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Typesetting Books with Special Needs

Yannis Haralambous*

July 26, 1999

What do we call a *book with special needs*? It is a book whose preparation demands special efforts by the author (or typist), weither because its structure is complex (dictionaries and critical editions are typical examples of books with complex structure), or because it contains information which must be presented in a special way (mathematics, phonetics, multiple languages and scripts) or simply because it has to obey to a certain number of constraints which go father than the standard technical document (whose needs are almost entirely handled by standard \LaTeX).

We will cover a few cases, taken from real world challenges we had to face in our typesetting work. Our goal is to achieve the typographical quality of traditional typography, while using the most appropriate IT methods and standards.

1 Visual Quality

It may sound strange (or at least pessimistic) to start a list of “special needs” by “visual quality.” After all, every book should have visual quality, this is the least to ask. Actually this is not always true: in real life many publishers are rather inclined to produce books in the cheapest possible way, and this leaves little room for any esthetic consideration.

Nevertheless there are cases where the book needs to comply to a certain visual quality standard. But how do we transform a standard \LaTeX document into a typographical masterpiece? Maybe we could start with something more realistic: how do we obtain a decently typeset book? Here is a tentative checklist of things to consider:

1. choose the right font and page layout (according to book format and paper nature);
2. apply basic typesetting rules (for the specific language and country);
3. apply principles of good typography with a maximum of good taste;
4. print the result and show it to a specialist.

*Atelier Fluxus Virus, <http://www.fluxus-virus.com>

1.1 Making the Right Choices

Fortunately \LaTeX allows an easy change of typographical and page layout parameters. But still we need a starting point: we have to choose the font, its size and leading, the dimensions of the printed page, the vertical space between paragraphs, text blocks, headers, footers and main text, the presentation of titles and subtitles, footnotes, captions, etc. In \LaTeX centric terms: everything that makes a class file (and often much more).

The choice of the font is a typical example: it has to do with the contents of the book: is it a modern text? an old text? in that case the font should not be significantly more recent than the text: you don't typeset Montaigne in Helvetica, nor Cervantes in Palatino; is it literary or technical? in the latter case, you should choose a neutral font (see § 1.1.1); in what extent should typographical choices be apparent? in a "luxury edition" you have more freedom because people expect to find a "nice" font, while a critical edition concentrates on contents and again the global appearance must be neutral (just like in the case of technical documents).

To illustrate the right choice of font, we have chosen to innovate by not using the Roman script, but fraktur. On fig. 1 the reader can see an example of font choices: three texts have been typeset in fraktur, the first one is from Carl Philipp Emanuel Bach's "Versuch über die wahre Art das Clavier zu spielen" (1753), the second from E.T.A. Hoffmann's "Der goldene Topf" (1822) and the third from H.K. Stein's "Lehrbuch der Geschichte" a schoolbook published in 1903. All three have been typeset in fraktur and for most readers—even German speaking ones—all fraktur looks the same. This idea is also reinforced by modern font foundries which often include only a single fraktur font in their catalogs ("Wittenberger Fraktur" for Linotype, "Walbaum Fraktur" for URW, etc. where both foundries also provide "Fette Fraktur," which is purely decorative). This is certainly not true: just like there are many Roman typefaces, drawn in different times and places, so there also many fraktur typefaces. The ones we have chosen for these texts are "Wartburg" (a 18th century typeface), "Unger" (drawn in 1794), "Normale Fraktur" ("normal type," the most common typeface of the 19th century).

We have chosen this example to show that often a little historical research is a better solution for choosing the right font ("what would choose a printer contemporary to the author?") than just personal taste ("I like Garamond very much, let us use it for all books").

1.1.1 "Neutral" typography

But what about technical documents or, more generally, documents needing a neutral appearance, where the reader's attention must be concentrated on the contents and only? This is a very common problem in the \TeX world, since \TeX is generally more often used for technical and scientific documents than for literary ones.

By definition, a "neutral" typeface is a typeface that doesn't attract attention, an "ordinary" typeface. But "ordinary" does not necessarily mean "ugly." The typefaces seen most often today in technical documents are Computer Modern for \TeX documents,¹ and Times for the rest of the world. Com-

¹While Ω provides Times-like fonts as default text fonts.

Man hat auffer vielen Arten der Claviere, welche theils wegen ihrer Mängel unbekant geblieben, theils noch nicht überall eingeführt sind, hauptsächlich zwey Arten, nemlich die Flügel und Clavicorde, welche bis hieher den meisten Beyfall erhalten haben. Jene braucht man insgemein zu starcken Musicken, diese zum allein spielen. Die neuern Forte piano, wenn sie dauerhaft und gut gearbeitet sind, haben viele Vorzüge, ohngeachtet ihre Tractirung besonders und nicht ohne Schwierigkeit ausstudiret werden muß. Sie thun gut bey dem allein spielen und bey einer nicht gar zu starck gesetzten Music, ich glaube aber doch, daß ein gutes Clavicord, ausgenommen daß es einen schwächern Ton hat, alle Schönheiten mit jenem gemein und überdem noch die Hebung und das Tragen der Tone voraus hat, weil ich nach dem Anschlage noch jeder Note einen Druck geben kan. Das Clavicord ist also das Instrument, worauf man einen Clavieristen außs genaueste zu beurtheilen fähig ist.

Mit Recht draf ich zweifeln, daß du, günstiger Leser, jemals in einer gläsernen Flasche verschlossen gewesen sein solltest, es sei denn, daß ein lebendiger neckhafter Traum dich einmal mit solchen feiischen Unwesen befangen hätte. War das der Fall, so wirst du das Glend des armen Studenten Anselmus recht lebhaft fühlen; hast du aber auch dergleichen nie geträumt, so schließt dich deine rege Phantasie mir und dem Anselmus zu Gefallen wohl auf einige Augenblicke in das Kristall ein. — Du bist von blendendem Glanze dicht umflossen, alle Gegenstände rings umher erscheinen dir von strahlenden Regenbogenfarben erleuchtet und umgeben — alles zittert und wankt und dröhnt im Schimmer — du schwimmst regungs- und bewegungslos wie in einem festgefrorenen Äther, der dich einpreßt, do daß der Geist vergebens dem toten Körper gebietet.

