Digital Scholarly Editions as Interfaces

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Between Innovation and Conservation: The Narrow Path of User Interface Design for Digital Scholarly Editions

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Abstract

In 2016, the Edition Visualization Technology (EVT: evt.labcd.unipi.it/) team started the design phase necessary for the development of the next version of this tool aimed at easy publishing of TEI XML-based digital editions: the current version (EVT 1.2), in fact, only supports diplomatic transcriptions linked to the corresponding manuscript images; EVT 2.0 will fully support critical editions encoded according to the TEI parallel segmentation method. To reach this goal, a completely new approach based on the AngularJS framework and the MVC (Model View Controller) architectural pattern was necessary because the old architecture, relying on XSLT 2.0 transformations, was no longer flexible enough to meet all the UI and navigation requirements of critical editions. Furthermore, during the design phase we decided that in some cases keeping a layout inspired by traditional printed editions would be a great help for our final users. After a long but interesting development process, a beta version of EVT 2 is out: we believe that the UI layout and solutions we devised are both effective in the short term, for all the projects that will adopt EVT, and a significant contribution to the theoretical discussion revolving around the very concept of DSE.

1 Introduction

When the first critical editions appeared in digital form as digital scholarly editions (DSE), they adopted the traditional printed editions model: the layout was typically based on multiple rectangular text frames arranged in a single HTML page within which all edition data – the main text, the critical apparatus, possibly textual notes, glossaries, etc. – would find its place in a very ordered manner.

One example of this approach can be seen in the *Codex Sinaiticus Project*,[1] where the global User Interface is organized in three different frames, one for the image, one

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[1] The *Codex Sinaiticus Project* (codexsinaiticus.org/) is an international collaboration born with the goal of creating a digital edition of this 4th century manuscript, containing the Christian bible in Greek, in order to make it accessible to the general public.
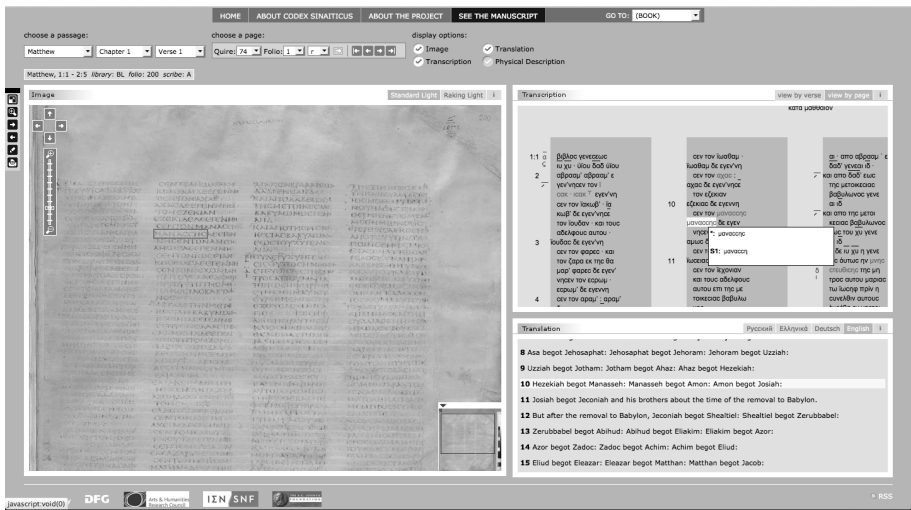
Figure 1: *Codex Sinaiticus Project.*

for the transcription and one for additional content such as a translation of the edited text (fig. 1).

Another important example is the critical electronic edition of Wolfram von Eschenbach's *Parzival* (*Parzival Project*),[2] where the content (critical edition text, base transcription text, images and witnesses text) is arranged in fixed frames of equal size (fig. 2).

This approach, which is still used in some recent editions, has been criticized because while it allows the user to take advantage of hypertext capabilities in a Web- or HTML-based edition, it is based on a 'slavish' reproduction of printed editions. This, in turn, leads to a somewhat inflexible layout which results in unacceptable limitations with regard to the methods of presenting and querying the textual material. The "printed page paradigm" (see Sahle *Digitale Editionsformen* 270; Sahle "What Is a Scholarly Digital Edition?" 26–27) heavily influences the first specimens of digital editions:

> Most digital editions are only timidly engaging with the medium, trying to reproduce on the screen the same experience offered by the printed page,

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2   The *Parzival Project* is a project funded by the Swiss National Science Foundation (SNF) and the German Research Council (DFG) with the primary aim of creating a critical electronic edition based on four witnesses of the *Parzival*, one of the greatest medieval poems attributed to the German poet Wolfram von Eschenbach.

Kritischer Text: Parzival 1.15 – 1.25

Übersetzung >>

1.15. diz vliegende bîspel

1.16. ist tumben liuten gar ze snel;

1.17. sine mugens niht erdenken,

1.18. wand ez kan vor in wenken

1.19. rehte alsam ein schellec hase.

1.20. zin anderhalp an dem glase

1.21. *gelîchet* und des blinden troum,

Hs. D: 'gelichent'

D m n o G [I] L M O Q [R] T U V [V] W Z Fr32 Fr58

Variantenapparat: Parzival 1.15 – 1.25

1.15.
1.15 *nach* 1.18–r: Q

diz] Daz Z Fr58, Diz D T, **Diz** Fr32, DJs m

vliegende] vl*gende vs gende M, fliende Q, fligenden Z

1.16.

tumben] tûmbe U

gar] om. U

ze] om. m W

snel *snele* m

Textzeugen

Hs. D:
St. Gallen, Stiftsbibliothek, Cod. 857

D S. 5a

D 1.15. Diz fligende bîspel.

D 1.16. ist tumben liŭten gár zesnêl

D 1.17. sine mugens niht erdenken.

D 1.18. wand iz kan vor in wenken.
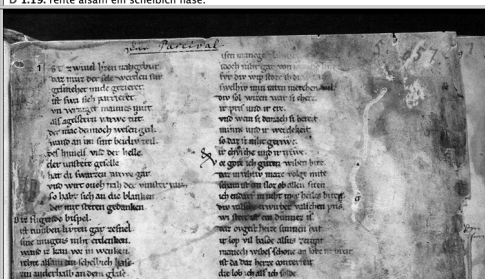
D 1.19. rehte alsam ein schelbich hase.

Figure 2: *Parzival Project.*

> desperately trying to demonstrate that digital editions are as good as printed
> ones. (Pierazzo *DSE* 2–3)

Which is why, starting from a certain moment onwards, digital editors have strayed
from this model to explore new concepts and new forms of User Interfaces applied to
DSEs. This has led to the introduction and use of a new layout, new graphical widgets,
new navigation methods, etc.

One consequence of this search for more effective approaches, however, is the fact
that all (or most) of today's DSEs are to some extent experimental, and that the general
layout of the UI and the solutions provided for the same tasks (browsing/navigating
the text, the critical apparatus, the notes, etc.) differ from edition to edition.[3] This

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[3] Some digital scholarly editions display the critical apparatus as a separate section that stands below the
main text (see e.g. *The Parzival Project*: www.parzival.unibas.ch/editionen/ed4_001/index001.html and
www.parzival.unibas.ch/editionen/ed019/index19.html or *Dante Alighieri: Commedia. A Digital Edition*:
sd-editions.com/AnaAdditional/CommediaEx/CommediaExhome.html) or next to it (see e.g. *De trein
der traagheid*: edities.kantl.be/daisne/ed/Tdt.htm?t=leestekst&c=P48 or the *Mark Twain Project Online*:
www.marktwainproject.org/xtf/view?docId=letters/UCCL00206.xml;style=letter;brand=mtp#APP); oth-
ers show it as a small pop-up that opens as the mouse passes over (see e.g. *The Codex Sinaiticus Project*:
codexsinaiticus.org/en/manuscript.aspx) or when the user clicks on the connected lemma (see *Excerpts
from the Chronicle of Matthew of Edessa*: byzantini.st/ChronicleME/text/excerpt1). In some editions,
however, the critical apparatus is shown in a separate window that opens when the user clicks on the
connected passage of the text (see *The Electronic Beowulf 4.0*: ebeowulf.uky.edu/ebeo4.0/CD/main.html),
while in more recent cases it is placed in a small box that opens below the line where the lemma appears

means that while *traditional layout* editions allow for a certain degree of uniformity even if the edited texts may vary (because of language, historical periods, types of textual tradition, etc.), *innovative layout* editions may be compared more to software programs than to books in digital form when it comes to their UI layout, and as for every non-trivial software it is necessary to learn how it works. A book does not need any accompanying instructions, and to some degree this is also true for traditional layout critical editions, but the great variability that is typical of more recent DSEs requires some adjusting and, in some cases, the willingness to invest a certain amount of time to learn how to use the navigation tools.

