Arabic hot metal: the origins of the mechanisation of Arabic typography

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The origins of the mechanisation of Arabic typography

In the 1870s, Ottmar Mergenthaler (1854–1899), a German émigré to the United States, began to investigate and develop machines to facilitate typographic composition and justification – a goal that was pursued with mixed results by inventors for most of the nineteenth century.[1] After a prolonged phase of trial and error, by 1886 the first functional machine was put to use at the *New York Tribune* newspaper, heralding the era of mechanised typesetting.[2] The machine Mergenthaler had developed, and its revolutionary concepts, transformed the practice of typography. Through the depression of keys on a keyboard, matrices of individual letters were assembled as a mould of one, automatically justified line. This mould was used to cast a so-called 'slug' – a line of type – from molten type metal, coining both the term hot-metal composition, and the name of the machine: the Linotype. Continuous improvements eliminated initial technical problems, and before the end of the century the Linotype had redefined the printing trade, making it widely recognised as the most important innovation since Gutenberg's movable type composition.[3] After paper-making and the printing press, typesetting was the last central element of the print-shop to be mechanised and thus provided the key to an unprecedented growth in printing and publishing.

With the Industrial Revolution incrementally spreading beyond its initial heartlands, the Linotype followed in close succession and found use across the world. As a consequence, demand arose for the mechanical composition of languages and scripts Mergenthaler could not have foreseen when inventing the device. But as Fiona Ross pointed out, "there existed considerable disadvantages for non-Latin typesetting, for which purpose the composing machines had never been designed", and the results of adapting those scripts to the limitations of the mechanical typesetters "ultimately redefined what was to become acceptable as legible typography".[4] Arguably, for many scripts the mechanical typesetting revolution was thus two-fold. Beyond the dramatic increase in speed and efficiency, and the causally related upheaval of the printing and publishing trades, which in the West are associated with the rise of the Linotype, for many writing cultures mechanisation also entailed the invention of a printed form without antecedent in its manuscript form. Arabic was one of the first scripts to undergo this process and therefore serves as a key example for the motivations and dynamics that drove the shift from manual to mechanical text production of non-Latin scripts.[5]

The precise date of this shift, however, has remained elusive – testimony to the little interest

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1   For a comprehensive account of the numerous attempts to mechanise typesetting see John Thompson, *History of Composing Machines* (Chicago: The Inland Printer Company, 1904).

2   For detailed accounts of Mergenthaler's invention and life see Carl Schlesinger, *The Biography of Ottmar Mergenthaler* (New Castle, Delaware: Oak Knoll Books, 1989); Basil Kahan, *Ottmar Mergenthaler: The Man and His Machine : A Biographical Appreciation of the Inventor on His Centennial* (Oak Knoll Press, 2000) and recently Frank Romano, *History of the Linotype Company*, (Rochester, NY: Rochester Institute of Technology, RIT Press, 2014).

3   Vaclav Smil, *Creating the Twentieth Century: Technical innovations of 1867–1914 and their lasting impact* (Oxford University Press, 2005), 204–207.

4   Fiona Ross, *The Printed Bengali Character and Its Evolution* (Richmond, Surrey: Curzon, 1999), 135.

5   For some writing cultures, as for example in Iran and South Asia, the stage of manual typography was even largely omitted as mechanical composition directly superseded manuscript production and lithographic printing. For an insightful study that juxtaposes the rapid acceptance of lithography for printing Arabic by Muslim populations in South Asia, with the reluctance towards letterpress printing in the Middle East, see Ian Proudfoot, "Mass Producing Houri's Moles, or Aesthetics and Choice of Technology in Early Muslim Book Printing," in *Islam: Essays on Scripture, Thought, and Society,* edited by Peter G. Riddell and Tony Street, 161–184. (Leiden: Brill, 1997).

the subject has received from type historians, and historians of Arabic printing alike. Until recently, no study had sought to precisely date and locate the beginnings of Arabic mechanical typography.[6] In the following discussion the conflicting dates which can be found in literature and primary sources are summarised, illustrating the hazy historical picture that has prevailed until now.

Contradictory claims

At the beginning of the twentieth century there were three successful typesetting machines that were widely used: the Linotype, the Intertype, and the Monotype system. Seeking to identify the first Arabic composing machine, however, the latter can be excluded, as Monotype only began to manufacture Arabic type from the late 1930s.[7] Mergenthaler Linotype's main competitor was the Intertype Corporation, and could in principle have developed the first Arabic linecaster.[8] Indeed, a relatively recent study locates the beginning of Arabic "machine setting" in 1910 at the Egyptian newspaper *al-Ahram*.[9] If *al-Ahram* really pioneered Arabic "machine setting", this would imply Intertype as the originator, for the newspaper primarily used Intertype machinery until the late 1960s. However, Hišām Baḥarī, *al-Ahram's* long-time technical manager, recorded in his history of the newspaper that it adopted Arabic typesetting machinery (sourced from Intertype) only in 1936.[10] According to Baḥarī, *al-Ahram* initially used composing machines only for English and French texts, and developed an Arabic machine jointly with Intertype from 1932.[11] This date, in turn, is supported by evidence of earlier printed issues of the newspaper being set with foundry type, and by Intertype Ltd's trade journal *Interludes,* which reported in 1933:

> *Al-Ahram*, the most important Arabic newspaper in the Near East, was also the first Arabic newspaper to use composing machines [for English and French matter]. The fact that further Intertypes equipped for Arabic composition are now being installed is another tribute to their adaptability for the most diversified forms of composition.[12]

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6   The author's PhD research, upon which this paper is based, covered significant ground in establishing a plausible account for this aspect of Arabic typographical history, but did not provide conclusive evidence. Titus Nemeth, "Arabic type-making in the machine age: the influence of technology on the form of printed Arabic type 1908–1993," PhD thesis, University of Reading, 2013. For a comprehensive publication of the author's research see *Arabic Type-Making in the Machine Age: The Influence of Technology on the Form of Arabic Type 1908–1993*, (Leiden: Brill, 2017).

7   The Monotype Corporation began to develop Arabic founts in 1938, when ample evidence of earlier mechanically composed Arabic typography exists.

8   The Mergenthaler Linotype Company (Mergenthaler) was located in the United States. Its subsidiary Linotype & Machinery Ltd (Linotype) was a British company formed from the Linotype Company and the Machinery Trust Ltd in 1903. It operated largely independently of Mergenthaler. The Intertype company was founded in 1911 (as the International Typesetting Machine Company) and began distributing its linecasting machines commercially from 1913. Yet, in 1913 only one Intertype machine was sold, and before 1917 the total number of units sold (mostly in the US) did not exceed 1000. In 1916 the company was discontinued and sold to new owners who changed the name to Intertype Corporation. Lawrence Wallis, *A Concise Chronology of Typesetting Developments 1886–1986* (London: The Wynkyn de Worde Society in association with Lund Humphries, 1988), 10–11. The Intertype Company Limited, the British subsidiary of the US Corporation, was founded in 1921. Romano, *History of the Linotype Company*, 129.