Die Geschichte sucht als Geschichtsforschung zu ergründen, was geschehen ist. Aber nicht alle Geschehnisse sind für sie von gleicher Bedeutung. Da der Mensch von den geschaffenen Wesen das wichtigste ist, so nimmt von aller Geschichte die Geschichte der Menschheit den ersten Rang ein. Nun ist aber nur da, wo es eine Entwicklung, ein Werden, eine Veränderung gibt, Geschichte möglich. Darum beschäftigt sich die Geschichte hauptsächlich mit denjenigen Völkern, die sich weiter entwickelt haben, deren Werke und Taten für den Werdegang der Menschheit wichtig waren oder noch sind. Das Material das dem Geschichtsforscher die Erkenntnis des Geschehenen ermöglicht, nennen wir die Quellen. Diese können von zweierlei Art sein. Entweder sind es Berichte von Zeitgenossen oder von Späteren, die den Zweck haben, die Kenntnis der Ereignisse der Mit- und Nachwelt zu übermitteln.

Figure 1: Three texts typeset in different fraktur fonts, according to their history and contents.

puter Modern is a nice, a bit old-fashioned font. If it hasn't been chosen by D.E. Knuth for T_EX, we probably would not call it “neutral” today (the closest commercial fonts are ITC Modern and Monotype Modern: these are certainly not “neutral” fonts, and give an old-fashioned look to a book), but so many documents have been typeset in Computer Modern that our eyes have become used to it.

If you want to use a Times-like font then Adobe Times (on the Mac) and Monotype New Times Roman (on Windows) are not your only choices: there are other, very nice “neutral” fonts, like Times Ten, Utopia, Le Monde, ITC Century or Linotype Centennial. On fig. 2 the reader can see a few lines taken from a technical document, typeset in the five typefaces we mentioned: Times Ten, Utopia, Le Monde, ITC Century and Linotype Centennial. These are only a few examples from the long list of typefaces suitable for technical documents.

1.2 Basic Typesetting Rules

These are the very fundamental rules for typesetting a given language, in a given country. You can find them described in books such as the *Chicago Manual of Style* [1] for US English or *Hart's Rules for Compositors and Readers* [3] for UK English, the *Lexique des règles typographiques en usage à l'Imprimerie Nationale* [4] for French, the *Duden-Taschenbuch Band 5 Satz- und Korrekturanweisungen, Richtlinien für die Texterfassung* [2] for German, and so on.

Whether they deal with punctuation, the use of italics or small caps, abbreviations, the use of lower and upper case, etc. most of these rules are clear and unambiguous. Some of them can be applied directly by T_EX itself, others can be applied by pre-processor scripts and finally others need the typesetter's attention.

1.3 Principles of Good Typography

Besides being a technique, typography is also an art. And an art is harder to learn than just a few rules. Of course there are very good books on typography around: books by Tschichold [10], Gill [7], Rogers [8], Wilson [11], Bringhurst [5], Solomon [9], Willberg/Forsman [12] (in German), Duplan/Jauneau [6] (in French) and many others will give you some insight (see also our Web site [14] for an additional list of interesting books on various topics). But still you only really learn by doing it, by seeing how others have done it, and by discussing with specialists.

2 Characters to Draw: Letters, Symbols, Diacritics,...

It happens often that an author needs a special symbol, whether this is a mathematical symbol, a pictogram, a phonetic character, a special accent to place upon or beyond an ordinary letter, etc.

The best solution is to *draw* this character and to include it into a new or an already existing font. This is the best solution, for the following reasons:

But freshwater resources are limited and unevenly distributed. In the high-consumption countries with rich resources and a highly developed technical infrastructure, the many ways of conserving, recycling and re-using water may more or less suffice to curb further growth in supply. In many other regions, however, water availability is critical to any further development above the present unsatisfactorily low level, and even to the mere survival of existing communities or

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Figure 2: A few lines from a technical document typeset in five different “neutral” fonts, suitable for technical documents: Times Ten, Utopia, Le Monde, ITC Century and Linotype Centennial.

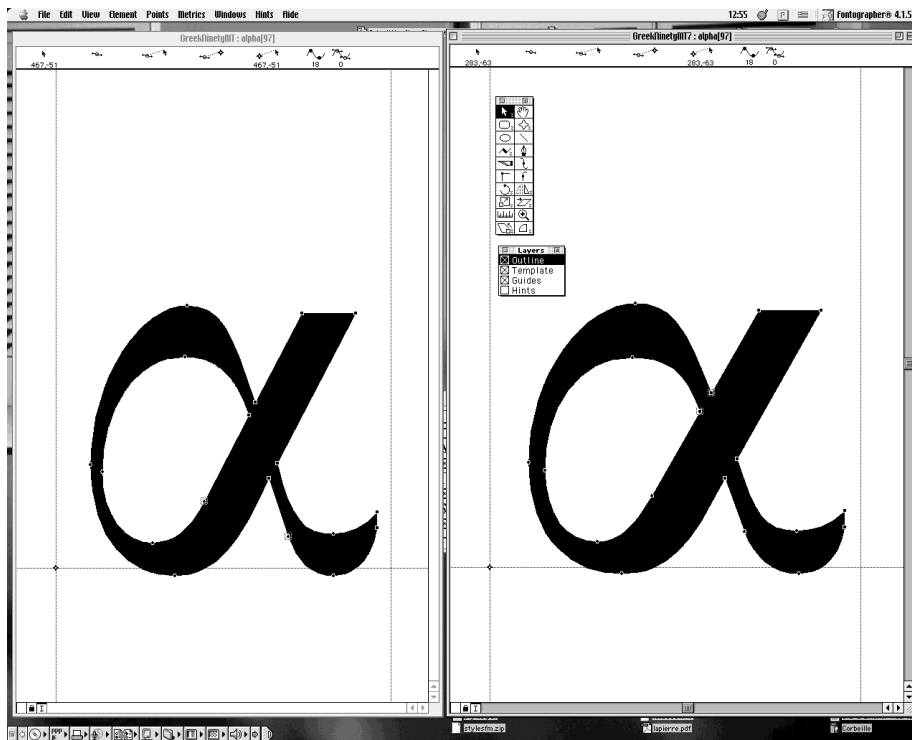


Figure 3: Working on the optical correction of letter alpha for Greek text: on the left, the original letter for 10 points typesetting; on the right the same letter corrected for 7 points typesetting.

