The Missing Scripts Project

Johannes Bergerhausen · Thomas Huot-Marchand

Abstract. The Missing Scripts Project, started in 2016, is a long-term initiative that aims to identify writing systems which are not yet encoded in the Unicode standard. As of today, there are still 140 scripts not yet to be used on computers and smart phones.

The first step in 2018 was a web site and a silk screen poster presenting one glyph for each of the 290 world's writing systems: www.worldswritingsystems.org.

The project is a joint effort of ANRT Nancy, France; IDG Mainz, Germany and SEI, Berkeley, USA.

Visible Speech, 1867

Alexander Melville Bell, a Scottish phonetician, developed a universal phonetic notation system called 'Visible Speech' which could represent every sound in every human language. The abstract, often circular symbols, could also help the deaf learn to understand spoken language. Melville Bell's son Alexander Graham Bell, continued his father's work on 'Visible Speech', involving himself intensively with the physiognomy of the human voice. In 1876, he would submit his new invention to the patent office: the telephone.

International Phonetic Alphabet, 1888

The International Phonetic association, established in 1886 by the French linguist Paul-Édouard Passy, introduced the International Phonetic Alphabet (IPA) in 1888. These characters were developed on the basis of Latin and Greek characters, revealing the bias of the researchers

Johannes Bergerhausen 0000-0001-5235-6779
Hochschule Mainz, School of Design, Holzstraße 36, D-55116 Mainz, Germany
E-mail: bergerhausen@hs-mainz.de

Thomas Huot-Marchand
Atelier National de Recherche Typographique (ANRT), School of Art and Design Nancy, 1, place Charles Cartier-Bresson, 54013 Nancy Cedex, France
E-mail: thomas.huot-marchand@anrt-nancy.fr

Y. Haralambous (Ed.), *Grapholinguistics in the 21st Century 2020. Proceedings*
Grapholinguistics and Its Applications (ISSN: 2681-8566, e-ISSN: 2534-5192), Vol. 4.
Fluxus Editions, Brest, 2021, pp. 439–454. https://doi.org/10.36824/2020-graf-huot
ISBN: 978-2-9570549-6-1, e-ISBN: 978-2-9570549-8-5

of that time. They missed the chance of taking more appropriate characters from other writing systems.

Intergalactic Network, 1962

J. C. R. Licklider, an American psychologist, formulated the idea of an 'Intergalactic Computer Network'. The computers of that time could fill up entire rooms. A year later, he half-jokingly referred to his colleagues as 'Members and Affiliates of the Intergalactic Computer Network'. But it was less of a joke than he had imagined. Within 7 years, Licklider was one of the developers of the ARPA-net, the precursor of the Internet.

ASCII, 1963

Bob Berner, a computer scientist at IBM, led a group of engineers developing the American Standard Code for Information Interchange, widely known as ASCII. No one imagined at the time that a purely American character encoding standard would still be in use on every computer in the 21st century. ASCII defined 95 typographic symbols and 33 control codes used to communicate between computers. The standard, which proved itself to be fundamental to the early Internet, was integrated as a subset of Unicode in 1991 and as such is nearly as well distributed as the DNA code.

ARPA-net, 1969

50 years ago, during the same year as Woodstock and the Moon Landing, ARPA-net, named after the Advanced Research Projects Agency (ARPA), and forerunner of today's Internet, went online. It originally connected four American universities each with just one computer. The first ever message delivered over the network on 29th of October, 1969 was the word 'LOG', meaning 'LOGIN'. The L and O were transmitted successfully in binary sequences but during the processing of the letter G, one of the two computers crashed.

Xerox PARC, Dynabook, 1971

Xerox corporation was so successful with their photocopy machines, they were able to fund the archetypal technology research center in California exploring the future of office work. The team at Xerox Palo Alto Research Center (PARC) in the 1970s would invent the signature technologies of the ensuing decades: the personal computer, the Graphical User Interface (GUI), the laser printer, and the Ethernet.