As a consequence, modern DSEs suffer from several drawbacks:

- this lack of homogeneity means that the learning curve may be quite high, sometimes even frustrating for the less experienced user;
- it can also happen that an excellent content is made less usable by an inadequate UI: not all design choices enable the user to access and browse the edition data in an effective way;
- a further problem concerns editions which offer digitized images of the manuscript(s) and/or the full text of all witnesses: when the material to be managed increases beyond a certain threshold, the navigation of edition data becomes tricky, and UI design and implementation is the critical problem to solve;
- from an editor's perspective, almost every project heavily customizes the final edition UI: this not only adds to the *UI fragmentation* problem, but also makes it difficult - if not impossible - to set common standards and share the available publication tools among different projects.

We have noticed,[4] however, that the reproduction of a fixed layout on the basis of printed critical editions is due not only to a natural conservative tendency: while the XIXth century arrangement of critical text and corresponding apparatus is a compromise, especially when it comes to the quantity of information that can be compressed in the apparatus layer, it is a very successful compromise nonetheless, to the point that printed scholarly editions are in no danger of extinction (quite the contrary, actually). When working on a DSE, one might think that the problem of space has gone away, and that the *digital editor* faces a much easier task when compared to the traditional one, but this is true in appearance only: on the one hand, we have an infinite storing space for philological data to be shown, on the other hand, the space to show it still is a two-dimensional surface only marginally larger than a printed page.

(see *The Wandering Jew's Chronicle*: wjc.bodleian.ox.ac.uk/HTML/WJC.html). For a complete list of digital scholarly editions, see Franzini, Sahle *A catalog of Digital Scholarly Editions*. The *ride* journal, a review journal for digital editions, is another useful resource (ride.i-d-e.de/).

[4]   See Di Pietro, ch. 1.3 *L'edizione Digitale*, and also ch. 2.2 *Analisi e progettazione concettuale*.

> However, whatever size it may have and whatever visual comfort it may offer, a display is far from being a universal panacea for all woes caused by printing technology. Organizing and presenting information architectures with an increasing underlying complexity poses serious challenges to online critical edition. (Apollon and Bélisle 111)

In other words, things are possibly even more complicated than before, since the designer of any edition browsing software will have to take into account this paradox.

Speaking of browsing tools, the question one may legitimately pose about them is: who should design and develop this kind of software? In the past, each DSE project had its own set of tools specifically created to answer the project's needs, the obvious exception usually being when the same framework was used to build different editions within the same project and/or prepared by the same scholar.[5] Only in more recent times there have been tools developed in such a way as to be usable for other projects. The approach, however, has been mainly based on the direct collaboration with ICT developers with little or no humanities background, requiring a patient and detailed explanation of the textual scholar's needs. The inherent danger in this approach is the fact that, since no scholar fully encompasses and represents all different methodologies existing in the textual criticism field, not only the browsing software will be limited to their knowledge and specifically tailored for their project's needs, but also that once the development directives are received they will be carried out to the letter: there will be no envisioning of other possibilities by the developers since they are unaware of what could be done to improve the software with regards to textual criticism functionality, and for the same reason they would not consider implementing a feature to supplement those already envisioned. The edition browsing tool becomes a perfect mirror of that scholar's approach to textual editing, often in relation to a specific work.

Since this, as hinted above, is a very difficult task, we think that the humanities scholar should be involved at all stages: design,[6] implementation, and feedback. Their opinion is invaluable to decide which features and tools are actually important and useful within a particular electronic edition, and to find the most suitable methods to present the edition content in a more effective way than the traditional printed

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[5]   See for instance *The Canterbury Tales Project*, currently published by SDE - Scholarly Digital Editions (www.sd-editions.com/index.html) and on the Textual Communities web site (www.textualcommunities.usask.ca/web/canterbury-tales). Another series of homogeneous and well designed digital editions was that created by Bernard J. Muir, in particular the *Junius 11* (McGillivray) and *The Exeter Anthology of Old English Poetry* (Cavill), but unfortunately the first is not available any more, and the second one is listed for a very high price. Note that in both cases the format chosen was that of a CD / DVD edition, not a web-based one.

[6]   On the importance of a good UI layout with regard to the effectiveness of a digital edition, see Rosselli Del Turco 2011.

edition. It is also crucial to receive feedback both during and after the development process, when a working product is released. Final users' criticism and suggestions, in particular, are essential to adjust the User Interface (and UX - User eXperience) aspects of any edition browsing tool.

In our experience, when developing such a tool (see the following section), the best workflow is the one relying on a prototyping process which goes through multiple iterations: the cycle starts with the design phase and the creation of several mockups to compare different options; then dynamic mockups[7] and/or a working prototype are created to test the best options; after a few tests, always going back to the design table if the results are deemed unsatisfactory, a final layout is implemented in an alpha/beta version: if the feedback received is positive, then the next step is a new stable release.

2 The starting point: EVT 1

Edition Visualization Technology (EVT)[8] is an open source tool to produce digital scholarly editions on the basis of TEI XML-encoded documents. Although it was born to serve the goals of a single project, the *Digital Vercelli Book* (Rosselli Del Turco 2017), it has been developed in such a way as to become a general purpose tool. In fact, there are several DSE projects using EVT, and more are in preparation by young researchers who have found in EVT the perfect tool for their needs. Some of them will be announced during the months to come. Here is a provisional list:

- the already mentioned *Digital Vercelli Book* project;
- the *Codice Pelavicino Digitale* project (Salvatori et al.);
- the *Tarsian* digital edition (Schulthess and Sankar);
- the viewer component of the *Clavius on the Web* project;[9]
- the digital edition of Gherardi's *Théâtre italien;*[10]
- the digital edition of Marciana Gr. Z 11 (379).[11]

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[7] There are several Web sites offering this kind of service, see e.g. Invision (www.invisionapp.com/) or Moqups (moqups.com/).

[8] Home page for the project with information and news about both versions in development (EVT 1 and EVT 2): evt.labcd.unipi.it/. See the *References* for details about distribution and code repositories.

[9] Editors of this project are adding semantic, lexical, and user annotations to each transcription. EVT is used to show the text of each document together with the corresponding digitized images.

[10] This is a forthcoming edition of Gherardi's first volume of the *Théâtre italien*, to be published on the web site of the pBDR - *piccola Biblioteca Digitale Romanza*: piccolabdr.humnet.unipi.it/.

[11] Current home page: humarec-viewer.vital-it.ch/. This is part of the wider HumaRec research project (humarec.org/).

As one might gather by browsing these projects, the first version of EVT is aimed at diplomatic/interpretative editions[12] accompanied by the images of the corresponding manuscript.[13] The fundamental insight behind its design is to avoid inserting the edition data in the navigation software, but to build a website around the data itself: in this way, the scholar is free from the burden of web programming, so that s/he can focus on preparing the edition documents according to the *TEI Guidelines* and schemas. Note that the EVT viewer is based on the client-only model, thus there is no need to install and configure additional software on the server. After the web edition is generated using EVT, the final user can browse, explore and study it by means of a user-friendly interface, providing a set of tools – zoom, magnifier and hot-spots[14] for manuscript images, text-image linking, and an internal search engine for the edited texts – for research purposes.

