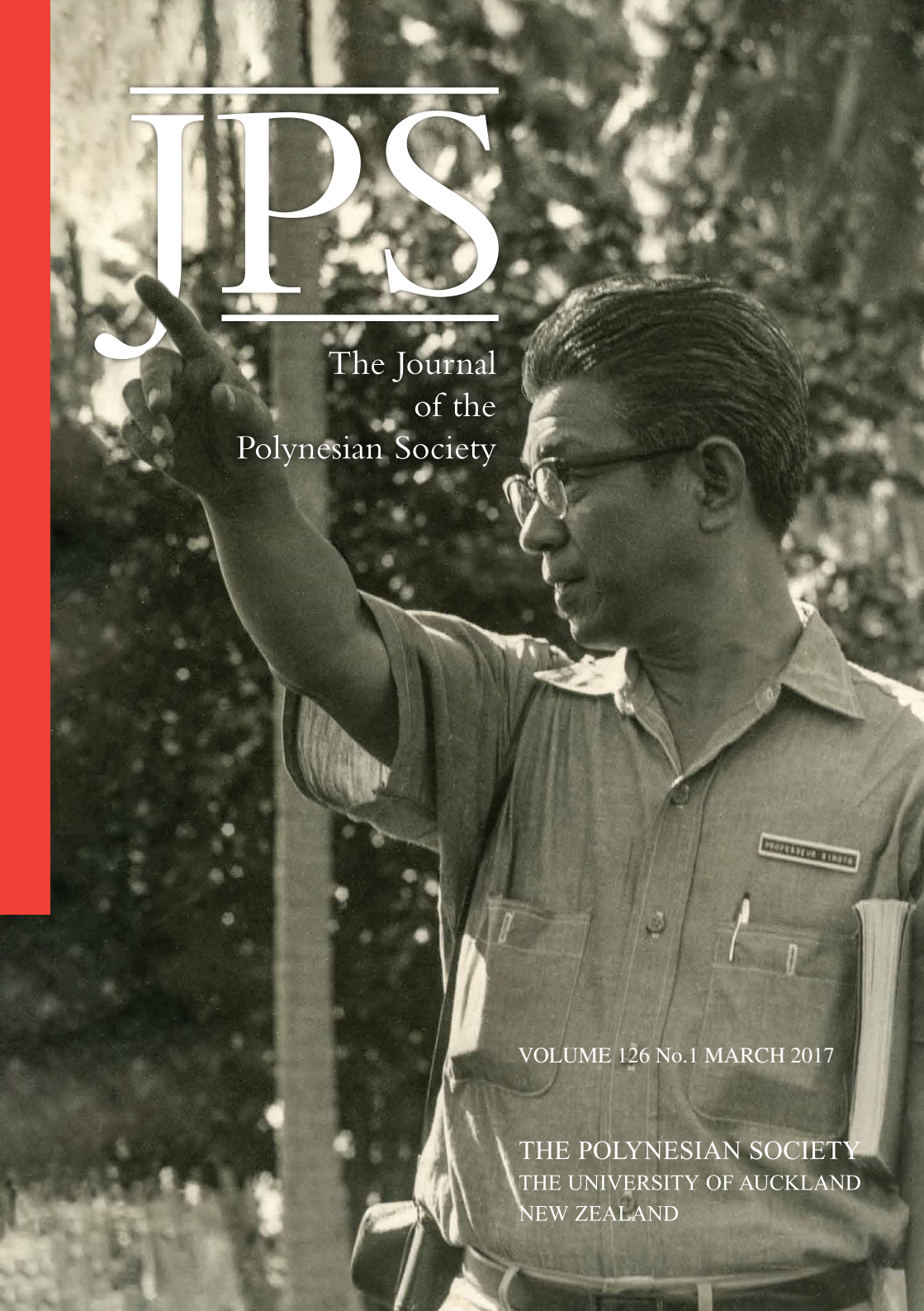

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ALLOGRAPHS, GRAPHIC VARIANTS AND ICONIC FORMULAE IN THE KOHAU RONGORONGO SCRIPT OF RAPA NUI (EASTER ISLAND)

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Ho'okauhua Hina-a-ke-ahi, hānau he moa,
He huamoa ke keiki a Hina

"Hina-of-the-Fire conceived, a fowl was born,
The child of Hina was delivered in the shape of an egg"

(*Kumulipo*, lines 1990-1991 in Beckwith 1951)

Dedicated to the memory of Boris Kudrjavtzev whose discoveries gave birth to this work.[1]

The Kohau Rongorongo script of Rapa Nui (Easter Island) remains undeciphered. It has been suggested that the script is an invention inspired by early contacts with European visitors (Emory 1968: 154). Nevertheless, the unique direction of writing, sometimes termed "double" or "reverse boustrophedon", and the logosyllabic nature of the script evidencing use of logographic signs, syllabic signs and phonetic complements (Davletshin 2012a, 2012b), make the hypothesis of a direct borrowing improbable. Emphatically, none of numerous pictorial signs of Kohau Rongorongo depict expected European objects such as ships, hats and knives. This observation strongly suggests that the invention of the script took place in pre-contact times. It also makes highly unlikely the hypothesis of an indirect borrowing based on observations of Europeans who wrote in the presence of islanders. After decipherment of the script scholars will have at their disposal a unique source of information about the pre-contact culture and language of Rapa Nui (referred to by linguists as Rapanui) and Oceania in general as the script is the only known writing system of Oceania that pre-dates the arrival of Europeans. Along with the Near East, the Far East and Mesoamerica, Rapa Nui seems to be one of three or four places where writing was independently invented by humankind.[2] Thus, decipherment of the Kohau Rongorongo script would significantly contribute to development of the typology of writing systems. Importantly, the surviving texts are of considerable length, around 12,000 glyphs in total. The size of the corpus implies that the writing system can be deciphered. Here glyphs are writing units separated by spaces. The total length of the texts in signs is considerably larger. Without doubt one of the

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main reasons why the Kohau Rongorongo script has not yet been deciphered is its intricate graphic system, a system with signs of a highly pictorial nature and without recognised word-dividers. Kohau Rongorongo signs are frequently combined to form complex ligatures, which also complicates graphic analysis of the script.

Graphic analysis is crucial for further development of Rongorongo studies. Nowadays, different authors give quite different estimations of the total number of individual signs used in the surviving texts. In his seminal work, Boris Kudrjavtzev (1949) detected 427 signs in two texts alone, the Great St Petersburg Tablet and the Small St Petersburg Tablet. He also presented graphic variants for some of the identified signs. Thomas Barthel's (1958) catalogue developed a classification scheme with 799 positions, some 190 of which remained empty. In a later publication Barthel (1971: 1170) indicated that if one counts only those signs that occur at least three times, 322 signs remain, and if one searches for the simplest graphical elements that cannot be further analysed one obtains a basic inventory of approximately 120 fundamental constituents. It should be noted that it is difficult to reconcile the two claims made by Barthel (1971: 1170), because the simplest graphical elements that cannot be further analysed are individual signs. The most recent catalogue (Pozdniakov and Pozdniakov 2007: 8) comprises 52 signs that are considered to account for 99.7% of all the texts. These estimations differ considerably in size (322, 120 and 52 signs). The consequences of such differences are dramatic because different systems of writing make use of different numbers of signs (see for example, Champollion 1822; Friedrich 1954; Kondratov 1969). The number of signs in an alphabetical system is about the number of phonemes in a language, for which the writing system was developed. The sign inventory of an alphabetical system would consist of a couple of dozens of independent units—the expected number depends on the particular language. For the Rapanui language, with its ten consonants and five vowels, the alphabetic system is expected to have 15 independent signs, which is definitely not the case for the Kohau Rongorongo script. In a syllabic system, this number can be equal to the number of independent syllables found in the language, though commonly only syllables of a certain type are represented. The number of syllables in Rapanui is 54, taking into account the absence of the syllable *vu* in the language (Fedorova 1963: 87). *Logosyllabic* writing systems show even larger inventories of signs, around several hundred, because they possess at least two functional types of signs—*phonetic signs* (those that indicate abstract sequences of sounds) and *word-signs* (those that spell words and indicate their lexical meanings). Boris Kudrjavtzev's tables and Thomas Barthel's catalogue imply a pronouncedly logographic nature for the Kohau Rongorongo script, even for those who reasonably believe that purely logographic writing cannot exist. At the same time, Igor and Konstantin Pozdniakovs' catalogue evidences

a syllabic writing system. Neither Barthel's nor the Pozdniakovs' catalogue explicitly presents graphic analysis of individual signs, evidently due to a lack of space. Remarkably, the relatively recent voluminous compendium on the script of Easter Island, which is 774 pages long (Fischer 1997), neither includes a catalogue of signs nor a chapter on graphic analysis.

Paradoxical divergences of counts between different scholars in the field are easy to understand: what one scholar considers as two different signs, another treats as graphic variants of the same sign. Alexander Kondratov (1969: 183) was the first to make use of the term "allograph" in Kohau Rongorongo studies, stating that "some allographs have not been recognised by Barthel and assigned different numbers in his catalogue". Irina Fedorova (1982: 37) was the first to give examples of "allographs".[3] Since then many works on the Kohau Rongorongo script have been dedicated to allographs either entirely or partially (Guy 2006; Horley 2005, 2007, 2009, 2010, 2011, 2012; Pozdniakov 1996; Rjabchikov 1988; Wieczorek 2011a, 2011b). The authors rarely give a definition of the term "allograph".[4] A careful reading reveals that in the literature on Kohau Rongorongo an allograph or allographic variant of a sign has been implicitly defined as "a similar graphic design", with a tacit implication that "a similar looking graphic design probably possesses a similar reading value". By implication, the art of graphic analysis is determined by the ability of the scholar to detect similarities between outwardly different graphic designs. However, this definition would not be accepted by students of other writing systems. This paper seeks to apply concepts developed and generally accepted in the graphic analysis of other pictorial writing systems with large numbers of signs. Its main purpose is to show that the graphic inventory of the Kohau Rongorongo script is quite different from what is found in the literature. Importantly, it is not necessary to decode the texts or assign any reading values to individual signs to achieve this purpose.