In 1971, Xerox employees English and Lampson designed the character generator, which was the first GUI type design program. The psychologist and PARC researcher Alan Kay, who foresaw, with his Dynabook concept, the development of the laptop by 20 years, tells us in a speech in 1986: "Here is an interesting thing: What do you do when you are doing a rough draft and you are printing it out in Times Roman? And the answer is: you use our own handwriting! I never understood why this didn't catch on [in type design]."

Writing, Typing

We informally say we are 'writing' on a computer. Of course, we do not mean we are writing by hand (Chirography) but rather we are 'typing' from the Greek τυπογραφία: Typographia: writing with types. This is an abstract process. One no longer writes or draws an 'A' but rather types on the 'A' key and an <A> is displayed on the screen. This is still, in principle, the same process as with a typewriter.

Interpress, 1982

Since he could not get any support or interest for the page description language he developed at Xerox PARC, John Warnock quit his job and went on to found his own company. He called his new software PostScript and his company Adobe.

Xerox and Apple, 1984

The Xerox-PARC researcher, and later co-founder of Unicode, Joseph D. Becker, published the groundbreaking paper 'Multilingual Word Processing' in *Scientific American*, where the important distinction is made between characters and glyphs. In the same year, Steve Jobs presented the first Macintosh, which employed and further developed many ideas pioneered at Xerox PARC.

Unicode 88

In his nine-page paper 'Unicode88', Joseph D. Becker foresees the "need for a new, world-wide ASCII". When humanity develops worldwide networked computers, the Latin ASCII letters will no longer be sufficient. Becker outlines the main features of the Unicode Consortium, which would be founded two years later.

Apple Newton, 1997

After 12 years at Next and Pixar, Steve Jobs returned to the first company he founded. It would not take him long to stop the development of the Newton platform with its shaky handwriting recognition. Jobs remarked in 2003 at the *All Things Digital* conference: "It's really slow to write stuff [by hand]! You could never keep up with your email if you had to write it all out".

World Standard

Unicode 12.1, released in May 2019, encodes 137,929 characters. This means that today exactly 150 scripts can be used on computers (and smartphones). Every year, new characters are added to this world standard. These can then be found in the operating system updates of all computers (including smartphones). Among these new characters, new emojis are added every year.

The Unicode consortium decides which characters are typographically available to people—and which are not. The consortium, registered in Mountain View, California, is primarily made up of representatives from the IT industry giants. Apart from Apple, Facebook, Google, IBM, or Microsoft, very few state institutions are represented. The academic world is also hardly represented. An exception would be the Script Encoding Initiative (SEI), led by the linguist Dr. Deborah Anderson from the Department of Linguistics at UC Berkeley. The Mainz university project decodeunicode is a liaison member without voting rights.

Any institution or company can become a member of the consortium. Through a 'full membership' at $21,000 USD per year, one has the right to vote and can participate in decisions.

The Internet speaks Unicode worldwide. There is no competition. For example, without this standard we could not send text messages from the Netherlands to Russia today. It would be nearly impossible to have both Cyrillic and Latin letters in text messages without Unicode.

Languages ≠ Scripts ≠ Countries, 2019

Brief overview: Ethnologue.com catalogs 7,111 known living languages, SEI Berkeley defines 290 scripts and the United Nations has 193 member states.

Cultural Achievement

Unicode is increasingly becoming a collection of human writing systems. For us, this is not only a technical, but also a cultural achievement.

It amazes us that such a utopian project has gained real international acceptance and is available on every computer. The world speaks, at least on this level, one language.

Characters and Glyphs

Unicode defines many technical specifications, but the principle of character encoding is simple. Each character is assigned a name and a hexadecimal number. Thus the letter A is encoded as LATIN CAPITAL LETTER A with the number U+0041 (41 is hexadecimal for decimal 65).

So when one sends an A by SMS or e-mail, one does not send the graphic form (glyph) of the letter, only the code. The receiving device receives a binary string, interprets the hexadecimal value and represents the matching glyph.

Unicode does not specify the appearance of characters. This is the work of the type designer. The transcription through code is akin to the Platonic concept of the character free of any particular form. Unicode encodes characters—not glyphs.

When Is an A an A?

Is it even possible to give a character a determinate form? For example, one might claim that the upper half of a capital A is always pointed, but it is easy to find examples where this is not the case.