In EVT 1, the edition data parsing is performed by a chain of XSLT 2.0 stylesheets: starting from an XML document in the standard TEI P5 format, by applying a single XSLT stylesheet, the TEI/XML text is turned into a web-based application – using HTML5, CSS3 and JavaScript in a client-only environment – which can be easily deployed on a server and shared on the Web. With the (almost) feature-complete version 1.0 published in March 2016[15], the development team started considering implementing the support for critical editions as the next logical step in the evolution of this tool. In fact, this essential feature had been suggested not only by the needs of the *Digital Vercelli Book* project, but also by several scholars that the team had met during presentations and papers given at Digital Humanities conferences.

The first consequence of this decision was an awareness that the UI was going to require a thorough redesign to accommodate the new features, so that both diplomatic/interpretative and critical editions of texts belonging to the same tradition could live side by side. Also, our initial plans already included the concept of a dialogue between diplomatic edition and critical edition, and vice versa, for example with the possibility to follow a variant to the image of the manuscript that preserves it.

Before starting with the UI redesign, however, we decided to undertake a full survey of the state of the art with regard to modern layouts for DSEs. The results,

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[12] Also known as *documentary editions*, on their relevance see Pierazzo 2014; for a somewhat different view see Robinson 2013.

[13] Note that, with a little tweaking of the configuration and thanks to recent support for critical notes, EVT 1 also allows you to create critical editions based on a *codex unicus*, as is the case for the *Codice Pelavicino Digitale*, it is, however, unsuitable for editions taking advantage of the proper *Critical Apparatus* module of the TEI schemas.

[14] Hot-spots are interactive sections available on the image that are connected to a commentary or an explanatory note. These sections are highlighted on the image so that the user can easily identify them and access the linked additional information.

[15] As announced on the *Edition Visualization Technology Blog*, "EVT version 1.0 has been released!", visualizationtechnology.wordpress.com/2016/03/07/evt-version-1-0-has-been-released/.

partly available in Chiara Di Pietro's MA thesis (2016), are those briefly exposed as an introduction to this article: the first DSEs show a conservative tendency which gives way to more innovative and experimental forms of edition, but this positive development comes with the price of more complicated and heterogeneous UI layouts for the final user. Was the initial conservatism completely negative, though? Or could we learn a lesson from it? This question, unfortunately, had to wait until other, more compelling problems could be solved with regard to the development of the next version.

3 A change of paradigm

In fact, just as we were beginning the DSE survey, we realized how the underlying EVT 1 framework was much less expandable and flexible than we thought. Our first task was to analyze the problem, and to find a viable solution in the shortest possible time.

3.1 UI problems in EVT 1

As explained in the previous section, EVT has been designed and developed to be a flexible and general-purpose tool, in order to suit many different kinds of texts and editions, right from the start. Many of the features available in the current stable version (EVT 1.2), in fact, are the result of a collaboration and discussion with other projects, leading to an expansion of its functionality: the support for named entities, for instance, is a feature request originally filed by the *Codice Pelavicino Digitale* research team. Moreover, since EVT is distributed as open source software and is not tied to a specific edition project, every new feature added to the software is automatically available to all users.

As the development has progressed and the software has grown in terms of features, however, its complexity has increased as well. This was clearly visible in the configuration of the parameters related to the navigation and the internal management of the edition: to cover a greater number of use cases, in fact, the configuration variables and elements within the web application have increased considerably. This has not only made EVT less user-friendly, because it may take quite some time to understand the meaning of all available configuration options; it has also made the development of new functionalities more difficult and time-consuming because of the essentiality of checking that any new feature is not in conflict with the existing ones.

Furthermore, we also had to consider the fact that the JavaScript functions used to manage the entire web application have a great impact both on the main memory used by the browser and on the CPU time for its operation. As a consequence, for

each new feature added to the software, the performance of the web application itself tended to slow down considerably.

As a last remark, the XSLT code base had grown to such an extent that it was very difficult for a newcomer to fully grasp its inner working in a short time, which meant more time and resources necessary to train new contributors.

3.2 Moving to a new framework

For these reasons, we decided to remodel the entire structure of the software in order to make it lighter, more manageable and more adaptable. We decided to take advantage of the Model View Controller (MVC) design pattern, which is a very popular architecture in object-oriented programming since it allows one to separate the ways in which the information is presented to the final user from the internal representation of the data and the domain logic that determines how data are created, stored and managed (Krasner and Pope).

Wanting to maintain the original feature set of EVT, and not give up the *client-only* approach, we decided to use AngularJS (Branas; Jain et al.), a JavaScript framework inspired by the MVC programming logic, especially suitable for the development of client-side Web applications; among other things, this framework allows to define custom HTML directives and uses the data-binding mechanism to associate the model of the data to the UI elements and to manage the updates of the latter avoiding the direct DOM manipulation.

Before the code refactoring, EVT was composed of two main units: EVT Builder, for the transformation of the encoded text using special XSLT 2.0 templates, and EVT Viewer, to visualize the web-edition resulting from the transformation in a browser and to allow the user to interact with it using the available tools. The idea behind the new version of EVT is to leave to the latter the task of reading and parsing the encoded text by means of JavaScript functions, and store as much as possible within a data model that persists in the client main memory. It is organized in such a way that it allows a very quick access to the data if need be (as far as our empirical tests show). This has obviously led to the elimination of the EVT Builder level, and therefore it allows to open a digital edition directly in the browser without any previous XSLT transformation (fig. 3).

The process of refactoring has been quite complex because of all the issues at stake and because of the many user interface changes, but the new design pattern, combined with use of the AngularJS framework, has led to a more user friendly and reactive web application. In this paper, we will focus particularly on the issues related to the development of critical edition support, exploring the path that led us to choose a specific solution among different possibilities.
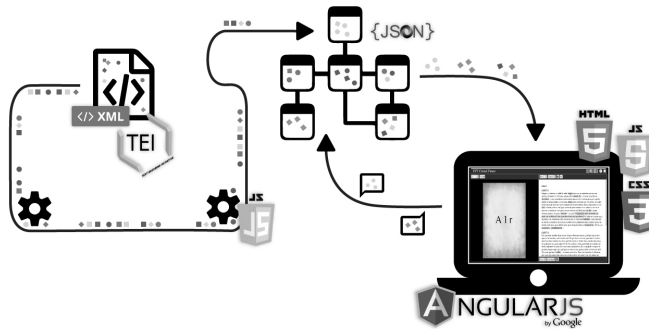
Figure 3: EVT 2 data flow.

3.3 Flexibility and customization of the final product

In addition to the elements inherited from tradition, in a digital critical edition it is possible to find different kinds of textual material (texts, images, metadata, etc.), whose presence or absence is due to both external factors, such as the unavailability of certain content, and conscious choices made by the editor, who selects what is to be offered to the reader. In the world of digital textual criticism, the scholar can encode a text at any level; hence, it becomes very important to offer the possibility to decide which information is going to be published and what is going to be left (maybe temporarily) aside, without necessarily deleting or modifying the original encoded text. This also means that part of the available content could be hidden by default, and only shown *on demand*, when the user needs to access specific textual components of the edition.

This is why, in the development of EVT 2, we tried to create a very flexible and dynamic environment which allows the editor to configure and customize the final product in an intuitive and fast way. Thanks to a JSON configuration file, which is opened at the very first initialization of the web application, the editor can override all the default settings, both in terms of content offered to the reader and in terms of tools to be included in the digital edition itself, based on the real needs of the reader to whom it is addressed. For example, the editor will be able to:

- select the type of variations which will be shown according to a principle of relevance defined by the editor;
- select which witnesses among all the encoded ones are deemed relevant, with regards to the stemma of that particular textual tradition or for other reasons related to the goals of the specific digital edition one wants to achieve;

- choose the initial view mode, e.g. a welcome message rather than the critical text and the commentary notes, or a parallel view of critical text and selected witnesses.

