Reimagining the Facsimile with *The Digital Fauvel*[1]
Project Report

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The future (and the past) of the facsimile

The Bodleian library's MS Canonici misc. 213 is covered in greyish-beige cloth; the Chigi codex has a red binding. Both are printed in black-and-white. These are, of course, descriptions of the facsimiles, not the manuscripts. But it was in such guises that the majority of scholars and performers working today got to know these sources. Besides their improved resolution compared to the microfilms they replaced, printed facsimiles had the advantage of being tangible objects with pages that turned—they could be annotated, carried from place to place, and even owned, at a range of prices.

That model has now been partially superseded by the online digitized manuscript. Its advantages are obvious: it is in colour, it can be made available to many users at the same time, it can have high resolution. The costs are relatively modest compared to paper publication and it will not go out of print. There is no question that the increasing availability of a wide range of sources digitized and put online by a growing percentage of world's libraries has had a positive impact on the field of medieval and Renaissance music studies. So much is gained by this move, indeed, that it is easy to forget what is lost. But something is always lost. In their new digital guises these collections of paper or animal flesh have been dissociated into component images that float free of their original spatial contexts, usually suspended between a pair of arrows that allows the user to navigate between them.

While the placing of digital images of manuscripts online does make these sources more "accessible" in the most literal sense, the barriers of understanding are as steep as they ever were with paper facsimiles—steeper, in fact, where inventories and bibliographies are not clearly linked to the images.[2] Like more traditional cataloguing and inventorying, current trends in digitization result in small pieces of data that can be recombined infinitely. But the same technologies can also be used to create a whole which, though digital, foregrounds the integrity of the original. *The Digital Fauvel* seeks to merge the categories of "facsimile" and "edition," moving beyond "mere" digitization in ways that can benefit scholars and students alike. As a synthetic rather than an analytical project, it points to new directions in digital approaches to medieval objects.

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[2] DIAMM, the Digital Image Archive of Medieval Music, is an obvious example of a resource that does connect images to research aids.

Our target source is the *Roman de Fauvel* as preserved in the manuscript F-Pn 146 (c. 1317–20). It is a particularly good candidate for an innovative approach to the facsimile-edition because its layout is both intricate and meaningful, intractably bringing together image, text, and music. Editions have separated *Fauvel* into its component parts, dividing the text from the music and the music into separate volumes based on genre, texture, and presumed authorship.[3] In the face of such dismemberment, the eloquence of layout, which places different media in meaningful conversation, is silenced. On the other hand, without editions *Fauvel* is a foreboding object, especially for students and non-specialists. To read it in the original requires a deep familiarity with Middle French, Latin, mensural notation, and 14th-century iconographic conventions. *The Digital Fauvel* project seeks to retain some of the most important qualities of the manuscript object—its size, layout, and extent—while garnering the power of digital data to lower the barriers of meaningful interaction.

The Digital Fauvel
BnF fr. 146 is a large manuscript—46 x 66 cm when open. To allow this scale to speak for itself and encourage more natural human interaction and exploration, we created the first version of *The Digital Fauvel* for a large multitouch tabletop computer (the Samsung SUR40, whose screen measures 92 x 54 cm[4]). The project is programmed in C#, and runs on any Windows 7 machine. Depending on the hardware available, it can be used with touch gestures (similar to those used on smartphones or tablets) on multitouch displays, or can be controlled with a mouse and keyboard and displayed on a large conventional monitor or projector, for example in a classroom.

The first version of *The Digital Fauvel* supports viewing and navigating high-resolution scans of the manuscript at nearly original scale, viewing text translations superimposed on the manuscript and aligned line-by-line with the original, viewing modern editions of the musical interpolations side-by-side with the original, playing audio files while viewing the musical items, and performing text-based search on poetry, lyrics, and image metadata using terms in the original language or in translations (see Figures 1–3).

