Slurs, Braces, Radicals: Obstacle or Challenge?

Bogusław Jackowski, Marek Ryćko

Bachotek, 2 V 2016

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Slurs, Braces, Radicals: **Obstacle**

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HOW DID IT START?

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The oldest handprints left by humans are probably (at least?) 40,000 years old (Sulawesi, Indonesia)

These handprints are not only the earliest form of graphics, they are also the erliest example of using replicable technique – the hand was used as a “stencil”

HOW DID IT START?

SEVERAL THOUSANDS YEARS LATER

people invented another technique of duplication of graphic signs: stamps

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Cylinder seal – Near Eastern
third millennium B.C.

Phaistos disc
second millennium B.C.

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Stamp-cylinder seal (“the Tyszkiewicz seal”)
Near Eastern, second millennium B.C.

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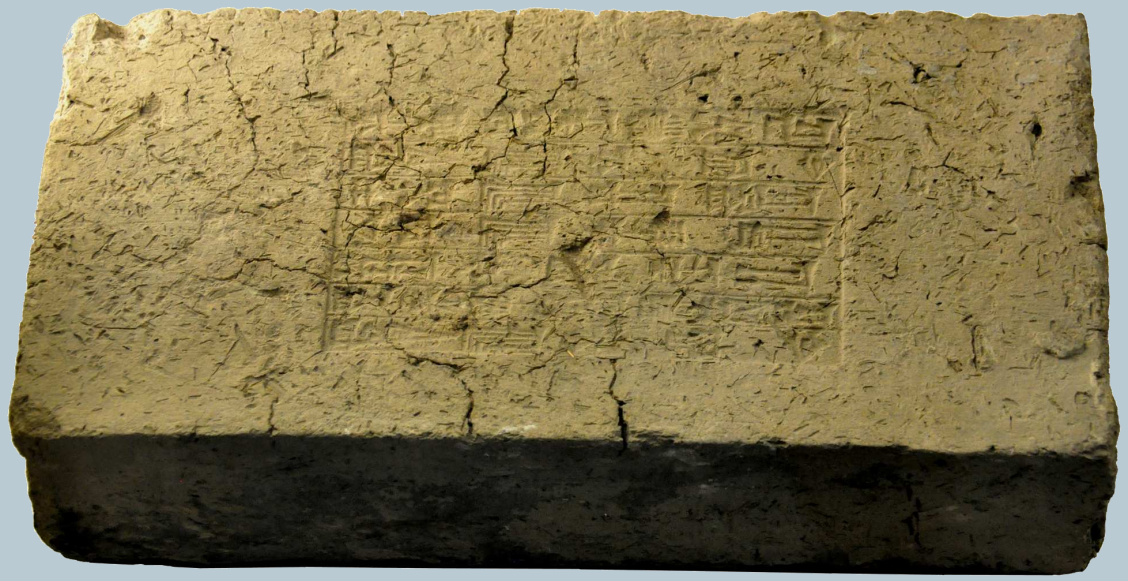

King of Babylon, fosterer of Esagilaand Ezida, son of Nabopolassar, King of Babylon

Soon (?), in the first millennium B. C., the “rectangle paradigm” began to emerge

A FEW MILLENNIA LATER

movable (metal) type was finally invented

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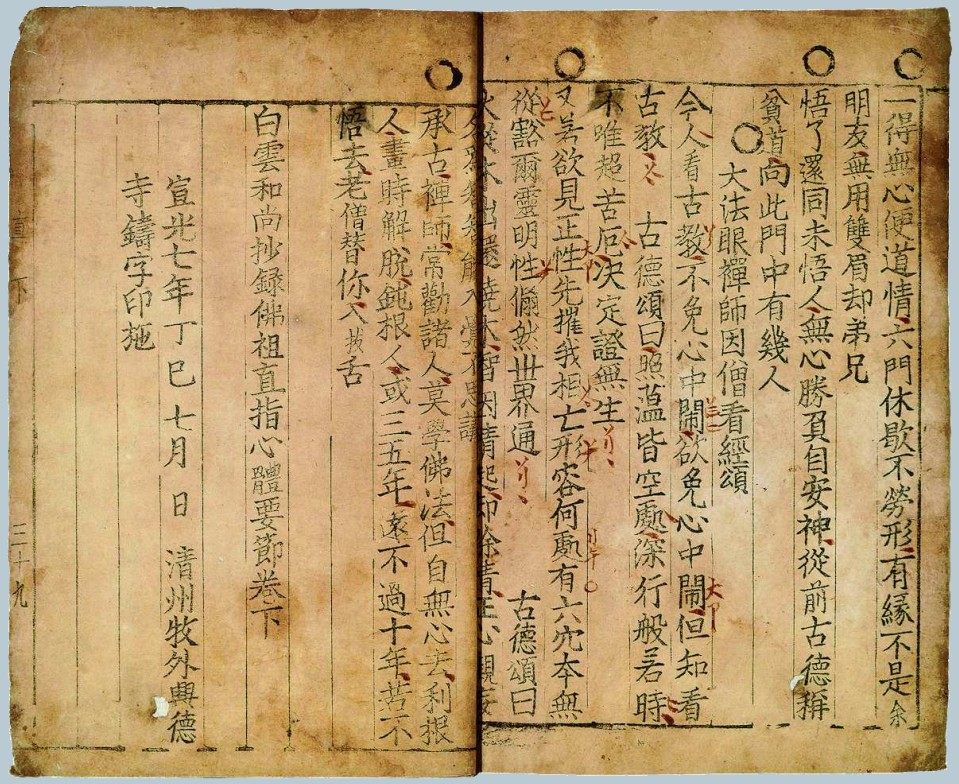

First, in Korea (probably with Chinese inspiration),
the *Anthology of Great Buddhist Priests' Zen Teachings* was printed in 1377

A FEW MILLENNIA LATER

movable (metal) type was finally invented

Nearly a century later, in Europe (with Korean and/or Chinese inspiration?), the *“Gutenberg” Bible* was printed in 1456