In addition, thanks to a dedicated stylesheet, the scholar can completely customize the graphic layout of each single TEI element (for example deletions, additions, omission, etc.), without affecting the general appearance of the whole web application.

4 Discussion of UI layout and appearance in EVT 2

According to the general principles of Human Computer Interaction[16], when you design and develop interactive applications, one of the main goals is to make them usable and accessible for the final users. The best UI is the *invisible* one (Fishkin; Krishna), the one that does not hinder the browsing/gathering of content and is designed in such a way that it maximizes the efficiency and the ease of use (ibid.).

For reasons of space, we will not list here all the rules of a good UI design[17]; in general, one should find a good balance between *expressivity*, i.e. the ability to transmit the desired information, and *efficiency*, i.e. the ability to communicate certain content so that it is easily available. It is therefore essential to avoid considering only the internal, functional aspects, and try to always take into account the user and the tasks s/he may intend to perform, designing the appearance of the contents only after a thorough analysis of the basic requirements of the system and the functionalities it has to offer.

In addition to these general considerations, as remarked above, creating a critical edition navigation tool presents specific problems, namely issues related to the overall layout of the UI and its individual components; also, remember that, for the latter, there is no consistency in their graphical appearance and with regard to how they are used in current digital scholarly editions. Thus, before defining a complete graphical UI for EVT 2, every single component was modeled separately, defining their unique characteristics and modalities of mutual interaction. Such modeling started from

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[16] Human Computer Interaction (HCI) is a discipline born in the early 1980s, which deals with the design, evaluation, and implementation of interactive computer applications and the study of the main phenomena surrounding them, with the main aim of creating usable, safe and effective products. The term HCI was first introduced in 1983 by Card, Moran and Newell in their book *The Psychology of Human-Computer Interaction,* in which they highlighted that the computer communicates with the user flexibly and openly. HCI principles aim to make technologies appropriate to the categories of users to which they are addressed and allow to take into account systematically the characteristics of final users, with their needs and capabilities, and the contexts in which they interact with the technological product (Gamberini et al. 3).

[17] For a basic reference see Nielsen, the ISO 9241-11 standard and Card et al. Note that, in Italy, there are mandatory rules about accessibility of Web sites since 2004 (Legge 4/2004 "Disposizioni per favorire l'accesso dei soggetti disabili agli strumenti informatici", see it.wikipedia.org/wiki/Legge_Stanca).

the analysis of the traditional editorial conventions, as we considered essential to impose as a minimum goal for the final product that it may be able to offer the scholars what they are used to see in a critical edition. Then, we tried to extend the features of every single element in order to offer innovative ways of content presentation and interaction, so that the tool could allow both a better access to what is traditionally considered essential when publishing a critical edition (see list below), and to what is normally excluded or relegated to not directly accessible positions – for example the orthographic variations and the full text of the witnesses – because of space constraints. This is the approach that we followed for the design of all the components identified: it has influenced both the graphical aspects of TEI elements presentation and the functional aspects of interaction and access to content. Listed below are the main components identified[18] and their primary features.

- Critical text: it is the primary object of the publication and, for this reason, it should have a prominent position and be easily distinguishable from the rest of the edition.
- Critical apparatus: it is traditionally static and consists of the minimum necessary information (lemma and significant variations); to make the edition more useful as a research tool, the apparatus should be extended and enhanced with information which is normally not included in printed editions (such as orthographic variants) and with new interactive features (for example, direct access to the context of a given reading).
- Support materials (prefatory matter, indexes, *conspectus siglorum*, etc.): as secondary materials, they should be placed in a decentralized area of the interface, but should be kept easily accessible to the user who requests them.
- Full text of the witnesses: since there is no longer the need to fall within the limits imposed by the printed page, it becomes possible to support the critical text by accompanying it with the text of all the witnesses used in the transcription, collation and text encoding phases.
- Lemma and alternative readings: they should be easily identified within the critical text and in the transcription of the single witness, and enriched with any additional information available (for example their type, or degree of certainty, or the responsible for a specific reading).

In parallel with the analysis of the components to be integrated in the interface, it was also necessary to identify the main interaction tools to be provided to the user; in particular, we considered giving the reader the possibility to compare the text of specific witnesses, possibly in relation to the critical text, to assess the textual variability globally, to distinguish and highlight the reading depending on their metadata (i.e. type, hand, certainty, responsibility, etc.) and to gain access to a very

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[18] See Di Pietro, ch. 2.2 *Analisi e progettazione concettuale*.

dynamic critical apparatus that hosts all the possible content and allows the user to rapidly move among the readings and their context. Some of those features were inspired by some of the existing digital editions analyzed in the initial phase of the refactoring process, when we assessed the state of the art, and improved on their potential weaknesses.

4.1 The global UI

Based on the analysis presented above, the real work of graphic design started. As we will see later, the most critical and difficult elements to design were the critical apparatus and the witnesses collation view, even considering the fact that in this first phase EVT 2 was limited to critical edition support, without implementing the views related to diplomatic and interpretative edition levels featured in EVT 1.[19]

Considering the overall look, although the initial idea was to maintain a sort of continuity with the UI of EVT for diplomatic editions, the proposed final solution – as we will see – slightly departs from the latter. The main distinctive feature is the removal of all the wasted space around the image and text panels, since it can be considered an obstacle with regards to the management of editions with parallel texts. In fact, in the case of a diplomatic edition with transcriptions and scanned images, the margin around the main container entailed a simple reduction of the image and text panels, without a significant loss of space for their content; in an edition where there could be the possibility of providing a parallel comparison of the full text of all the encoded witnesses, on the other hand, even a few pixels of margin space can make the difference.

The GUI (Graphic User Interface) we designed is composed of two main elements:

- a running header with the title of the edition and a toolbar for all the global tools, for example the information about the edition itself, or the search functionality;
- a body composed of as many panels/frames as necessary for the correct organization of the content in a specific view mode. In every frame there will be a header with navigation tools, a footer with local tools, and a body, eventually divided into different sections depending on the content to be displayed in it (fig. 4 and 5).

Regarding the choice of colors, we decided to take into account the basic principles of graphic design (Galitz; also see Gamberini et al.) which suggest to use cold and neutral colors for the boundary elements and the interface navigation, and to leave the warm and vibrant colors the role of drawing attention to important information. Initially, we defined two possible palettes: a brownish one, to maintain a sort of continuity with EVT 1, and a more neutral one verging on blue-gray tones. To further highlight

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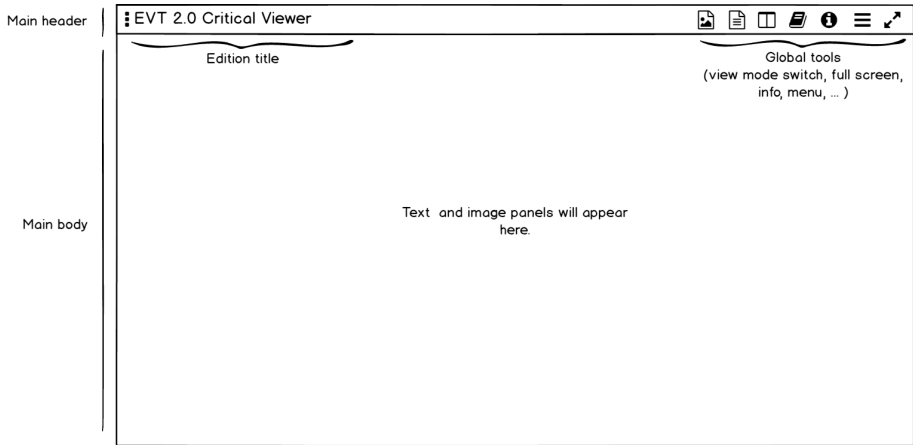[19] On the latter, see Rosselli Del Turco 2015.