Likewise, there are many glyphs for A that have no crossbeam but are still easily recognized as A.

Part of the definition of the character A might be that it is one of the 26 (or 52) letters of the Latin alphabet, that it is read from left to right, and that it usually stands for the sound /a/. However, such properties are emergent from the context and are form-independent.

We claim that an A is only really defined through its encoding into Unicode. Only thus can there be an international agreement about the character.

The definition of a character involves cultural conventions. If the glyphs look too similar, the name or code position can help distinguish them. For example, the two characters ┐ and ꟷ are almost indistinguishable, but in Unicode the former is called BOX DRAWINGS LIGHT DOWN AND LEFT, so it is always a perfect right-angle, while the latter is called TIRONIAN SIGN ET, a glyph from Roman times whose angle may vary.

Missing Scripts

Unicode has significantly reduced the relative visual presence of the Western (or, rather, the Latin) world. At the time of ASCII, it was almost impossible to display 'exotic' letters on the computer.

Imagine you could not use your own script on your smartphone. Unicode has remedied this for most writing systems. 150 scripts are usable today, a great success.

But there is still a lot to do. A first step of the Missing Scripts project at the Institut Designlabor Gutenberg (IDG) at Mainz University of Applied Sciences and at the Atelier National de Recherche Typographique (ANRT) in Nancy, was to ask Dr. Deborah Anderson (SEI) how many writing systems are missing from Unicode. After consulting her experts worldwide, she responded with an amazing number: 140. Only about half of the world's writing systems are available on today's computers.

United Nation of Type

Without binary code, scripts cannot be used on computers. This means that cultures whose writing systems are not accommodated by Unicode cannot be digitized, stored or published as texts without conversion to binary codes. Additionally, any culture so affected cannot compose and distribute new digital texts either. Every writing culture in the world should be able to disseminate and extend its cultural heritage on all modern devices. Unicode is becoming a kind of assembly of the united typographic nations. Here, every culture should be represented.

Historical Scripts

32 historical scripts have not yet been included in Unicode. The question here is whether it is worth encoding a script whose last users have died out thousands of years ago.

In a sense, no script is ever really extinct. Somewhere in the world there are scientists (or enthusiasts) still working with these historical texts. For example, there are around 3,000 people worldwide who can read and write cuneiform. This community also wants to use these characters in text editing programs. This is why they have to be encoded and included.

At the University of Bonn, there is a 10-year project to develop a dictionary of Mayan hieroglyphs. Without character encoding, these researchers will be at a loss. The dictionary won't be able to be published online (or be printed) unless the characters have been encoded and glyphs designed. Once this is done, it becomes available to humanity and can be copied and passed on freely. Perhaps if all Mayan

texts become available online, new possibilities for research will emerge through text comparisons and full-text search.

If we want to achieve the utopian-real goal of one day making available all the texts of humanity, we must also encode extinct scripts and digitize their texts.

7 out of 290

Incidentally, of the 290 scripts, there are exactly 7 that have not yet been deciphered. One is *rongorongo*, a playground for researchers and adventurers.

The World's Writing Systems

As a first step in the long-term project 'Missing Scripts' of IDG Mainz, ANRT Nancy and SEI Berkeley, we researched and designed a representative glyph for each of the 290 writing systems. In this collection, the letter A represents the Latin alphabet as the letter Omega Ω is internationally recognized as Greek.

In cases where there was no representative character, for alphabets we used the character for the sound /a/, for syllabic scripts the character for /ka/, and for pictographic-ideographic scripts, the character for human body.

In this way, typographic forms have been developed for some writing systems for the first time. This collection was presented with a poster and website www.worldswritingsystems.org in 2018. Research and type design were carried out by Johannes Bergerhausen, Arthur Francietta, Jérôme Knebusch and Morgane Pierson at ANRT.

The Unicode Proposals

In order for a new character or writing system to be implemented in Unicode, a formal application must be made. In 2019, there are exactly 71 proposals for scripts that have not yet been implemented in Unicode. These we have presented in the reading room in alphabetical order. Each proposal can be studied in peace. They have been available online for years but are hardly known. Why have some proposals still not yet been accepted though they were filed years ago?

