G002  : two Egyptian vultures.
TSL 3365

G003  : combination of  G001 and  U001.
TSL 3515

G004  : buzzard.
TSL 3551

G005  : falcon.
TSL 3582

G006  : combination of  G005 and  S045.
TSL 3598

G006A  : falcon on  V030.
Provisionally TSL 3257.

G007  : falcon on  R012.
TSL 3611

G007A  : falcon in boat.
TSL 3626_00

G007B  : falcon in boat.
TSL 3626_01

G008  : falcon on  S012.
TSL 3632

G009  : falcon with  N005 on head.
TSL 3648

G010  : falcon in Sokar barque.
TSL 3196

G011  : image of falcon.
TSL 3210

G011A  : image of falcon on  R012.
Not attested.

G012  : combination of  G011 and  S045.
TSL 3223

G013  : image of falcon with  S009.
TSL 3243

G014  : vulture.
TSL 3260

G015  : combination of  G014 and  S045.
TSL 3275

G016  : vulture and cobra each on  V030.
TSL 3293

G017  : owl.
TSL 3310

G018  : two owls.
TSL 3329

G019  : combination of  G017 and  D037.
composition
Provisionally TSL 3347. Not attested.

G020  : combination of  G017 and  D036.
TSL 3366

G020A  : combination of  G017 and  D021.
composition
Provisionally TSL 3649. Not attested in exact form.

G021  : guinea-fowl.

TSL 3381

G022  : hoopoe.
TSL 3404

G023  : lawping.
TSL 3417_00

G024  : lawping with twisted wings.
TSL 3417_01

G025  : northern bald ibis.
TSL 3444

G026  : sacred ibis on  R012.
TSL 3456

G026A  : sacred ibis.
TSL 3469

G027  : flamingo.
TSL 3473

G028  : glossy ibis.
TSL 3487

G029  : saddle-billed stork.
TSL 3500

G030  : three saddle-billed storks.
TSL 3516

G031  : heron.
TSL 3528

G032  : heron on perch.
TSL 3538

G033  : cattle egret.
TSL 3539

G034  : ostrich.
TSL 3541

G035  : cormorant.
TSL 3543

G036  : swallow.
TSL 3544

G036A  : swallow (low).
variant

G037  : sparrow.
TSL 3545

G037A  : sparrow (low).
variant

G038  : white-fronted goose.
TSL 3546

G039  : pintail.
TSL 3547

G040  : pintail flying.
TSL 3552

G041  : pintail alighting.
TSL 3562

G042  : widgeon.
TSL 3565

G043  : quail chick.
TSL 3566

G043A  : combination of  G043 and  X001.
composition

G044  : two quail chicks.
TSL 3568

G045  : combination of  G043 and  D036.
TSL 3569

G045A  : combination of  G043 and  D037.
composition
Provisionally TSL 3439.

G046  : combination of  G043 and  U001.
TSL 3570

G047  : duckling.
TSL 3571

G048  : three ducklings in nest.
TSL 3574

G049  : three ducklings in pool.
TSL 3576

G050  : two plovers.
TSL 3583

G051  : bird pecking at fish.
TSL 3584

G052  : goose picking up grain.
TSL 3586

G053  : human-headed bird with  R007.
TSL 3587

G054  : plucked bird.
TSL 3591

H001  : head of pintail.
TSL 3663

H002  : head of crested bird.
TSL 3681

H003  : head of spoonbill.
TSL 3694

H004  : head of vulture.
TSL 3705

H005  : wing.
TSL 3714

H006 : feather.
TSL 3717_00

H006A  : hieratic feather.
TSL 3717_01

H007  : claw.
TSL 3722

H008 : egg.
TSL 3724

I001  : gecko.
TSL 33

I002  : turtle.
TSL 40

I003  : crocodile.
TSL 49

I004  : crocodile on shrine.
TSL 46

I005  : crocodile with curved tail.
TSL 50

I005A  : image of crocodile.
TSL 42

I006  : crocodile scales.
TSL 39

I007  : frog.
TSL 54

I008  : tadpole.
TSL 56

I009  : horned viper.
TSL 35

I009A  : horned viper crawling out of enclosure.
TSL 57

I010  : cobra.
TSL 38

I010A  : cobra with feather.
To be added to TSL.