9   Dagmar Glass, 'Arabic Newspapers and Periodicals in the Arab World (1828–1928)', in *Middle Eastern Languages and the Print Revolution: A Cross-Cultural Encounter: A Catalogue and Companion to the Exhibition* (Westhofen: WVA-Verlag Skulima, 2002), 212. According to Frank Romano, the first Linotype was imported to Egypt in 1906 for the French language newspaper *Bourse Egyptiènne,* which thus introduced mechanical composition to the country. Romano, *History of the Linotype Company*, 72.

10   Hišām Baḥarī, *Ṣaḥāfa Al-Ġadu* (Cairo: Dār al-Maʿārif Bimiṣr, 1968), 138.

11   *Al-Ahram's* early adoption of machine composition for European languages may explain the origin of the claim in literature for the debut of Arabic composition in 1910.

12   Intertype Ltd, 'With the Editor', *Interludes* III, no. 2 (April 1933): 9. Foundry type is movable type for manual composition as used from Gutenberg to the advent of mechanical composition.

It follows that any Arabic machine composition before the 1930s could only have been done with a Linotype machine, as suggested by the account of Walter Tracy (1914–1995), the long-time typographical adviser of Linotype. According to Tracy, who was instrumental in developing Linotype's Arabic library after the Second World War, the company "began to manufacture matrices for the Arabic language in 1911", referring to "records of supplying Altrincham-built Linotype machines to Turkey [*sic*] during the period 1911 to 1914".[13]

Corroborating evidence for the earliest use of Arabic typesetting machines is found in the autobiography of Reginald Orcutt, a travelling representative of Mergenthaler, who reported from his visit to Constantinople in 1928:

> [...] Composing machines were strange and exotic novelties in Turkey. To be truthful, the only two in the country at the time (they had long been in disuse and were beyond repair) were early English Arabic Linotypes which a predecessor of mine named Jack Banks had sold to the then progressive public printer before World War I.[14]

Although confirming that British Arabic Linotype machines were found in Turkey in 1928, and had allegedly already been there since before 1914, the anecdotal nature of Orcutt's account does not make it a reliable source.[15]

Moreover, all accounts cited above are contradicted by Chauncey Griffith, Mergenthaler's long-time director of typographical development. In an internal memorandum to his successor Jackson Burke, Griffith wrote in 1954:

> Prior to (circa) 1940 all Oriental, and particularly Arabic, typographic development was centered in Brooklyn, which made it possible to organize a group of experts, recognized scholars in their respective fields, for advice and consultation on every phase of this branch of our development. In later years L. & M. [Linotype] considered it more advantageous to assume the initiative in Arabic and Hebrew development, since the bulk of Linotype business in these languages originated in countries served directly by them through their local representatives.[16]

From the same document it emerges that "the first [Arabic] Linotype font was developed C. 1912 to be accommodated in the two-magazine Model 4 mixer Linotype"; and in another article Griffith dates the "introduction of Arabic" to 1913, "followed by Syriac, Armenian, Hebrew, Turkish, and other related scripts."[17] Both accounts suggest, however, that Arabic Linotype composition was first achieved in the United States.

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13 Walter Tracy to Merryl Cook, 23 October 1972, WT correspondence, folder 18, DTGC. Tracy may be the source of a frequently quoted date: the year 1911 can be found in later specimens by the company and articles by Hrant Gabeyan, 'Modern Developments in Arabic Typesetting', in *Middle Eastern Languages and the Print Revolution: A Cross-Cultural Encounter: A Catalogue and Companion to the Exhibition* (Westhofen: WVA-Verlag Skulima, 2002), 216–21; and Yasin H. Safadi, 'Printing in Arabic', *Monotype Recorder*, New Series, no. 2 (October 1981): 2–7. According to Romano, the first Linotype was shipped to Constantinople in October 1910 for a French newspaper. Romano, *History of the Linotype Company*, 72.

14 Reginald Orcutt, *Merchant of Alphabets* (London: Jarrolds Ltd., 1947), 71.

15 Orcutt's assertion that the machines were particularly old is curious, as 15 to 20 years was well within the life-span of a linecasting machine.

16 Chauncey Griffith to Jackson Burke, 'Re: Arabic L.&M. Letter of September 3, 1954', Internal Memorandum, (14 September 1954), Box P3640, NMAH. Ross also demonstrates that the British company did not regard itself qualified to undertake any conceptual work on 'Oriental' language developments as late as the 1930s, relying entirely on the expertise of various consultants of Mergenthaler. Ross, *The Printed Bengali Character and Its Evolution*, 139.

17 Chauncey Griffith, 'The Linotype Development of Type Faces', in *The Annual of Book Making 1927 · 1937*, Colophon (New York, 1938), no page numbers. Griffith's inclusion of 'Turkish' as a distinct script is curious: before 1928 Ottoman Turkish used to be written with the Arabic script, just as Persian, Urdu and other non-Arabic languages are. From 1928 Mustafa Kemal Atatürk's radical reform projects prescribed the abandonment of the Arabic script in favour of the Latin script, which has been used for the Turkish language since.

Unexpected origins

Although the above sources provide numerous clues, hitherto their contradictions precluded the development of an unambiguous, historically accurate image. New evidence found for this study, however, may reconcile some of the accounts and sharpen our understanding of the origins of mechanical Arabic composition.

In October 1911 *The Linotype Bulletin*, a trade journal published by Mergenthaler, reported that "the first machine in the world to set Arabic characters has been installed in the office of Al-Hoda (The Guidance), a Syrian daily published in New York City", an account that has previously been overlooked.[18] Moreover, Mergenthaler company records and a 1929 specimen book identify the provenance of its first Arabic typeface as foundry type that had been provided in 1908 by a certain S. A. Mokarzel.[19] While unfamiliar to historians of printing and typography, Salloum Mokarzel (1881–1952) is well known amongst scholars of the Arab-American diaspora (figure 1).[20]

He was the brother of Naoum Mokarzel (1864–1932), the founder and proprietor of the newspaper *al-Hoda,* as referenced in *The Linotype Bulletin*.[21] A Maronite Lebanese immigrant, Naoum established the weekly Arabic language publication in Philadelphia, Pennsylvania, where the first issue appeared on 22 February 1898. In 1903 the newspaper moved to New York and became a daily. *Al-Hoda,* unlike other Arab-American newspapers from this era, established itself and turned into the longest-published, and thus most influential Arabic newspaper in the US.[22] Although the claimed representatives in 40 countries appear to be hyperbole, its impact went beyond the Arab-American diaspora.[23] Given Naoum's explicit political stance as a propa-

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18 Mergenthaler Linotype Co., "Arabic on the Linotype," *The Linotype Bulletin* VII, no. 10, (October 1911): 81.