TYPESETTING MUSIC AND MATH – BEGINNING

Initially, typesetting music and math was not demanding

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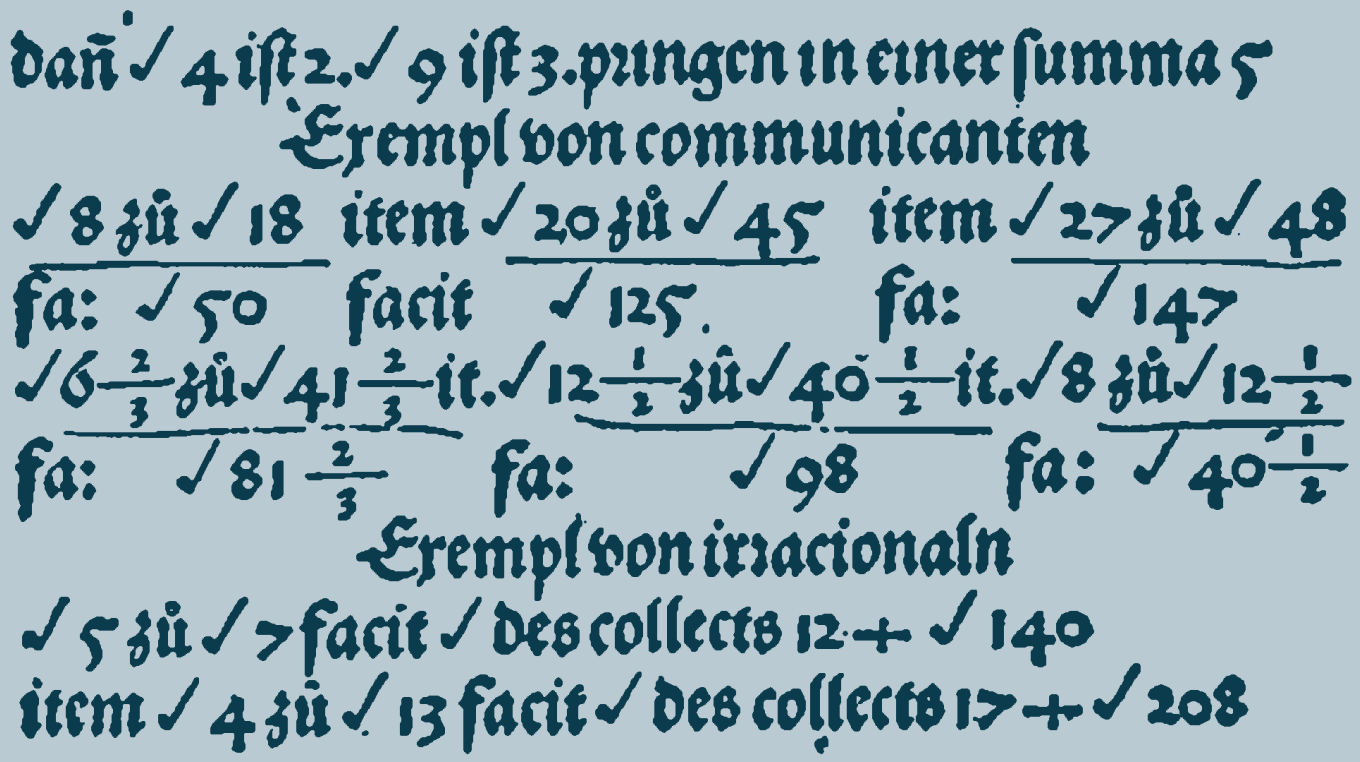
dañ ✓ 4 ist 2. ✓ 9 ist 3. pringen in einer summa 5

Exempl von communicanten

✓ 8 zů ✓ 18 item ✓ 20 zů ✓ 45 item ✓ 27 zů ✓ 48

fa: ✓ 50 facit ✓ 125. fa: ✓ 147

✓ $6\frac{2}{3}$ zů ✓ $41\frac{2}{3}$ it. ✓ $12\frac{1}{2}$ zů ✓ $40\frac{1}{2}$ it. ✓ 8 zů ✓ $12\frac{1}{2}$

fa: ✓ $81\frac{2}{3}$ fa: ✓ 98 fa: ✓ $40\frac{1}{2}$

Exempl von irracionaln

✓ 5 zů ✓ 7 facit ✓ des collects 12 + ✓ 140

item ✓ 4 zů ✓ 13 facit ✓ des collects 17 + ✓ 208

Christoph Rudolff, *Nimble and beautiful calculation via the artful rules of algebra [which] are so commonly called "coss"*, 1525

TYPESETTING MUSIC AND MATH – BEGINNING

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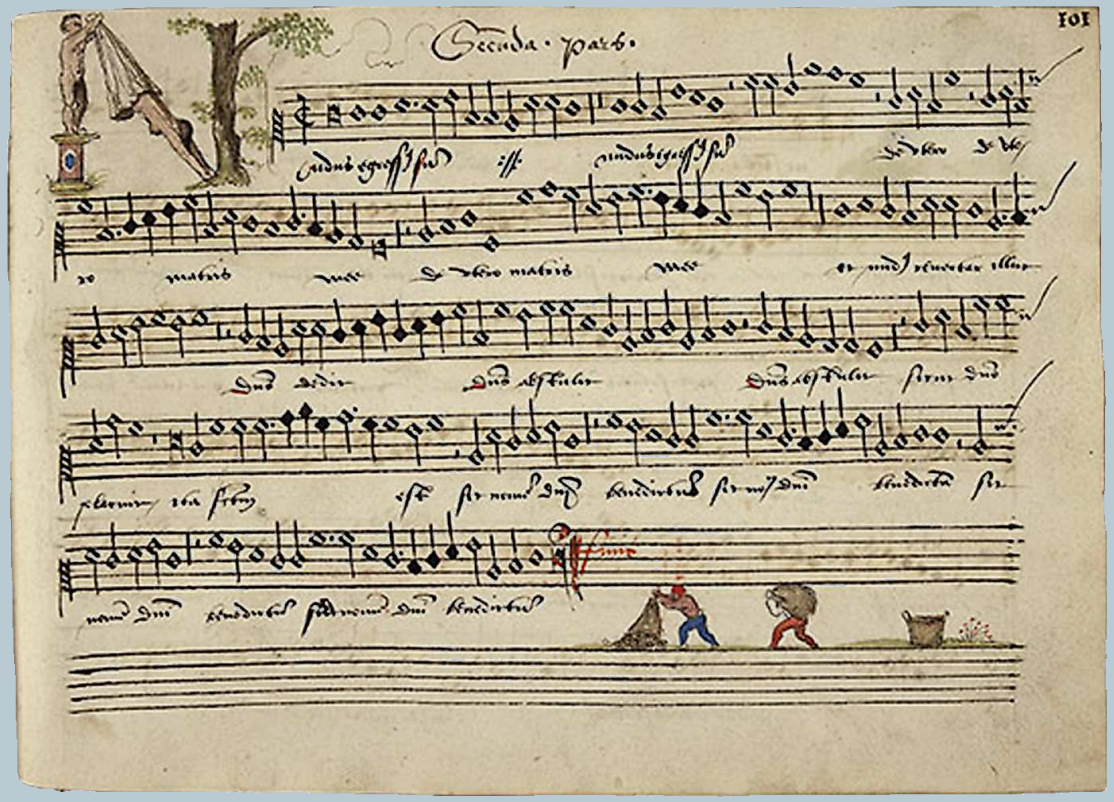