THEORETICAL CONCEPTS AND TECHNICAL TERMS

Writing is a system of visually perceived signs, traditionally painted or incised, and the rules for their combination developed for the purposes of transmitting messages in a certain human language in order to influence the behaviour of the receiver of the message (Davletshin 2003: 87; cf. Coulmas 1999: 560; Daniels and Bright 1996: 3). A *sign* represents the relationship between a certain *graphic design* (*signifier* or external form of the sign) and a certain *reading value* (*signified* or internal form of the sign) that is assigned to a particular graphic design in a given writing system. Reading values realise in certain contexts, i.e., in combinations with other signs (Davletshin 2003: 92). Sometimes a set of different reading values is associated with a particular graphic design. Signs that possess more than one reading value are called *polyvalent signs* or *homographs*.

It is easy to illustrate these statements with three examples based on English writing. Here I use the International Phonetic Alphabet as it is an explicit and acknowledged unifying system of transcription. Walking on a sea beach one might find a nicely drawn "o" in the sand; it would be ambiguous as to whether this was an abstract drawing or a letter, and if the latter, should it be read [oʊ] or [ɔ]; most likely you would interpret this as a circle. Importantly, no-one would be able to prove that the circle drawn on sand is a letter, which has a reading value. Further, one would read the letter "o" differently according to the context—as [oʊ] in "bone" versus [ɔ] in "dog". In another example, a native speaker of English, would probably read "John has been beaten by Mary, that is to say, Mary has beaten Jahn" as a misspelling, where "a" has been incorrectly substituted for "o" in the second reference to John. These examples show that a reading value does not exist without context and even interpretation of a graphic design depends on the reading values of its sign. Further, a speaker of Spanish and a speaker of English would read the same letter "o" in quite different ways, as for example in the word "tortilla"; this highlights that writing systems have been developed and are used for particular human languages.

There is considerable variation concerning the exact form of a sign, particularly in handwriting. It is exactly the relation between a graphic design and an associated reading value that permits us to recognise dramatically distorted forms of signs and assign the reading value "o" to the letter "a" in the sentence "... Mary has beaten Jahn". Nevertheless, different graphic variants of the same sign share graphic elements. Graphic designs can be described or defined verbally; such definitions are called *iconic formulae* in this paper. In pictorial scripts the graphic design of a sign refers to the idea or mental concept depicted as an object or action. The method of *iconic formulae* involves analysing two or more graphic designs for potentially shared elements. To obtain an iconic formula for a graphic design, it is necessary to gather as many examples as possible of a given sign and then formulate a description of its graphic design. This description should correspond to all attested examples and at the same time it should differ from graphic designs of other signs in the writing system. If verbal descriptions of two graphic designs partially coincide, they are considered *graphic variants* of the same sign; if not they belong to different signs. If two graphic designs possess the same reading value and the graphic descriptions have nothing in common, they are considered allographs, as further discussed below. Thus it is possible to define *graphic variant* as a standardised modification of a graphic design that preserves its general outlines, is recognisable as such, and therefore is used with the same reading value. Typically, writing systems also include different *graphic designs* that indicate the same reading value or the same set

of reading values. For example, in English writing there are three different signs: "A", "a" and "ɑ". It is easy to show that the three are not different graphic variants but different graphic designs. By applying the method of iconic formula we determine that "A" has three lines, "a" has two and "ɑ" has one, and none of these lines are of the same form. In fact, only our cultural knowledge that prevents us from seeing how different these graphic designs are from a formal point view. It should be stressed that formal description of a writing system is a synchronic procedure and has nothing to do with the origin of its constituents, which sometimes go back to another writing system developed for another language and situated far away in time and space. In the above case, for example, historically, the three graphic designs originated from an image of a triangular ox head with two horns extended.

The term "allograph" is used to differentiate incomparable graphic designs with the same reading value (Houston *et al.* 2001; Knorozov 1963). Sometimes they are called *homophonic signs*. The term homophonic signs is etymologically incorrect but it helps to avoid inaccurate parallels with the linguistic terms phoneme and allophone (see Pulgram 1951).[5] To differentiate allographs in transliteration, the most frequent of them is indicated by the reading value only: for example, **a**, the second most frequent is indicated by the reading value with a subscript "2" as in $\mathbf{a}_2$, the third as $\mathbf{a}_3$, and so on. Herein a polyvalent sign, that is a sign with different reading values, is treated as one entity and signs that possess the same reading value are treated as different entities. From a formal point of view it is possible to distinguish different graphic designs but it is impossible to prove that a polyvalent sign is a set of different signs that coincide graphically but not a set of different reading values associated with the same graphic design. As a rule, allographs of a polyvalent sign are assigned the same set of different reading values; for example, the English signs "A", "a" and "ɑ". The existence of different signs with the same reading values, and signs with different reading values, is possible and unavoidable due to such universal characteristics of semiotic systems as insufficiency and redundancy. Exact transmission of a message in detail is too costly, so the system resorts to insufficiency but then the system needs to disambiguate and resorts to redundancy, transmitting the same information more than once.

A direct corollary of the definition of "sign" is that graphic variants and allographs are in free distribution in texts and consequently they substitute for each other in the same context. The only reason for utilising a certain graphic design is the associated reading value, and the graphic design itself has no influence on its use. The last statement is not always correct because sometimes the choice of graphic variants or allographs depends on their ability to combine with adjacent signs, as for example in the case of English

handwritten letters that are found at the beginning, in the middle or at the end of a word. In this case we deal with *functional graphic variants* or *ligature graphic variants*. Note that the distribution of functional graphic variants also depends on the context.

Reading values can be of a different nature depending on the functional type to which a particular sign belongs, and on a particular writing system, because different writing systems make use of different functional types of signs (e.g., Daniels and Bright 1996; Gelb 1963). Some signs are phonetic, that is, they indicate abstract sounds or abstract sequences of sounds that form syllables, as for example, English letters. Other signs are word-signs that indicate both sounds of a word and corresponding lexical meanings, as for example, numerals "1" and "2" in English. Diacritical signs do not possess a phonetic reading value but indicate that a sign nearby has a special reading value, as for example in English capital letters can indicate the beginning of a sentence, a personal name, etc. Semantic determinatives do not possess a phonetic reading value on their own but indicate the semantic class to which a spelled word belongs. This functional type is absent in English writing systems but it is very important, for example, in Chinese writing where such signs are called radicals. Importantly, the functional type to which a particular sign belongs does not affect the relation between its graphic shape and the reading value assigned to this graphic shape.

COMPARISON WITH OTHER WRITING SYSTEMS

Allography is a wide-spread phenomenon in writing systems, which are not restricted to alphabetic traditions, at least the author is unaware of any writing system that does not make use of allographs. Writing systems differ in how often and how many allographs they use—some of them rely more heavily on allographs than the others. The total number of signs in the Kohau Rongorongo script considerably exceeds the number of syllables in the Rapanui language (54 syllables in total) and certain combinatorial properties of signs imply the logographic nature of some signs and the syllabic nature of the others (Davletshin 2012a, 2012b, 2016). Because of this, I will make comparisons with other logosyllabic writing systems.

Allographs are prolific in Maya hieroglyphic writing (Houston *et al.* 2001; Knorozov 1952: 116; Lounsbury 1984). A recently published list of syllabic signs (Stuart 2005: 28-32), which can be easily expanded mostly thanks to allographs, includes 84 different reading values but 133 different signs; in other words, 49 signs (37% of the entire list) are allographs of more frequent signs. In Maya hieroglyphic writing allographs abound in both phonetic signs (syllabic signs) and word-signs (logographs). To illustrate the importance of allographs in the script I have chosen the Tablet of 96 Hieroglyphs from Palenque, Mexico (for drawings and photos see Miller and Martin 2004: 124;

Pérez de Lara n.d.). The text is 356 signs long and the number of individual signs is 149; 39 of them are allographs of more frequent signs and they constitute 23% of the text, that is 83 signs in total. In the text consisting of 356 signs, only the syllable '*u* is written by nine different signs and the word '*ajaw* 'lord, king' by five different signs (Fig. 1).

In Nahuatl hieroglyphic writing (Aubin 1849; Lacadena 2008) allographs are less frequent. The syllabic grid of Nahuatl script is still incomplete. Out of 54 expected positions in the syllabic grid only 41 are filled, seven signs in this list (or 15% of the entire list) are allographs of more frequent signs (Fig. 2). Examples of Nahuatl hieroglyphic writing nicely illustrate one important feature of pictorial writing systems. In *linear scripts*, graphic designs are abstract combinations of lines, strokes, dots and wedges (Akkadian Cuneiform, Modern Chinese, English, etc.), while in *pictorial scripts* (Egyptian, Maya, Nahuatl, Kohau Rongorongo, etc.) graphic designs mostly depict recognisable objects and actions. In other words, in pictorial scripts a reading value is associated with a visually depicted object or action, and not with the way the object is depicted. In Nahuatl script one of the graphic designs with the syllabic reading value **a** depicts "Flowing Water (with Shells some of which are Transversally Cut)", while the other represents "Stagnant Water (Reservoir with Similarly Depicted Shells)" (Fig. 2). Both graphic designs refer to the idea of water and the syllabic value of the sign is acrophonically derived from the Nahuatl word *ātl* 'water'. One of the syllabic

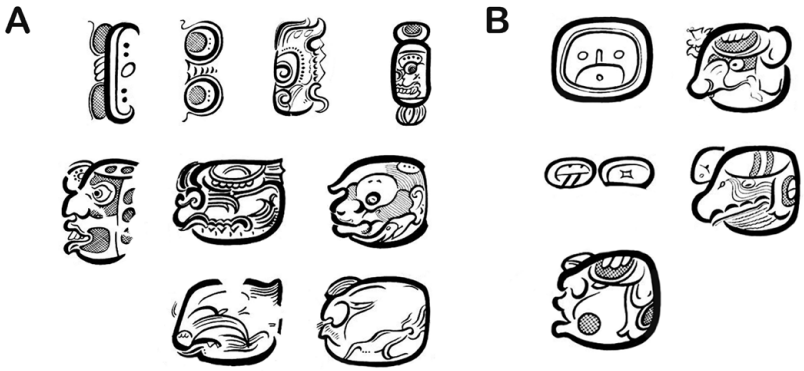

Figure 1. Allographs in Maya hieroglyphic writing. A. Different signs with the phonetic reading value '**u** found on the Tablet of the 96 Hieroglyphs, Palenque, Mexico. B. Different word-signs for '**AJAW** 'lord, king' found on the same tablet. After Simon Martin's drawing with his permission.