Figure 4: EVT GUI design. Main layout structure.

the difference with the previous version of the software, we decided to use the latter palette.

4.2 Parallel view and scalability problems

The first problem we faced was one related to the collation view and the interface scalability in the presence of a theoretically infinite number of witnesses to compare. Well aware from the very beginning that the computer screen sets limits in terms of amount of content that can be displayed simultaneously, the main goal we wanted to achieve was not to show all the available witnesses at the same time, but to display as many of them as possible while maintaining a certain order and regularity in the interface.

The first three proposals for the layout were based on the existing Text-Text view of EVT 1:

- witnesses displayed one under the other, into a panel juxtaposed to the main text (fig. 6);
- witnesses displayed under the main text, next to one another, in a box that scrolls horizontally (fig. 7);
- panels of equal dimensions for the comparison between witnesses only (fig. 8).

To avoid a disruption of the original layout because of the addition of new panels, these solutions were designed for a comparison of a maximum of four witnesses at a time (or three witnesses and the critical text).
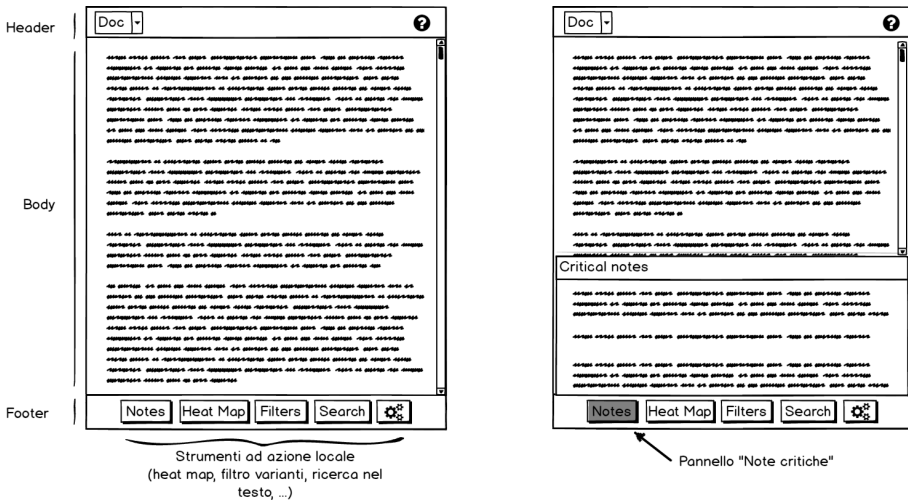
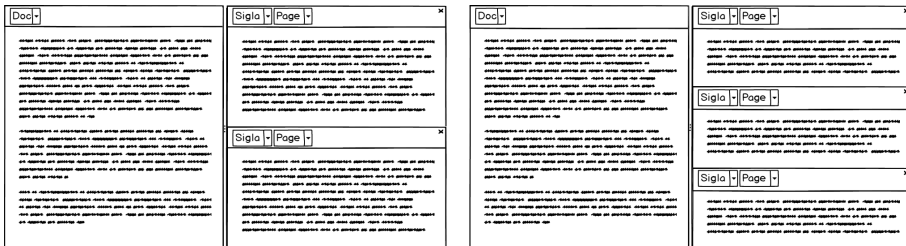Figure 5: EVT GUI design. Single panel development.

Figure 6: EVT GUI design. Witnesses comparison: panel juxtaposed to main text.

Despite being able to group similar items so that they are easily recognizable, thereby respecting one of the indications of HCI studies, and to always maintain a harmonic and well-structured interface, those proposals were not considered satisfactory. In fact, in the hypothetical usage case we imagined, the simultaneous consultation of more texts seemed more natural when the texts are arranged next to each other rather than one above the other. Therefore, we tried different approaches and finally reached consensus on the ultimate proposal, which provided the alignment of the compared witnesses on the horizontal axis (see fig. 9).
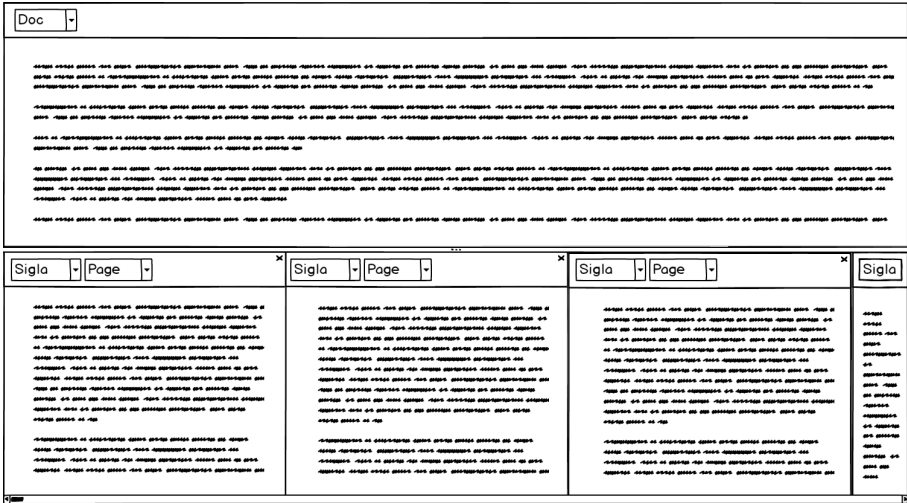
Figure 7: EVT GUI design. Witnesses comparison: scrolling panel below main text.
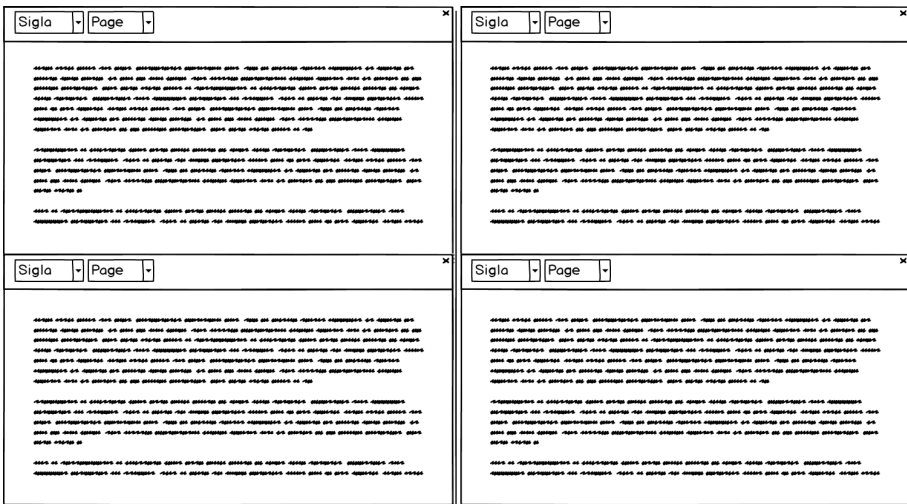

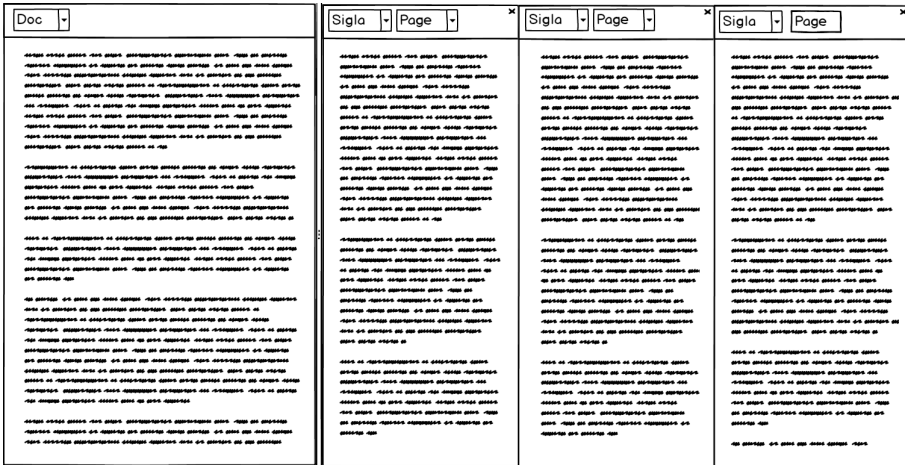Figure 8: EVT GUI design. Witnesses comparison: equal dimensions panels.