19 Mergenthaler-Linotype Co., 'Origin of the Designs of the Arabic Faces', 20 August 1943), Box 3614, NMAH. *Al-Munaḍḍada al-ʿarabiyya* (New York, 1929). The author is indebted to Frank Romano for sharing this valuable source.

20 See for example Linda Jacobs, *Strangers in the West: The Syrian Colony of New York City, 1880–1900* (New York: Kalimah Press, 2015), 271–274. Mokarzel saw himself as Lebanese, and although the country did not then exist 'Lebanon' is used here as shorthand for the origin of this migrant community.

21 الهُدى *al-hudā* (the guidance).

22 Between 1892 and 1930 some forty-four Arabic language newspapers were published in New York alone. Jacobs, *Strangers in the West*, 262. *Al-Hoda* ceased publication in 1971, reflecting the demographic changes in the Arab-American community where few people still read Arabic. Linda Charlton, 'End Comes To Al-Hoda, Arab Paper', *The New York Times*, 21 September 1971, 39.

23 Jacobs, *Strangers in the West*, 272.

gator of Lebanese nationalism and independence from the Ottoman Empire, *al-Hoda*'s influence undoubtedly reached back to the homeland.[24] Indeed, the founding of *al-Hoda* coincided with the peak of Lebanese migration: between 1890 and 1920, about a third of the peasant population of Lebanon emigrated, making the relation between diaspora and homeland current and active.[25]

For the first years of *al-Hoda*'s publication the printing equipment was modest, "consisting of a few sets of type imported from Egypt, a small old fashioned press and a commercial press".[26] But after its relocation to New York the newspaper's readership expanded, and the Mokarzels soon sought to increase its print capacity. According to Salloum's daughter Mary Mokarzel, who later became editor of *al-Hoda*, to this end the newspaper proprietors collaborated with Mergenthaler and developed the first Arabic Linotype:

> [...] in 1910, Naoum's brother, Salloum Mokarzel, conceived the idea of adapting the Linotype to Arabic, which he did for the Mergenthaler Linotype Company. *Al-Hoda* became the first newspaper to acquire such a machine. Consequently, he was then able to expand *Al-Hoda* to eight standard-size pages.[27]

Salloum Mokarzel recognised the significance of this feat, as is apparent from an article in *The New York Times* published at the occasion of *al-Hoda's* fiftieth anniversary:

> Looking back over the last decades, Salloum A. Mokarzel, present editor and publisher of Al-Hoda [...] said yesterday that the most significant milestone in the paper's long history was the installation in its old offices at 81 West Street of the first Arabic Linotype.
>
> Mr. Mokarzel himself had adapted the Linotype to Arabic characters in the cellar of 55 Washington Street. Al-Hoda adopted the machine in 1912 [*sic*] and was the first Arabic paper to use it commercially. This invention made possible and immeasurably stimulated the growth of Arabic journalism in the Middle East.[28]

From the evidence presented here one can conclude that following Salloum's initiative, Mergenthaler worked from 1908 in collaboration with *al-Hoda* to develop the first Arabic Linotype machine. By 1911 a first installation was completed at the newspaper's premises in Manhattan – as the announcement in *The Linotype Bulletin* noted, "to make the Linotype practical for the voluminous [*sic*] Arabic language required years of study and hard work."[29]

Such collaboration between client and manufacturer would have been a prerequisite for a successful Arabic typesetting machine, as Mergenthaler neither had the competence, nor the incentive to develop type without a prospective customer. The geographical proximity of Mergenthaler and *al-Hoda* in New York facilitated their successful cooperation: the combination of Arabic script and language knowledge, as provided by the newspaper proprietors, with the technical expertise required for the development of composition machinery was a rare, probably unique situation at this point in time. Mary Mokarzel's anecdote that Mergenthaler offered Salloum $1,500 for a trip to Lebanon as an expression of gratitude for the sale of "thousands of Li-

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24 "Naoum rejoiced in the fruits of his journalistic enterprise, *Al-Hoda*, as it aroused Lebanese nationalism and loyalty among the immigrants. After all, this was his primary purpose in founding the newspaper." Mary Mokarzel, *Al-Hoda, 1898–1968: The Story of Lebanon and Its Emigrants Taken from the Newspaper Al-Hoda* (New York: Al-Hoda, 1968), 8.

25 Jürgen Osterhammel, *The Transformation of the World: A Global History of the Nineteenth Century* (Princeton University Press, 2014), 117.

26 Mokarzel, *Al-Hoda, 1898–1968,* 1.

27 Ibid., 1–2.

28 'Arabic Paper Here Now 50 Years Old; Editor of Al-Hoda Recalls First Linotype Installed in 1912 as Significant Milestone', *The New York Times*, 9 August 1948.

29 Mergenthaler Linotype Co., "Arabic on the Linotype".

notype machines to Arabic presses throughout the Middle East" underlines that their collaboration had been fruitful and satisfactory for all involved.[30] Based on the work done in New York, British Linotype was able to manufacture similar Arabic machines, and may have shipped them to Constantinople before the outbreak of the First World War. By 1915 Mergenthaler's *Specimen Book of Type Styles* featured a sample of an Arabic 22 pt fount: the first Arabic typeface ever made for mechanical composition (figure 2).

30 Mokarzel, *Al-Hoda, 1898–1968*, 52.

The making of Mergenthaler's first Arabic founts

Whilst the model for Mergenthaler's first Arabic Linotype fount was one of *al-Hoda's* foundry types, documentation about its adaptation is lacking. The methods employed would, however, have been similar to those described in authoritative literature on type-making.[31]

The process differed substantially from the crafting of foundry type: with the advent of mechanised typesetting, also type-making became a rationalised process of mass production. Whereas every manually cut punch was unique, in the mechanical production of type all matrices of a given character had to be identical, irrespective of the number of copies required. But because a frequently used punch would gradually wear down, changing the face it carried, a different means of storing the character configuration was necessary. Pantographic punch-cutting offered a solution to this problem because it allowed for exact copies of a master configuration, making it possible to replace worn punches by identical replicas. In the type-making process this master configuration became the so-called pattern, an element unknown before the advent of the Linotype.