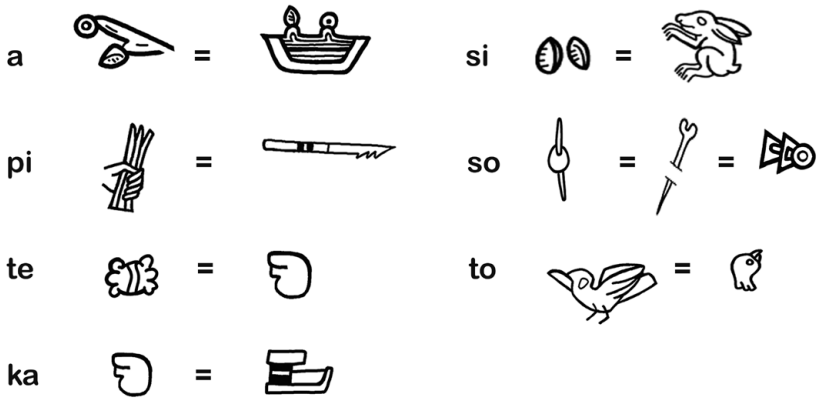

Figure 2. Allographs and graphic variants of **CV** phonetic signs in Nahuatl hieroglyphic writing. The sign "Mouth" is polyvalent; it is used with two different syllabic values—**ka** and **te**. Drawings by the author.

signs **so** depicts a "Threaded Bead", another one depicts "(Something) Pierced by a Bone Awl" and the third one depicts a "Nose-Plug". The three graphic designs refer to the idea of *sōk* '(something) pierced'. Both "Bird Head" and "Bird (as a Whole)" have the syllabic value **to** related to the generic word for 'bird' in Nahuatl *tōtōtl*. The method of iconic formulae method can help us to distinguish between graphic variants of the same sign and allographs: in the case of graphic variants their verbal descriptions partially coincide. Applying this definition one can see that two graphic designs with the reading value **ka** in Nahuatl script depict two different objects: "Mouth" derived from *kamatl* 'mouth' and "Sandal" derived from *kaktli* 'sandals' (Fig. 2). These are allographs. In contrast, the graphic designs for the syllable **a** "Flowing Water" and "Stagnant Water" depict the same visual idea 'water', so they should be classified as graphic variants.

To recap, a *sign* is the relationship between a *graphic design* and a *reading value* assigned to it. In pictorial scripts, graphic designs depict recognisable objects that can be verbally described by means of their shared graphic designs, that is a shared iconic formula. If two similar graphic designs possess the same reading value and can be described by means of one iconic formula, they are *graphic variants* of one sign. If two graphic designs possess the same reading value but look very different and cannot be described by means of one iconic formula they are considered *allographs*.

METHODS

The method of *sign substitution* has been shown to be efficient for identifying graphic variants and allographs (Knorozov 1952: 116; Lounsbury 1984; Stuart 1987). The method consists of examining changes in the writing of the "presumed" same unit of script in identical contexts, where identical surroundings imply the same reading value of the signs in question. In the Rapa Nui case, I used Tablet P as my point of reference. The occurrence of a given sign on Tablet P (for example #A Seal) was compared with the occurrence (or substitution) of that sign in corresponding places on the other two tablets, H and Q. From a practical point of view, unique examples of substitution, and examples with the appearance of additional symbols before and after the sign in question, should not be considered. It is important to distinguish *complete* and *incomplete substitutions*. Incomplete substitutions are those that show interchange between two signs only in some particular contexts. An incomplete substitution does not imply identical, but rather similar, reading values of two signs. In Maya script, for example, incomplete substitutions between syllabic signs at the end of the words are restricted to the syllables that share the same consonant and differ in vowels; this kind of substitution is related to the loss of vowel length and glottalisation in the Late Classic Period and their representation by disharmonic spellings (Houston *et al.* 1998). Sometimes incomplete substitutions include functional graphic variants of signs. For example, in Maya script the so-called "Distance Number Introductory Glyphs" '*uhtiiy* '**u-ti-ya** prefers the syllabic sign '**u** of square form because two remaining signs **ti** and **ya** are elongated. That is why rare allographs of '**u** are frequently found in Distance Number Introductory Glyphs (see examples in Stuart 1990).

Sign substitutions often remind non-epigraphers of homonyms. Nevertheless, examples of substitutions in Maya script show that this is almost never the case. Probably this is because absolute homonyms are extremely rare in natural languages, which tend to eliminate instability resulting from homonymic conflict (Williams 1944).

Importantly, the same method of sign substitution can be used to prove that two graphic designs possess different reading values in spite of their visual resemblance. Two graphic designs with the same reading value are in free distribution so that the probability of sign substitution between two graphic designs A and B should be close to the probability obtained by multiplication of probabilities of occurrence for the designs A and B in the texts. If this condition is not satisfied, in the case of an infinitely large text it would be possible to prove that all graphic designs attested are allographs, because there always are errata and unrecognised differences of similar, but not identical contexts. Errata and unrecognised differences of contexts

result in *false substitutions*, that is, seeming equivalences between two signs that do not exist in the writing system under study. I will call this method for identification of seeming allographs the "*inverse sign substitution*". I also suggest the following practical criterion to avoid examples of false substitutions in graphic analysis: a substitution is considered reliable if at least two signs to the left of the sign in question, and two signs to the right, match in two texts under analysis. This criterion is particularly useful when passages of two different texts are compared. In the case of two long parallel texts, false substitutions are infrequent, though some examples when one or more signs are inserted are also attested in parallel texts.

In sum, a *sign* is the relationship between a *graphic design* and a *reading value* assigned to it. If two similar graphic designs systematically substitute for each other in identical contexts, they are considered *graphic variants* of one sign. If two similar graphic designs do not systematically substitute for each other in identical contexts, their resemblance is illusive and they are should be considered two different signs. One can call such graphic designs *false* or *seeming graphic variants*. If two similar graphic designs systematically substitute for each other in identical contexts, but look very different and cannot be described by means of one iconic formula, they are considered *allographs*.

DATA AND ABBREVIATIONS USED

The surviving Kohau Rongorongo texts provide us with many different testing areas for the study of substitutions. These include: (i) two lengthy parallel texts, one consisting of three inscribed artefacts—the Great St Petersburg Tablet, the Small St Petersburg Tablet and the Great Santiago Tablet (Kudrjavtsev 1949) and another one attested on the London Tablet and the recto side of the Small Santiago Tablet (Butinov and Knorozov 1956, 1957), as well as (ii) several attested lists (Barthel 1958; Butinov and Knorozov 1956, 1957), (iii) recurrent sign-groups shared by various texts (Butinov and Knorozov 1956, 1957; Horley 2007; Pozdniakov 1996), and (iv) highly structured text fragments (Guy 1982). Different versions of the two parallel texts seem to be almost exact copies of each other, while the parallel text fragments show a considerable degree of variation. Because of this, the present study is based mainly on the large parallel text discovered by Boris Kudrjavtzev (Kudrjavtzev 1949; Olderogge 1949). Following the Assyriological tradition, I suggest that the interlinearly ordered comparisons of these three texts be called the Kudrjavtzev collations (Fig. 3). The data from the other texts are used only when necessary.

In this paper, I use drawings by Paul Horley (2009, 2010, 2011), which were compared with drawings by Mikhail Kudrjavtsev (published in Olderogge 1949), Bodo Spranz (published in Barthel 1958), Steven Fischer (1997), and

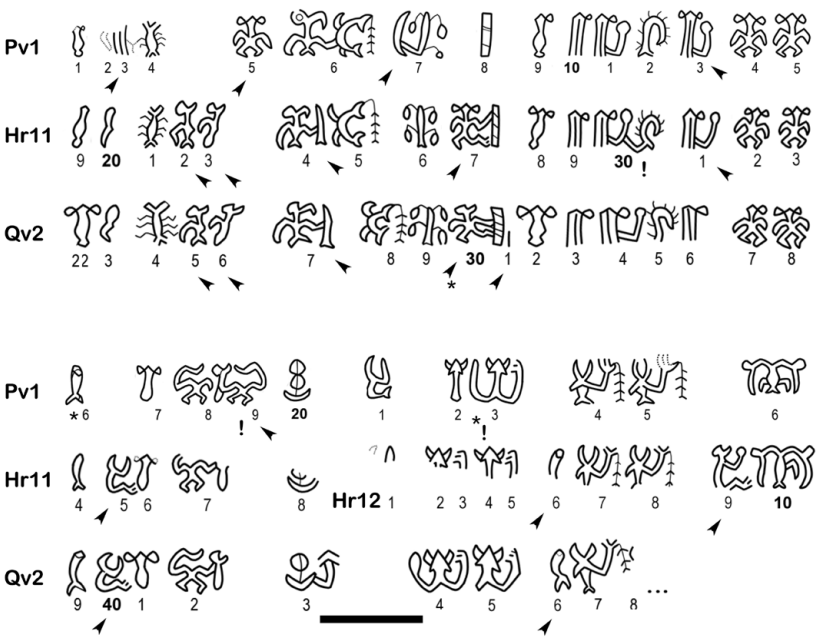

Figure 3. Fragment of Kudrjavtzev collations. An interlinearly ordered comparison of Line 1, verso on the Large St Petersburg Tablet (P) with parallels on the Large Santiago Tablet (H) and the Small St Petersburg Tablet (Q). Arrows indicate signs that are omitted in parallel texts, asterisks—significant graphic variations, exclamation marks—different ligature compositions and black squares – possible substitutions of a sign for two others. Numbers refer to the corresponding glyph counted from the beginning of the line, where the sign in question occurs. Note that alternative interlinear ordering is possible in at least two cases: Pv1:3 and Pv1:21-23. After Paul Horley's drawings with his permission.

my own drawings and photographs taken in the Peter the Great Museum of Anthropology and Ethnography, St Petersburg and in the British Museum, London. Satisfactory photographs of the Great Santiago Tablet have never been published, so I am particularly grateful to Rafal Wieczorek for the opportunity to work with his photographs of the cast of the Great Santiago Tablet hosted in the Father Sebastian Englert Anthropological Museum on Rapa Nui.