The Songbook of Zeghere van Male, 1542

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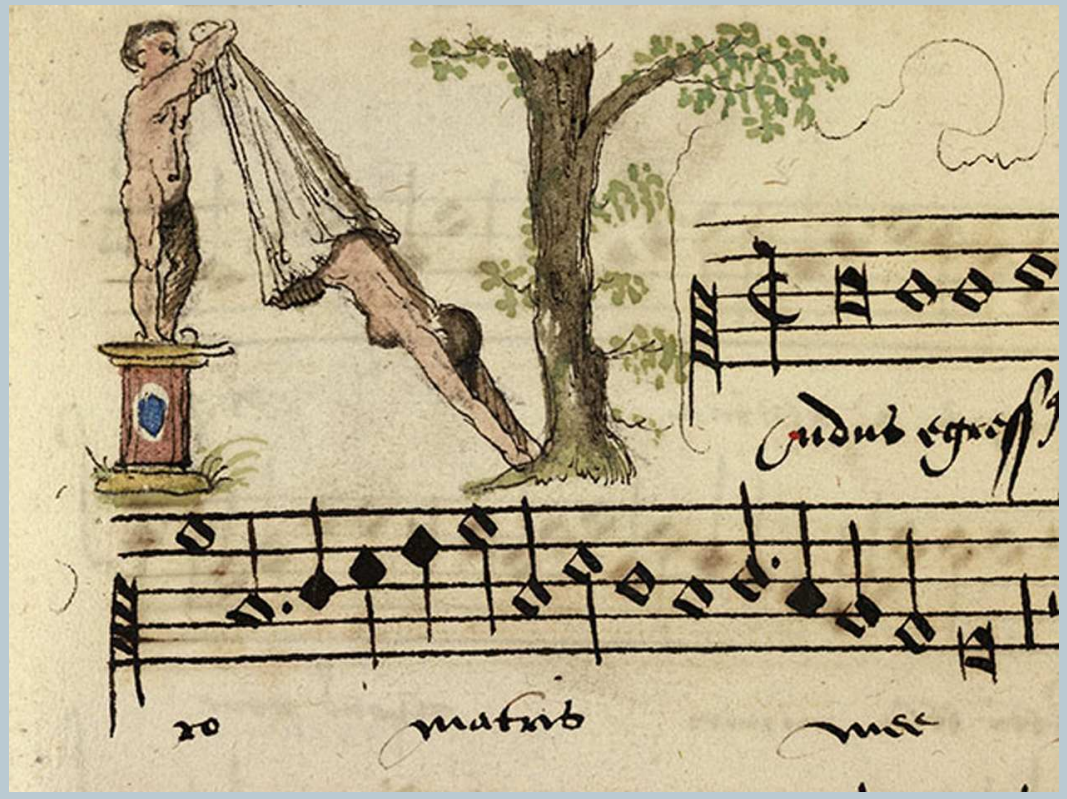

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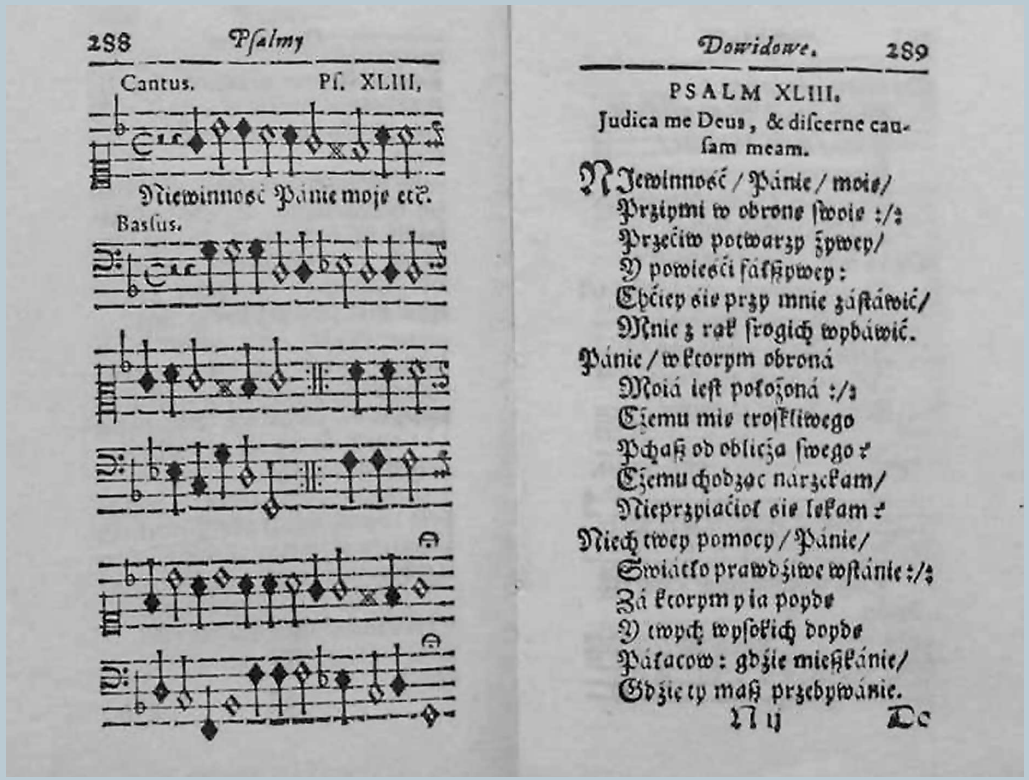
288 Psalmy

Cantus. Ps. XLIII.