Mechanical type-making began with the choice of artwork from either of two sources, (1) existing type or (2) new letter drawings, often provided by external designers. Where type served as a model, an optical device was used to project its enlarged face onto a drawing board. The enlargement was then copied in a process that gave ample room for interpretation of shape. Similarly, if the artwork was provided by external designers the drawings could not be used directly for manufacture, but had to be adapted to the type-making processes. In both scenarios, the drawing office held a crucial role. Its draughtspeople were in charge of adapting the source, whether type or artwork, and translating it to the large, high precision drawings that were required for pattern making. In the next step the character outline guided a pantograph that cut a reduction of the drawing into a brass plate, creating a relief character shape, the pattern (figure 3).[32]
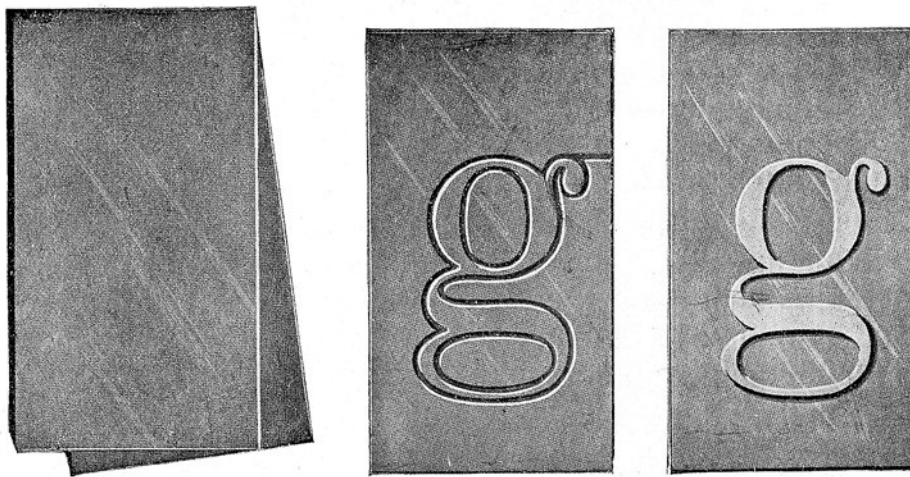
Finally, this pattern was used to guide the punch-cutting machine which cut a reduced copy of the character in steel (figure 4). The resulting punch was then used in matrix manufacture, a laborious process including up to 60 different operations.[33]

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31 For general discussions of type-making and design methods see Walter Tracy, *Letters of Credit: A View of Type Design* (Boston: David R Godine Publishers, 1987); Richard Southall, *Printer's Type in the Twentieth Century: Manufacturing and Design Methods* (London & New Castle, Delaware: The British Library & Oak Knoll Press, 2005).

32 The process described here was followed at Mergenthaler Linotype, the Monotype Corporation had slightly different workflows. For a comprehensive account of the technical aspects of Monotype's processes see Richard Southall, 'Technical History of Monotype Composing Machines', in *History of the Monotype Corporation*, eds. Andrew Boag and Christopher Burke (London & Woodstock: Printing Historical Society, Vanbrugh Press, 2014), 350–370.

33 On average a matrix was subject to 35–40 operations. Linotype & Machinery Ltd, 'Many Stages, Chapter IV in The
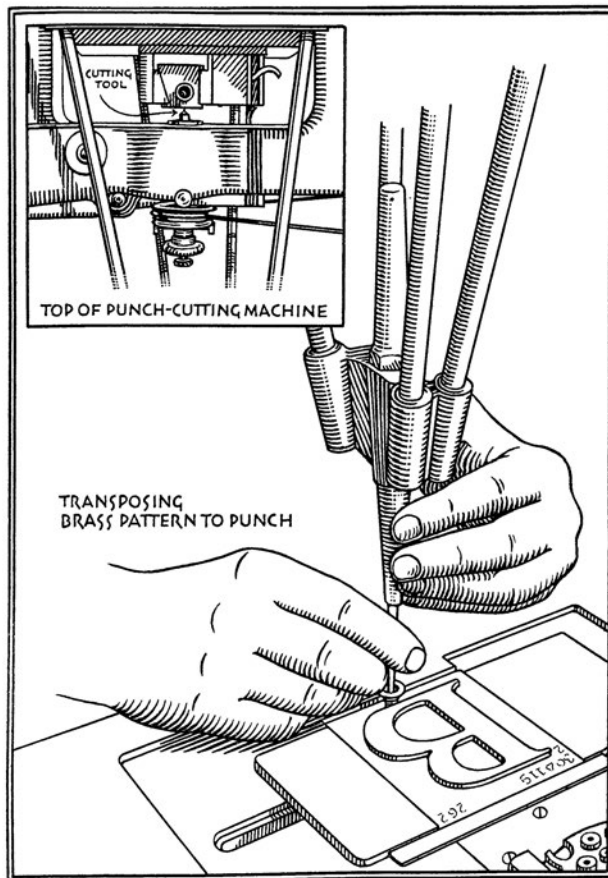
The 22 pt Arabic was the first of a number of founts developed by Mergenthaler according to models and requirements specified by Salloum Mokarzel, and it demonstrates recurring design issues of Arabic linecaster founts.[34] In the 1915 specimen (see figure 2 above) an accompanying paragraph explains the setup of the first Arabic Linotypes:

> The complete Linotype font of the 22 point consists of 181 characters and the usual quads. In order to accommodate the font it is necessary to use a machine carrying at least two magazines. Eighty-nine of the most frequently used characters and en quad are distributed in one magazine, and the other 89 characters and en quad are notched so that they will run in another magazine. The 3 remaining characters run as sorts. The number of matrices in a font of 22 point is 2,526.[35]

This description summarises one of the primary difficulties of mechanical Arabic composition: the character set limitation of composing machines.[36] Traditionally, the typographic reproduction of the Arabic script required large character sets: for example the popular and successful Egyptian Government Press typeface from the same period contained around 470 sorts (figure

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Matrix Story', *Linotype Matrix* II, no. 6 (Spring 1950): 7.

34 These founts ranked among the first non-Latin typefaces available for Linotype composition and set a precedent for the adoption of other scripts. For example, in 1915, Joel E. Werda, an Assyrian protestant pastor in New York insti-gated the manufacture of a Syriac fount. James Coakley, *The Typography of Syriac. A Historical Catalogue of Printing Types, 1537—1958* (New Castle and London: Oak Knoll Press and The British Library, 2006), 251. The type was subse-quently used in the bi-lingual weekly *Izgaddā: Persian American courier,* published from 1915–1931 in New York. Touraj Atabaki and Sanjyot Mehendale, *Central Asia and the Caucasus: Transnationalism and Diaspora* (Routledge, 2004), 223.

35 *Specimen Book of Type Styles* (New York: Mergenthaler Linotype Company, 1915), 463–464. Although only the 22 pt size was shown, also a 26 pt fount was advertised as being "ready by the time this book is in your hands".

36 Right-to-left composition was not mechanically challenging. An article in the *Linotype Matrix* described it thus: "Arabic and Hebrew, which are read from right to left, are easily dealt with by the use of the special device which re-verses lines after casting." Linotype & Machinery Ltd, 'Linotype Organizations Are Making Valuable Contributions to the Typographic Resources of the East', *Linotype Matrix* II, no. 14 (1953): 1.