Following traditional conventions, I use capital letters to refer to Barthel's designations of the Kohau Rongorongo texts (Barthel 1958):

A (Tahua Tablet)
B (Aruku Kurenga Tablet)
C (Mamari Tablet)
D (Échancrée Tablet)
E (Keiti Tablet)
F (Chauvet Fragment)
G (Small Santiago Tablet)
H (Large Santiago Tablet)
I (Santiago Staff)
L (London Small Reimiro Wooden Gorget)
M (Large Vienna Tablet)
O (Berlin Tablet)
P (Large St Petersburg Tablet)
Q (Small St Petersburg Tablet)
R (Small Washington Tablet)
S (Large Washington Tablet)

Lowercase letters r and v stands for the sides, *recto* and *verso*, when the beginning of the text is identified; lowercase letters a and b are conventional designations of two sides for the cases when the beginning of the text is unknown. Designation of lines on the Santiago Staff (I) are given after Horley (2011). Numbers following lowercase letters indicate the corresponding line, and numbers following the colon sign ":" refer to the corresponding glyph counted from the beginning of the line, where the sign in question occurs. Here glyphs are writing units separated by a space; they can be individual signs or ligatures (connected writings) of several signs. The multiplication sign "×" indicates substitution between two parallel texts. For example, "Pr3:4 × Qr2:42" should be read as "a sign found in the fourth glyph of line 3 on the *recto* of the Great St Petersburg Tablet and a sign found in position 42 of line 2 on the *recto* of the Small St Petersburg Tablet substitute for each other". The question mark sign "?" shows that the identification of a graphic design is problematic, mostly because of poor preservation.

I use the method of iconic formulae to identify graphic designs and assign them descriptive nicknames. These are given in double quotation marks and listed in the Appendix. In this article every graphic design is assigned a capital letter, preceded by the number sign "#"; graphic variants are indicated by lowercase letters. "#Hb" should be read as "the variant b of graphic design H". It is important to emphasise that the specific nickname "Turtle" does not mean that the sign should be read as "turtle" in Rapanui, only that the sign looks like a turtle. To the extent possible, I am inclined to apply descriptive nicknames consistent with iconographic analysis of the signs in question but to date many signs have not received satisfactory iconographic interpretations.

The equality sign "=" and the non-equality sign "≠" are used to indicate equivalences and differences between readings values of two signs.

A final note is about ligatures (connected writings of two and more signs). Taking into account the complexity of the Kohau Rongorongo graphic system, and the great number of ligatures, sometimes it is impossible to determine whether a graphic design is a ligature of two signs or an independent sign, and sometimes it is impossible to determine what would be a ligature version of a particular sign. Because of this, I try to avoid discussions of ligatures and ligature variants of signs in this paper.

A CONSERVATIVE GRAPHIC ANALYSIS OF THE KOHAU RONGORONGO SCRIPT

Allographs

The graphic design #A represents a "Seal (Sitting on Its Tail)", alluding to the particular skeletal structure of sea lions and fur seals that allows them to sit in semi-upright positions. It is attested 13 times on P (Table 1), though mostly in ligatures (r1:25, v4:52, v5:28, v5:50, v6:53, v7:2, v7:43, v8:32, v9:48, v11:10). Ligature forms are slightly different visually and thus can be a different graphic design. The sign #A "Seal" is attested 13 times on P and 14 times is found in corresponding places of the two other texts, H and Q, an occurrence that is referred to here as "without substitution". Two times, however, instead of the sign #A, we see the sign #B "Blenny Fish", that is, the sign #B substitutes for the sign #A (Fig. 4; for images of the blenny in the Rapanui art see Horley and Lee 2012: 16, Fig. 14). Note here and below that the parallel text of the Kudrjavtzev collations is attested in all three versions (Tablets H, P and Q). This means that if a graphic design is attested on P, for example 10 times, it can theoretically be substituted 20 times for another graphic design. The sign #B is uncommon, and only attested six or seven times in the Kohau Rongorongo texts in total (Hv9:23,25; Gv6:21-24; ?Ia3:75).

There are two different types of Kohau Rongorongo signs according to their combinatorial properties. Some signs form sequences of the kind ABAB, BABA, AAAA and AAA in combinations with other signs; here A and B designate the same sign in combinations (Davletshin 2012a). Other signs do not form such sequences, tend to be used in isolation, and not as parts of sign groups (Davletshin 2016). Probably signs of the first type are phonetic signs (spelling syllables) and signs of the second type are word-signs (spelling lexical roots). The sign #A is attested in ABAB sequences twice (Pv10:33-36, Db1:4-5) and the sign #B is attested as ABAB (Hv9:23-26) and as AAAA (Gv6:21-24). Thus, the signs #A and #B belong to the same combinatorial class supporting the suggestion that they share their reading value.[6]

Table 1. Allographs on Tablet P and their substitutions on Tablets H and Q.

Sign #A "Seal" × Sign #A "Seal": Pr1:25 × Hr1:26 × Qr1:17, Pv4:52 × Hv2:40 × Qv5:25, Pv5:28 × Hv3:24 × Qv6:13, Pv5:50 × Hv4:2, Pv6:23 × Hv4:24 × Qv7:14, Pv6:53 × Hv5:2, Pv7:2 × Hv5:9, Pv7:43? × Hv6:4, Pv8:32 × Hv6:53, Pv11:10 × Hv9:63 See also: Pv9:48
Sign #A "Seal" × Sign #B "Blenny Fish": Pv10:33 × Hv9:23, Pv10:35 × Hv9:25
Sign #C "Two Vines Growing Up" × Sign #C "Two Vines Growing Up": Pv8:25 × Hv6:46 See also: Pr3:56
Sign #C "Two Vines Growing Up" × Sign #D "Tuber (a Kind of)": Pr2:40 × Hr2:44 × Qr2:18, Pv5:48 × Hv3:45, Pv6:50 × Hv4:51
Sign #D "Tuber (a Kind of)" × Sign #D "Tuber (a Kind of)": Pr3:59 × Hr4:16, Pr6:59 × Hr7:26 × Qr7:11
Sign #F "Berried Stem" × Sign #F "Berried Stem": Pr8:22 × Qr8:42, Pv1:7 × Hr11:26 × Qv2:29, Pv3:33 × Hv1:24 × Qv4:19, Pv4:9 × Hv1:40 × Qv4:36, Pv4:12 × Hv1:43, Pv4:20 × Hv2:8, Pv4:25 × Hv2:13, Pv6:27 × Hv4:28 × Qv7:18, Pv10:17 × Hv8:49, Pv11:2 × Hv9:54 See also: Pr5:69
Sign #G "Stem Stripped of Berries" × Sign #F "Berried Stem": Pv4:16 × Hv2:4, Pv4:46 × Hv2:34

The graphic design #C represents "Two Vines Growing Up" and #D, a "Tuber (of a Kind)" (Fig. 4). Note that the graphic design "Two Vines Growing Up" is different in distribution from "Two Vines Hanging Down" (see Pr4:39 × Hr4:57 × Qr4:38). The design #C is attested four times on P, and it is substituted four times for #D (Table 1). #D is attested two times on P ; in three cases it is used without such substitution in the parallel texts. Remarkably, the sign #C is not attested on Q and it is attested only once on H, so it is characteristic to the text P. Thus, #C and #D are allographs and possibly depict different part of the same plant. Both #C and #D are used in isolation as word-signs. Notably some tablets bear traces of two-stage carving,

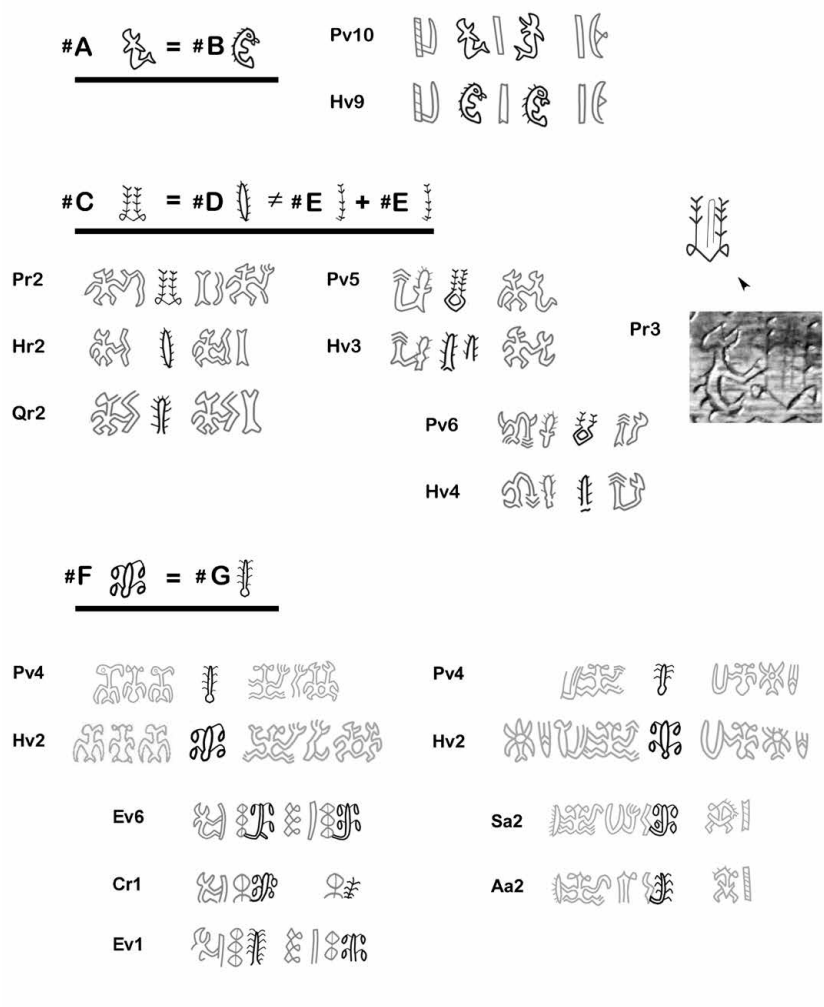

Figure 4. Allographs in the Kohau Rongorongo texts: Sign #A "Seal" = Sign #B "Blenny Fish", Sign #C "Two Vines Growing Up" = Sign #D "Tuber (a Kind of)" ≠ Sign #E "Leaved Vine Growing Up" + Sign #E "Leaved Vine Growing Up", Sign #F "Berried Stem" × Sign #G "Stem Stripped of Berries". After Paul Horley's drawings, with his permission, and a photograph of the Great St Petersburg Tablet by the author.

pre-incising with an obsidian flake and posterior contour enhancement with a shark tooth (Fischer 1997: 388-9; Horley 2009). Sometimes signs originally incised with an obsidian flake were corrected and/or replaced with other signs during a second stage of writing. On Pr3:56 the pre-incised contours of a sign #D can be seen inside the sign #C (Fig. 4). These findings may indicate that #C and #D have the same reading value. If so, the scribe may have substituted one sign for the other during the second stage of writing.