Niewinność Pánie moje etc.

Bassus.

Dowidowe. 289

PSALM XLIII.

Judica me Deus, & discerne causam meam.

Niewinność / Pánie / moie /
Przyimi w obronę swoię :/:
Przećiw potwarzy żywey /
Y powieśći fáłszywey:
Chćiey śię przy mnie zástáwić /
Mnie z rąk srogich wybáwić.
Pánie / w ktorym obroná
Moiá iest położoná :/:
Czemu mię troskliwego
Pchasz od oblicza swego?
Czemu chodząc nárzekam /
Nieprzyiaćioł śię lękam?
Niech twey pomocy / Pánie /
Swiátło prawdźiwe wstánie :/:
Zá ktorym y ia poydę
Y twych wysokich doydę
Páłacow: gdźie mieszkánie /
Gdźie ty masz przebywánie.

N ij Do

Jan Kochanowski, Mikołaj Gomółka, *Melodies for the Polish Psalter*, typeset and printed in Łazarz Printing House in Cracow in 1580

ARTIS'S AND SCIENTIST'S INVENTION IS UNTAMEABLE

Unfortunately or, if one prefers, fortunately, scientist and artists developed and thus complicated notation

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$$\overbrace{\sqrt{ccc}+\sqrt{cccccc}-bbbbbb}$$

$$\sqrt{-\tfrac{1}{2}a+\sqrt{\tfrac{1}{4}aa+bb}}$$

Long horizontal brace in connection with the radical sign to express the aggregation of terms was introduced by Thomas Harriot (*Artis analyticæ praxis*, 1631) – top

René Descartes, maybe inspired by Harriot, attached the vinculum to the radical sign (*La Géométrie*, 1637) – bottom

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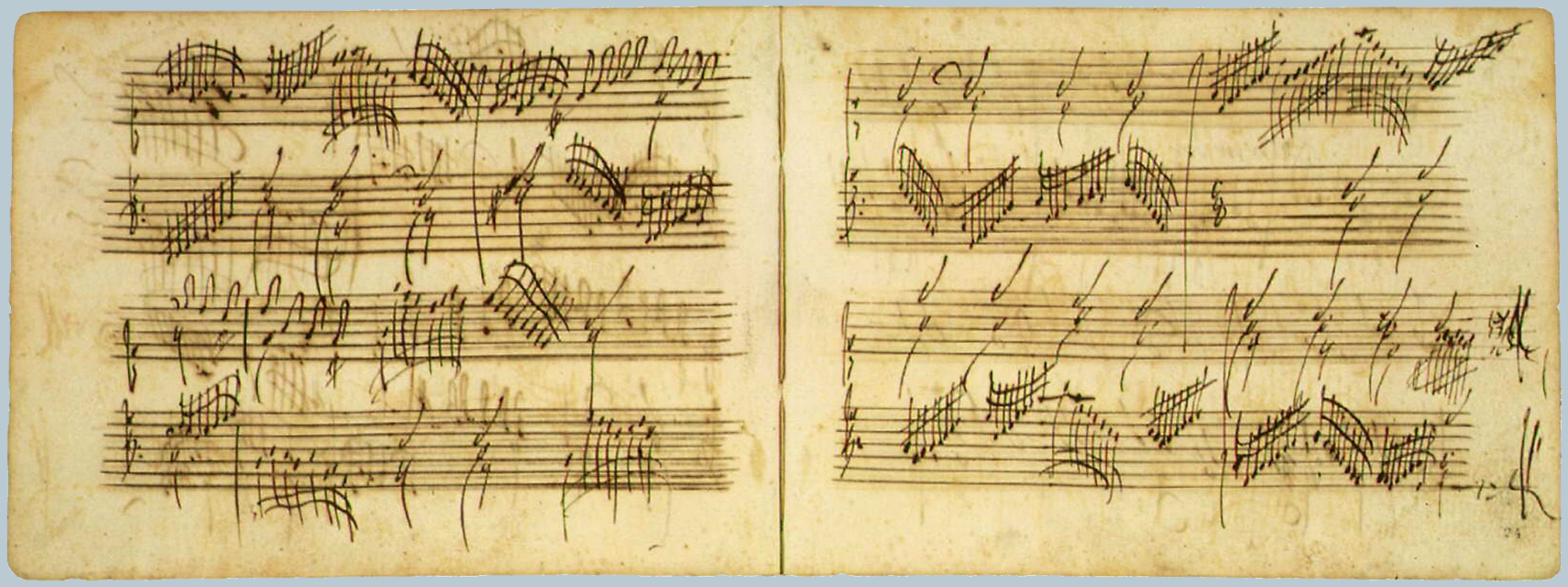

Manuscript of keyboard music ("toccata"), XVII century, probably owned by Girolamo Frescobaldi