I011  : two cobras.
TSL 70

I011A  : combination of  I010,  X001 and  N018.
composition

I012  : erect cobra.
TSL 6835

I013  : erect cobra on  V030.
TSL 80

I014  : snake.
TSL 34

I015  : snake.
TSL 81

K001  : tilapia.
TSL 3725

K002  : barbel.
TSL 3740

K003  : mullet.
TSL 3751

K004  : elephant-snout fish.
TSL 3752

K005  : Petrocephalus bane.
TSL 3755

K006  : fish scale.
TSL 3756

K007  : puffer.
TSL 3758

K008  : catfish.
TSL 3731

L001  : dung beetle.
TSL 6

L002  : bee.
TSL 16

L002A  : combination of  M023,  L002 and two  X001.
composition

L003  : fly.
TSL 17
Not attested in hieroglyphic texts.

L004  : locust.
TSL 21

L005  : centipede.
TSL 22

L006  : shell.
TSL 24

L006A  :  L006 reversed.
mirroring

L007  : scorpion.
TSL 27

L008  : click beetle.
Attested, but not clear whether prototype should have legs.

M001  : tree.
TSL 3761

M001A  : combination of  M001 and  M003.
composition
Provisionally TSL 3903.

M001B  : combination of  M001 and  I009.
composition
Provisionally TSL 4034. Only attested in transcription.

M002  : plant.
TSL 3907

M003  : branch.
TSL 3978

M003A  : combination of  G017 and  M003.
composition
Provisionally TSL 4013.

M004  : palm branch.
TSL 4019

M005  : combination of  M004 and  X001.
TSL 4037

M006  : combination of  M004 and  D021.
TSL 4053

M007  : combination of  M004 and  Q003.
TSL 4065

M008  : pool with lotus flowers.
TSL 4083

M009  : lotus flower.
TSL 4109

M010  : lotus bud with straight stem.
TSL 3762

M010A  : lotus bud with winding stem.
TSL 4069

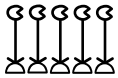
M011  : flower on long twisted stalk.
TSL 3775

M012  : lotus plant.
TSL 3792

M012A 
composition

M012B 
composition

M012C 
composition

M012D 
composition

M012E 
composition

M012F 
composition

M012G 
composition

M012H 
composition

M013  : papyrus.
TSL 3805

M014  : combination of  M013 and  I010.
TSL 3824

M015  : clump of papyrus with buds.
TSL 3838

M015A  : combination of  M015 and  O049.
Provisionally TSL 3818.

M016  : clump of papyrus.
TSL 3852

M016A  : combination of  M016 and  O049.
Provisionally TSL 3820.

M017  : reed.
TSL 3866

M017A  : two reeds.
composition

M018  : combination of  M017 and  D054.
TSL 3880

M019  : heaped conical cakes between  M017 and  U036.
TSL 3892

M020  : field of reeds.
TSL 3908

M021  : reeds with root.
TSL 3921

M022  : rush.
TSL 3932

M022A  : two rushes.
TSL 7001

M023  : sedge.
TSL 3946

M024  : combination of  M023 and  D021.
TSL 3958

M024A : lily.
TSL 3800

M025  : combination of  M026 and  D021.
TSL 3970

M026  : flowering sedge.
TSL 3971

M027  : combination of  M026 and D036.
TSL 3973

M028  : combination of  M026 and V020.
TSL 3974

M028A  : three lilies on  O049.
Provisionally TSL 3827.

M029  : pod.
TSL 3975

M030  : root.
TSL 3979

M031  : rhizome.
TSL 3987

M031A  : M001 in pot.
Associated with TSL 3987, but represents something different: tree in pot. Cf. Collombert in RdE 65 (2014).

M032  : rhizome.
TSL 3991

M033  : 3 grains horizontally.
TSL 3993_00

M033A  : 3 grains vertically.
TSL 3993_01

M033B  : 3 grains in triangular arrangement.
TSL 3993_02

M034  : ear of emmer.
TSL 3996

M035  : heap of grain.
TSL 3998

M036  : bundle of flax showing bolls.
TSL 3999

M037  : bundle of flax.
TSL 4001

M038  : wide bundle of flax.
TSL 4005

M039  : basket of fruit or grain.
TSL 4008

M040  : bundle of reeds.
TSL 4020

M040A  : bundle of reeds.
variant

M041  : piece of wood.
TSL 4024

M042  : flower.
TSL 4025

M043  : vine on trellis.
TSL 4026

M044  : thorn.
TSL 4029

N001  : sky.
TSL 4127

N002  : sky with sceptre.
TSL 4204_00

N003  : sky with sceptre.
TSL 4204_01

N004  : sky with rain.
TSL 4272

N005  : sun.
TSL 4293

N006  : sun with uraeus.
TSL 4312

N007  : combination of  N005 and  T028.
TSL 4334

N008  : sunshine.
TSL 4348

N009  : moon with lower half obscured.
TSL 4363_00

N010  : moon with lower section obscured.
TSL 4363_01

N011  : crescent moon.
TSL 4145

N012  : crescent moon.
TSL 4161

N013  : combination of  N011 and  N014.
TSL 4173

N014  : star.
TSL 4188

N015  : star in circle.
TSL 4195

N016  : land with grains.
TSL 4196_00

N017 : land.
TSL 4196_01

N018  : sandy tract.
TSL 4201

N018A  : combination of  N018 and N035.
TSL 4131

N018B  : combination of  X004B and O034.
Unclear whether a middle insertion is appropriate to form composed sign.