It is possible to suggest that the design #C, "Two Vines Growing Up", are two signs #E "Leaved Vine Growing Up" written together as a ligature. Therefore #D is a word-sign of the structure $C_1V_1C_1V_1$ and E is a syllabic sign C_1V_1; here C stands for a consonant and V for a vowel, and the subscript number indicates whether or not the consonants or vowels are identical. Nevertheless, I could not find any plant names in Rapanui or proto-Eastern-Polynesian of the structure $C_1V_1C_1V_1$ (see Englert 1978; Greenhill and Clark 2011). #C on Pv5:48 is substituted for two identical signs #D on Hv3:45-46, the last of which is on the edge of the tablet and damaged; in other words, what is written as #C in the text P is written as #D + #D in the text H. Rhetorical repetitions of words, which abound in traditional Polynesian narratives, is a likely explanation for this (Davletshin 2012c).

The graphic design #F represents a kind of plant with berries or round leaves "Berried Stem" and the graphic design #G is a "Stem Stripped of Berries" (Fig. 4). The design #G is attested two times on P, it is substituted three times for #F (Table 1). #F is attested 10 times on P and 14 times is used without substitution. #F and #G substitute for each other several times in the parallel fragments on the tablets A, C, E and S (Fig. 4). #G is a very uncommon sign but it is possible to show that it possesses the same reading value as #F, thanks to the substitutions attested. #F behaves as a word-sign but it is difficult to maintain the same claim about #G due to its rarity. Probably the designs #F and #G depict the same plant in two different ways.

Graphic Variants

The graphic design #H represents "Turtle". Sometimes the turtle's tail is depicted (#Hb "Tailed Turtle"), its plastron is shown (#Hc "Overturned Turtle"), its mouth is open (#Hd "Gaping Turtle"), the back flippers are missing (#He "Turtle, Without Back Flippers"), one of flippers is clipped (#Hf "Turtle, One Flipper Clipped") or its belly is shown as hollow (#Hg "Turtle, Hollow Belly") (Fig. 5). On one occasion, the turtle sign is carved with a tail and plastron, which in the suggested system will require the simultaneous use of two characterising letters, #Hbc. The total number of occurrences for the sign #H "Turtle" on P is 25, with two problematic cases where it is difficult to be sure about identification of the sign (Pv10:19,

Pv10:21). #Hb, #Hd and #Hg are attested only once each and #Hf twice. The graphic variant #Hg is not attested on P and only once on Q. In other words, the graphic variants #Hb, #Hd, #Hf and #Hg are very uncommon. The variant #Hc "Overturned Turtle" is attested four times on P and once on Q, that is #Hc is the characteristic variant of the text P. The variant #He "Turtle, Without Back Flippers" is attested seven times on P and three times on H; specifically this graphic variant is not used by the carver of the Tablet Q. In the three texts, these graphic variants of the "Turtle" sign are found in free distribution (Table 2): #Hb is attested once and once it is substituted for another variant, #Hc is attested four times and four times it is substituted for other variants, #Hd is attested once and once it is substituted for another variant, #He is attested seven times and seven times it is substituted for other variants, #Hf is attested twice and twice it is substituted for another variant, once #Hg substitutes for #Hf, and once two designs #Hb and #Hc co-occur (Pv7:44). It is clear that one sign has seven different variants and all of them depict the same subject, a turtle. The sign "Turtle" behaves as a word-sign.

The graphic design #I represents a "Head? on a X-shaped Base" and #Ib is a "Head? on an Angular Pedestal" (Fig. 5). Two graphic variants freely substitute for each other (Table 2): #I is attested four times on P, five times no substitutions are found in the parallel texts and three times it is substituted for Ib. Interestingly, the graphic design #I (Fig. 5) never substitutes for the visually similar design #J representing a "Sprout? on a X-shaped Base" which is found in free distribution with #Jb "Sprout? on an Angular Pedestal" (Table 2): #J is attested six times on P; five times no substitutions are found in the parallel texts and three times it is substituted for #Jb. A recently published paper (Wieczorek and Horley 2015: 132; see also Fig. 5) has shown that the only problematic example of the substitution between #I and #J (Ma2:25) is an artefact of inaccurate drawings. One can suspect that the graphic designs "Angular Pedestal", "X-shaped Base", "Head?" and "Sprout?" are independent signs with their own reading values which combine with one another to spell certain words. Simple statistical observations rule out this possibility; none are attested in combinations with other signs and none are used independently. An exception is the graphic design "Head?" which may be attested independently (Aa8:76, Aa8:78, etc.) and in combination with other signs (Hr7:34, Pr3:25, etc.). This anomaly strongly suggests that the graphic design "Head?" by itself on one the hand, and "Head? on an Angular Pedestal/X-shaped Base" on the other, belong to two different signs with two different reading values. All examples of the graphic element "Angular Pedestal" are found on Q. One can suspect that the graphic element "Angular Pedestal" and "X-shaped Base" refer to the same object, while "Head?" and "Sprout?" are differential graphic elements of the two signs. Unfortunately, it is not clear what "Pedestal",

Table 2. Graphic variants on Tablet P and their substitutions on Tablets H and Q.

Sign #H "Turtle" (#b—"Tailed Turtle", #c—"Overturned Turtle", #d—"Gaping Turtle", #e—"Turtle, Without Back Flippers", #f—"Turtle, One Flipper Clipped", #g—"Turtle, Hollow Belly"): Pr1:8(#c) × Hr1:9, Pr1:12(#f) × Hr1:13, Pr1:21 × Hr1:22 × Qr1:14, Pr4:60 × Hr5:18 × Qr5:8, Pr6:35(#e) × Hr7:5 × Qr6:37, Pr8:3(#e) × Qr8:8(#g), Pr11:13 × Qv2:1, Pr11:14 × Qv2:2(#c), Pv2:20(#f) × Qv3:7, Pv4:14(#e) × Hv2:2, Pv4:47(#e) × Hv2:35 × Qv5:18, Pv5:9 × Hv3:3 × Qv5:34, Pv7:44(#bc) × Hv6:5, Pv7:46(#c) × Hv6:7, Pv8:26(#e) × Hv6:47(#e), Pv8:42(#d) × Hv7:7, Pv8:44 × Hv7:10, Pv8:46 × Hv7:13, Pv9:4(#e) × Hv7:33(#e), Pv9:10(#c) × Hv7:40, Pv9:21 × Hv7:52(#e), Pv9:51(#e) × Hv8:32 See also problematic examples: Pv10:19(#e)? × Hv8:51(#e), Pv10:21(#e)? × Hv9:1(#e)-2 See also: Pv9:37
Sign #I "Head? on a X-shaped Base" (#Ib—"Head? on an Angular Pedestal"): Pr2:31 × Hr2:36 × Qr2:10(#b), Pr2:36(?) × Hr2:41(?) × Qr2:15(?#b), Pr7:9 × Hr7:39 × Qr7:23(#b), Pr9:27 × Hr10:14, Pv8:51 × Hv7:16
Sign #J "Sprout? on a X-shaped Base" (#Jb—"Sprout? on an Angular Pedestal"): Pr6:55 × Hr7:21 × Qr7:6, Pr7:14 × Hr7:44 × Qr7:28(#b), Pr8:25 × Qr8:45(#b), Pr9:36 × Hr10:23, Pr9:42 × Hr10:29, Pv3:9 × Qv3:43(#b)
Sign #K "Calabash" (#Kb—"Hollow Calabash"): Pr7:5 × Hr7:36 × Qr7:20, Pv3:8 × Hv1:6 × Qv3:42, Pv5:4(#b) × Hv2:46(#b) × Qv5:29, Pv7:13 × Hv5:29(#b) × Qv8:11, Pv7:15 × Hv5:31(#b) × Qv8:13, Pv7:17 × Hv5:33(#b) × Qv8:15, Pv7:26 × Hv5:44(#b) × Qv8:26, Pv7:27 × Hv5:45(#b) × Qv8:28, Pv8:28(#b) × Hv6:49(#b), Pv8:41 × Hv7:6
Sign #L "Gourd": Pr6:31 × Hr7:1 × Qr6:33, Pr8:24 × Qr8:44, Pv9:8 × Hv7:38, Pv9:19 × Hv7:51, Pv9:48 × Hv8:29

"X-shaped Base" and "Sprout" depict. The two signs #I and #J seem to be word-signs (but see Fa4:3-6 for #J).