Acceptance into Unicode is not trivial. First, it must be proven that a community that uses these characters exists. This is sometimes more difficult than one might think. Subsequently, the applicant must prove that the character set is complete. Each character must have a unique name according to scientific standards. It is often not easy to find an expert for an obscure script. Additionally, the information from the community of users is often contradictory.

When Is a Script a Script?

Scripts are writing systems, collections of visual characters which can completely represent at least one human language. Therefore emojis are not scripts. Sometimes two experts, when presented with two similar scripts, cannot concur whether or not they are 'only' glyph variants of the same script. This is why, for instance in 2001, the Etruscan or Venetian alphabets of the Italian peninsula were encoded under the generic category "Old Italic".

Missing Living Scripts

In Unicode, living scripts take priority. Why do we then still find, among the 71 scripts which have been proposed but not yet accepted, 39 living scripts? Can it have any-thing to do with the fact that these are used in regions which promise no commercial potential (as yet) for the IT sector? Why has there never been a Unesco project to ensure that these scripts are taken up as quickly as possible into Unicode? This is surprising given that everyone has been talking about digitization for so long.

Research at ANRT, Nancy

There are scripts for which no confirmed typographic form has been established. During encoding, the script inevitably must make the leap from chirography (handwriting) to typography. This is where research at the ANRT in Nancy, headed by Director Thomas Huot-Marchand, begins.

As part of the IDG, ANRT and SEI's 18-month research program Missing Scripts, post-graduate students at ANRT often develop a typographic form for the first time. They consult all available documents and do handwritten and typographic analyses. If they work with a living script, they obtain feedback from the user community. This research program started in 2016.

Not Neutral

The reference glyphs for our project were designed in a monolinear, non-contrasting manner to make the shapes comparable. As with 'conventional' font design, the impression is that all the glyphs were designed with the same (analogue) instrument.

Critics might say that this is a Western approach. We would agree. Our typographic eyes were trained in the 'Western World'. But one

might also draw these characters in another style. It is easy to imagine writing all the shapes with a ballpoint pen. Our glyphs do not claim universality.

Can there be a 'neutral' shape for all glyphs?—No. There is no neutral font. A more general style would perhaps emerge if one were to draw all the characters with a finger in the sand (i.e., monolinear rounded, stroke width: one finger). Characters have been written in this manner for millennia, does that mean a finger is a neutral tool?

Latin letters are still very dominant worldwide. Our hardware and software is mainly made in the USA. In type specimen books in the 'Western' world, 'other' writing systems are called 'exotic' or 'Non-Latin' even today. This is as problematic as the term 'World Music'.

General Visual Typographic Laws

Are there 'universal' visual laws according to which the letters of all the most diverse cultures, at least those on this planet, are shaped?—We think so. We must discover these laws. We would like to suggest one principle: gravity.

Every type designer knows that there is a 'visual gravity' in the way a character 'stands up'. They 'lie' on the paper. An <O> can visually 'tilt' left or right if it is not drawn correctly. An <M> stands sturdily with both legs on the script line, an invisible but imaginary floor. We humans project things we have learned through our natural senses into these glyphs. Therefore, I think that gravity is a first element of the general visual typographic laws.

Two Ships Passing in the Night

It remains astonishing how persistently many disciplines keep to themselves and don't see what is going on around them. This is how it is possible that the excellent work Dr. Deborah Anderson has been doing at SEI since 2002 is still today so little known in the worlds of typography and type design. Likewise, should the Irish linguist Michael Everson, author of the most Unicode proposals, be invited much more often to typography conferences?

Interest in the commercial sector only emerges when smartphones begin to be marketed in a new country and suddenly it becomes apparent that the people there use an obscure script which is not yet available from the operating system. Only Google's Noto-project has the universal vision which is capable of grappling with this task.

Funding for Encoding

It is complex work to linguistically and typographically systematize an exotic writing system and to write a proposal for Unicode. Outside of the passionate amateurs, experts cannot sustain this work without funding. It is all the more astounding how the IT sector does not support funding a comprehensive vision. In such a situation, we can only call for Dr. Deborah Anderson's SEI to be funded.