N019  : two sandy tracts.
TSL 4203

N020  : tongue of land.
TSL 4205

N021  : short tongue of land.
TSL 4213

N022  : broad tongue of land.
TSL 4216

N023  : irrigation canal.
TSL 4217

N024  : irrigation canal system.
TSL 4218

N025  : three hills.
TSL 4227

N025A  : three hills (low).
variant

N026  : two hills.
TSL 4228

N027  : sun over mountain.
TSL 4229

N028  : rays of sun over hill.
TSL 4231

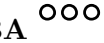
N029  : slope of hill.
TSL 4236

N030  : mound of earth.
TSL 4238

N031  : road with shrubs.
TSL 4240

N032  : lump of clay.
TSL 4250

N033  : grain.
TSL 4251

N033A  : three grains.
TSL 4252

N034  : ingot of metal.
TSL 4253

N034A  : ingot of metal.
variant

N035 : ripple of water.
TSL 4255

N035A  : three ripples of water.
TSL 4256

N036  : canal.
TSL 4259

N037  : pool.
TSL 4265_00

N037A  : pool.
TSL 4265_03

N038  : deep pool.
TSL 4265_01

N039  : pool with water.
TSL 4265_02

N040  : combination of  N037 and  D054.
TSL 4273

N041  : well with ripple of water.
TSL 4275_00

N042  : well with line of water.
TSL 4275_01

NL001  : sign of first nome of Lower Egypt.

NL002  : sign of second nome of Lower Egypt.

NL003  : sign of third nome of Lower Egypt.

NL004  : sign of fourth nome of Lower Egypt.

NL005  : sign of fifth nome of Lower Egypt.

NL005A  : sign of fifth nome of Lower Egypt.

NL006  : sign of sixth nome of Lower Egypt.

NL007  : sign of seventh nome of Lower Egypt.

NL008  : sign of eighth nome of Lower Egypt.

NL009  : sign of ninth nome of Lower Egypt.

NL010  : sign of tenth nome of Lower Egypt.

NL011  : sign of eleventh nome of Lower Egypt.

NL012  : sign of twelfth nome of Lower Egypt.

NL013  : sign of thirteenth nome of Lower Egypt.

NL014  : sign of fourteenth nome of Lower Egypt.

NL015  : sign of fifteenth nome of Lower Egypt.

NL016  : sign of sixteenth nome of Lower Egypt.

NL017  : sign of seventeenth nome of Lower Egypt.

NL017A  : sign of seventeenth nome of Lower Egypt.

NL018  : sign of eighteenth nome of Lower Egypt.

NL019  : sign of nineteenth nome of Lower Egypt.

NL020  : sign of twentieth nome of Lower Egypt.

NU001  : sign of first nome of Upper Egypt.

NU002  : sign of second nome of Upper Egypt.

NU003  : sign of third nome of Upper Egypt.

NU004  : sign of fourth nome of Upper Egypt.

NU005  : sign of fifth nome of Upper Egypt.

NU006  : sign of sixth nome of Upper Egypt.

NU007  : sign of seventh nome of Upper Egypt.

NU008  : sign of eighth nome of Upper Egypt.

NU009  : sign of ninth nome of Upper Egypt.

NU010  : sign of tenth nome of Upper Egypt.

NU010A  : sign of tenth nome of Upper Egypt.

NU011  : sign of eleventh nome of Upper Egypt.

NU011A  : sign of eleventh nome of Upper Egypt.

NU012  : sign of twelfth nome of Upper Egypt.

NU013  : sign of thirteenth nome of Upper Egypt.

NU014  : sign of fourteenth nome of Upper Egypt.

NU015  : sign of fifteenth nome of Upper Egypt.

NU016  : sign of sixteenth nome of Upper Egypt.

NU017  : sign of seventeenth nome of Upper Egypt.

NU018  : sign of eighteenth nome of Upper Egypt.

NU018A  : sign of eighteenth nome of Upper Egypt.

NU019  : sign of nineteenth nome of Upper Egypt.

NU020  : sign of twentieth nome of Upper Egypt.

NU021  : sign of twenty-first nome of Upper Egypt.

NU022  : sign of twenty-second nome of Upper Egypt.

NU022A  : sign of second nome of Upper Egypt.