The graphic design #K represents a "Calabash" and #Kb represents a "Hollow Calabash" (Fig. 5). They freely substitute for each other: #K is attested eight times on P, ten times no substitutions are found in the parallel texts and five times it is substituted for #Kb. #Kb is attested twice on P, twice it is substituted for #Kb and once for #K (Table 2). The graphic element

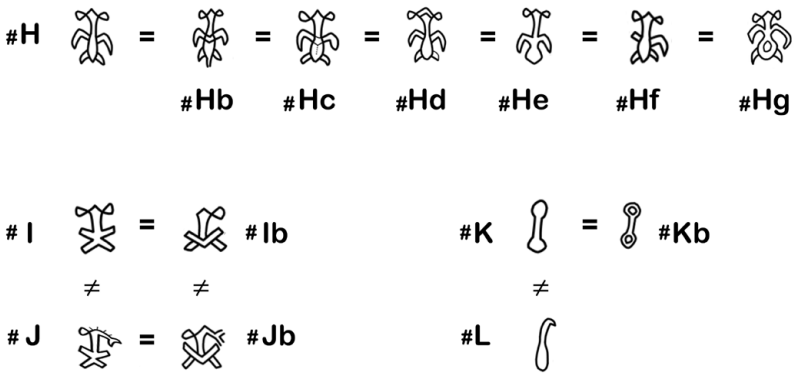

Figure 5. Graphic variants in the Kohau Rongorongo texts: Sign #H "Turtle" = #Hb "Tailed Turtle" = #Hc "Overturned Turtle" = #Hd "Gaping Turtle" = #He "Turtle, Without Back Flippers" = #Hf "Turtle, One Flipper Clipped" = #Hg "Turtle, Hollow Belly", Sign #I "Head? on a X-shaped Base" = #Ib "Head? on an Angular Pedestal Pedestal" ≠ Sign #J "Sprout? on a X-shaped Base" = #Jb "Sprout? on an Angular Pedestal", Sign #K "Calabash" = #Kb "Hollow Calabash" ≠ Sign #L "Gourd". After Paul Horley's drawings with his permission.

"Hollow" is never found on Q. A very similar graphic design, #L "Gourd", represents a "calabash with slightly narrowed upper part" (Fig. 5). #L never substitutes for #K "Calabash" and #Kb "Hollow Calabash" (Table 2): #L is attested five times on P and occurs without substitution six times. #L "Gourd" never includes the graphic element "Hollow", so this graphic element is characteristic of the sign #K "Calabash". Remarkably, #K is likely to be a phonetic sign according to its properties (Pv7:13-16 × Hv5:29-32 × Qv8:11-14) and #L is not (see Ab6:42-55).

Seeming Graphic Variants

There are many different graphic designs depicting fish on the three tablets: #M "Fish (Head Upwardly)", #N "Spiny Fish", #O "Fish Upside Down", #P "Swimming Fish", #Q "Fish on Fishing Line" and #R "Catch of Fish (Fishes Strung on A Cord)" (Fig. 6). These are different signs because they do not substitute for each other: #M is attested 17 times on P and occurs without substitution 27 times in parallel texts. #N is attested 11 times on P and occurs without substitution 17 times. #O is attested five times on P and occurs without substitution 13 times, #P is attested twice on H and is occurs without substitution three times, #Q is attested six times on P and occurs

without substitution nine times, and #R is attested three times on P and occurs without substitution five times (Table 3). One example of the sign #N (Pr10:39) is so obliterated that only its general outlines can be seen. There are three problematic examples of substitution between #M and #N which require discussion: Pr10:15(#M) × Qv1:9(#N) and Pr10:37(#M) × Hr10:48(#N) × Qv1:33(#N). They can be analysed as examples of incomplete substitution. However, three examples are restricted to two contexts and in both cases there are some other changes in neighbouring signs; in other words, they might represent examples of false substitution. #P on Pv1:16 rather looks like #M, but it is found on the very edge of the tablet, which makes it difficult to differentiate the two graphic designs and would make it difficult to carve the sign. Besides this, the slight variations in the text between Pv1:16 and Hr11:34 × Qv2:39 suggest false substitution as an alternative explanation. The signs #M, #N and #Q are syllabic signs, while #P and #R are word-signs (for ABAB and AAA combinations see Br7:4-5, Ca5:26-28, Db4:7-8, Er6:37-39, Ev2:17-20, Gv5:14-16, Ma2:9-14, Rb4:3-6, Sb3:30-32). It is difficult to be sure about the type to which the sign #O belongs because the only likely example of #OOO may involve another graphic design (?Ma1:14-16). It is possible to analyse #N as a combination of two signs written in ligature "Spikes" and "Fish". However, the sequence #NNNN found on Rb4:3-6 rules out this possibility and shows that #N is a syllabic sign.

Different graphic elements accompany the signs #M-R: #b—"Fish, Gills", #bb—"Fish, Double Gills", #c—"Fish, Bulbed Tail", #d—"Fish, Lateral Line", #e—"Fish, Extra Fins", #f—"Fish, Without Head". None of them are discriminating graphic elements and sometimes they are combined (Table 3). The graphic element #c is restricted to the signs #M and #N and #f to the sign #O. Remarkably, the element #e is never attested as part of the sign #R and seldom (only twice) as part of the sign #P, probably due to the lack of space. The number of fishes strung on a cord in the sign #R "Catch of Fish" can be four (five of eight examples) or three (two of eight examples found on P). One example of "two fishes strung" (Hv9:53) can be explained by the lack of space at the end of the text.

Surprisingly, Barthel's catalogue (1958) recognises only three different fish signs between the discussed examples: "Fish, Gills" (700), "Fish, Without Gills" (710) and "Fish on a Fishing Line" (711). Seven graphic designs depicting fish (#B, #M-R) are attested in the three parallel texts under consideration and have been discussed here, but even more signs depicting fish can be found in other Kohau Rongorongo texts.

Orientation according the vertical axis, "Up" versus "Down", seems to be an important principle of the Kohau Rongorongo graphic system. Two similar graphic designs, #E "Leaved Vine Growing Up" and #S "Leaved Vine Hanging Down", have been never recognised as independent signs in the literature (Fig. 6). Nevertheless, they never substitute for each other and

belong to different contexts: #E is attested five times on P and occurs 10 times without substitution, while #S is attested 42 times on P and occurs 72 times without substitution (Table 3). Without doubt these two signs are assigned two different reading values in the script. They behave as syllabic signs (see ABAB for #E: Aa1:39-40, Cb8:9-10, Gr5:29-30, Pr5:18-19 × Hr5:35-36 × Qr5:26-27 and for #S: ?Bv3:43-Bv4:1, Bv4:4-5, ?Gv8:29-30, ?Rb4:12-13). The graphic designs #T "Arm (Pointing Up)" and #U "Arm Pointing Down" follow the same principle of the vertical axis (Fig. 6). Note that I distinguish two different graphic designs here: "Hand" and "Arm", the latter including an "Elbow" in its graphic design. The sign #U is extremely rare; it is attested only once on P and occurs once without substitution and I do not know of other non-ligature examples of the sign in question (Pv8:60 × Hv7:24). Ligature examples of graphic design may correspond to another sign (see Br5:36, Bv12:28, 41). The sign #T is attested 13 times on P and occurs 14 times without substitution (Table 3). #T seems to be a syllabic sign (for ABAB see Ev3: 14-17, Ev8:2-3, ?Fa4:3-6, Ma2:9-14, Ma5:8-11, Oa8:18-21, Pr24-26). It is difficult to identify the class of the sign #U due to its rarity. Note also that the graphic design "Fish Upside Down on Fishing Line", which is attested only four times on C7-9, is contrasted by the context with the sign #Q "Fish on Fishing Line" (Guy 1990: 140) and probably represents another sign with a different reading value.

The only difference between two very similar graphic designs #V "Comb" and #W "Wide-Handled Comb" is a little swelling on the lower end of #W (Fig. 6). It is unclear what these two signs depict and "Comb" is just a nickname here. The sign #V is commonly interpreted as *kōmari* 'female genitalia, vulva' based on comparison with the well-known Rapa Nui rock-art motif (Geiseler 1883 in Ayres and Ayres 2005: 58; Lee 1992: 35; Métraux 1940: 409; Thomson 1891: 517). Paul Horley (pers. comm., 2014) has pointed out to me that the sign on the tablets is oriented the other side up, so that it is unlikely to represent female genitalia. Besides, there is a sign which depicts *kōmari* and resembles the corresponding rock-art motif; see for example, La:33, Ia9:88 and Ia14:9. Two graphic designs #V and #W never substitute for each other (Table 3): #V is attested 16 times on P and occurs 22 times without substitution, #W is attested seven times on P and occurs 12 times without substitution. They belong to different contexts and neither of them participates in ABAB sequences.

The graphic designs #X "Worm" and #Y "Eel" represent snake-like living creatures; #X "Worm" differs from #Y "Eel" by its wriggling body (Fig. 6). Two graphic designs #X and #Y never substitute for each other (Table 3): #X is attested five times on P and occurs 10 times without substitution, #Y is attested four times on P and occurs five times without substitution. A very similar graphic design #Z "Hand-Tailed Eel" is attested twice in the three texts (Pv6:25 × Hv4:26) and once it seems to be substituted for #Y (Qv7:16).

Table 3. Seeming graphic variants on Tablet P and their substitutions on Tablets H and Q.