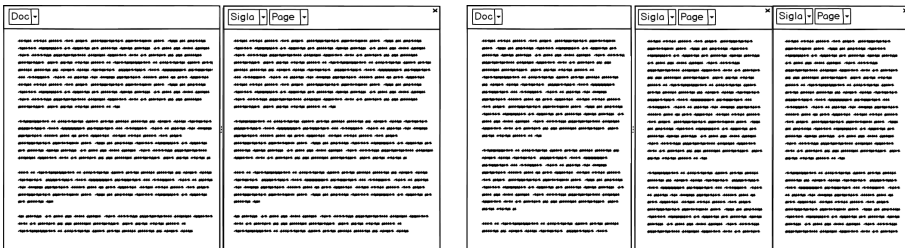Figure 9: EVT GUI design. Witnesses comparison: adopted proposal.

Figure 10: EVT GUI design. Witnesses comparison.

In order to be able to handle the comparison of a hypothetically infinite number of witnesses, always maintaining a well-structured and clean interface, we chose a compromise solution that leverages the principles of the responsive design only in part.

Starting from the situation in which the critical text is compared to a single witness, the addition of a new panel to the collation view involves an automatic resizing of the visible boxes, so that each one of them will occupy about one-third of the space (fig. 10).

If a third witness is then added to the comparison, the resizing will no longer be proportional to the available space, but will be led by a minimum width. From that moment on, the new boxes will simply be placed next to one another, without being
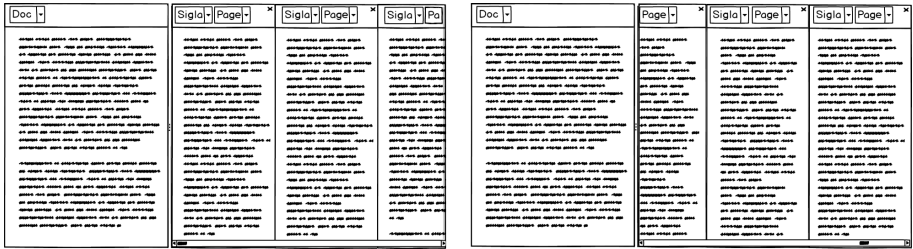
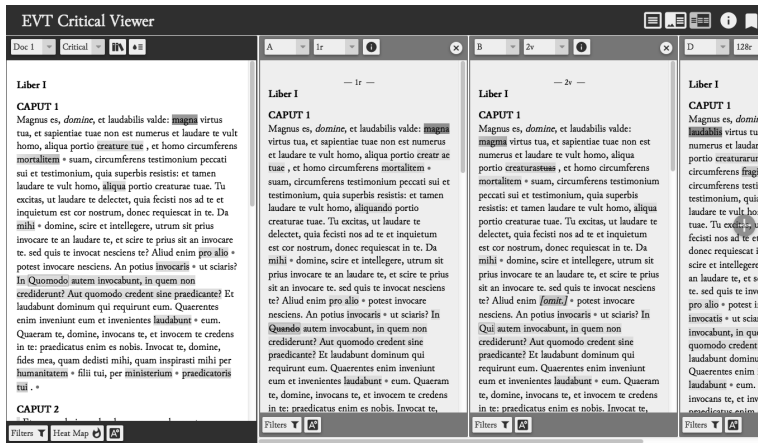Figure 11: EVT GUI design. Witnesses comparison.

Figure 12: EVT GUI design. Final implementation of witnesses comparison.

resized. As shown in the following figures (fig. 11 and 12), the interface will remain stable and clean, and the access to the witnesses that are not immediately visible will be possible thanks to a horizontal scroll bar.

The container of the critical text will remain fixed in the first third of the interface and will visually have more importance: in this way it will always be well distinguishable from the text of the encoded witnesses. As we can see in the preceding image, this distinction is also reinforced by the color assigned to its container panel.

As in the previous proposals, this solution implies that it is still not possible to display more than three or four witnesses at a time (the exceeding witnesses will flow outside the screen); however, it is an unavoidable problem, and we believe that the proposed layout can be regarded as a good compromise. In fact, although a tradition can count a very large number of witnesses, the reader hardly feels the need

to compare them all together at the same time, since the most interesting ones, those corresponding to the families of witnesses placed in the higher levels of the stemma, are usually few.

4.3 The critical apparatus

The element that has brought major difficulties in the planning stage was the critical apparatus layer: it includes a list of readings which were excluded from the published text, but are nonetheless fundamental to document and justify the editor's choices.

One of the most common solution used within the digital critical apparatus is the hyperlink from a word in the text to the linked apparatus, usually placed at the bottom of the screen, in a separate window or in an inline pop-up[20]. While remaining faithful to the traditional method of presentation, this solution offers an immediate access to the list of variants for a given portion of the text: after the lemma, all the rejected variants are listed, followed by a list of *sigla* which are converted into hyperlinks for a quick access to the full context of each reading.

Since we decided to follow the editorial conventions typically followed by the printed editions as much as possible, we tried to find a good compromise solution: features and elegance of the traditional apparatus on one side and access to a wider content and more opportunities of interaction on the other side.

First of all, we had to decide the best positioning for it.

Our first choice was a pop-up enriched with more information about the variant. Within it, the substantive variants, the orthographic ones, and the critical notes are displayed side by side; they are organized in three distinct sections and the first ones are given a different and more immediate visibility (fig. 13).

As we can see from the image, in the upper part there is the traditional apparatus, composed of the lemma, optionally followed by the *sigla* of witnesses attesting that reading, a square bracket and the list of rejected variations followed by the *siglas* of the witnesses attesting them. The lower degree of importance assigned to the orthographic variations that are displayed in the middle part reflects also on their look and feel: smaller font and access through an expansion box.

This first proposal was rejected mainly because of the intrinsic nature of the pop-up: it is a very small element that will hardly be able to hold more than a couple of variants; moreover, it is effectively difficult to handle in a responsive and dynamic interface such as EVT.

Thus, we tried a different approach: using a new panel juxtaposed to the main text, where the apparatus is displayed in a traditional way, but constantly updates when the text scrolls (fig. 14).

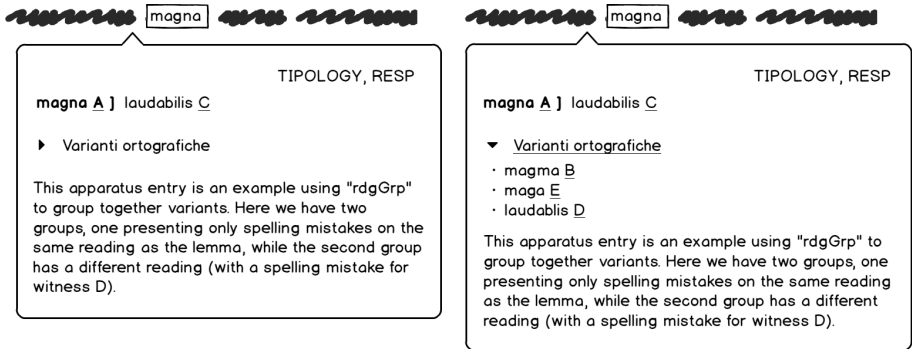[20] See the examples mentioned in the *Introduction*.