5).[37]
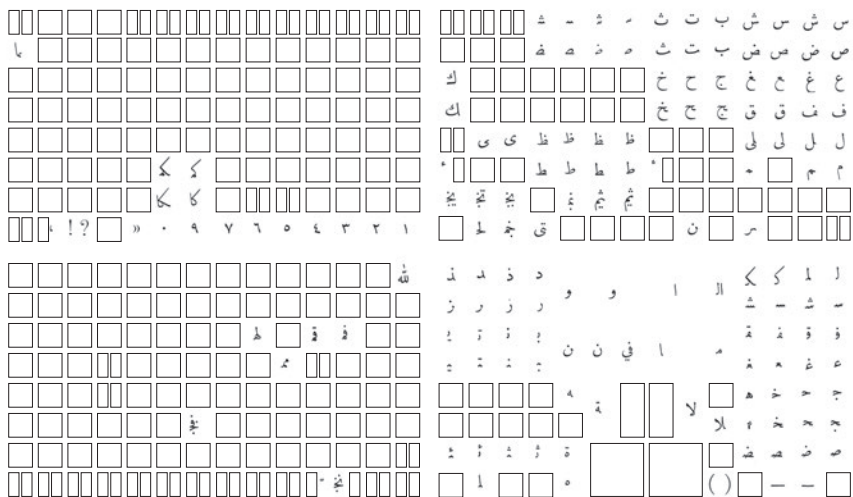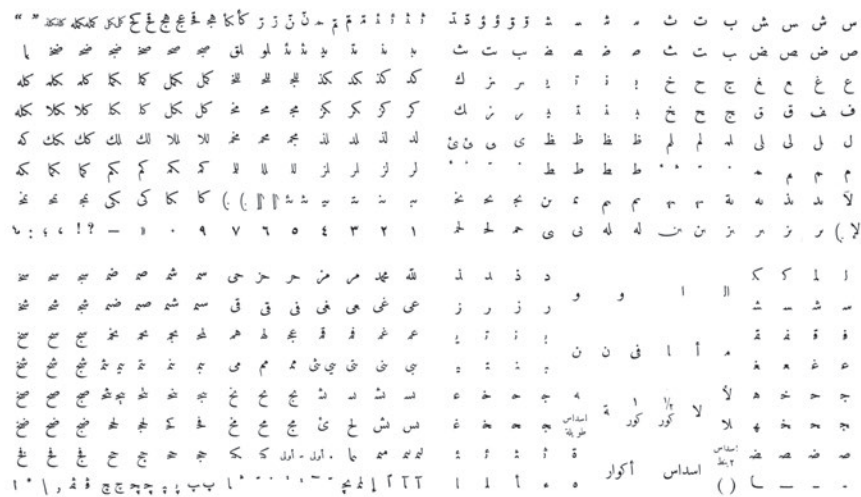
But compared to such foundry type where the size of the character set was discretionary and in practice only limited by expense, the Linotype only held 90 characters per magazine. This meant that for Arabic a machine with a secondary magazine was required to compose text in one size and one type style only. Basic typesetting therefore necessitated a significantly higher initial investment than was the case for Latin composition. Moreover, the composing speed was slower as the operator had to shift between two magazines and occasionally resort to the manual insertion of matrices.[38] As explained by Ross in relation to the adaptation of Bengali to the Linotype, for complex scripts the operation of the machine imposed its logic on the very concept of the fount:

> The keying method indubitably governed the design of the characters. Its size determined the number of sorts, and thereby the fount conspectus. Its manner of composition, in this case linear, affected the actual shape of the letter forms, as well as their spacing which was also governed by the channel sizes.[39]

In addition to the reduction of characters, the specimen of the 22 pt type demonstrates other

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37 A fount cut by the Ottoman printer Ohannis Mühendisoğlu is on record as having contained approximately 1,500 sorts. Thomas Milo, 'Arabic Script and Typography', in *Language, Culture, Type*, ed. John D. Berry (New York: ATypI Graphis, 2002), 122.

38 Matrices for manual insertion were called 'sorts' in a different use of the term to the conventional meaning of a character of foundry type. *Linotype Machine Principles* (Brooklyn, New York: Mergenthaler Linotype Company, 1940).

39 Ross, *The Printed Bengali Character and Its Evolution*, 144.

deficiencies that Arabic linecaster founts were to retain for the entire period of hot-metal type-setting. Because whole lines were cast from rows of matrices, characters could not kern (figure 6).[40]
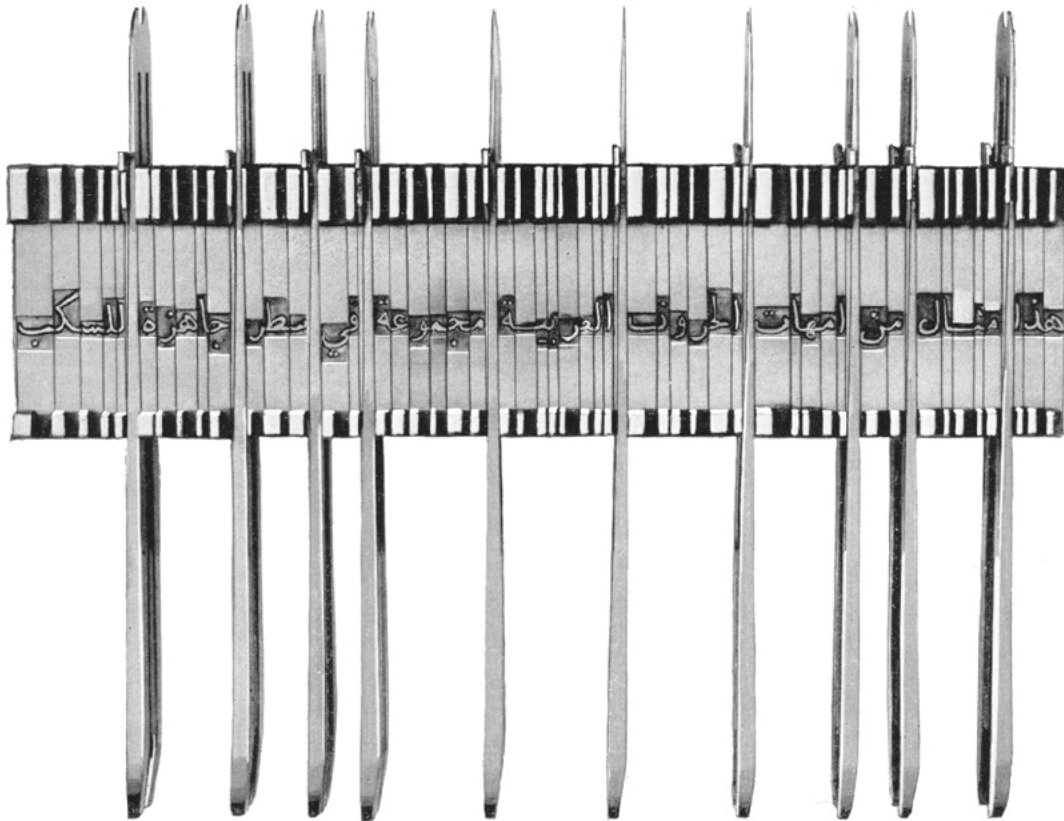
And while the lack of kerning was an aesthetic shortcoming in Latin type, for the Arabic script this limitation amounted to a severe design and legibility problem. Not only do Arabic letter-forms frequently protrude into the space above or below adjacent letters, resulting in the inter-locking of elements from discreet letters, (figure 7) but there are also semantically distinct spaces.
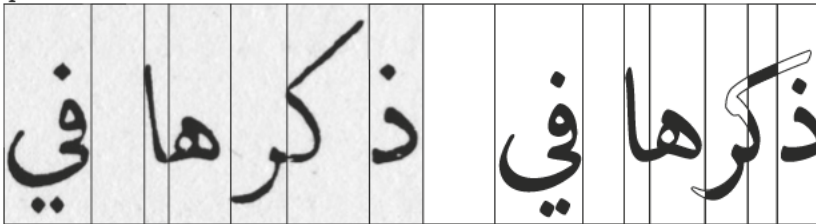
Because some Arabic letters are not joined to the following letter, words may be visually in-terrupted by inner-word spaces that ought to be clearly differentiated from word spaces. In that first Linotype fount this was not achieved, as the lack of kerning was exacerbated by character shapes that largely maintained conventional, poorly adapted letterforms and proportions (fig-ure 8).