1. by including the character into the same font, you can kern it with other characters;
2. by making a regular character out of it (and not some weird construction made out of boxes, \accents, \raises, rules, etc.) it can participate in hyphenation;
3. only by drawing a character you have complete control on his form and can make it fit with the surrounding characters;
4. (this applies only to accented letters) accents often change form when placed on different letters: for example accents placed on uppercase letters are lower than the ones placed on lowercase letters; in Greek, the circumflex accent is narrower when placed on the iota than when placed on the omega, etc. Inversely, sometimes the shape of a letter may change because an accent has been placed upon it: in the case of the Esperanto 'h' with circumflex accent, we can very well imagine the vertical stroke of the 'h' being lower so that the accent doesn't get too high.

Drawing characters also allows us to apply rules of optical correction, that is the variation of shape according to the size of printed letters. This very important method has been successfully applied to the Computer Modern family: cmr5, cmr7, cmr10, cmr12, cmr17 (Computer Modern Roman at 5–

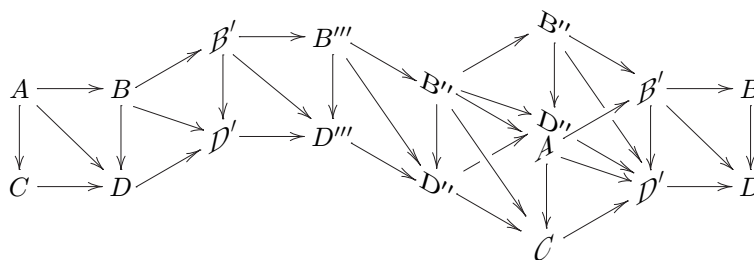


Figure 4: A mathematical construction made under Illustrator out of pieces made by XYPic.

17 points) are all the same font, but the shape of letters is (slightly) different. This method can also be applied to non-Metafont fonts, in a more manual and less precise manner: by redrawing characters for each important size. See fig. 3 for an example of optical correction of Greek letter alpha (at 10 and 7 points size).

2.1 How do I Draw Characters

All depends on the kind and use of the characters. If you need to draw a geometrical symbol, you will get better results using Metafont or Metapost and then converting the result to PostScript. Especially if it is a mathematical symbol which has to fit with other Metafont-generated mathematical symbols, like those in CMSY or in the AMS fonts.

If it is not geometrical, then you'll better draw it in a font drawing program like Fontographer or FontLab or Ikarus, and then save it in PostScript form. With these programs you can also open existing fonts and redraw, compose or re-arrange the glyphs (of course you can do this only for personal use, since copyright of the original font applies).

You can also ask a specialist to do it for you: fonts are complex objects and there is a long way from the first sketch of a character to the accomplished real-world usable font.

3 Mathematics

Typesetting of mathematics is a very interesting challenge. It is especially important for the $\text{T}_{\text{E}}\text{X}$ community, since D.E. Knuth has developed $\text{T}_{\text{E}}\text{X}$ in the first place to typeset the mathematics of his own books. One could expect that after D.E. Knuth's work, and twenty years of collective efforts, all problems of mathematical typesetting should be resolved. Also it is a very pleasant fact that $\text{T}_{\text{E}}\text{X}$ has slowly become a universal method for communicating and storing mathematical texts, so that mathematicians conform their style of writing to $\text{T}_{\text{E}}\text{X}$'s range of possible mathematical constructions.

But still, sometimes mathematics can be so complex that even the combined efforts of $\text{T}_{\text{E}}\text{X}$, AMS- $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$, XYPic and YHMath cannot typeset them conveniently. These are rare cases, and for them one can always use graphical

$$\frac{mNq^2}{2} = \frac{P}{2} \iint \vec{r} \cdot d\vec{S}$$

$$\frac{mNq^2}{2} = \frac{3P}{2} \iiint dV = \frac{3PV}{2}$$

Figure 5: Double and triple curvilinear integral signs: An example of mathematical characters specially drawn.

tools like Metapost or Adobe Illustrator to create the desired construction out of existing pieces. For example, the commutative diagram on fig. 4 has been made under Illustrator using pieces from constructions made by XYPic. The fact that some letters are shown under perspective is supposed to increase the legibility of this “2.5-dimensional” mathematical expression.

When a mathematical symbol is missing, it has to be drawn (see § 2). Sometimes this involves using existing glyphs, and making precise measurements. For example, to draw the symbols on fig. 5, the author had to first make precise measurements of the distance of integral glyphs in AMS- \TeX constructions `\iint` and `\iiint`, then combine two (resp. three) integral glyphs with that precise distance into a single character, and finally draw the ellipses.

This has been done in a PostScript font editor, because these symbols are part of the SMF Baskerville family of math fonts (see § 3.1). But when the surrounding math symbols are designed in Metafont, then it is easier to stay with that font design language. The YHMath package does exactly that: to produce larger delimiters and wider accents, it adds another 128 glyphs to the CMEX font. Here is an (hypothetical) example of the use of YHMath:

$$\det \begin{pmatrix} a & b & c & d & e \\ f & g & h & i & j \\ k & l & m & n & o \\ p & q & r & s & t \\ u & v & w & x & y \end{pmatrix} = \text{area}(\overbrace{A_{ay}B_{ay}C_{ay}}) - \left\langle \begin{matrix} y & x & w & v & u \\ t & s & r & q & p \\ o & n & m & l & k \\ j & i & h & g & f \\ e & d & c & b & a \end{matrix} \right\rangle .$$

3.1 Typesetting Mathematics in Typefaces other than Computer Modern or Times

In 1.1.1 we have discussed the possibility of using fonts other than Computer Modern or Times for technical documents. What happens with mathematics included in such documents?

The only mathematical typefaces widely available for \TeX are Computer Modern, Mathtime and Lucida: a very small number of typefaces compared to the large number of existing typefaces for text. The author has had the opportunity to design other mathematical typefaces for specific projects: the mathematics had to fit with the text typefaces Stempel Garamond, Sabon and ITC New Baskerville. The latter is called “SMF Baskerville” and has been drawn especially for the French Mathematical Society. On fig. 6 the reader can see an example of mathematics typeset in SMF Baskerville.

Drawing a mathematical typeface using a text typeface as model is an interesting experience. Latin letters have to be redrawn (they have to be larger and their position in the character box often changes entirely). Geometrical symbols (that is: mathematical symbols made out of geometric forms, like $+$, $-$, \times , \otimes , \triangle etc. contrarily to “alphabetical symbols” like ∇ , \int , \sum , \prod , etc.) have to be redrawn with a different width of stroke, different extremities and corners (sharp or round) and a different mathematical axis.