All Texts, All Times

The human project and human dream to make all the texts of all the ages digitally available is today within reach. The time is ripe. This massive undertaking must only take place once in the history of humanity, in the 21st century.

One example: The Murty Classical Library of India aims to make accessible modern translations of all classic Indian texts in print and online. In the first five years, 22 volumes in 12 different languages have been published.

A complex, multilingual typographic system is needed for this unique 100-year publishing project.

Missing Completed, 2044

Unicode took 27 years to encode 150 scripts. At the same pace, all the writing systems of humanity will be united in a universal code around the year 2044. It will have taken a little more than 50 years to encode approximately 5,000 years of written history. The prerequisite for making all texts of mankind available digitally would be created.

References

André, Jacques and Jean-Louis Estève, eds. (1995). *Ligatures & caractères contextuels*. Vol. 22. Cahiers Gutenberg. Rennes.

André, Jacques and Michel Goossens, eds. (1995). *Codage des caractères et multi-linguisme : de l'ASCII à Unicode*. Vol. 20. Cahiers Gutenberg. Rennes.

Barthes, Roland (1981). *Das Reich der Zeichen*. Frankfurt: Suhrkamp.

Becker, Joseph D. (September 1984). "Mehrsprachige Textverarbeitung." In: *Spektrum der Wissenschaft*, pp. 42–54.

Benjamin, Walter (1928). *Einbahnstraße*. Berlin: Ernst Rowohlt.

Bergerhausen, Johannes (2014). *Digitale Keilschrift / Digital Cuneiform*. Mainz: Hermann Schmidt.

Bergerhausen, Johannes and Siri Poarangan (2011). "decodeunicode— Die Schrift-zeichen der Welt." `https://decodeunicode.org/`.

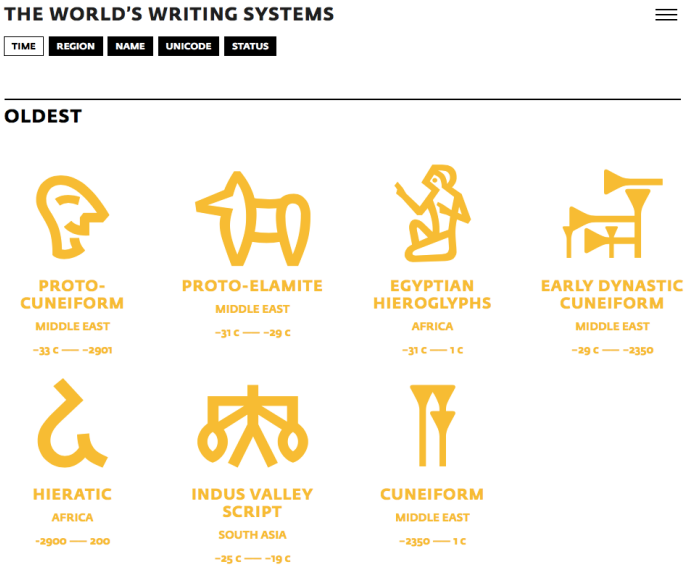

FIGURE 1. Screenshot of `www.worldswritingsystems.org`, scripts sorted by time of creation

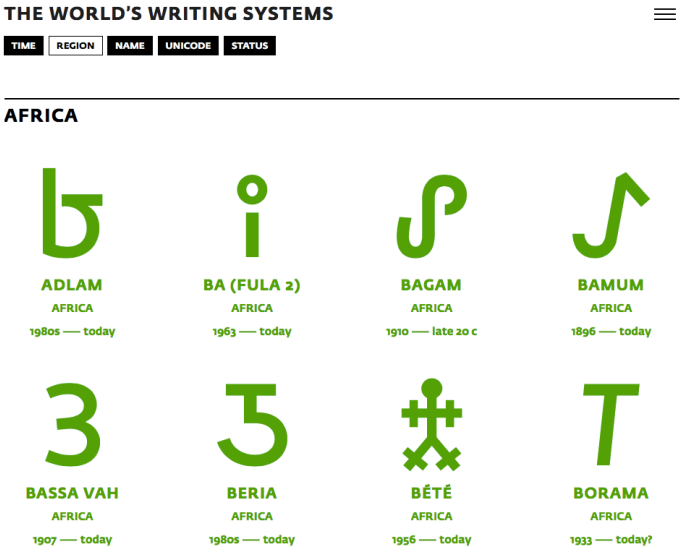

FIGURE 2. Screenshot of `www.worldswritingsystems.org`, scripts sorted by geographical region