40 In movable type 'kerns' are the elements of letterforms that extend beyond the body of the character, such as the terminal of the Latin minuscule letter 'f'.

Deliberately designed characters could have minimised the problem, but here wide letter-forms contributed to the erratic spacing, as inner-word spaces sometimes appear as wide as word spaces. In addition to these noticeable effects of kerning restrictions, fitting of the fount is uneven. Where some character combinations create noticeable white gaps, other characters are almost colliding, as illustrated by the final د *dāl* followed by a و *wāw* (figure 9).

الغرب فوحدوها متشابهة

The fount exhibits another critical weakness inherent in the linecaster's mechanics. In the Arabic script vowels and other discretionary marks should be positioned above or below the letter that they are meant to modify. Analogous to the lack of kerning, here the mechanism prevented the casting of such marks in their conventional position. Rather than taking the correct and unambiguous position above or below the modified character, matrices carrying marks had to precede or trail them as illustrated by the word رأس (figure 10).

رأس رأس

The mark ء *hamza*, which is supposed to be centred on its carrying ا *alif*, follows the letter and causes a large white space within the word – a considerable defect for this relatively frequent letter. Yet, as the principal market for Linotype machines was the Press, and since it was customary for newspaper composition to rarely employ vowels and other discretionary marks, these could be side-lined in the development of the first Arabic hot-metal founts.[41]

Stylistically, Mergenthaler's 22 pt Arabic fount had similarities with foundry type widely used in the late nineteenth and early twentieth century. Basing a fount on an existing typeface was not unusual, as the copying of an established model was the safest and easiest route to an acceptable rendering, and would have been sought by customer and manufacturer alike. Similar type was used by contemporary Arabic newspapers and the quality of some examples would have commended them as models for Mergenthaler (figure 11).

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41 Note that the *hamza* in the example is compulsory in Arabic orthography.

من الاسبوع الى الاسبوع

بعد روغ دام اسبوعين ردت الحكومة الالمانية
عَلَى انذار حكومة واشنطون بمذكرة جاءت غاية
الابداع في الكذب والنفاق ولؤم الطباع . فهي
في هذا الباب هرم المانيا الخالد وفصل الخطاب :
فقد كذبت فيها بما روته نفاقاً عن حكاية الاوامر
التي ارسلتها الى قواد الغواصات ، وجبنت في
قولها انها طلبت الصلح مرتين ولم يجبها الحلفاء
الى طلبها ، وفي التماسها من اميركا التوسط
لديهم في ان يكفوا عن قتلها جوعاً ، ولأمت
طبعاً في ظهورها بمظهر التائب عما جناه ، النادم
عَلَى ما اثمه . فلما وقف الرئيس ولسن عَلَى ما في
هذه المذكرة التي عقدت المانيا لجنة من الثعالب
لنسجها فجاءت غليومية ، هي بتمانية ، جاكوفية
ثعلبية ادرك انه اسقط في يده فاجاب غليوم
عليها بمذكرة وجيزة يمكننا اجمالها بهذه
الكلمات « وعدت فكذبت واستمهلت
فامهلناك ، فان تبت عفونا ، وان عدت قطعناك . »
ولكن انى للمجرم ان يتوب وقد شب عَلَى الجريمة
ولكل ما اعتاده ، فسيعود غليوم او غول اليوم
الى جناياتهِ ونعود فنسمع قرع عصا الاستاذ
ارئيس في ظهره . فلمثلها خلق ولمثله نبتت .

With features and proportions closely following the standardised *Nasḫ* manuscript hand, readability and elegance of such late Arabic foundry type make them exemplary for pre-industrial Arabic typography. Their principal characteristics were large character sets, conventional and well executed letterforms retaining proportions of great similarity to their manuscript forms, and numerous, often widely projecting kerns. Yet as has been shown, on a linecaster all

of these characteristics were either unfavourable, as they increased cost and reduced speed, or simply impossible due to its mechanics.

Mergenthaler's first Arabic fount looks like it aspired to reproduce the foundry type model without substantial divergence from the original. It is improbable that at this point a deliberate design was sought; the adaptation of Arabic to the Linotype was undoubtedly the primary and dominating concern: Arabic had to be 'put on the machine'. As the 1915 specimen shows (see figure 2 above), excepting the compromises imposed by mechanical constraints, some aspects of the fount suggest that a deliberate effort was made to reproduce the model as faithfully as possible. A number of letters are represented with more than the bare minimum of characters, indicating an attempt to maintain the standards of pre-mechanical Arabic type. For example, the letter ب *bāʾ* has five, instead of the minimum four characters, and س *sīn* and ص *ṣād* feature six distinct characters for use in different contexts. 35 ligatures of letter combinations were also included in the fount, an apparent attempt to lend a more familiar appearance to composed text.