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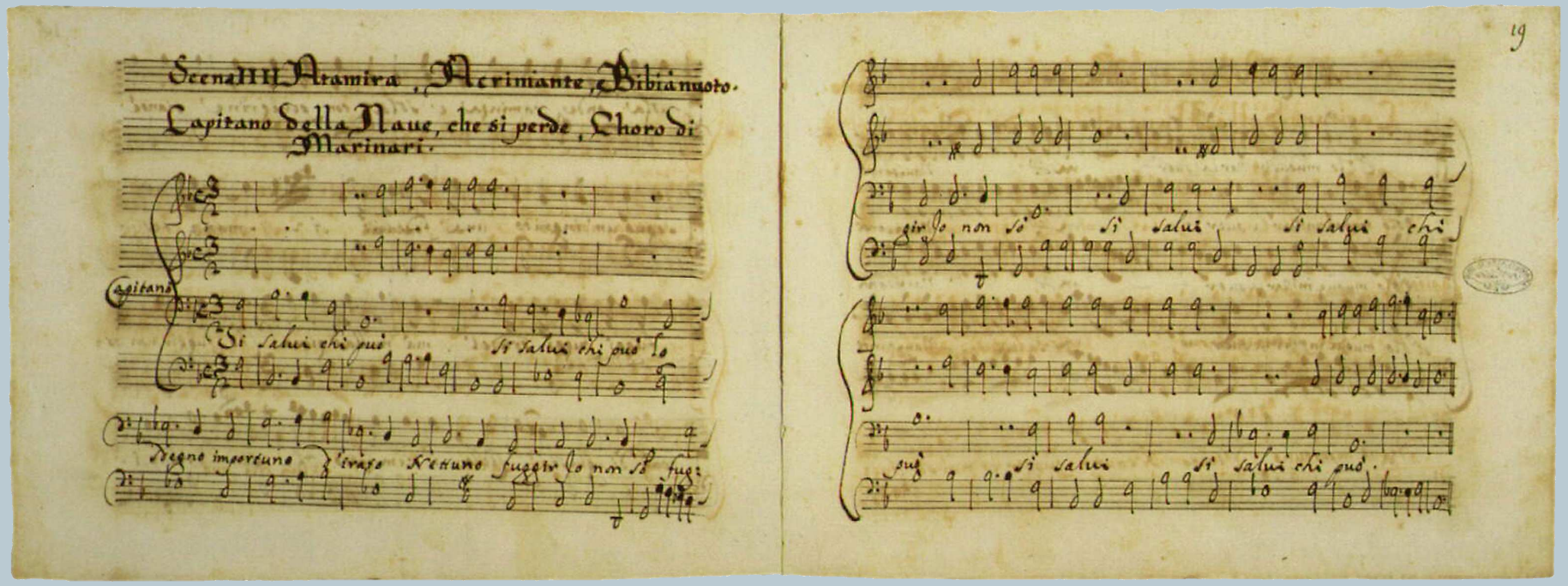
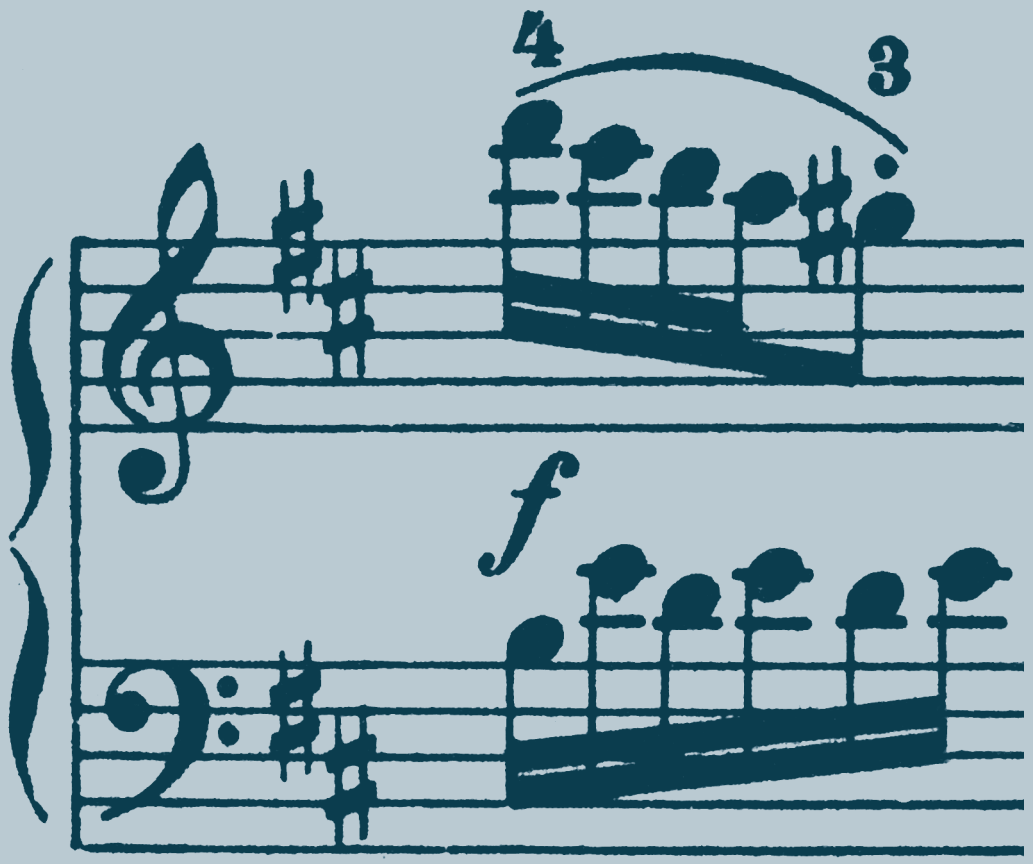