But the most interesting is the drawing of Greek letters: these must keep their very specific form (Greek letters used in mathematics have fixed forms and cannot adopt the design characteristics of their Latin counterparts like in the case of Greek text fonts) but at the same time must be homogenized with Latin letters. To achieve this, their heights and widths, and widths of thin and fat strokes must be modified so that they optically fit with Latin letters.

3.2 Mathematics and the Web

Sometimes we have an additional constraint: the mathematics of a given book must be coded in such a way that the book can be easily ported to the Web. In other words, one must choose a method of publishing mathematics on the Web ($\text{\LaTeX}2\text{HTML}$, $\text{\TeX}4\text{HT}$, IBM TechExplorer, $\text{\TeX}Spider$, WebEQ Java applets, MathML produced by Ω or by WebEQ, Acrobat PDF, etc.) and write (or re-write) the code in such a way that it is compatible with the chosen method. This issue is out of the scope of this article.

4 Multilingual Documents

Various issues arise when we are dealing with multilingual documents. In some cases we want to make different languages look similar, in other cases we want them to look different. Independently of how we present them, languages have their own rules, grammatical, or typographical. In the latter case we may want to impose the typographical rules of one language (the “background language”) to others, or keep the rules of each language (which often leads to weird problems when we have to decide to which language belong neutral elements such as digits or punctuation).

On fig. 7 the reader can see an illustration of the two methods: (a) making scripts look different, this can be useful when we have short insertions of text in a different script and we want the reader’s eye to immediately notice the difference. To achieve this we take the most traditional form of each script: in the example, French is typeset in Didot, Greek in Monotype Greek 90, Russian in an old-fashioned Russian font, Armenian in traditional oblique (with uppercase letters straight) and Georgian in a nice traditional font. Method (b) is the exact opposite: we want all scripts to look as close as possible (for example, Latin ‘o’, Greek omicron, Cyrillic ‘o’ are all identified, also identified are Latin ‘n’ and Armenian ‘a’, etc.). In the example we have used an ordinary Times font. This method is more efficient if we are typesetting well separated text blocks in different languages and want to keep a globally homogeneous presentation; a typical example are publications of the European Union, where everything is translated in all languages of the Union.

If a function ρ belongs to $L^1(\mu_K)$ then for the conditional expectation of ρ with respect to the inverse image of the whole σ -field under f^k , we have the formula:

$$\mathbf{E}_{\mu_K}(\rho | f^{-k}(\mathcal{B}))(x) = \sum_{y \in f^{-k}(f^k(x))} \frac{\rho(y)}{\psi(y)}.$$

Hence:

$$(8.5) \quad \int \left(\frac{\psi}{\varphi} - 1 \right) d\mu_K = \int \mathbf{E}_{\mu_K} \left(\frac{\psi}{\varphi} - 1 | f^{-k}(\mathcal{B}) \right) d\mu_K \\ = \int \sum_{y \in f^{-k}(f^k(x))} \left(\frac{1}{\varphi(y)} - \frac{1}{\psi(y)} \right) d\mu_K(x) = \int (1 - 1) d\mu_K = 0.$$

Assume now that μ_K is a measure with maximal entropy for $f^k|_K$, and that $x \in K \setminus B$, $f^{kn}(x) = x$. By (8.4) and (8.5), we have $\varphi = \psi$, μ_K -almost anywhere. The whole trajectory of x (under f^k) is disjoint from B and hence, in view of (8.1), (8.2) and Theorem (6.2) (c), φ and ψ are contiguous in some neighbourhood of the trajectory of x . Thus, there are equal on the whole trajectory of x . Therefore by (8.1) and (8.2) we obtain:

$$|(f^{nk})'(x)| = \prod_{i=0}^{n-1} |(f^k)'(f^{ik}(x))| = \prod_{i=0}^{n-1} \psi(f^{ik}(x)) = \prod_{i=0}^{n-1} \varphi(f^{ik}(x)) = \beta^n.$$

Figure 6: Mathematics typeset in SMF Baskerville, according to the tradition of the *Publications mathématiques de l'I.H.E.S.*

Making scripts look different. A little French: un peu de français dans une police Didot, and Greek: λίγα ἑλληνικά γιὰ νὰ δοῦμε τὴν διαφορά, Russian: Все шрифты классифицируют по группам, Armenian: Գոհութիւն Աստուծոյ, and finally Georgian: მხელრულო ასოები.

Making scripts look similar. A little French: un peu de français dans la même police Times, and Greek: λίγα ἑλληνικά γιὰ νὰ δοῦμε τὴν διαφορά, Russian: Все шрифты классифицируют по группам, Armenian: Գոհութիւն Աստուծոյ and Georgian: მხელრულო ასოები.

Figure 7: The two methods of mixing different scripts.

A

A,a — [a] *όν. αρσ. πρώτο γράμμα του αλφαβήτου. De A à Z, από το Α ως το Ω. Prouver par A + B, αποδεικνύω τελειωτικά.*

à — [a] *πρόθ. ι. σε. 1. Je vais à Paris. Πηγαίνω στο Παρίσι. 2. Je pars à quatre heures. Φεύγω στις τέσσερις. ii. με. 1. Ce moteur marche à l'essence. Αυτή η μηχανή δουλεύει με βενζίνη. 2. Il y avait environ de mille à mille cinq cents manifestants. Υπήρχαν περίπου χίλιοι με χίλιους πεντακόσιους διαδηλωτές. iii. une machine — écrire, μια γραφομηχανή. iv. 1. Il obéit à ses parents. Υπακούει τους γονείς του. Il est fidèle à ses promesses. Κρατά τις υποσχέσεις του. 2. Le livre est à moi. Το βιβλίο είναι δικό μου.*

abaissant — βλ. **abaisser 2**.