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[3] In earlier editions the texts of the manuscript were separated based on whether they were part of the original poem by Gervès du Bus, the poetic interpolations by Chaillou de Pesstain, or the texts of songs. The recent edition by Armand Strubel (*Le roman de Fauvel,* Paris: Librarie Général Française, 2012) brings these together, but the music is still to be found in a variety of places depending whether it is polyphonic or monophonic, its genre, and whether it has ever been attributed to Philippe de Vitry. For full bibliography Margaret Bent and Andrew Wathey, eds, *Fauvel Studies: Chronicle, Music, and Image in Paris, Bibliothèque Nationale de France, MS français 146* (Oxford: Clarendon, 1998).
[4] More information about this technology, officially referred to as the Samsung SUR40 with Microsoft Pixelsense technology, can be found at http://www.samsung.com/uk/business/business-products/large-format-display/specialised-display/LH40SFWTGC/EN

In its current state *The Digital Fauvel* allows for unprecedented depth of access to this complicated source. But our aims in this project go beyond merely creating a usable digital facsimile. We are also working to develop appropriate practices for designing such interactive digital objects, to create a technological foundation upon which other scholars and programmers can build new and different types of objects and interactions, and to explore the educational value of engaging students in the design and implementation of new tools. Below we briefly outline our work in these areas and report on the current state and next steps of the project.

Participatory design methodology: Process and outcomes
Because a fruitful and satisfying user experience was a first-order concern, our process of creating this technology drew on practices in human-computer interaction. Specifically, we applied methodologies from participatory design[5], in which many potential users of the technology are closely involved in its design, refinement, and evaluation. At the onset of the project, we formed a Digital Fauvel Working Group at Princeton University, consisting of 21 students and researchers from departments including Computer Science, Music, and French and Italian, as well as researchers and staff from the Office of Information Technology and the university libraries. In two meetings, participants brainstormed ideas for how a digital version of the *Roman de Fauvel* might be useful in their own research, teaching, study, or public outreach activities. We facilitated group discussions while taking notes. This initial phase also included weekly observations over one semester of graduate students enrolled in a Music department graduate seminar on Fauvel. While the second author led the seminar discussions, the first author took notes on the types of difficulties encountered by students when beginning study of the manuscript and its musicological significance, and on the ways that they employed facsimiles, editions, and BnF's Gallica site (http://gallica.bnf.fr/ark:/12148/btv1b8454675g). Finally, we conducted brainstorming sessions with these students as well as Computer Science students enrolled in a graduate seminar on Interactive Music Systems.

This phase allowed us to prioritize development work and led to a first version of the interactive manuscript that could be immediately useful to a large and diverse audience of students, researchers, and members of the public. We observed that finding translations, text and music editions, and musical audio, and coordinating these with their locations in the manuscript were among the most important and time-consuming tasks for graduate students learning about *Fauvel*. Along with navigation within the manuscript and search of poetry, lyrics, and metadata, these were the features most often requested by both students and members of the Working Group.

Best practices from human-computer interaction were also employed to design and refine the user interfaces for the interactive manuscript. Nielsen's well-known user interface design principles[6] guided the basic design; for example, the interface borrows established interaction

[5] M. J. Muller and A. Druin, 'Participatory design: The third space in human-computer interaction', *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications*, ed. J. Jacko (Boca Raton, FL, 2012), pp.1125–54.
[6] J. Nielsen, 'Heuristic evaluation,' *Usability Inspection Methods*, ed. J. Nielsen and R.L. Mack (New York, NY, 1994).

conventions familiar to users of smartphones, tablets, or e-readers (e.g., double-tap to zoom, swipe sideways to turn pages). Paper prototypes and low-fidelity digital mock-ups[7] were used to elicit feedback from researchers and students early in the design process, ensuring (before any time was devoted to writing code) that the software would be easy to use and offer the appropriate functionality. Think-aloud walk-throughs[8] (in which users verbalize their thoughts as they interact with a technology) were used to identify and fix problems with early versions of the software.

Digital Fauvel as platform

The group brainstorming activities and our observations of seminars served to map out the enormous space of functionality that could potentially be built into a digital manuscript. Proposed functions ranged from those we had initially anticipated would appeal to students and scholars (e.g., in-place English translation of text), to behaviours that would support very specialised types of scholarship (e.g., the ability to apply computational image search and analysis techniques to study scribal hand), to fanciful interactions aimed at introducing *Fauvel* to general audiences (e.g., *Fauvel* the videogame). The breadth and promise of these many ideas led us to design the *Digital Fauvel* as both a user-facing technology—a manuscript that a student or scholar can interact with "out of the box" —and a platform on which many sorts of new technologies might be built. Just as an iPhone developer can build new "apps" using the phone functionality exposed through the iOS operating system, a "Fauvel developer" should be able to build on our existing data encodings, search functions, display and zoom functionality, and so on, to create new modes of interacting with the manuscript. Our development work has therefore included the design of a *Digital Fauvel* API (application programming interface) to enable other programmers to easily develop new software on our platform.