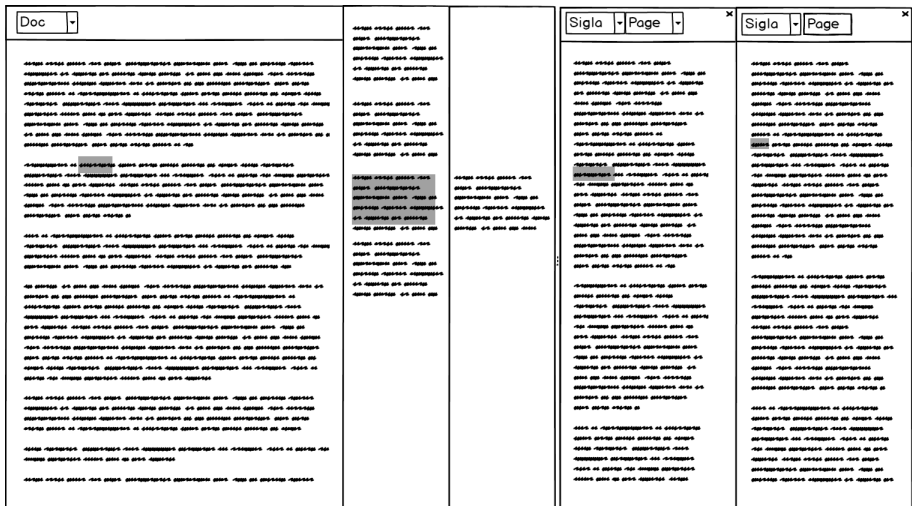Figure 13: EVT GUI design. Critical apparatus: inline pop-up.

Figure 14: EVT GUI design. Critical apparatus: separate panel juxtaposed to main text.
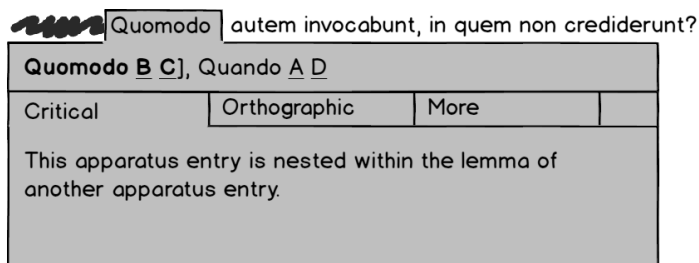
Figure 15: EVT GUI design. Critical apparatus: adopted proposal.

This solution allowed us to divide and distinguish the text from the apparatus itself more efficiently, but had the main problem of reducing the space generally available. Moreover, in the case of very long apparatus notes, a text that is lined up vertically tends to be more difficult to read.

Therefore, we defined a third and final proposal that consisted of an inline box that opens when clicking on one reading, and presents its content opportunely divided by typology (fig. 15).

In this panel, the more traditional part of the apparatus – composed of the lemma and significant variants – is positioned at the top, in a section that remains fixed, while the additional content of interest is inserted in a lower, scrollable box, divided into specific and easily accessible tabs. Among the additional content, the reader can find the critical notes, the orthographic variations, and the metadata associated to the apparatus itself, such as the responsibility for that reading or the degree of certainty.

As the result of various considerations, this final proposal was chosen as the definitive solution for the critical apparatus: it was considered a good compromise, one that allows the user to study the critical apparatus without the need for additional panels and without losing focus on the main text. In addition, it offers a virtual space that is much larger than that of the pop-up, it does not cover the text and it is suitable to be easily enriched with other functionalities, such as groupings of variants or other interesting content (fig. 16).

4.4 Increased visibility and interactivity of the readings

The reading chosen as *lemma* and those recorded in the witnesses have an important role in a critical edition as they provide both information about the variability of the tradition as well as details about the choices made by the editor. Therefore, the presence of text portions for which there are alternative readings should be visually expressed.
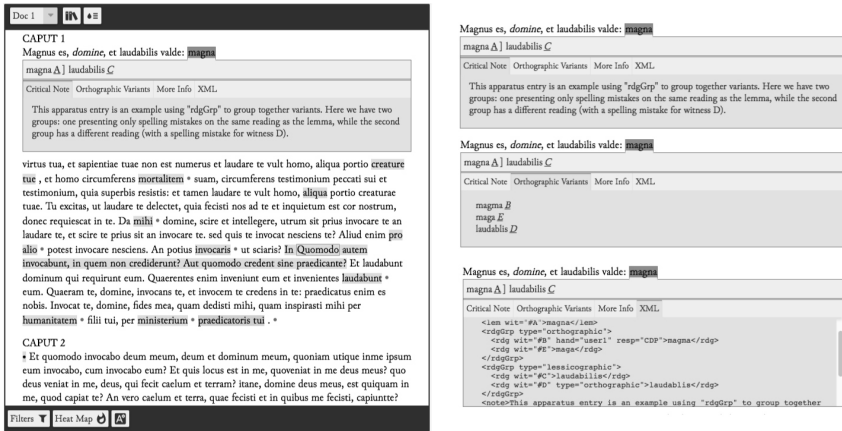
Figure 16: EVT GUI development. Critical apparatus.

After evaluating several graphical cues, including the underline and bold styles, we decided to use the background color to highlight variants, as it allows to convey additional and combined information associated with the readings: it is possible to correlate different tones to distinct typology (indicating, for example, the omissions in blue and the false emendations in red) and indicate the variability of the tradition with the color intensity (the more intense the color, the greater the variability registered). The significance associated with each color, of course, should be explained in an appropriate legend (fig. 17). Since the usability rules advise not to assign colors to essential information, in the future it will be necessary to conduct a more thorough and targeted study in order to choose an alternative graphic solution that causes no loss of information if the user is color blind or otherwise unable to fully distinguish colors. Since the reader may not be interested in every reading, and may want to focus only on a certain typology, we decided to provide a specific tool that allows one to filter out readings that match a specific combination of metadata (for example, all the additions made by a specific hand) (fig. 18).

4.5 Heat map for the textual variability

Following the example of Juxta[21], we decided to use a map of color intensity in order to provide the reader with immediate information about the variability of the textual

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[21] Juxta is a stand-alone desktop application that allows to compare and collate different versions of the same text and export the results in a format that is aligned with the TEI standards. Thanks to the available APIs (Juxta Commons), it can also easily be integrated into other software.

Figure 17: EVT GUI development. Highlighted readings with explanatory legend.

tradition. According to this artifice, the background color of the *lemmas* in the critical text will be more or less intense according to the number of alternative readings recorded within the tradition: the more intense the color, the greater the number of alternative readings recognized by the system as registered for a specific critical entry (fig. 19).

4.6 Additional materials hidden, but easily accessible

All the additional materials (i.e. the introductory note in which the editorial criteria are exposed, the bibliography, the specifics of coding, etc.), have been made available to the reader only on his/her explicit request. Since those are global utility instruments, the access to them is guaranteed by means of an appropriate button positioned outside of the textual containers, in the main header, available at all times (fig. 20).

4.7 The bookmark for a direct reference to a section of text

One important problem that comes with many digital scholarly editions is the impossibility to properly cite a specific section of text. Since, in a web edition, there

Figure 18: EVT GUI development. Filters of readings.

are no pages to refer to, it is often very difficult to find a way to reference a specific paragraph, commentary, or critical note.

Thus, when defining the tools to offer in EVT, we decided to include a 'bookmark' to tackle this problem and try to solve it. At the moment, the parameters that can be tracked are the display mode, the document, the page, the edition level, the list of displayed witnesses (including the number of their current folios/pages) and the selected critical entry; in the future, more sections will be taken into consideration (e.g. the paragraph or the line). When first loading the edition, if one or more of those parameters are set in the URL, the interface will be reorganized in order to show the exact portion of text referenced by the URL itself.