1. abaisser — [abese] *ρ. μτβ. Α. (3). κατεβάζω, χαμηλώνω. 1. — la vitre de la voiture, κατεβάζω το τζάμι του αυτοκινήτου. 2. — les impôts, κατεβάζω τους φόρους. abaisser (s') E. (5). à la fin du spectacle, le rideau s'abaisse. Στο τέλος του θεάματος, η αυλαία χαμηλώνει. abaissement *όν. αρσ. 1. κατέβασμα π. 2. ελάττωση, μείωση f. (= baisse, diminution).**

2. abaisser — *ρ. μτβ. Α. (3). υποβιβάζω, ταπεινώνω. — qqn, υποβιβάζω κπ. abaisser (s') E. (5). ταπεινώνομαι. Il s'est abaissé à me demander de l'argent. Ταπεινώθηκε με το να μου ζητήσει χρήματα. abaissant, -ante *επ. ταπεινωτικός, -ή, -ό.**

abandonner — [abãðne] *ρ. μτβ. Α. (3). I. εγκαταλείπω, παρατώ (-άω), αφήνω (= laisser). 1. — un lieu, un bateau, εγκαταλείπω ένα μέρος, ένα πλοίο. 2. — sa famille, εγκαταλείπω / παρατώ την οικογένειά μου. 3. — une théorie, αφήνω μια θεωρία. ii. — un nouveau-pé, εκθέτω ένα βρέφος. iii. J'abandonne! Τα παρατώ! abandonner (s') E. (5). 1. εγκαταλείπομαι. — au désespoir, εγκαταλείπομαι στην απελπισία. 2. εξομολογούμαι (= se confier). abandonné, -ée *επ. εγκαταλειμμένος, -η, -ο. maison —, εγκαταλειμμένο σπίτι. abandon *όν. αρσ. 1. εγκατάλειψη f. — de biens, de poste, εγκατάλειψη περιουσίας, θέσης. 2. νωθρότητα f. (= nonchalance). abandon (à l') *επίρρ. Le parc est à l'abandon. Το πάρκο είναι εγκαταλειμμένο.****

abaque — [abak] *(μαθημ. κλπ.) *όν. αρσ. άβακας m.**

abasourdir — [abazurdir] *ρ. μτβ. Α. (23). 1. ξεκουφαίνω, ζαλίζω. 2. (μτφ.) καταπλήσσω / καταπλήττω. Cette nouvelle m'a abasourdi. Αυτή η είδηση με κατέπληξε. abasourdissant, -ante *επ. 1. εκκωφαντικός, -ή, -ό. 2. κατάπληκτος / κατάπληχτος, -η, -ο. abasourdissement *όν. αρσ. κατάπληξη f. σάστιμα π.***

abâtardir — [abatardir] *ρ. μτβ. Α. (23). μπασταρδέω, νοθεύω. abâtardir (s') E. (25). νοθεύομαι. abâtardissement *όν. αρσ. μπαστάρδεμα π.**

abat-jour — [abazur] *όν.αρσ. αμπαζούρ π. inv.*

abats, abattage — βλ. **abattre 1. / abattement** βλ. **abattre 1 κ. 2.**

abattis — [abati] *όν. αρσ. πληθ. 1. (πουλερικών) πλατάρια π. pl. 2. ° Numérote tes abattis! Πρόσεχε, θα σε σκοτώσω!*

1. abattre — [abatr] *ρ. μτβ. Α. (69). I. ρίχνω κάτω, καταρρίπτω, κόβω (= couper). 1. — un mur, ρίχνω κάτω έναν τοίχο. 2. — un avion, καταρρίπτω / κατεβάζω ένα αεροπλάνο. II. ξεκάνω, σκοτώνω (= tuer). 1. — un animal, ξεκάνω ένα ζώο. 2. — qqn, ξεκάνω κπ. III. 1. — du travail, βγάζω πολλή δουλειά. 2. (χαρτοπ.) — son jeu, κατεβάζω τα χαρτιά μου. abattre (s') E. (69. 5). καταπέφτω. abattage *όν. αρσ. 1. (ζώων) σφάξιμο π. σφαγή f. 2. ° avoir de l'—, είμαι γεμάτος δυναμισμό. abattement *όν. αρσ. (φόρων) ελάττωση f. abattoir *όν. αρσ. σφαγείο π. abats *όν. αρσ. πληθ. (ζώων) εντόσθια π. pl.*****

2. abattre — *ρ. μτβ. Α. (69). (μτφ.) τσακίζω, σπάζω / σπάω (= briser). 1. Cet échec l'a abattu. Αυτή η αποτυχία τον τσάκισε. 2. — le courage de qqn, τσακίζω το κουράγιο κάποιου. abattu, -e *επ. 1. τσακισμένος, εξασθενημένος, -η, -ο. 2. αποθαρρημένος, -η, -ο. (= découragé). abattement *όν. αρσ. 1. εξασθένηση, εξάντληση f. (= épuisement). 2. αποθάρρση, κατάπτωση (= prostration) f.***

abbé — [abe] *όν. αρσ. 1. ιερωμένος, κληρικός m. 2. (μοναστηριού) αβάς, ηγούμενος m. l' — Pierre, ο αβάς Πιερ. abbatial, -e, aux *επ. 1. ηγουμεινικός, -ή, -ό. 2. μοναστηριακός, -ή, -ό. abbaye *όν. θηλ. αβαείο π. abbesse *όν. θηλ. ηγουμένη f.****

A B C — [abese] *όν. αρσ. 1. αλφαβητάριο π. 2. C'est l'a b c du métier. Είναι το άλφα βήτα της τέχνης. abécédaire *όν. αρσ. αλφαβητάριο.**

abcès — [apse] *όν. αρσ. απόστημα π.*

abdiquer — [abdike] *ρ. αμτβ. μτβ. Α. (3). παραιτούμαι. 1. Le roi a abdicué. Ο βασιλιάς παραιτήθηκε. ii. (μτφ.). J'abdique! Παραιτούμαι! abdication *όν. θηλ. παραίτηση f.**

abdomen — [abdɔmen] *όν. αρσ. κοιλιά f. (= ventre). abdominal, -ale, -aux *επ. κοιλιακός, -ή, -ό.**

abduction — [abdyksjɔ̃] *(ανατ.) *όν. θηλ. απαγωγή f. (# adduction). abducteur *επ. κ. *όν. αρσ. απαγωγός, -ός, -ό. muscles —, απαγωγοί μύες.****

abécédaire — βλ. **A B C**.

abeille — [abej] *όν. θηλ. μέλισσα f.*

aberrant -ante — [abεrã, -ã] *επ. 1. εξωφρενικός, -ή, -ό. C'est aberrant! Είναι αφάνταστο! 2. εξαιρετός, -έα, -έο. aberration *όν. θηλ. εξωφρενικότητα f.**

abêtir — [abetir] *ρ. μτβ. Α. (23). αποβλακώνω. abêtir (s') E. (25). αποβλακώνομαι. abêtissant, -ante *επ. αποβλακωτικός, -ή, -ό. abêtissement *όν. αρσ. αποβλάκωση f. αποβλάκωμα π.***

• **abhorrer** — [abore] *ρ. μτβ. Α. (3). απεχθάνομαι. — la grossièreté, απεχθάνομαι τη χυδαιότητα.*

abîme — βλ. **abîmer 2**.