O001  : house.
TSL 4374

O001A  : combination of  O001 and  S034.
composition

O002  : combination of  O001 and  T003.
TSL 4538

O003  : combination of  O001,  P008,  X003, and  W022 .
TSL 4706

O004  : shelter.
TSL 4790

O005  : winding wall from upper-left corner.
TSL 4852

O005A  : winding wall from lower-left corner.
mirroring

O006  : enclosure.
TSL 4867

O006A  : opening of ḥwt -enclosure.
typographical

O006B  : opening of ḥwt -enclosure.
typographical

O006C  : opening of ḥwt -enclosure.
typographical

O006D  : closing of ḥwt -enclosure.
typographical

O006E  : closing of ḥwt -enclosure.
typographical

O006F  : closing of ḥwt -enclosure.
typographical

O007  : combination of  O006 and  X001.

TSL 4884

O008  : combination of  O007 and  O029.
TSL 4896

O009  : combination of  O007 and  V030.
TSL 4912

O010  : combination of  O006 and  G005.
TSL 4375

O010A  : combination of  O006 and  S034.
composition

O010B  : combination of  O006 and  L002.
composition

O010C  : combination of  O018 and  D002.
composition

O011  : palace.
TSL 4389

O012  : combination of  O011 and  D036.
TSL 4403

O013  : battlemented enclosure.
TSL 4422

O014  : part of battlemented enclosure.
TSL 4439

O015  : enclosure with  W010 and  X001.
TSL 4455

O016  : gateway with serpents.
TSL 4469

O017  : open gateway with serpents.
TSL 4489

O018  : shrine in profile.

TSL 4502

O019  : shrine with fence.
TSL 4520_00

O019A  : shrine.
TSL 4520_01

O020  : shrine.
TSL 4539

O020A  : shrine.
variant

O021  : faade of shrine.
TSL 4552

O022  : booth with pole.
TSL 4572

O023  : double platform.
TSL 4590

O024  : pyramid.
TSL 4622

O024A  : pedestal of sun temple.
Shape is similar to TSL 4634, but it may be a different sign.

O025  : obelisk.
TSL 4635

O025A  : obelisk and pedestal of sun temple.
variant

O026  : stela.
TSL 4647

O027  : hall of columns.
TSL 4663

O028  : column.
TSL 4676

O029  : horizontal wooden column.
TSL 4692_00

O029A  : vertical wooden column.
TSL 4692_01

O030  : support.
TSL 4707

O030A  : four supports.
composition

O031  : door.
TSL 4718

O032  : gateway.
TSL 4729

O033  : faade of palace.
TSL 4746

O033A  : closing of srḫ -enclosure.
typographical

O034 : bolt.
TSL 4760

O035  : combination of O034 and  D054.
TSL 4771

O036  : wall.
TSL 4776

O036A  : opening of oval fortified wall enclosure.
typographical

O036B  : closing of oval fortified wall enclosure.
typographical

O036C  : opening of square fortified wall enclosure.
typographical

O036D  : closure of square fortified wall enclosure.
typographical

O037  : falling wall.
TSL 4783

O038  : corner of wall.
TSL 4785

O039  : stone.
TSL 4788

O040  : stairway.
TSL 4791

O041  : double stairway.
TSL 4803

O042  : fence.
TSL 4814_00

O043  : low fence.
TSL 4814_01

O044  : emblem of Min.
TSL 4837

O045  : domed building.
TSL 4841_00

O046  : domed building.
TSL 4841_01

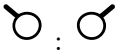
O047  : enclosed mound.
TSL 4844

O048  : enclosed mound.
TSL 4845

O049  : village.
TSL 4848

O050  : threshing floor.
TSL 4853

O050A  : hieratic threshing floor.
Not attested.

O050B  : O050A reversed.
mirroring
Exact form not attested.

O051  : pile of grain.
TSL 4854

P001  : boat.
TSL 4933

P001A  : boat upside down.
TSL 4976

P002  : ship under sail.
TSL 4979

P003  : sacred barque.
TSL 5010

P003A  : sacred barque without steering oar.
variant
Not attested.

P004  : boat with net.
TSL 5028

P005  : sail.
TSL 5050

P006  : mast.
TSL 5088

P007  : combination of  P006 and  D036.
TSL 5110

P008  : oar.

TSL 5126

P009  : combination of  P008 and  I009.
TSL 5139

P010  : steering oar.
TSL 4934

P011  : mooring post.
TSL 4948

Q001  : seat.
TSL 5153

Q002  : portable seat.
TSL 5177

Q003  : stool.
TSL 5195

Q004  : head-rest.
TSL 5207

Q005  : chest.
TSL 5217

Q006  : coffin.
TSL 5218

Q007  : brazier.
TSL 5228

R001  : high table with offerings.
TSL 5238

R002  : table with slices of bread.
TSL 5320

R002A  : high table with offerings.
Provisionally TSL 5317. Or could be the same sign as TSL 5315.