Sign #M "Fish" (#b—"Fish, Gills", #bb—"Fish, Double Gills", #c—"Fish, Bulbed Tail", #d—"Fish, Lateral Line", #e—"Fish, Extra Fins"):
Pr1:7(#bc) × Hr1:8(#b), Pr1:45(#b) × Hr1:47(#b), Pr2:51(#b) × Hr2:53(#b) × Qr2:27(#b), Pr4:25(#bbe) × Hr4:44(#b) × Qr4:24(#b), Pr4:35(#b) × Hr4:52(#b) × Qr4:33(#b), Pr6:17(#bce) × Hr6:53(#b) × Qr6:19(#b), Pr8:51(#bde) × Hr9:24(#b) × Qr9:23(#b?), Pr9:32(#bce) × Hr10:19(#b), Pr9:38(#bc) × Hr10:25(#b), Pr11:24(?) × Hr11:9(#b) × Qv2:12(#b), Pv3:30(#bb) × Hv1:21(#b) × Qv4:16(#b), Pv4:6(#bb) × Hv1:37(#b) × Qv4:32(#b), Pv4:34(#b) × Hv2:22(#b) × Qv5:5(#b), Pv6:28(#bb) × Hv4:29(#b) × Qv7:19(#bb?), Pv7:64(#bc) × Hv6:21(#b), Pv8:1(#bbc) × Hv6:22(#b), Pv8:29(#bc) × Hv6:50(#b)
Sign #N "Spiny Fish" (#b—"Fish, Gills", #c—"Fish, Bulbed Tail", #e—"Fish, Extra Fins"):
Pr8:38(#bce) × Hr9:10(#b) × Qr9:9(#b?), Pr10:13(#b) × Qv1:10(#b), Pr10:26(#b) × Qv1:20(#b), Pr10:27(#b) × Qv1:21(#b), Pr10:29(#b) × Hr10:40(#b) × Qv1:25(#b), Pr10:31(#b) × Hr10:42(#b) × Qv1:27, Pr10:33(#b) × Hr10:44(#b) × Qv1:29, Pr10:35(#b) × Hr10:46(#b) × Qv1:31, Pr10:39?(#b?) × Hr11:2(#b) × Qv1:35(#b), Pv9:42(#bc) × Hv8:23(#b), Pv9:43(#bc) × Hv8:24(#b)
Sign #M "Fish" × Sign #N "Spiny Fish" (problematic examples, #b—"Fish, Gills"):
Pr10:15(#Mb) × Qv1:9(#Nb), Pr10:37(#Mb) × Hr10:38(#Nb) × Qv1:23(#N?)
Sign #O "Fish Upside Down" (#b—"Fish, Gills", #bb—"Fish, Double Gills", #f—"Fish, Without Head"):
Pv5:45(#bbf) × Hv3:42(#b), Pv6:16(#bbf) × Hv4:18(#bb) × Qv7:8(#bbf), Pv6:45(#bbf) × Hv4:46(#bbf) × Qv7:36(#b), Pv7:37(#b) × Hv5:55(#bbf), Pv8:7(#b) × Hv6:28(#b) × Qv9:13(#b?)
Sign #P "Swimming Fish" (#b—"Fish, Gills"):
Pv1:16?(#b) × Hr11:34 × Qv2:39(#b) See also: Hr12:6(#b) × Qv2:46(#b)
Sign #Q "Fish on Fishing Line" (#b—"Fish, Gills"):
Pr2:61 × Hr3:5 × Qr2:36, Pr4:10 × Hr4:31 × Qr4:12(#b), Pr4:13 × Hr4:33 × Qr4:14, Pr8:5 × Hr8:37 × Qr8:12, Pv8:65(#b) × Hv7:29 See also: Pr6:49

Sign #R “Catch (of Fish)”: Pv7:26(3 fishes) × Hv5:44 × Qv8:26, Pv7:27(3 fishes) × Hv5:45 × Qv8:28, Pv11:1(?) × Hv9:53(2 fishes)
Sign #E “Leaved Vine Growing Up” × Sign #E “Leaved Vine Growing Up”: Pr5:18 × Hr5:35 × Qr5:26, Pr5:19 × Hr5:36 × Qr5:27, Pr5:22 × Hr5:39 × Qr5:31, Pr5:24 × Hr5:41 × Qr5:34, Pr6:15 × Hr6:51 × Qr6:17 See also: Hr4:13
Sign #S “Leaved Vine Hanging Down” × Sign #S “Leaved Vine Hanging Down”: Pr1:16 × Hr1:17 × Qr1:9, Pr1:17 × Hr1:18 × Qr1:10, Pr1:18 × Hr1:19 × Qr1:11, Pr1:24 × Hr1:25 × Qr1:16, Pr1:25 × Hr1:26 × Qr1:17, Pr1:26 × Hr1:27 × Qr1:18, Pr2:54 × Hr2:56 × Qr2:30, Pr2:57 × Hr3:1 × Qr2:32, Pr3:8 × Hr3:16 × Qr3:2, Pr3:19 × Hr3:27 × Qr3:13, Pr3:22 × Hr3:30 × Qr3:17, Pr3:23 × Hr3:31 × Qr3:18, Pr3:25 × Hr3:32 × Qr3:19, Pr3:26 × Hr3:33 × Qr3:20, Pr3:27 × Hr3:34 × Qr3:21, Pr3:28 × Hr3:35 × Qr3:22, Pr3:29 × Hr3:36 × Qr3:23, Pr3:30 × Hr3:37 × Qr3:24, Pr3:31 × Hr3:38 × Qr3:25, Pr3:34 × Hr3:42 × Qr3:29, Pr3:36 × Hr3:43 × Qr3:30, Pr3:39 × Hr3:48 × Qr3:35, Pr3:40 × Hr3:49 × Qr3:36, Pr3:42 × Hr3:50 × Qr3:37, Pr3:63 × Hr4:20, Pr4:38 × Hr4:54 × Qr4:35, Pr7:1 × Hr7:32 × Qr7:16, Pr7:18 × Hr7:48 × Qr7:33, Pr7:54 × Hr8:34, Pr8:3 × Qr8:9, Pr11:24 × Hr11:9 × Qv2:12, Pv1:6 × Hr11:25 × Qv2:28, Pv1:24 × Hr12:7 × Qv2:47, Pv1:25 × Hr12:8, Pv3:13 × Qv3:47, Pv7:11? × Hv5:22 × Qv8:4, Pv8:56 × Hv7:20, Pv8:58 × Hv7:22, Pv8:60 × Hv7:24, Pv8:63 × Hv7:27, Pv9:11 × Hv7:40 See also: Pr3:54
Sign #T “Arm (Pointing Up)” × Sign #T “Arm (Pointing Up)”: Pr3:12 × Hr3:21 × Qr3:6, Pr3:14 × Hr3:23 × Qr3:8, Pr3:16 × Hr3:25 × Qr3:10, Pr7:54 × Hr8:34, Pv4:18 × Hv2:6, Pv4:8 × Hv2:6, Pv6:44 × Hv4:45 × Qv7:35, Pv8:63 × Hv7:27, Pv9:52? × Hv8:33, Pv10:3 × Hv8:37 See also: Pr3:24, Pr3:25, Pv6:34, Hv8:35
Sign #U “Arm Pointing Down” × Sign #U “Arm Pointing Down”: Pv8:60 × Hv7:24
Sign #V “Comb” × Sign #V “Comb”: Pr1:3 × Hr1:4 × Qr1:4, Pr2:18 (twice) × Hr2:23 (twice), Pr2:18 × Hr2:23, Pr4:13 × Hr4:33 × Qr4:14, Pr6:38 × Hr7:8 × Qr6:40, Pr7:46 × Hr8:25, Pr7:50 × Hr8:28, Pr7:52 × Hr8:32, Pr7:59 × Qr8:5, Pr8:45 × Hr9:17 × Qr9:16, Pr9:29 × Hr10:16, Pv4:44 × Hv2:32 × Qv5:15, Pv4:49 × Hv2:37 × Qv5:20, Pv8:55 × Hv7:19, Pv8:64 × Hv7:28 See also: Hr11:4 × Qv1:37, Hr11:5 × Qv1:38

– Table 3 continued over page

Sign #W "Wide-Handled Comb" × Sign #W "Wide-Handled Comb": Pr4:17 × Hr4:37 × Qr4:17, Pr7:33 × Hr8:13, Pv7:19 × Hv5:35 × Qv8:17, Pv7:21 × Hv5:37 × Qv8:19, Pv7:22 × Hv5:38 × Qv8:20, Pv7:24 × Hv5:40 × Qv8:22, Pv11:47 × Hv10:38
Sign #X "Worm" × Sign #X "Worm": Pr5:12 × Hr5:29 × Qr5:20, Pr5:13 × Hr5:30 × Qr5:21, Pr5:14 × Hr5:31 × Qr5:22, Pr5:15 × Hr5:32 × Qr5:23, Pr6:34 × Hr7:4 × Qr6:36
Sign #Y "Eel" × Sign #Y "Eel": Pr5:52 × Hr6:6, Pv5:27 × Hv3:22 × Qv6:10, Pv5:49 × Hv4:1, Pv6:52? × Hv5:1?
Sign #Z? "Hand-Tailed Eel" × Sign #Z? "Hand-Tailed Eel": Pv6:25 × Hv4:26 × Qv7:16(?)

It should be noted that the sign #Y on Q is obliterated, with only its general outlines preserved. It is difficult to assert that the graphic design #Z "Hand-Tailed Eel" is an independent sign due to its rarity. It can be a graphic variant of the sign #Y or a ligature of the sign #Y with the sign "Hand", but the fact that two known examples of #Z are restricted to the same context suggests that #Y and #Z are two different signs. The sequence #XXXX, which is attested 4 times (Aa1:5-8 × Pr5:12-15 × Hr5:32 × Qr5:23), implies that #X is a syllabic sign. The sign #Y behaves as a word-sign (see Ab6:42-55).