1. abîmer — [abime] *ρ. μτβ. Α. (3). χαλώ (-άω), στραπατσάρω, καταστρέφω. 1. L'humidité a abîmé les murs. Η υγρασία χάλασε / κατάρτηξε το τοίχο. 2. — qqn, στραπατσάρω κπ.*

Figure 8: A page from a French/Greek dictionary, typeset in Univers and Monotype Porson.

The French/Greek dictionary page we are showing on fig. 8 is also a typical example of method (a): since Greek and Latin scripts are very close² and since in such a dictionary French and Greek words constantly alternate, the two scripts have to be presented in a clearly different way. The author has chosen the notorious French sans serif typeface Univers for the French text, and the equally notorious scholarly Greek typeface Porson (of English origin) for the Greek text. These two typefaces contrast in almost every extent: the first is sans serif, straight, thin or fat, of French origin; the second is serified, slanted, of medium weight and of English origin.

For the phonetic description of French words we have taken a condensed version of Stone Phonetic. Not everyone is interested in the phonetic description, this is why we want to keep it as small as possible; on the other hand the choice of a sans serif font makes it more legible, although it is condensed and brings it closer to the French text. The font chosen for the entries and sub-entries is a bold Univers: this makes these subentries immediately identifiable inside the text. In this dictionary Greek is never typeset in bold.

Another problem that arises when we typeset multilingual documents is related to hyphenation. For most languages we have already hyphenation algorithms. Nevertheless one should always be ready to modify these algorithms. Here is what can happen:

1. New characters can get involved, needing special patterns (long and short ‘s’ for German, pre-Leninian Cyrillic letters for Russian, etc.)
2. In dictionaries and primers, additional signs are often used to simplify the learning of the given language; for example, in Russian, acute accents are used to show which vowel must be stressed. These signs should not interfere with hyphenation.
3. Sometimes we use transcriptions instead of the original alphabet, for example Greek is often transcribed in the Latin alphabet. In that case the hyphenation algorithms and the transcriptions must be compatible.
4. Hyphenation rules can vary according to the location where a book is published. For example, ancient Greek is not hyphenated in the same way in Greece and in the United States. This means that the language and dialect information is not always sufficient for choosing properly a document’s hyphenation rules.

In some cases people even argue if hyphenation should be applied or not: this the case of Ivrit (modern Hebrew). Classical Hebrew is never hyphenated (just as Arabic and Syriac) and as a derivative of classical Hebrew, Ivrit should not be hyphenated as well; but Ivrit has often long words (of foreign origin) and these could very well be hyphenated. Whether an algorithm is able to recognize these words is another (open) question. We have the same problem with Yiddish: being a German dialect, there is no reason why Yiddish shouldn’t be

²In Greece the author has often seen graffiti accidentally mixing the two scripts, like in ‘NO ΠΑΡΚΙΝΓ’, that is ‘NO PARKING’ where the first three letters of the second word are Greek, and while writing the next three (who are indeed common to the two scripts) the writer has forgotten he was writing in Greek—after all these are English words—and finished the inscription with a Latin ‘G.’

hyphenated, and indeed it is. The Yiddish Institute (YIVO) even provides hyphenation rules; but one of the rule is *not to hyphenated Hebrew words*. Can an algorithm distinguish these from German ones?

We see that often to do proper typesetting we need first to apply natural language processing methods.

5 Natural Language Processing Methods Needed for Typesetting

Many minor grammatical phenomena can be handled automatically by the typesetting software, for example the fact that in Greek or Dutch, when a broken diphthong is hyphenated, the dieresis disappears (for example the Dutch word “poëeten” is hyphenated “po-eeten”), in German when ‘ck’ gets hyphenated, it becomes ‘k-k’ and another similar phenomena.

But in some cases a real morphological analysis is needed, which of course cannot be carried out by the software alone.

Our first example is an ongoing project of the author, dealing with the long and short ‘s’ in German, as well as with the use or non-use of certain ligatures. In broken script, there are two kinds of ‘s’ the “short s” *ſ* and the “long s” *ſ̄*. In German, the former is used at the end of the word, and at the end of word components inside a composite word; the latter is used in all other cases. So, for example, ‘das’ is written with a short s: *das*, while ‘dasein’ is written with a long one: *daſ̄ein*. The word ‘aus’ is also written with a short s: *aus*; when this word is used to make a composite, it retains the short s: ‘ausmachen’ *ausmaçhen*; but a word can start with ‘aus’ without being a composite: ‘ausser’ *auff̄er*. Furthermore any German word can be combined with others to produce composite ones; no word list, or dictionary can predict all possible combinations. And German words get declined: such a word list should also take into account all possible forms.

The long and short ‘s’ are not the only cases where the morphology of words plays a rôle in typesetting: there is also a rule saying that there should be no ligatures formed by letters belonging to different components of a composite word. For example, in the word ‘Auflage’ there should be no f-l ligature: *Auflage* and not *Auflage*. These rules affect also the typesetting of German in Roman type, at least for the ligatures ‘fi’, ‘ff’, ‘ffi’, ‘ffl’, ‘fl’ that are still in use in Roman type.

All of these problems can be solved automatically by using Natural Language Processing tools. Currently the author is working upon adapting Oliver Lorenz’s DMM [13] (Morphological Analyzer of German, based on the programming language Malaga) to this task. By preprocessing texts (or by using this tool as an external Ω Translation Process) one can detect and treat all cases of short and long ‘s’ and broken ligatures.

A similar problem arises in Thai: in South East Asian languages (besides Vietnamese), words are not separated inside a sentence. Nevertheless typesetting software must be able to separate words because sentences can be very long. Unicode provides a word-separator character, but Thai people are not accustomed into using it. The Thai T_EX package provides a pre-processor which analyzes text and inserts the necessary word-separator marks (in the

forthcoming Ω Thai package this pre-processor will be included internally as a Translation Process).

6 Parallel Texts and Critical Editions

A typical example of parallel texts is a literary text and its translation(s). In the Renaissance many polyglot Bibles have been printed, featuring sometimes up to six parallel versions of the same text (in different languages, scripts and writing directions). A more general case are critical editions: in this case, not only we have two or more parallel texts, but these also produce several bodies of footnotes, endnotes and critical apparati.