R003  : low table with offerings.
TSL 5349

R003A  : low table.
Provisionally TSL 5383.

R003B  : low table with offerings (simplified).
Could be seen as variant of R3.

R004  : loaf on mat.
TSL 5394

R005  : narrow censer.
TSL 5410_00

R006  : broad censer.
TSL 5410_01

R007  : bowl with smoke.
TSL 5439

R008  : cloth on pole.
TSL 5457

R009  : combination of  R008 and  V033.
TSL 5471

R010  : combination of  R008,  T028 and  N029.
TSL 5239_00

R010A  : combination of  R008 and  T028.
TSL 5239_03

R011  : reed column.
TSL 5258

R012  : standard.
TSL 5269

R013  : falcon and feather on standard.
TSL 5282

R014  : feather on standard.
TSL 5287

R015  : spear emblem.
TSL 5291

R016  : sceptre with feathers and string.
TSL 5294

R016A  : sceptre with feathers.
Attested.

R017  : wig on pole.
TSL 5297

R018  : combination of  R017 and  N024.
TSL 5302

R019  :  S040 with feather.
TSL 5309

R020  : flower with horns.
TSL 5321_00

R021  : flower with horns.
TSL 5321_01

R022 : two narrow belemnites.
TSL 5334_00

R023  : two broad belemnites.
TSL 5334_01

R024  : two bows tied horizontally.
TSL 5338

R025  : two bows tied vertically.
TSL 5340

R026  : combination of N017,  F036,  M024A and  M013.
Attested.

R027  : two arrows crossed over a shield.
Not attested.

R028  : Bat.
TSL 5279

R029  : niche with serpent.
Provisionally TSL 4529.

S001  : white crown.
TSL 5482

S002  : combination of  S001 and  V030.
TSL 5636

S002A  : combination of  S001 and  O049.
Attested.

S003  : red crown.
TSL 5659

S004  : combination of  S003 and  V030.
TSL 5689

S005  : double crown.
TSL 5710

S006  : combination of  S005 and  V030.
TSL 5727

S006A  : combination of  S003 and  O049.
Attested.

S007  : blue crown.
TSL 5744

S008  : ʒtf -crown.
TSL 5761

S009  : two plumes.
TSL 5773

S010  : headband.
TSL 5483

S011  : broad collar.
TSL 5501

S012  : collar of beads.
TSL 5517

S013  : combination of  S012 and  D058.
TSL 5537

S014  : combination of  S012 and  T003.
TSL 5551

S014A  : combination of  S012 and  S040.
TSL 5563

S014B  : combination of  S012 and  S040.
Not attested.

S015  : pectoral.
TSL 5567

S016  : pectoral.
TSL 5582

S017  : pectoral.
TSL 5593

S017A  : girdle.
TSL 5603

S018  : necklace with counterpoise.
TSL 5606

S019  : necklace with seal from side.
TSL 5622

S020  : necklace with seal from front.
TSL 5637

S021  : ring.
TSL 5643

S022  : shoulder-knot.
TSL 5645

S023  : knotted cloth.
TSL 5647

S024 : girdle knot.
TSL 5648

S025  : garment with ties.
TSL 5649

S026  : apron.
TSL 5650

S026A  : apron.
Merged into TSL 4201.

S026B  : apron.
Only attested in facsimile.

S027  : cloth with two strands.
TSL 5651

S028  : cloth with fringe on top and  S029.
TSL 5653

S029  : folded cloth.
TSL 5655

S030  : combination of  S029 and  I009.
TSL 5660

S031  : combination of  S029 and  U001.
TSL 5669

S032  : cloth with fringe on the side.
TSL 5670

S033  : sandle.
TSL 5672

S034  : sandle-strap.
TSL 5673

S035  : sunshade.
TSL 5676_01

S035A  : sunshade.
variant

S036  : sunshade.
TSL 5676_00

S037  : fan.
TSL 5681

S038 : crook.
TSL 5686

S039  : shepherd's crook.
TSL 5688

S040  : sceptre.
TSL 5690

S041  : sceptre with spiral shaft.
TSL 5691

S042  : sceptre of authority.
TSL 5692

S043  : walking stick.
TSL 5694

S044  : walking stick with  S045.
TSL 5699

S045  : flagellum.
TSL 5701

S046  : covering for head and neck.
TSL 5719

T001  : mace with flat head.
TSL 5786

T002  : mace with round head diagonally.
TSL 5859

T003  : mace with round head vertically.
TSL 5915

T003A  : combination of  T003 and  N026.
Attested.