Overall, the 22 pt fount avoids too mechanical an impression through a slight slant and a generally rounded appearance. This is emphasised through variety in the height and vertical alignment of individual characters that lend the type a certain liveliness. Overall the design of the letterforms appears unassuming, yet individual characters such as the initial and medial ك *kāf* look idiosyncratic and stand out on the page. Because the angle of their prominent, uppermost strokes had to be adjusted to fit within the width of the matrix, the letterform appears distorted and exceedingly tall, and causes a large white gap within words. Notwithstanding its shortcomings and the marked quality difference to foundry type, vivacity and relative proximity to conventional letterforms made the 22 pt fount a viable proposition. Combined with the significant gains in efficiency and speed that mechanical composition offered, the first Arabic Linotype fount must have been considered satisfactory for its intended use at *al-Hoda*.

During the following years a range of related sizes and styles was developed by Mergenthaler. Of the thirteen founts mentioned in an internal memorandum of 1943, five were based on sources provided by Mokarzel, six followed other specimens submitted to Mergenthaler, and a further two were based on punches probably obtained from the British Linotype company.[42] In the 1940 Mergenthaler *Linotype faces* specimen book, twelve of these earliest Arabic Linotype founts are shown (figure 12).

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42 Mergenthaler-Linotype Co., 'Origin of the Designs of the Arabic Faces'.

Arabic

14 Point (14△67)   Code word. IGSI

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم (لينوتيب) هي من عجائب الاختراء ٥٤٣٢١

18 Point (18△207)   Code word. IGTO

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم (لينوتيب) هي من عج ٥٤٣٢١

22 Point (22△1)   Code word. IGVU

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم (لينوتيب) هي من عجا ٥٤٣٢١

24 Point (24△145)   Code word. IGUN

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم (لينوتيب) ٥٤٣٢١

26 Point (26△1)   Code word. IGUV

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم (لينوتيب) هي ١٥٤٣٢

Arabic Bold

14 Point (14△83)   Code word. ZIPVO

ان المنضدة العربية او ماكنة صف الجروف المعروفة باسم (لينوتيب) هي من ٥٤٣٢١

Arabic Old Style

14 Point (14△89)   Code word. ZIPYE

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم (لينوتيب) هي من عجائب الاختراعات ٥٤٣٢١

18 Point (18△253)   Code word. ZIPZI

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم (لينوتيب) هي من عج ٥٤٣٢١

24 Point (24△217)   Code word. ZIRAD

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم (لين ٥٤٣٢١

Arabic Bold Old Style

14 Point (14△91)   Code word. ZIRAK

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم (لينوتيب) هي من عجائب الاختراعا ٥٤٣٢١

18 Point (18△261)   Code word. ZIRAR

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم (لينوتيب) هي ٥٤٣٢١

24 Point (24△221)   Code word. ZIRBI

ان المنضدة العربية او ماكنة صف الحروف المعروفة باسم ٥٤٣٢١

Although presented in groups that suggest familiarity (Arabic, Arabic Bold, Arabic Old Style, Arabic Bold Old Style), the founts betray their heterogeneous origins.[43] There is little consistency in terms of form or execution. The 14 pt fount was based on the 22 pt, and is among the more successful sizes. A specimen from 1921 shows a face with reduced liveliness, more homogenous vertical alignment and adjustments in details from the earlier fount, such as the size reduction of the ك *kāf* and the shallower angle of its uppermost stroke (figure 13).

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43 The denomination of some of the typefaces as 'Old Style' is an idiosyncratic choice. Neither does it correspond to any established Arabic script classification, nor is the intended reference apparent from their design.

The fount synopsis has been reduced, limiting the number of characters for the rendering of most letters to their respective minimum. Moreover, the specimen presents only a fraction of the ligatures available in the earlier 22 pt size, further reducing the number of matrices required for Arabic composition.

The potentially most significant change is the introduction of half-forms. It meant that letterforms were divided into multiple characters that could be re-used in different contexts. In the 14 pt fount this renewed decrease of characters was only employed sparingly, perhaps to test its viability. The letter ف *fāʾ* is commonly rendered with a minimum of four distinct characters for all positions within a word. Instead of this typical breakdown, the fount provides only three characters that may be used in more than one function, creating the four letterforms through their respective combinations. In the specimen's presentation of individual characters, this method is shown at its best, rendering the initial and final letterforms joined together, constructed from the three separate characters (figure 13 a). However, in practice the assembly of letterforms from multiple characters was error-prone, for even in Mergenthaler's specimen a composition error occurs no later than the first line of the text: an isolated ف *fāʾ* was keyed instead of the required final form (figure 13 b). Moreover, whereas the initial, medial and final forms of the letter are acceptable, the composition of the isolated form with two characters results in a deformed, unwieldy letterform. The noticeable nick in the main horizontal stroke and the added width make the shape and proportion of the letter awkward, and inconsistent with similar letters such as the ب *bāʾ* (figure 13 c). This direct influence of the fount synopsis on the design of the type is typical for the hot-metal era and representative of the often detrimental influence of mechanical constraints on aesthetics and legibility.

Yet, the use of the half-form for the letter ف *fāʾ* must have been deemed acceptable by Mergenthaler, as the principle was adopted in later founts. Its deficiencies are most flagrant in the 24 pt Arabic Old Style, where misalignment between characters reaches unacceptable levels.[44]

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44 Despite the issues one can observe in these early Arabic linecaster founts, half-forms remained in use and were applied more successfully in later designs.

Strikingly, the 14 pt fount under the same heading exhibits individual characters (see final ر *rāʾ* and م *mīm*) that belong to the Arabic Bold fount of the same size. The latter, arguably the least successful of all, has numerous borrowings from the calligraphic *Ṯuluṯ* style (see for example ا *alif*, ر *rāʾ*, و *wāw* and final د *dāl*), detrimentally influencing consistency and coherence of proportions. Indeed, the lack of competence is confirmed by a spelling mistake: instead of *al-ḥurūf* (the letters), the line of Arabic Bold reads *al-ǧurūf* (the cliffs). Such laxity in an official specimen calls into question the company's quality control mechanisms, and may also suggest an underdeveloped appreciation of Arabic type.

It follows that the continued addition of sizes and styles to Mergenthaler's library did not entail a concurrent improvement of quality. The most successful founts were those first cut by the company, or those based directly on the original designs. The manufacturing issues observable in the founts under the heading Arabic Old Style are indicative of a lack of competence and care, and the diversity of sources and styles suggest little vision to develop a typographic programme that merits this description. Rather than a coherent, systematic selection of related faces and sizes, the Arabic library resembles a *pot-pourri* in which circumstance and convenience governed the addition of new founts.