The example on fig. 9 is such a critical edition: it has 5 major blocks of text (not counting headers): the original text (ancient Greek) on the upper even page, translation (French) on the upper odd page, and three blocks underneath: critical apparatus, linked to the Greek text by line number, footnotes and references linked to the translation by numbers or lowercase letters.

All five blocks grow simultaneously: the Greek text and French translation blocks always stay on a single page (even for the former, odd for the latter); the other three blocks spread to occupy the remaining space underneath (even if this space is not symmetric, or is only on the even side or only on the odd side). Any word of Greek text you add may produce entries in the critical apparatus or words in the translation, which again may require footnotes and references.

But of course the typesetting system is not a translation engine, and hence is not capable of knowing exactly what part of the translation corresponds to each word of Greek text. It is the authors responsibility to mark up the Greek text and the translation so that the typesetting engine can then interpolate between corresponding tags and typeset the two blocks of text as parallel as possible.

How can $\text{T}_{\text{E}}\text{X}$ do that?³ There is certainly a way, but the author decided to do it otherwise. He developed a system, called PARALLEL, which extracts lines from DVI files and reassembles them according to a given setup. That way it is easy to control the growth of each one of the text blocks. As for the critical apparatus, which is special because it contains line numbers (and these may be initialized at each new even page), it is recompiled again at each new (double) page.

Footnote and reference numbers are also added automatically, since these also get initialized at every new double page. Hence, the system has to rearrange lines from five different DVI files, to complete them by adding some automatically generated material (line numbers, etc.) and to restart compilation and line extraction of the critical apparatus at every new double page. It is written in Perl, backed up by a MySQL database, the two communicating through the DBI module: the choice of Perl makes PARALLEL a bit slower, but much easier to debug and maintain.

How do you prepare the data for such a critical edition? Every author may find his/her own way; to be able to be compatible with any author's method, and to store the data in a unique and efficient way we have adopted XML as

³Note that a good $\text{T}_{\text{E}}\text{X}$ ist never asks "can $\text{T}_{\text{E}}\text{X}$ do that?" but "how can we do that with $\text{T}_{\text{E}}\text{X}$?" since, by definition, $\text{T}_{\text{E}}\text{X}$ can do everything.

Διὸ παραινῶ φεῶγεν αὐτῶν τὴν μανίαν· μανίαν γὰρ
 ἔγωγέ φημι εἶναι ἐσχάτην τὸ φιλονεικεῖν εἰδέναι τὴν
 τὴν οὐσίαν ἐστὶν ὁ Θεός. Καὶ ἵνα μάθῃς ὅτι μανίας
 ἐσχάτης τοῦτο, ἀπὸ τῶν προφητῶν ὑμῶν τοῦτο ποιήσω
 5 φανερόν· οἱ γὰρ προφήται οὐ μόνον τὴ τὴν οὐσίαν ἐστὶν
 ἀγνωοῦντες φαίνονται, ἀλλὰ καὶ περὶ τῆς σοφίας αὐτοῦ
 πόση τίς ἐστιν ἀπορούσι· καίτοι γε οὐχ ἡ οὐσία ἀπὸ
 τῆς σοφίας, ἀλλ' ἡ σοφία ἐκ τῆς οὐσίας. Ὅταν δὲ
 10 μὴδὲ ταύτην δύνωνται καταλαμβάνειν οἱ προφήται μετὰ
 ἀκριθείας, πόση ἀν εἴη μανίας τὸ τὴν οὐσίαν αὐτῆν
 νομίζειν δύνασθαι τοῖς οικείοις ὑποδύλλειν λογισμοῖς;
 Ἀκούσωμεν τοίνυν τί φησιν ὁ προφήτης περὶ αὐτῆς·
 «Ἐθαυμαστώθη ἡ γνώσις σου ἐξ ἑμοῦ.» Μάλλον δὲ
 ἀνωτέρω τὸν λόγον ἀγάγωμεν· «Ἐξομολογήσομαί σοι,
 15 ὅτι φοβερός ἐθαυμαστώθης.» Τί ἐστι «φοβερός»; Πολλὰ
 θαυμάζομεν μόνον, ἀλλ' οὐ μετὰ φόβου, ὅσον κτιῶν

1 μανία²; μανίας EL DG OVX || 2 ἐγὼ γε om. DG || φημι B; transp.
 post. ἐσχάτης E O om. cett. || εἶναι: ὁμοια VX om. DG || ἐσχάτης EL
 DG OVX om. B || τὸ om. DG || 3 μανίας ἐσχάτης; μανίαν ἐσχάτην
 AC om. B || 9 μετ' corr. Duc || 16 μόνον; ὅν E om. CL G VX.

a. Ps. 138, 6.
 b. Ps. 138, 14.

1. Le mot *περοφήτης* a des nuances diverses dans l'Ancien et le Nouveau Testament et à l'intérieur de chacun d'eux, mais ces sens divers ont un caractère commun : le prophète est l'homme qui parle sous l'inspiration de l'Esprit. Cf. *homm.* III, li. 150 s. C'est ainsi que Jean va citer successivement des textes du Psalmiste, d'Isaïe et de Paul.

2. On remarquera que Jean utilise très fréquemment la tournure *οὐ μόνον... ἀλλὰ καὶ καὶ*. C'est sans doute une habitude de style enseignée par la rhétorique mais elle correspond chez lui, croyons-nous, à une tendance profonde. Son dynamisme naturel ne se contente pas d'une constatation pure et simple; il la renforce soit

Je vous exhorte donc à éviter leur folie, car c'est le comble de la folie que s'acharner à connaître Dieu dans son essence. Et pour que vous compreniez que c'est bien en effet le comble de la folie, je vous le montrerais à l'évidence par le témoignage des écrivains sacrés¹ : non seulement ceux-ci ignoraient manifestement ce qu'il est dans son essence, mais encore ils ne savent que dire de l'étendue de sa sagesse²; or ce n'est pas l'essence qui dérive de la sagesse, mais la sagesse de l'essence. Quand donc les écrivains sacrés ne peuvent pas même délimiter celle-là avec exactitude, quelle est la folie de ceux qui croient pouvoir soumettre son essence elle-même à leurs propres raisonnements³? Écoutons donc ce que dit l'écrivain sacré à ce sujet : « La connaissance que tu as de moi m'a été un objet d'admiration^a. » Mais suivons plus loin son propos : « Je te bénirai, parce qu'on t'admire avec crainte^b. » Que signifient ces mots : « avec crainte »? Nombreuses sont les choses que nous nous contentons d'admirer⁴, mais non

dans un sens positif, soit dans un sens négatif. Ici, la tournure marque un nouveau point érigé sur l'adversaire, grâce au témoignage d'hommes inspirés. Loin de prétendre connaître l'essence de Dieu, ils ont un mouvement de recul, de confusion, même lorsqu'il s'agit de parler des manifestations de la sagesse.