T004  : mace with strap.
TSL 5938

T005  : combination of  T003 and  I010.
TSL 5948

T006  : combination of  T003 and two  I010.
TSL 5962

T007  : axe.
TSL 5981

T007A  : axe.
Provisionally TSL 5996.

T008  : dagger.
TSL 6000_00

T008A  : dagger.
TSL 6000_01

T009 : bow.
TSL 6022_00

T009A : bow.
TSL 6022_01

T010 : composite bow.
TSL 5787

T011  : arrow.
TSL 5800

T011A  : two crossed arrows.
There are doubts about desired prototype.

T012  : bow-string.
TSL 5817

T013  : joined pieces of wood.
TSL 5831

T014  : throw stick vertically.
TSL 5844_00

T015  : throw stick slanted.
TSL 5844_01

T016  : scimitar.
TSL 5849

T016A  : scimitar.
Provisionally TSL 5850.

T017  : chariot.
TSL 5851

T018  : crook with package attached.
TSL 5852

T019  : harpoon head.
TSL 5854

T020  : harpoon head.
TSL 5854

T021  : harpoon.
TSL 5869

T022  : arrowhead.
TSL 5881_00

T023  : arrowhead.
TSL 5881_01

T024  : fishing-net.
TSL 5888

T025  : floats.
TSL 5893

T026  : bird-trap.
TSL 5899_00

T027  : bird-trap.
TSL 5899_02

T028  : butcher's block.
TSL 5909

T029  : combination of  T030 and  T028.
TSL 5911

T030  : knife.
TSL 5916

T031  : knife-sharpener.
TSL 5919

T032  : combination of  T031 and  D054.
TSL 5921

T032A  : combination of  T031 and  S029.
composition

T033  : knife-sharpener of butcher.
TSL 5924

T033A  : combination of  T033 and  S029.
composition

T034  : butcher's knife.
TSL 5926_00

T035  : butcher's knife.
TSL 5926_01

T036  : shield.
TSL 5928

U001  : sickle.
TSL 6042_00

U002  : sickle (low).
TSL 6042_01

U003  : combination of  U001 and  D004.
TSL 6154

U004  : combination of  U001 and AA011.
TSL 6197_00

U005  : combination of  U002 and AA011.
TSL 6197_01

U006  : diagonal hoe.
TSL 6224_00

U006A  : vertical hoe.
rotation

U006B  :  U006A reversed.
mirroring,rotation

U007  : horizontal hoe.
TSL 6224_01

U008  : hoe without connecting rope.
TSL 6250

U009  : grain-measure with grain.
TSL 6261

U010  :  U009 beneath  M033.
TSL 6043

U011  : combination of  S038 and  U009.
TSL 6058

U012  : combination of  D050 and  U009.
TSL 6069

U013  : plough.
TSL 6081

U014  : two joined branches.
TSL 6090

U015  : sledge.
TSL 6092

U016  : sledge with head of jackal.
TSL 6094

U017  : pick in ground.
TSL 6099_00

U018  : pick in basin.
TSL 6099_01

U019  : adze.
TSL 6101_00

U020  : adze.
TSL 6101_01

U021  : adze on wood.
TSL 6115

U022  : chisel.
TSL 6117

U023  : chisel.
TSL 6120

U023A  : chisel.
variant
Provisionally TSL 6121.

U024  : drill for stone.
TSL 6126_00

U025  : drill for stone.
TSL 6126_01

U026  : drill for beads.
TSL 6146_00

U027  : drill for beads.
TSL 6146_01

U028  : fire-drill.
TSL 6151_00

U029  : fire-drill.
TSL 6151_01

U029A  : fire-drill with string.
Provisionally TSL 6153.

U030  : kiln.
TSL 6155

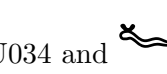
U031  : baker's rake.
TSL 6158

U032  : pestle and mortar.
TSL 6159

U032A  : hieratic pestle and mortar.
Attested.

U033  : pestle.
TSL 6163

U034  : spindle.
TSL 6166

U035  : combination of  U034 and  I009.
TSL 6168

U036  : club.
TSL 6170

U037  : razor.
TSL 6173

U038  : balance.
TSL 6175

U039  : post of balance.
TSL 6179

U040  : hieratic post of balance.
TSL 6198

U041  : plummet.
TSL 6199

U042  : pitchfork.
TSL 4717

V001  : coil of rope.
TSL 6282

V001A 
composition

V001B 
composition

V001C 
composition

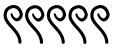
V001D 
composition

V001E 
composition

V001F 
composition

V001G 
composition

V001H 
composition

V001I 
composition

V002  : combination of O034 and  V001.
TSL 6343

V002A  : hieratic form of  V002.
Cf. TSL 3130.