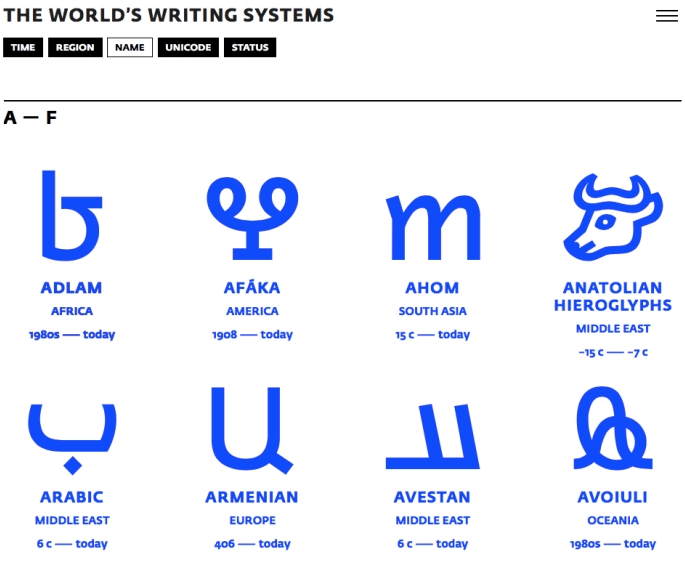

FIGURE 3. Screenshot of `www.worldswritingsystems.org`, scripts sorted by name, sorted by Latin Alphabet

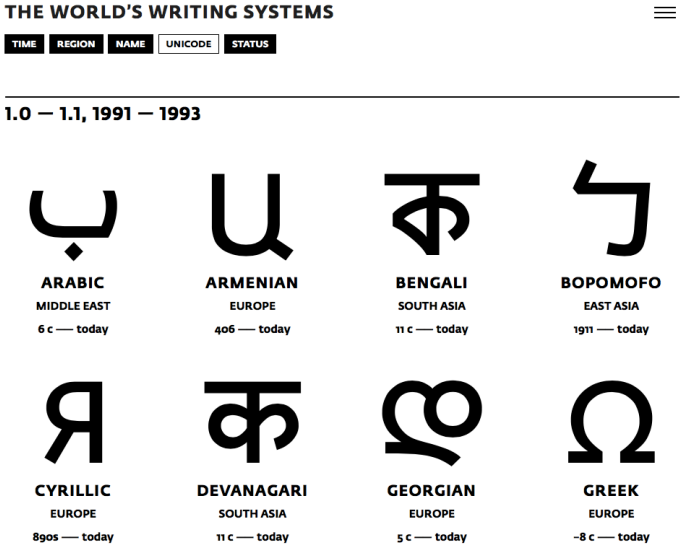

FIGURE 4. Screenshot of `www.worldswritingsystems.org`, scripts sorted by time of Unicode encoding