3. Jean oppose ici la saisie claire du mystère de Dieu, dont se prévalent les Anoméens, *καταλαμβάνον μετὰ ἀκριθείας*, à la connaissance conjecturale, forcément imparfaite lorsqu'elle ne s'appuie que sur des raisonnements humains. En fait, Eunome affirme qu'il ne s'appuie pas uniquement sur « ses propres raisonnements », mais grâce à une théorie du langage qu'il tire de l'Écriture (*Gen.* 1, 3), il attribue à Dieu l'origine du nom qui le désigne exactement. Voir *Apologetica*, chap. 7, PG 30, 84f.

4. Ici encore, le choix des textes permet à Jean de faire progresser son argumentation. L'usage du verbe *θεωροῦν* dans le premier texte suggère l'admiration dans plus. Mais dans le second, l'adjonction de *φοβερός* montre l'homme saisi d'une crainte renouvelée en présence de Dieu, devant l'océan infini de sa sagesse : τὸ ἀπειρόν... πάλαιτος τῆς τοῦ Θεοῦ σοφίας.

Figure 9: Sample of critical edition (John Chrysostome, *On the non-understandability of God*).

من عرف ان هذا احسن فقد عرف⁸ شئ الذي هو احسن منه الا ان تكون⁹ المعرفة توهمًا لا يقينا فانه ان لم يعرف الشئ الذي به قيل فيه انه احسن قد¹⁰ يمكن ان لا¹¹ يكون شئ دونه في الحسن فيكون¹² قوله فيه انه احسن كذبا ومن هذا يظهر ان الراس واليد ليست من المضاف الحقيقي فانه قد^d يعرف¹³ ماهية كل واحد¹⁴ منها من حيث هما في الجوهر على التحصيل من غير ان يعرف الشئ الذي هو له راس ولا الشئ الذي هو له يد قال الا ان بالجملة الحكم بالحقيقة على^e ما هو من المضاف من سائر المقولات وماليس من المضاف هو مما يصعب¹⁵ ما لم يتدبر مرارا كثيرة فاما التشكك¹⁶ فيها فليس فيه صعوبة¹⁷.

⁸ فقد F : قد L — يكون C : تكون F, L — ان هذا احسن فقد عرف C *repetit* — ويكون C : فيكون F, L — الا F : ان لا C, L — ¹¹ 'jam', j, ذكرب h ; و C — يضعف C : يصعب ¹⁵ — واحدة F : واحد C, L, h — ¹⁴ تعرف F : يعرف C, L, h, j — ¹³ صعوبة ¹⁷ Ita C, F, L, h — ¹⁶ التشكك C : التشكك F, L —

357 ضرورة ان يكون يعلم ايضا ذلك الشئ الذي هذا احسن منه محصلا فانه ليس يجوز ان يكون انما يعلم ان هذا احسن مما دونه في الحسن فان ذلك انما يكون توهمًا لا علما وذلك انه ليس يعلم يقينا انه احسن مما هو دونه فانه ربما اتفق الا¹ يكون شئ^{t*} دونه فيكون قد ظهر انه واجب ضرورة متى علم الانسان احد المضافين محصلا ان يكون 360 [15] يعلم ايضا¹ ذلك الاخر الذي اليه اضيف محصلا. فاما الراس و اليد وكل^{t*} واحد مما^d يجري مجراهما مما هي جواهر فان ماهياتها¹ انفسها قد تعرف محصلة فاما ما يضاف^{t*} اليه فليس واجبا ان يعرف وذلك انه لا سبيل الى ان يعلم على التحصيل راس من هذا ويد من هذه فيجب من ذلك ان هذه ليست من المضاف واذا¹ لم تكن هذه من 365 [21] المضاف فقد يصح القول انه ليس جوهر من الجواهر من المضاف الا انه خليق ان^e يكون قد يصعب التقحم على اثبات الحكم على امثال هذه الامور ما لم تتدبر¹ مرارا كثيرة فاما التشكك فيها فليس مما لا درك فيه.

— ماهيتها⁽³⁶²⁾ — فكل* — ايضا يعلم⁽³⁶¹⁾ — شيا* — ان لا⁽³⁵⁹⁾ — LECT. t : — يتدبر⁽³⁶⁶⁾ — واذا⁽³⁶⁴⁾ — تضاف*

Figure 10: Sample of critical edition (Averroes, *Comments of Aristoteles' Book of Categories*).

the intermediate format between data preparation and typesetting. Hence the system takes data from five XML files, converts it to T_EX code and runs T_EX (actually Ω , since there is ancient Greek involved) upon it to produce the five DVI files.

In this way, T_EX (Ω) is entirely responsible for what happens on a single line, and PARALLEL is responsible for making paragraphs and pages out of these lines. This would be absurd in any other case (since E_TX for example knows very well how to make paragraphs and pages, even if it sometimes swallows a few floating figures) but in this case it has proven to work efficiently. The author is investigating another possibility where PARALLEL would ask T_EX (Ω) to recompile the different blocks of text many times until a perfect double page is obtained, and then move to the next double page: one of the problems is that once T_EX has made the DVI file, it is difficult to find out where you are exactly in the source file, especially if the text is in Greek and has been transformed several times by Ω Translation Processes (from input encoding to Unicode and then to the 16-bit font encoding).

Another interesting example is the one on fig. 10: it is a critical edition of Averroes' Comments on Aristoteles' Book of Categories. There are four blocks of text, on the same page: the text of Averroes (from right to left), the critical apparatus (entries from left to right), the original Arabic text of Aristoteles (from right to left) and the critical apparatus on that text (also from left to right).

7 Conclusion

The issues covered in this paper may seem somehow unrelated. The author has tried to present some of the problems he had to solve in his daily typesetting work of the last few years. Their common point is the effort to respect by all possible means, and even re-invent in some cases, typographical tradition. At the same time the constraints of real life forced him to prefer practical solutions that work, to more elegant solutions that may have taken longer to realize. In any case, what counts is the result, and this is why this paper is full of examples, which we hope the reader has enjoyed.

The reader can find more information on past and ongoing projects, on the "research" page [14] of the Atelier's Web site.

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