V003  : combination of O034 and three  V001.
TSL 6379

V004  : lasso.
TSL 6406

V005  : looped rope.
TSL 6420

V006  : cord with ends upward.
TSL 6433

V007  : cord with ends downward.
TSL 6447

V007A  : cord with ends downward.
variant

V007B  : hieratic cord with ends downward.
Provisionally TSL 6419. Only attested in hieratic.

V008  : cord downward.
TSL 6458

V009  : round cartouche.
TSL 6469

V010  : oval cartouche.
TSL 6283

V011  : end of cartouche.
TSL 6296

V011A  : opening of cartouche.
typographical

V011B  : closing of cartouche.
typographical

V011C  : closing of knotless cartouche.
typographical

V012  : string.
TSL 6310

V012A  : string.
variant
Provisionally TSL 3689.

V012B  : string.
variant

V013  : rope.
TSL 6321

V014  : rope with tick.
TSL 6332

V015  : combination of  V013 and  D054.
TSL 6334

V016  : looped cord.
TSL 6335

V017  : shelter of papyrus.
TSL 6338_00

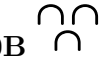
V018  : shelter of papyrus.

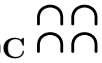
TSL 6338_01

V019  : hobble with cross-bar.
TSL 6342

V020  : hobble.
TSL 6344

V020A 
composition

V020B 
composition

V020C 
composition

V020D 
composition

V020E 
composition

V020F 
composition

V020G 
composition

V020H 
composition

V020I 
composition

V020J 
composition

V020K 
composition

V020L 

composition

V021  : combination of  V020 and  I010.
TSL 6353

V022  : whip.
TSL 6359_00

V023  : whip.
TSL 6359_01

V023A  : whip.
variant
Provisionally TSL 6361.

V024  : cord on stick.
TSL 6363_00

V025  : cord on stick with tick.
TSL 6363_01

V026  : netting needle.
TSL 6365_00

V027  : netting needle.
TSL 6365_01

V028  : wick.
TSL 6369

V028A  : combination of  V028 and  D036.
TSL 6449

V029  : swab.
TSL 6375

V029A  : combination of  V029 and  V031.
composition
Provisionally TSL 6470.

V030  : basket.
TSL 6380

V030A  : basket (low).
variant

V031  : basket with right handle.
TSL 6381_00

V031A  : basket with left handle.
TSL 6381_01

V032  : frail.
TSL 6385

V033  : bag.
TSL 6391_00

V033A  : bundle.
Attested. It may be a variant of TSL 6391 , or an independent sign.

V034  : bag.
TSL 6391_01

V035  : bag.
TSL 6391_02

V036  : receptacle.
TSL 6394

V037  : bandage.
TSL 6402

V037A  : bandage.
Provisionally TSL 2935.

V038  : bandage.
TSL 6403

V039  : knot-amulet.
TSL 6404

V040  : hobble on its side.
rotation

V040A  : two hobbles on their side.
composition

W001  : oil jar with ties.
TSL 6480

W002  : oil jar.
TSL 6534

W003  : alabaster basin.
TSL 6580

W003A  : alabaster basin (low).
variant

W004  : combination of  O022 and  W003.
TSL 6600

W005  : combination of  T028 and  W003.
TSL 6614

W006  : metal vessel.
TSL 6628

W007  : granite bowl.
TSL 6640

W008  : deformed granite bowl.
TSL 6653

W009  : jug with left handle.
TSL 6664

W009A  : jug with right handle.
mirroring

W010  : cup.
TSL 6481

W010A  : pot with tick.
Provisionally TSL 6492.

W011  : round ring stand.
TSL 6495_00

W012  : square ring stand.
TSL 6495_01

W013  : earthenware pot.
TSL 6515

W014  : water jar.
TSL 6516

W014A  : combination of  V028,  W014 and O034 .
composition

W015  : water jar with water.
TSL 6518

W016  : water jar with water in ring stand.
TSL 6521

W017  : three water jars in rack.
TSL 6523_00

W017A  : three water jars in rack (simplified).
Similar to TSL 6523_02 .

W018  : four water jars in rack.
TSL 6523_01

W018A  : four water jars in rack (simplified).
variant
Possibly does not exist. (Added to Unicode for uniformity with W017A ?)