At the moment we are finishing minor refinements to the code so that the *Digital Fauvel* software functions as a "container" into which new translations, and even new manuscripts, could be dropped with little or no programming. The project employs Text Encoding Initiative (TEI) conventions for storing all manuscript content.[9] Separate TEI files represent content and layout using Extensible Markup Language (XML), which has the advantage of being both human- and machine-readable. The layout XML (Figure 4) stores information about where each object (e.g., blocks of poetry, musical interpolations) appears on each folio; this allows new translations to be displayed in the correct location without writing new code. The content XML files store texts and translations:

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<xml>
<text>
<body>
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[7] M. Beaudouin-Lafon and W. E. Mackay, 'Prototyping tools and techniques,' *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications*, ed. J. Jacko (Boca Raton, FL, 2012), pp.1081–1102.

[8] J. Dumas, 'Usability testing methods: Think aloud protocols,' *Design by People for People: Essays on Usability*, ed. R. Branaghan (Chicago, IL, 2001), pp.119–30.

[9] http://www.tei-c.org/

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<lg id="Te_0001-5986">
<l n="1"> Because of Fauvel, whom I see stroked so much—</l>
<l n="2"> Sweetly, without flaying him—</l>
<l n="3"> I have become melancholic,</l>
<l n="4"> Because he is such a well-polished beast.</l>
<l n="5"> Often they see him in painting,</l>
<l n="6"> Those who do not know if he stands for</l>
<l n="7"> Mockery, wisdom or folly.</l>
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It will soon be possible to add new translations, for example, merely by adding an XML file with line information into the project.

In the next stage of the project, we will work to ensure that our software can be used to create digital versions of other manuscripts simply by supplying layout XML, text and translation XML, and high-resolution image files. We will also release our user-facing tools for creating layout XML by visually annotating high-resolution images with bounding boxes for each element.

<<< FIGURE 4 NEAR HERE >>>

Design and development as educational activities
The design and implementation of this project have been undertaken as undergraduate research projects by students in music, computer science, and engineering from Princeton, Harvard, and Columbia, supervised by both authors of this article. Such activities have proven useful for teaching engineering and computer science students about creating new technologies for real-world use, and for allowing them to explore technical research questions (e.g., applying computer vision techniques to accurately find locations of text and music elements on a scanned page). In our experience, though, students also learned to engage with humanistic questions. Is the column a property of the page or opening, or do pages consist of aggregate columns? How is it best to describe the way columns interact with musical objects that span several openings? Should drop-caps be encoded as aspects of content or layout? Such questions must be answered during the implementation of the software, but they have implications beyond the code. For example, rising sophomore computer science student Alison Y. Chang wrote that "many answers to these questions [about drop caps] depend on underlying classifications of drop caps as art versus text, categories that are easy for us to comprehend and negotiate in a humanities sense but harder to reconcile when we are forced to draw clear-cut lines for technology."[10] In fact the distinction between art and text, though perhaps intuitively clear, is no easier to make from a humanities perspective than it is from an engineering one. Thus the very acts of encoding and deciding on an underlying representation structure led our students—and us—to ponder fundamental and often overlooked aspects of manuscript production and textual culture.

Project state and vision

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[10] Alison Y. Chang, "Encoding and Navigating Fauvel: XML and Search Capabilities for Digital Fauvel," Project report, August 2013.

The *Digital Fauvel* software is open source and available for public download at https://code.google.com/p/digitalfauvel/. It currently supports the display and navigation of the manuscript, the translation of text into Modern French and English, display of the music in score, playback of musical audio, and textual search of poetry, lyrics, and metadata in the original Middle French and in French and English translations. We hope to put this version of the *Digital Fauvel*, running on large format multitouch hardware, to use in universities and public libraries. We are currently refining the software so that it can be more easily applied to new manuscripts. Further, our vision is to provide an extensible software platform with a usable API, enabling future software developers to build new interactive applications—for teaching, specialized research, public outreach, or other purposes—on top of digitized manuscripts.

Figures

Figures can be downloaded in high-resolution PDF format from
https://dl.dropboxusercontent.com/u/7151055/FiebrinkZayaruznayaFigures.zip

Figure Captions

Figure 1. *The Digital Fauvel* displays BnF-Fr 146, end of index and folio 1r with English
translation overlay; toolbar at right

Figure 2. Displaying an edition and playback options

Figure 3. Searching for "fortune" in *The Digital Fauvel*

Figure 4. The beginning of the layout XML file for *The Digital Fauvel*, corresponding to F-Pn
146, folio 1r. Zones designated by the XML file are linked to the corresponding
manuscript areas.