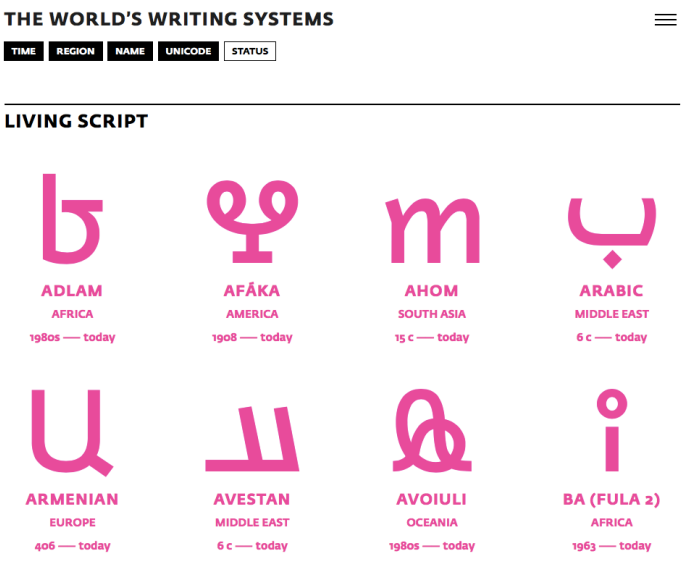

FIGURE 5. Screenshot of `www.worldswritingsystems.org`, scripts sorted by status (living or historical)

Berry, John D., ed. (2002). *Language, Culture, Type*. New York, NY: Graphis.
Bringhurst, Robert (1999). *The Elements of Typographic Style*. 2nd ed. Hartley and Marks.
Cajori, Florian (1993). *A history of mathematical notation*. Mineola, NY: Dover.
Consortium, The Unicode (2006). *The Unicode Standard*. Mountain View, CA: Addison-Wesley.
Daniels, Peter T. and William Bright (1996). *The world's writing systems*. Oxford, UK: Oxford University Press.
Dehaene, Stanislas (2010). *Lesen*. München: Knaus.
Dürscheid, Christa (2012). *Einführung in die Schriftlinguistik*. Göttingen: UTB.
Eco, Umberto (2002). *Einführung in die Semiotik*. Stuttgart: UTB, Fink.
———— (2009). *Die unendliche Liste*. München: Hanser.
———— (2015). *Zeichen. Einführung in einen Begriff und seine Geschichte*. Frankfurt: Suhrkamp.
Ed Annink, Max Bruinsma (2010). *Gerd Arntz, graphic designer*. Rotterdam: 010 Publishers.
Eisele, Petra and Isabel Naegele, eds. (2012). *Texte zur Typografie. Positionen zur Schrift*. Zürich: Niggli.
Fara, Patricia (2010). *4000 Jahre Wissenschaft*. Heidelberg: Spektrum.

FIGURE 6. Silk screen poster of one reference glyph for each writing system of the world. Type design of 290 glyphs: J. Bergerhausen, Arthur Francietta, Jérôme Knebusch, Morgane Pierson; poster design: J. Bergerhausen, Ilka Helmig—first edition 2018 ANRT Nancy, France; IDG Mainz, Germany; SEI Berkeley, USA (second edition 2019)