Opera score (Alessandro Melani, *L'Empio Punito*), XVII century

“RECTANGLE” PARADIGM: TYPESETTER’S MOUSTACHE



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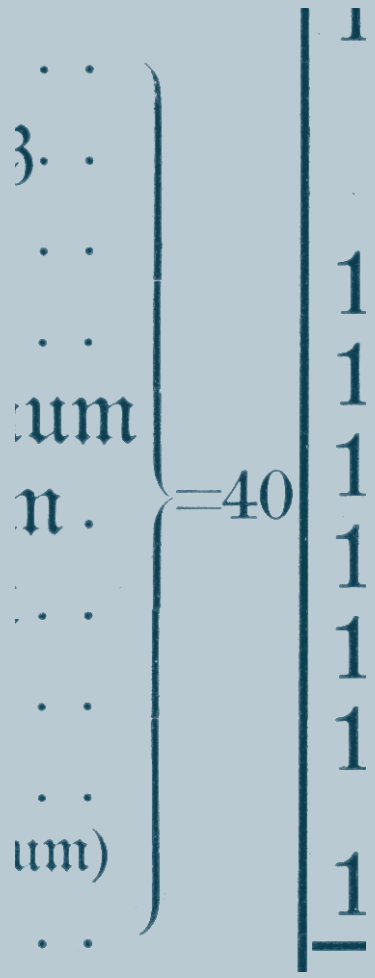
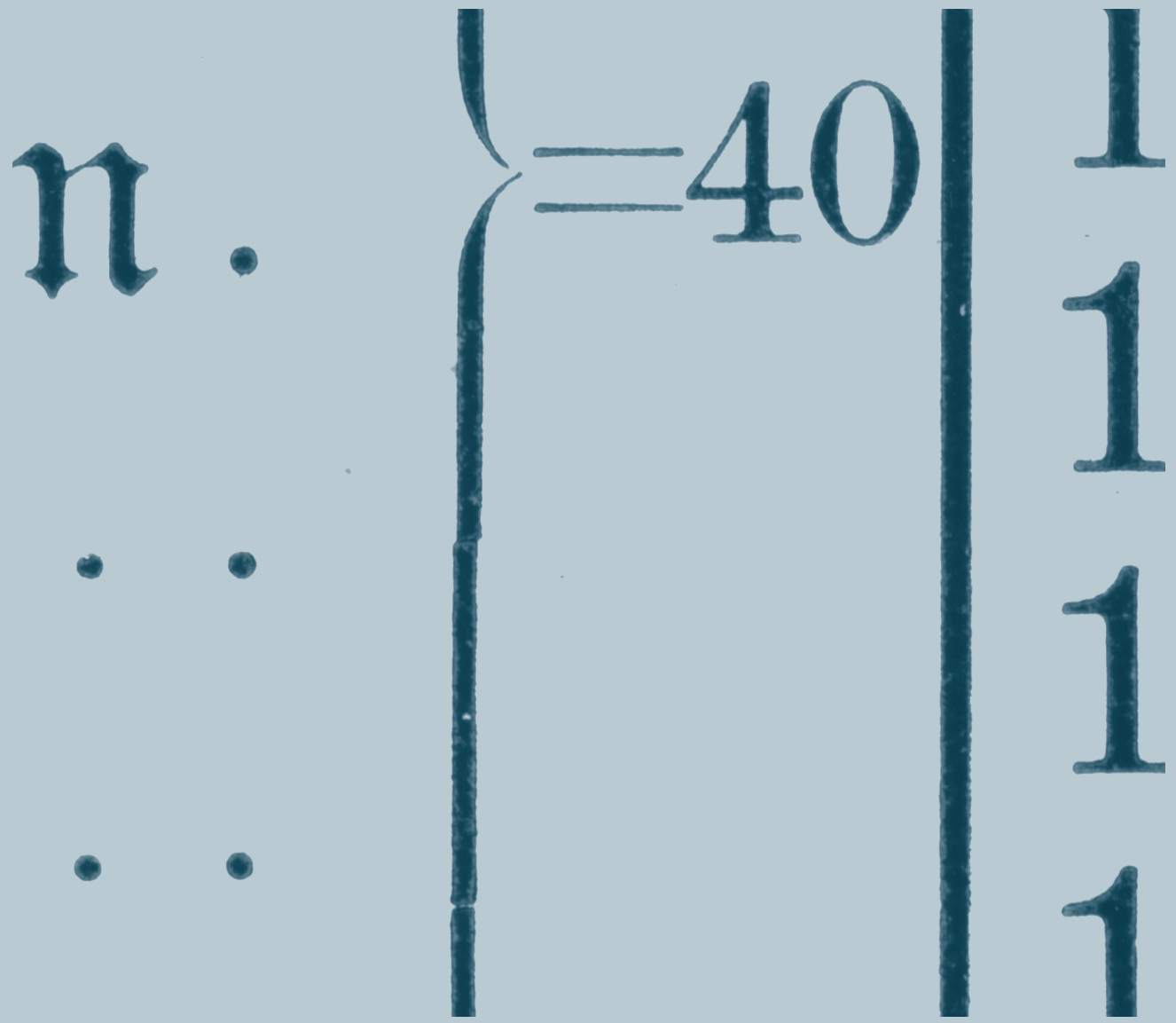
“RECTANGLE” PARADIGM: TYPESETTER’S CURLY BRACE




n .
=40
1
1
1
1

“RECTANGLE” PARADIGM: TYPESETTER’S RADICAL

$$\operatorname{tg}\frac{a}{2} = \sqrt{\frac{\sin\frac{\varepsilon}{2}\sin\left(A - \frac{\varepsilon}{2}\right)}{\sin\left(B - \frac{\varepsilon}{2}\right)\sin\left(C - \frac{\varepsilon}{2}\right)}}$$

$$\operatorname{tg}\frac{a}{2} = \sqrt{\frac{\sin\frac{\varepsilon}{2}}{\sin\left(B -\right.}}$$

INTERLUDE: PAST

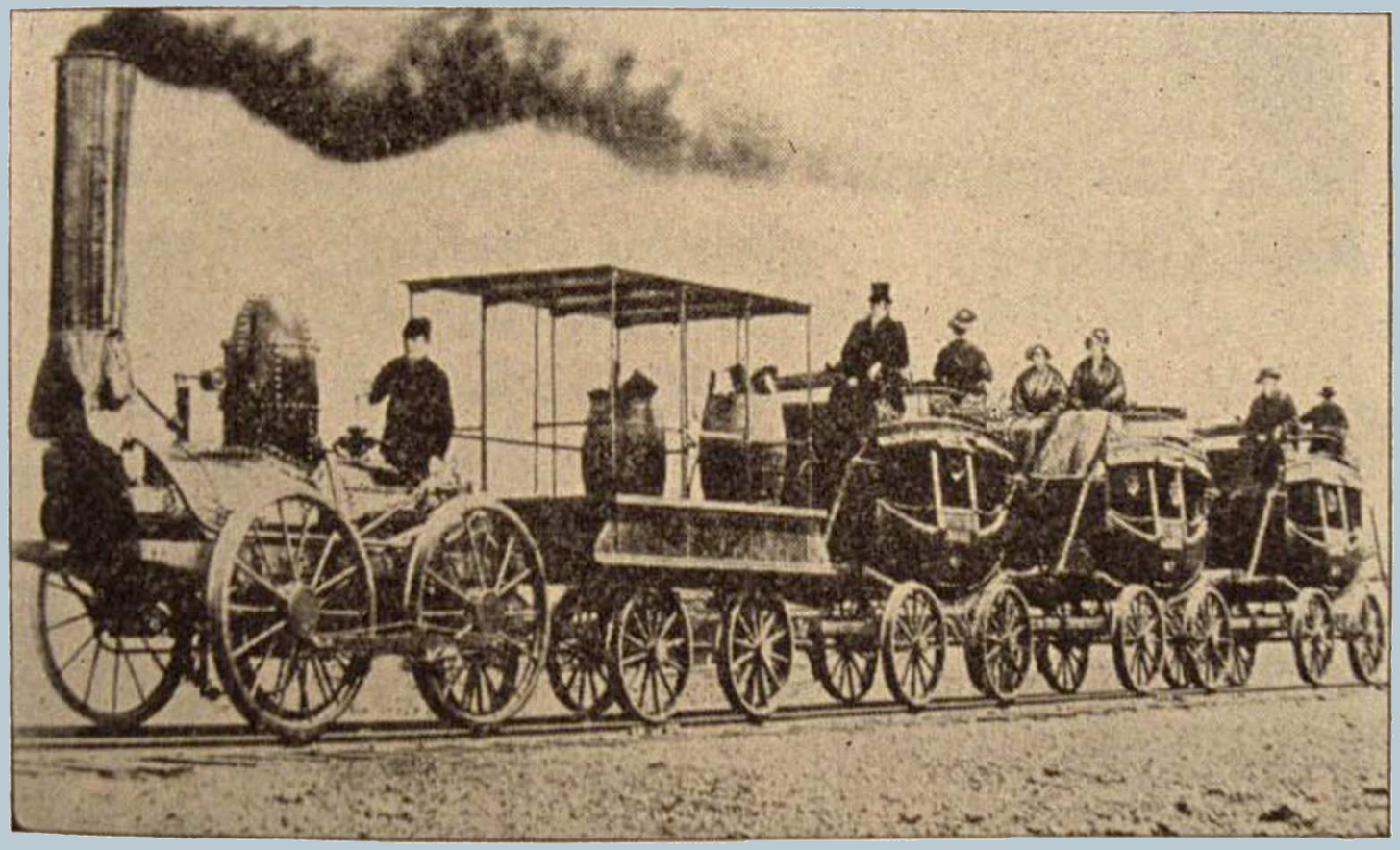
Johannes Gutenberg (et al., as always) set the milestone in the development of reproduction technology. The movable metal type approach, facilitating multiplication of documents, ruled for half a millennium.