An Arabic typographic programme that featured considered planning and demonstrated initiatives informed by a firm grasp of the subject emerged later (then pursued by the British L&M, rather than Mergenthaler). Only in the middle of the twentieth century, when independence from colonial rule, advancing industrialisation and societal changes provided the context for increased indigenous publishing ventures, demand for typographic equipment increased and a veritable market emerged. Against this background, and after a hiatus of some decades, Western typesetting machine manufacturers renewed their interest in the Arabic script and began the active development of Arabic type libraries – but now for clients in the Middle East.[45]

Conclusion
In the 1910s, the adaptation of the Linotype for Arabic composition undoubtedly appeared as an impressive achievement, demonstrating to contemporaries the rapid advancement of the machine age. Only some 15 years after the commercial breakthrough of Mergenthaler's machine, the mechanical composition of a script perceived as exotic and complicated seems to have contributed to the view that the Linotype embodied the pinnacle of printing technology. For example, Lucien Legros and John Grant's seminal book *Typographical Printing-Surfaces* demonstrates the belief that the then current technology could adapt to any typographical challenge.[46]

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45 For a key example of mid-twentieth century Arabic type developments see Titus Nemeth, 'Simplified Arabic, a New Form of Arabic Type for Hot Metal Composition', *Typography Papers*, no. 9 (2013).

46 Lucien Legros and John Grant, *Typographical Printing-Surfaces: The Technology and Mechanism of Their Production* (London: Longmans, Green and Co., 1916).

PART II.

MACHINES OF THE LINOTYPE CLASS ; CASTING THEIR COMPLETE LINE AT A SINGLE OPERATION OF POURING.

بسم الله الرحمن الرحيم

قل لئن اجتمعت الأنس والجنّ على ان يأتوا بمثل هذا القرآن لا يأتون بمثله ولو كان بعضهم لبعض ظهيرا

The Koran, chapter XVII, intitled The Night Journey.
Composed and cast in Cairo on a Linotype machine in 18-point and 14-point arabic.

IN THE NAME OF THE MOST MERCIFUL GOD.

Say, Verily if men and genii were purposely assembled, that they might produce *a book* like this Korân, they could not produce *one* like unto it, although the one of them assisted the other.   Sale's Translation.

Brevier modern.

Three lines of Arabic set on a Linotype open the chapter on linecasting machines (figure 14), and in the ensuing discussion of the intricacies of Arabic Linotype composition a stance emerges that became a recurring view on Arabic typography, and an influential factor in the evolution of the script's printed form:

> The form of character is perforce more upright than would be the case were kerning permissible, but the result attained testifies to the skill of those workers at the subject, who have overcome the really great and exceedingly complicated typographical difficulties involved in adapting the Arabic character to the restrictions of the composing machine.[47]

Mechanisation and its resulting advantages were considered so important that compromises were sought with the script, rather than the equipment. In consequence, many of the conventions which had evolved in the manuscript form of the script were altered, abridged, or discarded, eroding its characteristics. Arguably, this loss of authenticity in the typographic form of Arabic also deteriorated its intrinsic qualities as a sign system, which, in its very nature, is contingent on conventions. New letterforms, unprecedented connections between letters, gaps within words, ambiguities in syntax and orthography, not to mention the apparent compromises of aesthetics, are all directly traceable, radical modifications of the script through the constraints of inadequate technology. Taking convention as a key factor for the success of any sign system, one may conjecture that a considerable loss of legibility and readability occurred in the mechanisation of Arabic typography.

Legros and Grant's reasoning as authors on typographic technology suggests that the difficulties in adapting Arabic for mechanical composition were seen as justifying the drawbacks that were recognised in the resulting typography: a curious interpretation of means serving an end. Yet, and although certainly caused by the bias and ignorance of an uneducated Western perspective, Legros and Grant were not alone in their embrace of technology. After all it was the Mokarzels who initiated, oversaw and approved the reduction of their type founts from 400 to 180 characters, with all the compromises this entailed. Indeed, inspiration from and emulation of Western achievements featured prominently among the Arabic intelligentsia from the middle of the 19th century, and the urge for progress through technological advance was a *leitmotif*

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47 Legros and Grant, *Typographical Printing-Surfaces*, 542. The accompanying caption reads "composed and cast in Cairo on a Linotype machine in 18 pt and 14 pt Arabic".

for the educated Arab elite, as captured in the announcement of the Arabic Linotype in *The Linotype Bulletin*:

> N. A. Mokarzel, the publisher, says he is receiving congratulations from Syrians all over the world, who believe the adaptation of the Linotype to their language will make for the progress and further advancement of their race [*sic*].[48]

The latest technology, which at this time was almost exclusively of Western origin, also stood for the more general aspirations of self-determination and progress in society; and the pride taken in the adoption of and participation in technological advances is palpable in the description of the newspaper's equipment:

> *Al-Hoda* now had the best Arabic pressroom in the world. No Arabic newspaper had comparable equipment, for Naoum was extravagant in equipping his New York pressroom. He bought set after set of type from Mergenthaler, and machine after machine of the best quality. When Model 14 was newly brought out, he immediately bought two more machines; this model allowed the use of three different sets of type at one time.[49]

Pride was not only taken in modern equipment, but also in the emulation of Western ideals such as the freedom of speech, and the independence of publishers. Unlike in the homeland, the Press that the diaspora encountered was a well-established institution, and its principles were recognised, valued, and adopted. With their explicitly nationalistic stance, the editors of *al-Hoda* aspired to blaze a trail for a Lebanese state and used their position in the US to articulate and spread their ideology. To this end the Western Press was emulated where possible, from the editorial policy to the design of the newspaper. With hindsight, Mokarzel emphasised this influence on *al-Hoda's* development:

> One of the reasons why Al-Hoda's influence has been so great through the years [...] is that it brought the American tradition of objectivity to Arabic journalism. In the East no distinction used to be made between news and comment. Everything was, and often still is, editorialized. Al-Hoda was the first Arabic newspaper to treat news strictly as news, to adopt the American system of headlines and regularly to run pictures.[50]

The beginning of mechanical composition of Arabic thus happened alongside important evolutionary steps of Arabic journalism. The Linotype, whilst just a tool for the advancement of publishing, attained a central role as the first, and most widely employed typesetting machine, shaping the appearance of printed Arabic for decades. Although compromising the form of the written Arabic word, the importance of the Linotype's contribution to the creation of a public sphere through the reduction of costs, and the multiplication of content cannot be overstated. But if in the first decades of the twentieth century the ends of mass publishing and general literacy may have justified the means, one hundred years later this rationale should no longer apply, and the still existing remnants of obsolete typographical technology ought to be abandoned for good.

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48 Mergenthaler Linotype Co., "Arabic on the Linotype".

49 Mokarzel, *Al-Hoda, 1898–1968*, 6.

50 'Arabic Paper Here Now 50 Years Old; Editor of Al-Hoda Recalls First Linotype Installed in 1912 as Significant Milestone'.

Abbreviations

Acknowledgements

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