Faulmann, Carl (2003). *Schriftzeichen und Alphabete aller Zeiten und Völker*. Reprint of 1880 Edition. Augsburg: Augustus.
Flusser, Vilém (2002). *Die Schrift*. 5th ed. Göttingen: European Photography.
Frutiger, Adrian (1978). *Der Mensch und seine Zeichen*. 1st ed. Frankfurt: Stempel AG.
———— (2000). *Zeichen*. 3rd ed. Vol. 7. Typotron. St. Gallen.
Gardiner, A. H. (1928). *Catalogue of the Egyptian hieroglyphic printing type*. Bibliotheca Aegyptiaca. Chicago Ridge, IL: Ares Publishers.
Gelb, Ignace J. (1963). *A Study of Writing*. 2nd ed. Chicago, IL: The University of Chicago Press.
Gill, Erik (2013). *An Essay on Typography*. London: Penguin Books.
Gillam, Richard (2002). *Unicode Demystified*. Boston, MA: Addison-Wesley.
Gillessen, Maximilian and Anton Stuckardt (2019). *Roussel, Brisset, Duchamp. Engineers of the Infra-Thin*. The Hague: Alphabetum.
Gottlob, Max-Peter and Gerhard Strecker (1984). *Die BTX-Fibel*. Haar: Markt & Technik.
Graß, Tino, ed. (2008). *Schriftgestalten. Über Schrift und Gestaltung*. Sulgen/Zürich: Niggli.
Haralambous, Yannis (2004). *Fontes & Codages*. Paris: O'Reilly.
Herzfeld, Andy (2005). *Revolution in the Valley*. Sebastopol, CA: O'Reilly.
Hiltzik, Michael A. (2000). *Dealers of Lightning: Xerox PARC and the Dawn of the Computer Age*. New York: Harper Business.
Hofstadter, Douglas R. (1985). *Gödel, Escher, Bach. Ein endloses geflochtenes Band*. Stuttgart: Klett-Cotta.
Huot-Marchand, Thomas, Roxane Jubert, and Sébastien Morlighem (2016). *Atelier national de recherche typographique, Archives 1985–2006*. Nancy: Les presses du réel.
Kinross, Robin (1992). *Modern Typography*. London: Hyphen Press.
Klee, Paul (2003). *Pädagogisches Skizzenbuch*. Neue Bauhausbücher. Berlin: Gebr. Mann.
Koch, Rudolf (1926). *Das Zeichenbuch*. 2nd ed. Offenbach am Main: Wilhelm Gerstung.
Korpela, Jukka K. (2006). *Unicode Explained*. Sebastopol, CA: O'Reilly.
Krampen, Martin (1983). *Die Welt als Zeichen: Globale Kommunikation mit Piktogrammen*. Berlin: avedition.
Mackenzie, Charles E. (1980). *Coded Character Sets. History and Development*. Reading, MA: Addison-Wesley.
Magritte, René (1929). "Les mots et les images." In: *La Révolution surréaliste* 12, pp. 32–33.
Maldonado, Tomás (1959). *Kommunikation und Semiotik*. Vol. 5. ulm. Ulm: Hochschule für Gestaltung Ulm.
Markoff, John (2005). *What the dormouse said*. New York, NY: Penguin Books.

Melville Bell, Alexander (1867). *Visible Speech. The Science of Universal Alphabetics*. London: Simkin, Marshall & Co.

Mitchell, Sandra (2008). *Komplexitäten. Warum wir erst anfangen, die Welt zu verstehen*. Frankfurt: unseld.

Munari, Bruno (2013). *Suplemento al dizionario italiano*. Mantova: Corraini Editore.

Neurath, Otto (1980). *International Picture Language*. Reading, UK: University of Reading.

———— (2010). *From hieroglyphs to Isotype*. London: Hyphen Press.

Noordzij, Gerrit (2005). *The stroke. Theory of writing*. London: Hyphen Press.

Revues de recherche en design. Un panorama (2014). Vol. 40–41. Azimuts. Saint-Étienne: École supérieure d'art et de design.

Saussure, Ferdinand de (1916). *Cours de linguistique générale*. Ed. by Charles Bally and Albert Sechehaye. Paris: Payot.

Schuller, Gerlinde (2009). *Designing universal knowledge*. Baden: Lars Müller.

Spencer, Herbert (1969). *The visible word*. 2nd ed. London: Lund Humphries/Royal College of Art.

Stöppel, Daniela (2008). *Visuelle Zeichensysteme der Avantgarden 1910 bis 1950*. München: Silke Schreiber.

Stötzner, Andreas (2000). *Signographie. Entwurf einer Lehre des graphischen Zeichens*. Grimma: Waechterpappel.

Tschichold, Jan (1953). *Formenwandlungen der Et-Zeichen*. Frankfurt: Stempel AG.

"Underware: From Typography to Grammatography" (2019). conference booklet. The Hague. URL: http://www.tokyoartbeat.com/event/2019/7100.en.

Venturi, Robert, Denise Scott Brown, and Steven Izenour (1968). *Learning from Las Vegas*. Cambridge, MA: MIT Press.

Wehde, Susanne (2000). *Typografische Kultur*. Tübingen: Niemeyer.

Wittgenstein, Ludwig (2010). *Tractatus logico-philosophicus. Logisch-philosophische Abhandlung*. Frankfurt: Suhrkamp.

Zali, Anne and Annie Berthier (1997). Vol. 1. L'aventure des écritures. Paris: Bibliothèque Nationale de France.

———— (1998). Vol. 2. L'aventure des écritures. Paris: Bibliothèque Nationale de France.

———— (1999). Vol. 3. L'aventure des écritures. Paris: Bibliothèque Nationale de France.