A specific bookmark button inserted in the top bar will make it possible to always retrieve a bibliographic reference, enriched by the hyperlink, of the current view (fig. 21).
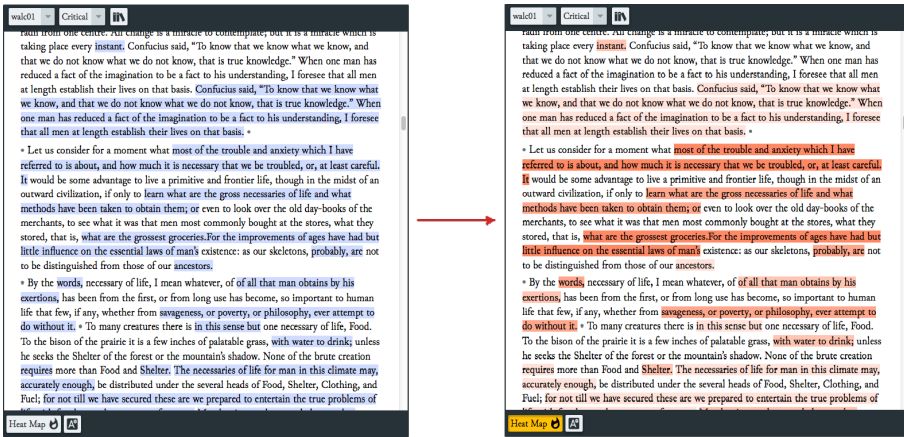
Figure 19: EVT GUI development. Heat map.

5 Future development

After every new EVT release, development slows down so that we can gather feedback from our users or other interested parties. This feedback helps us to adjust the User Interface and/or improve specific features, fix the inevitable bugs, etc. It is also very important to 'step down' for a while and reconsider past choices. So far, we have received little criticism for EVT 2, which is good in a way ("People like the new version!"), less so in other ways ("What about this feature/design we were unsure about?"). As explained above, the other method we use to evaluate the soundness of our decisions is through collaboration with DSE projects that have different goals and different problems than our own. This also allows us to consider the inclusion of new features and a re-design of the current layout.

An assessment of current features, carried out after we received feedback[22] for the alpha version released in July 2016, confirmed that the path we have chosen to tread is sound, and that the mix of an innovative way to present the overall textual information (a drop down widget for each variant showing separate areas for each aspect of the apparatus) and the traditional critical apparatus entry (at the very top of the drop down widget, and thence in the most visible position) is effective and user-friendly for the final user. A click on the highlighted variants is an intuitive action even for unskilled users – perhaps the only aspect that could be improved upon

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[22] We receive feedback from our users as a mix of email messages and comments to our announcements on social media. However, we have also used Google Forms to perform surveys with regard to major releases.

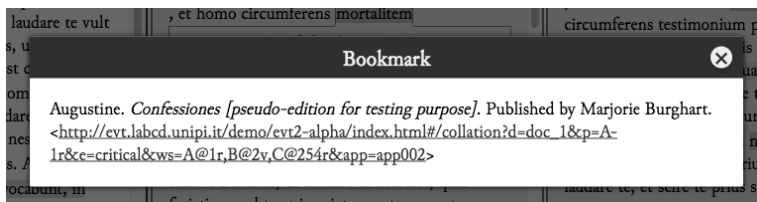Figure 20: EVT GUI development. Edition prefatory matter.

Figure 21: EVT GUI development. Bookmark.

is discoverability – and bringing up the apparatus content in its most familiar form makes the user feel at ease, at the same time proposing further, more sophisticated information that can be accessed in the lower part of the widget.

This successful coupling of innovation and familiarity led us to consider expanding EVT capabilities in such a way that we could propose the critical apparatus layer as a whole, in a dedicated text panel, instead of a local, *per variant* entry. We surely don't want to go back to a limiting layout model, but it is true that the critical text view at the present moment wastes a lot of precious space on the sides, space that could be used to include a separate panel hosting the apparatus view. A further advantage of this approach is that the second panel could include more content, such as a supplementary critical apparatus layer, an *apparatus fontium*, a sources and analogues textual view, etc., leaving room for enriching the information that the editor makes available to the user.

If the critical text view is expanded by adding a second text panel, the way philological information is displayed could be made context-driven:

- when the user is browsing the critical text view, a click on a reading will highlight the corresponding apparatus entry in the critical apparatus panel; the same mechanism would apply for the *apparatus fontium*;
- when the user is browsing the collation view, space constraints would not allow to show the full apparatus panel – the area on the right of the critical text is used to show one or more of the available witnesses – so the more compact, single variant apparatus entry by means of the drop-down widget makes perfect sense and allows to access all the relevant information.

The double text panel view as standard view for the critical text plus apparatus layers will also be useful in a particular case that we are considering to support, that of a double *recensio* for a complex textual tradition (fig. 22). This is still in the planning stage and will probably be implemented for a stable version of EVT 2.

On a more technical level, we have planned to migrate the software to the new version of Angular[23], which was released as a stable version during September 2016 (Frost et al.), in order to be always synchronized with the latest possible technology. This new version of the framework is a complete re-write of the previous one and will not be backward-compatible, but it is easier to learn (for absolute beginners, in particular) and it has increased the overall web application performances[24].

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[23] See the home page for the new version: angular.io/.
[24] See the full announcement for the final release version of Angular 2: angularjs.blogspot.it/2016/09/angular2-final.html. For more information about the new architecture: angular.io/guide/architecture.

Figure 22: EVT GUI development. Double *recensio*.

6 Conclusion

In this paper, we have shown how an essential requirement, the addition of support for critical editions in EVT, has called for a debate on the broader subject of UI design for digital scholarly editions within the development team. This reflection, combined with more technical considerations on the issues of development and evolution of the initial EVT version, led us through a series of phases (design, prototype, testing, evaluation) which resulted in a new software architecture and a new UI layout for EVT. The composite nature of the critical edition and especially the lack of a standard form for the electronic publication have been a major challenge in defining the global layout and modeling of each component. The difficulties encountered were not few, especially as regards the critical apparatus layout and the interface scalability in relation to a possibly very large amount of content. However, we believe to have reached an effective and visually harmonious solution which can improve and enrich the user experience in the fruition of contents. The initial proposals (preliminary discussion documents, graphical mockups) were guided by the desire to arrive at a full exploitation of the potential of the digital environment, while always maintaining a certain connection with traditional solutions. The solutions implemented in the current version of EVT 2 do not presume to be conclusive or definitive, but they want to be the starting point for further discussions on the matter.

As we stated in the introduction, we are convinced that reevaluating the tradition and the concept of familiarity may not be considered just conservatism; of course we do not want to go back to a limiting layout model, but we think that it is important to take into account the audience and its habits, even when they derive from different media (the printed page, in our case). The constant quest for innovation is important because it often allows to achieve results that were not possible before, due to the

physical limitations of the printed medium, or to improve a well-known way to access textual information. A good browsing tool makes it possible to examine all the available data from new points of view, and to make it easier for the user to connect different parts of the edition text. When an interface is too innovative, however, too much *outside the box* – or *outside the tradition*, in this case – it can obtain the opposite results: the scholar may feel confused, disoriented, and may not find what s/he is looking for, just because s/he does not know how to move in the edition s/he is reading, how the content is organized and how to find the desired information.

That is why it is very important to know the traditional layout of critical apparatus in printed editions, to be able to meet the users' expectations and to enhance and make as user-friendly as possible every single detail of the edition components that are going to be included in the final application. The UI of EVT is not completed yet, and in the future we will surely continue to add new features and implement support for other kinds of content. But the design and implementation will always follow the same path: sticking to the traditional methods when they allow viable and user-friendly solutions, at the same time enriching them in content and functionalities, and looking for innovative ways to take advantage of the digital medium.

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