W019  : milk jug in net.
TSL 6531

W020  : milk jug with leaf.
TSL 6535

W021  : twin wine jars.
TSL 6545

W022  : beer jug.
TSL 6559

W023  : jar with handles.
TSL 6568

W024  : bowl.
TSL 6571

W024A  : three bowls.
composition

W025  : combination of  W024 and  D054.
TSL 6572

X001  : flat loaf.
TSL 6678

X002  : tall loaf.
TSL 6686_00

X003  : tall loaf.
TSL 6686_01

X004  : roll of bread.
TSL 6695_00
Prototype should be adjusted.

X004A  : roll of bread.
variant

X004B  : roll of bread.
TSL 6695_01

X005  : hieratic roll of bread.
TSL 6703

X006  : round loaf.
TSL 6705

X006A  : round loaf.
variant

X007  : half-loaf.
TSL 6710

X008  : conical loaf.
TSL 6711

X008A  : hieratic conical loaf.
variant

Y001  : scroll with ties.
TSL 6712_00

Y001A  : vertical scroll with ties.
TSL 6712_01

Y002  : scroll.
TSL 6712_02

Y003  : scribe's outfit with palette on left.
TSL 6740_00

Y004  : scribe's outfit with palette on right.
TSL 6740_01

Y005  : game board.
TSL 6746

Y006  : game piece.
TSL 6748

Y007  : harp.
TSL 6749

Y008  : sistrum.
TSL 6751

Z001 : stroke.
TSL 6753

Z002 : three Z001 horizontally.
TSL 6781_00

Z002A : three Z001 horizontally.
variant

Z002B : three D067 horizontally.
variant

Z002C : three Z001 in triangular arrangement.
TSL 6781_01

Z002D : three Z001 in triangular arrangement.
TSL 6781_02

Z003 : three Z001 vertically.
TSL 6799

Z003A : three lying Z001 vertically.
TSL 6810

Z003B : three D067 vertically.
variant

Z004 : two diagonal strokes.
TSL 6811

Z004A : two Z001 horizontally.
TSL 6812

Z005 : curved diagonal stroke.
TSL 6814

Z005A : diagonal stroke.
Provisionally TSL 6815.

Z006 : hieratic substitute for A013 or A014.
TSL 6816

Z007 : hieratic quail chick.
TSL 6818

Z008 : oval.
TSL 6819

Z009  : diagonal cross.
TSL 6820

Z010  : wide diagonal cross.
TSL 6754

Z011  : cross.
TSL 6764

Z012  : hieratic striking man.
Provisionally TSL 6772.

Z013  : circle.
Could be used for an abstract circle not representing any particular object, including use as phonetic determinative qd

Z014  : indeterminable hieratic tick.
Hard to assign a precise meaning.

Z015 : long vertical stroke.
Merged into TSL 6753?

Z015A 
composition

Z015B 
composition

Z015C 
composition

Z015D 
composition

Z015E 
composition

Z015F 
composition

Z015G 

composition

Z015H 
composition

Z015I 
composition

Z016 : long horizontal stroke.
rotation
Merged into TSL 6753?

Z016A 
composition

Z016B 
composition

Z016C 
composition

Z016D 
composition

Z016E 
composition

Z016F 
composition

Z016G 
composition

Z016H 
composition

AA001  : basket from above.
TSL 931

AA002  : pustule.
TSL 953

AA003  : pustule with liquid.
TSL 1000

AA004  : pot with two ticks.
TSL 1015

AA005  : navigation instrument.
TSL 1028

AA006  : instrument.
TSL 1043

AA007 : instrument.
TSL 1054

AA007A  :  AA007 reversed.
mirroring

AA007B  : later equivalent of  AA007.
May represent leg of cow.

AA008  : irrigation canal.
TSL 1065

AA009 : instrument.
TSL 1069

AA010  : unknown.
TSL 932

AA011 : platform.
TSL 937_00

AA012 : platform.
TSL 937_01

AA013  : sharp half.
TSL 947_01

AA014  : bent half.
TSL 947_02

AA015  : blunt half.
TSL 947_00

AA016  : short half.
TSL 948

AA017  : lid.
TSL 949_00

AA018  : square lid.
TSL 949_01

AA019  : instrument.
TSL 952

AA020  : bag.
TSL 954

AA021  : instrument.
TSL 958

AA022  : combination of  AA021 and  D036.
TSL 962

AA023  : high warp between stakes.
TSL 963_00

AA024  : low warp between stakes.
TSL 963_01

AA025  : unknown.
TSL 987

AA026  : unknown.
TSL 989

AA027  : spindle.
TSL 990

AA028  : level.
TSL 998_00

AA029  : instrument.
TSL 998_01

AA030  : frieze.
TSL 1001_00

AA031  : frieze.
TSL 1001_01

AA032  : archaic bow.
TSL 1003