* * *

Application of the technical terms and concepts developed in graphic analysis of other pictorial writing systems to the surviving Kohau Rongorongo texts leads us to promising results. First, it has been shown for the first time that some visually different signs of the Kohau Rongorongo script have the same reading value. Signs of this type (allographs) are relatively uncommon in the Kohau Rongorongo script in contrast to, for example, Maya writing. Second, several graphic designs that were previously thought of as variants of more frequent signs have been identified as independent signs. Some of them are very rare in the inscriptions. Probably a thorough graphic analysis would considerably increase the total number of signs attested in the Kohau Rongorongo writing system. Some graphic variants are limited to particular tablets; they probably pertain to certain scribes or schools of scribes or could be chronological variations of the script (see Wieczorek 2011b). Some graphic variants are restricted to contexts where there is a lack of space. It

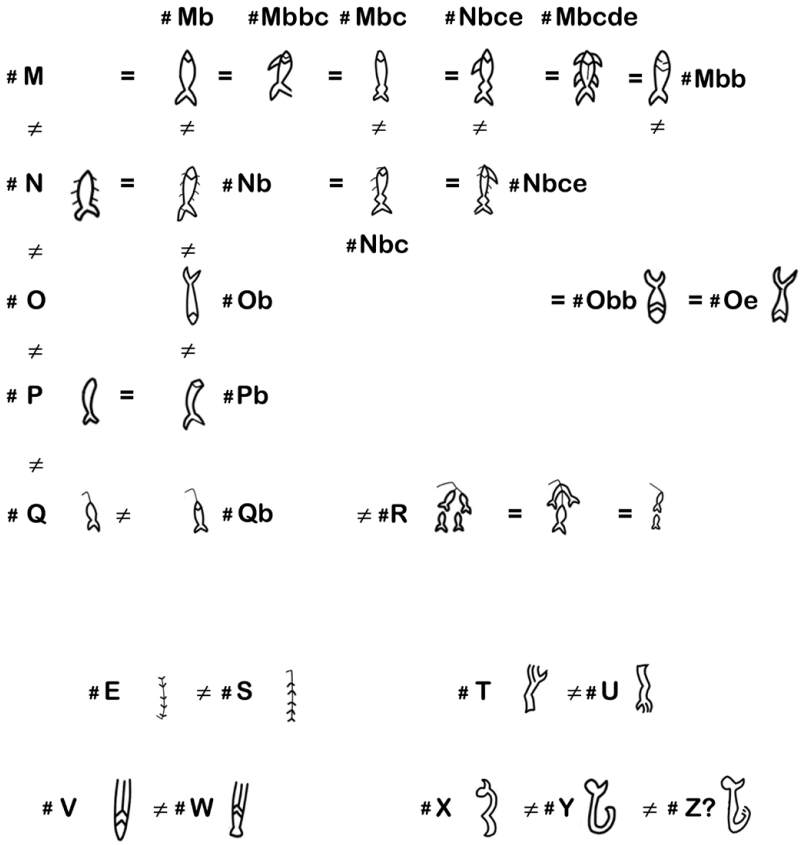

Figure 6. Seeming graphic variants in the Kohau Rongorongo texts: Sign #M "Fish" ≠ (#b "Fish, Gills", #bb "Fish, Double Gills", #c "Fish, Bulbed Tail", #d "Fish, Lateral Line", #e "Fish, Extra Fins") ≠ Sign #N "Spiny Fish" (#b "Fish, Gills", #c "Fish, Bulbed Tail", #e "Fish, Extra Fins") ≠ Sign #O "Fish Upside Down" (#b "Fish, Gills", #bb "Fish, Double Gills", #f "Fish, Without Head") ≠ Sign #P "Swimming Fish" (#b "Fish, Gills") ≠ Sign #Q "Fish on Fishing Line" (#b "Fish, Gills") ≠ Sign #R "Catch of Fish"; Sign #E "Leaved Vine Growing Up" ≠ Sign #S "Leaved Vine Hanging Down"; Sign #T "Arm (Pointing Up)" ≠ Sign #U "Arm Pointing Down"; Sign #V "Comb" ≠ Sign #W "Wide-Handled Comb"; Sign #X "Worm" ≠ Sign #Y "Eel" ≠ Sign #Z? "Hand-Tailed Eel". After Paul Horley's drawings with his permission.

is the context that is important in graphic analysis because graphic analysis is concerned with signs that possess reading values, that is meanings, which actualise in certain graphic environments. Every violation of the free distribution statistics of two graphic designs that supposedly represent the same sign should be addressed in detail. If such violations cannot be explained in a satisfactory way, it would indicate that graphic analysis alone is insufficient. Sometimes violations can be explained by the fact that the available data is scarce (i.e., sample size effects). Third, sometimes variations of the same graphic design with corresponding verbal descriptions help us to understand the objects depicted by signs. The method of iconic formulae may lay down a foundation for the future iconographic analysis of highly pictorial signs of the Kohau Rongorongo script.

My aim here was not to identify as many allographs and independent signs as possible but rather to show how the mechanics of the Kohau Rongorongo graphic system work. Because of this, I have excluded graphically complex signs, such as those depicting birds and human beings. I have also restricted myself to the three large parallel texts. The results presented here can be easily applied to and verified with data from the other inscribed tablets. I suggest that the methods of graphic analysis outlined here—sign substitution, inverse sign substitution and iconic formulae—should be carefully applied to every single sign of the Kohau Rongorongo script and the results of such application should be constantly re-checked and revised. Graphic analysis of individual signs and their identifications should not be freely assumed, but explicitly presented and justified. It is important to bear in mind that sometimes examples of substitution are lacking or their number is insufficient, so we cannot be sure with the data at our disposal whether two similar graphic designs are indeed variants of the same sign or if they belong to two different signs with two different reading values.

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NOTES

1. I dedicate my article to Boris Kudrjavtzev who in 1938, around the age of 16, made one of the most important Kohau Rongorongo discoveries to date: the same text is written on the Great St Petersburg Tablet, the Small St Petersburg Tablet and the Great Santiago Tablet (Zhamoida 1996: 1113). Boris recognised the significance of his discovery, which makes it possible to establish the reading order, and identify graphic variants, ligatures and word boundaries of the three texts, but tragically he died at a young age during World War II. Although he was not able to complete his studies, a very interesting 46-page manuscript was posthumously published (Kudrjavtzev 1949; Olderogge 1949). It is a crucial work for scholars working on the Kohau Rongorongo script, but unfortunately has never been translated into any European language. The miraculous birth from an egg referred to in this epigraph is a wide-spread heroic motif in Polynesia and in many other parts of the world.
2. The logosyllabic writing systems of the Far East (Chinese, Japanese, Jurchen, Khitan, Tangut, etc.) are similar graphically and thus undoubtedly derived from one original system. Several families of writings developed in the Near East (Cretan, Cuneiform, Egyptian, Luwian, including the Indus script) are different in external form, and typologically, so they cannot be derived from one source. The mere fact that different writing systems quickly developed in geographical proximity strongly suggests that the idea of writing was invented only once and afterwards other systems were developed by the people who were familiar with this idea (Gelb 1963). In my opinion, it is unclear which writing system of the Near East appeared first; the Cuneiform script and the Egyptian one are likely candidates. It is also unclear whether the idea of writing was independently invented in the Far East or was somehow introduced thereto from the Near East.
3. The following signs of Barthel's catalogue are considered allographs by Fedorova: 011=001, 041=040, 056=027, 081=008, 091=090, 102=003, 174=015, 205=204, 246=244, 356=244, 386=385, 421=430, 606=604, and 651=680 (Fedorova 1982: 42-70).
4. Jacques Guy (2006: 55) coined the odd term "alloglyphs" which are defined as variants of the same "glypheme", that is, the same letter. He also claims to borrow the term "glyph" from Mayanists. In Maya epigraphy "glyph" is an informal abbreviation for the term "hieroglyph", defined as a sign or a combination of several signs that are used to write a word. The basis for his claim that "the Russian School has been using the term grapheme to cover what is all at once graph, grapheme and allograph in Crystal's glossary" is also unclear, as is what he means by "the Russian School".
5. The term allography was originally introduced by analogy with the terms "phoneme" and "allophone" by Ernst Pulgram (1951). Unfortunately, the author makes use of a non-formal emic concept "letter" and does not distinguish two different phenomena which are called "allographs" and "graphic variants" in the present paper. This makes it impossible to use his definitions for graphic analysis of an undeciphered writing system.
6. The Rapanui word for 'seal' is *pakia* and 'blenny' is *pātuki*, suggesting the reading value **pa** for the signs under discussion.

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APPENDIX:
LIST OF SIGNS, THEIR DESCRIPTIVE NICKNAMES AND NUMBERS ACCORDING TO THOMAS BARTHEL'S CATALOGUE OF 1958

#A "Seal" – 730
#B "Blenny Fish" – 790
#C "Two Vines Growing Up" – ?30b
#D "Tuber (a Kind of)" – 22c
#E "Leaved Vine Growing Up" – 3a
#F "Berried Stem" – 34
#G "Stem Stripped of Berries" – ?73b
#H "Turtle" – 280
#I "Head? on a X-shaped Base/Pedestal" – 99
#J "Sprout? on a X-shaped Base/Pedestal" – 522
#K "Calabash" – ?74a
#L "Gourd" – 45, 46
#M "Fish" – ?700a
#N "Spiny Fish" – unrecognised as a graphic design, transcribed 700f
#O "Fish Upside Down" – ?710b
#P "Swimming Fish" – unrecognised as a graphic design
#Q "Fish on Fishing Line" – 711
#R "Catch of Fish" – unrecognised as a graphic design
#S "Leaved Vine Hanging Down" – 3b
#T "Arm (Pointing Up)" – 6
#U "Arm Pointing Down" – unrecognised as a graphic design, transcribed 6x
#V "Comb" – ?50
#W "Wide-Handled Comb" – unrecognised as a graphic design, transcribed 50
#X "Worm" – unrecognised as a graphic design, transcribed 440
#Y "Eel" – 451
#Z "Hand-Tailed Eel"? – unrecognised as a graphic design, transcribed 451

ABSTRACT

In a writing system with a large number of signs, in particular in the case of a pictorial script, some similarity of two graphic designs is an insufficient basis for considering them to have the same reading value. This paper seeks to apply concepts developed in the graphic analysis of other pictorial writing systems to the still undeciphered script of Rapa Nui (Easter Island). The following technical terms are adapted and defined from both theoretical and practical points of view: sign, reading value, graphic design, allograph, graphic variant, seeming graphic variant, iconic formula, and complete, incomplete and false substitution. A modified version of the substitution method

(method of inverse sign substitution) is proposed for verifying equivalences and differences between readings values corresponding to the graphic designs analysed in this paper. This method is based on the assumption that two graphic designs that possess the same reading value are in free distribution, so the probability of sign substitution between them should be close to the probability obtained by multiplying the probabilities of their occurrences in texts. Application of these technical concepts to the parallel texts discovered by Boris Kudrjavtzev shows that many graphically similar signs with different reading values have not been previously recognised. This conservative graphic analysis also has permitted the identification of allographs in the strict sense of the word, i.e., signs that look different but possess the same reading value. However, technically speaking, "allograph" in the strict sense of the word is an antonym for "graphic variant". It is suggested that the method of iconic formulae provides a useful foundation for future iconographic analysis of the highly pictorial signs of the Kohau Rongorongo script.

Keywords: Kohau Rongorongo script, Rapa Nui (Easter Island), logosyllabic writing systems, graphic analysis, allographs (homophonic signs), substitution method

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