Some portions of documents, mainly embelishments (ornaments, initials), but also some elements of musical notation and of the mathematical notation, were either drawn by hand or included in some other way.

INTERLUDE: PRESENT

The advent of computer technology changed document production; it inherited, however, many features from its predecessor, the Gutenberg paradigm. In particular, the same characters which caused typesetting difficulties in the old times – including our favorite slurs, braces, and radicals – are still causing trouble to users employing programs typesetting texts.

INTERLUDE: PRESENT



"The DeWitt Clinton" locomotive and railcars that initiated the New York Central System, 1831; note the similarity of the railcars and stagecoaches

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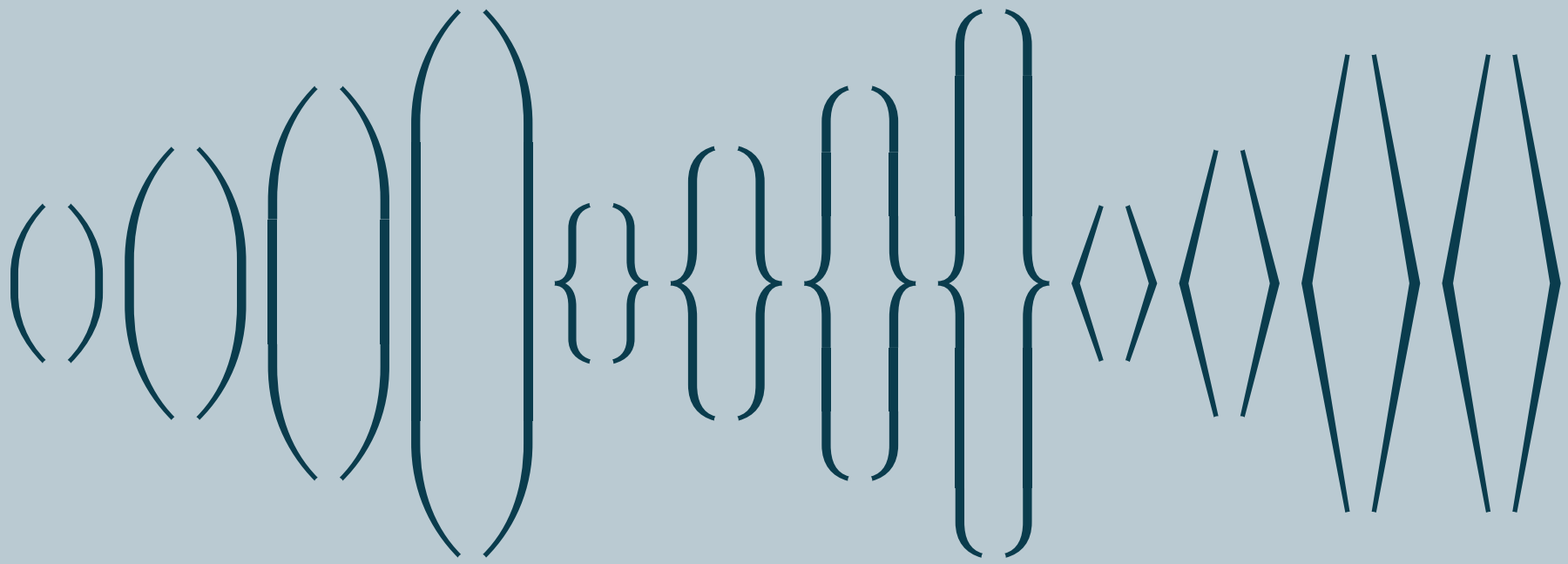
We will refer to the currently existing paradigm of text typesetting as the *Gutenberg-Knuth paradigm*, to stress the contribution of Donald E. Knuth, who in the years 1977–1982 created a model of typesetting rooted in Gutenberg's ideas and implemented it for computers creating the TEX typesetting system. Of course, Knuth's approach is actually an instance of a *rectangle paradigm*: TEX "sees" all characters as merely rectangles.

NOT ONLY TEX...



Delimiters typeset with MS Word 2010 Equation Editor
(the font is TEX Gyre Pagella OTF)

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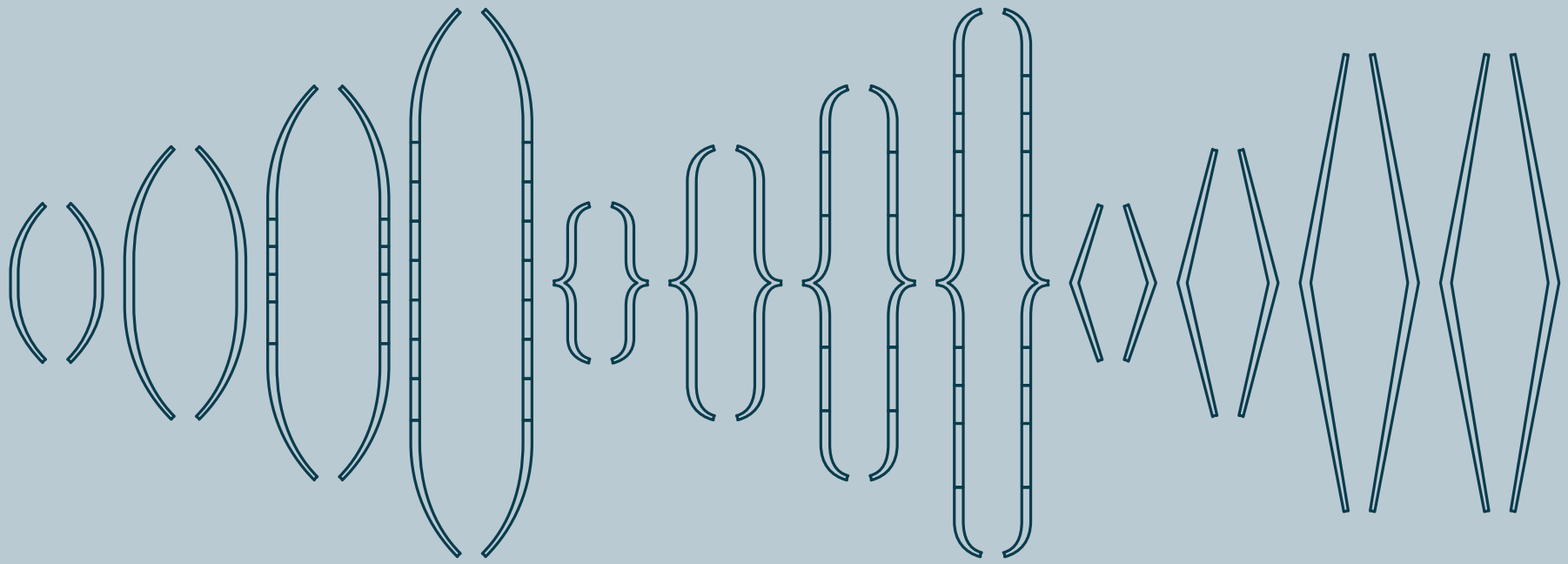

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NOT ONLY TEX...

$$\sqrt[9]{\sqrt[8]{\sqrt[7]{\sqrt[6]{\sqrt[5]{\sqrt[4]{\sqrt[3]{\sqrt[2]{\sqrt{z^{1}}}}}}}}}}$$

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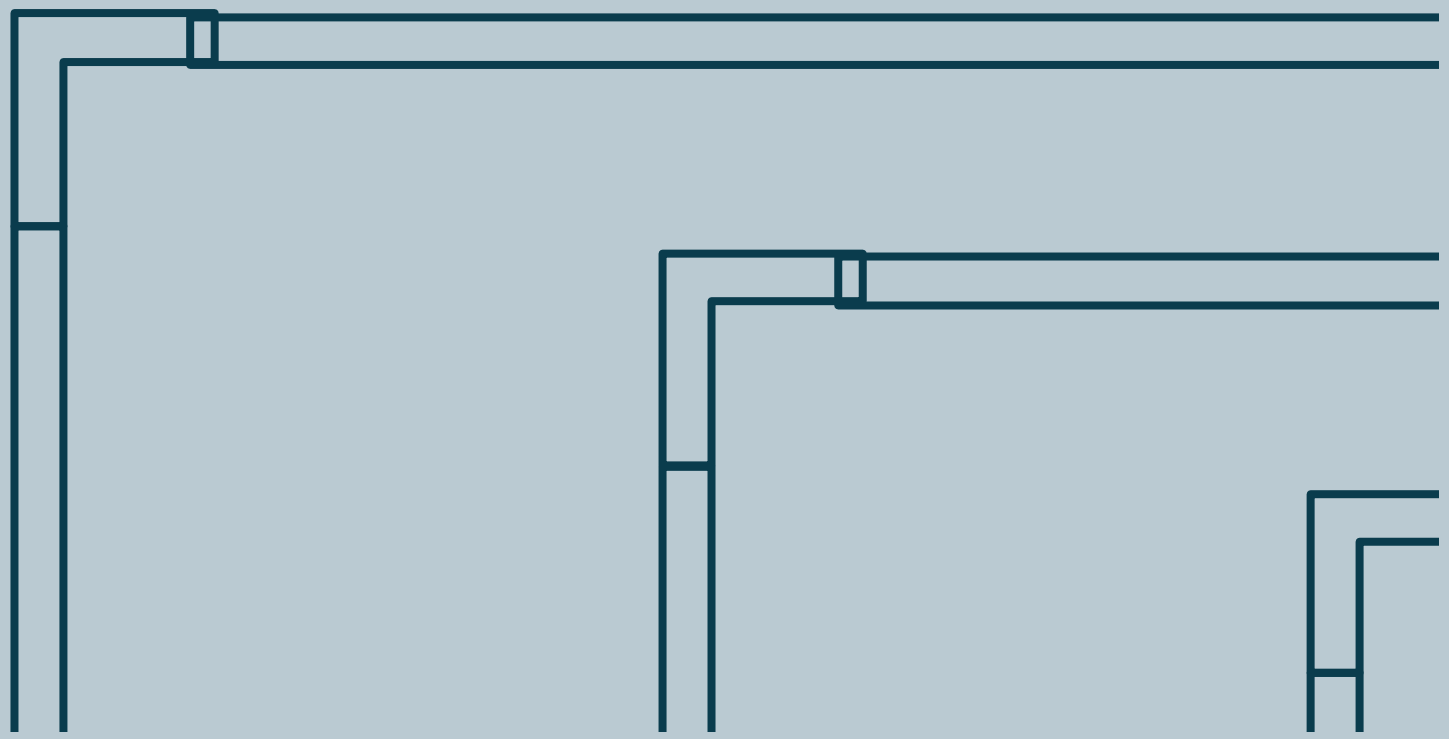

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That’s all from my side, it’s Marek’s turn now...