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Has the Historian's craft gone digital?

Some observations from France

Franziska HEIMBURGER and Émilien RUIZ *

Since the end of the 1980s the historiographical context has changed considerably. Over the course of the last ten years, we have reached the “digital age” and computers as well as resources available via the Internet have become indispensable tools for all researchers. Be it for the stage of documentation or for actual writing, we are now living and working in a context where historians can no longer completely refuse all IT tools. As long as there are no solid, durable, large-scale training efforts to equip all historians with the skills to use the new and old IT tools, their potential is necessarily limited. While there have been studies on “researchers” in general and also on political scientists in particular, there has, to our knowledge, been no scientific study which would allow us to reach conclusions on the use of IT tools and digital resources by French historians. It is thus difficult to reach conclusions on a larger scale and we have decided to base our analysis on our own experience in order to consider what could be the transformations of the historian's craft in the digital age. We will thus proceed first to a series of conclusions based on our activities in mediation (teaching and blogging), before proposing a typology of the principal evolutions. We will conclude with a certain number of propositions as far as training of historians is concerned.

Introduction¹

The use of IT technology in historical research is certainly not an innovation of the 2000s. The first hesitant steps in mecanography in the 50s² led to something of an IT revolution in the discipline between the end of the 1960s and the 1980s³. The invention of the PC in the mid-1970s⁴ obviously played a large part in this development. Emmanuel Le Roy Ladurie thus stated as early as 1967 that «the historian will be a programmer or he will be nothing»⁵ while the editorial of the first volume of «Histoire & Mesure» in 1986 concluded that computers had already «changed historians' practices in depth»⁶. Despite these early advances, the principal field of application having been in the quantitative domain, it was still possible to make the conscious choice of ignoring these tools.

Since the end of the 1980s the historiographical context has changed considerably, in France quantitative history is no longer fashionable⁷ (with some exceptions⁸) and IT tools for historians have grown in number. Over the course of the last ten years, we have reached the “digital age” and computers as well as resources available via the Internet have become indispensable tools for all researchers. Be it for the stage of documentation or for actual writing, we are now living and working in a context where historians can no longer completely refuse all IT tools.

The most recent transformations are not of the same nature as the IT revolution of the 70s and 80s. The digital era has several distinguishing factors. First of all, the

¹ This paper is a revised and updated translation of: «Faire de l'histoire à l'ère numérique: retours d'expériences», in *Revue d'histoire moderne et contemporaine*, 58, 4bis/2011. We are very grateful to the editorial board of the RHMC for authorising this translation.

² GENET, Jean-Philippe, «Histoire, Informatique, Mesure», in *Histoire & mesure*, I, 1/1986, pp. 7-18.

³ For the American case, see: CLUBB, Jerome M., ALLEN, Howard, «Computers and Historical Studies», in *The Journal of American History*, 54, 3, 1967, pp. 599-607; SWIERENGA, Robert P., «Computers and American History: The Impact of the “New” Generation», on *The Journal of American History*, 60, 4, 1974, pp. 1045-1070.

⁴ CERUZZI, Paul E., *A History of Modern Computing*, Cambridge, Mass. & London, The MIT Press, 2003; for the French case, see: BELTRAN, Alain, GRISET, Pascal, *Histoire d'un pionnier de l'informatique: 40 ans de recherche à l'Inria*, Les Ulis, EDP Sciences, 2007; MOUNIER-KUHN, Pierre-Éric, *L'informatique en France de la Seconde Guerre mondiale au Plan Calcul. L'émergence d'une science*, Paris, Presses Universitaires Paris-Sorbonne, 2010.

⁵ Declaration made at a conference in Ann Arbor on quantitative history, quoted in: RABB, Theodore K., «The Development of Quantification in Historical Research», in *The Journal of Interdisciplinary History*, 13, 4/1983, pp. 591-601; see also: ROY LADURIE, Emmanuel LE, *Le territoire de l'historien*, Paris, Gallimard, 1973, p. 14.

⁶ «Éditorial», in *Histoire & mesure*, I, 1/1986 [our translation].

⁷ LEPETIT, Bernard, «L'histoire quantitative: deux ou trois choses que je sais d'elle», in *Histoire & mesure*, IV, 3-4, 1989, pp. 191-199.

⁸ ZALC, Claire, LEMERCIER, Claire, *Méthodes quantitatives pour l'historien*, Editions La Découverte, 2008.

reduction in price for personal computers⁹ has led to a democratisation of their usage¹⁰. Furthermore, the proportion of Internet users has been multiplied by five between 2000 and 2010¹¹. Finally, the development of “Web 2.0” technologies¹² has led to the apparition of tools, which are sufficiently intuitive to be used without in-depth, IT skills. This is both the true novelty and the principal danger in the current situation: there is considerable potential but the gap between easy use and misuse is very small. As long as there are no solid, durable, large-scale training efforts to equip all historians with the skills to use the new and old IT tools, their potential is necessarily limited.

While there have been studies on “researchers”¹³ in general and also on political scientists in particular¹⁴, there has, to our knowledge, been no scientific study which would allow us to reach conclusions on the use of IT tools and digital resources by French historians¹⁵. It is thus difficult to reach conclusions on a larger scale and we have decided to base our analysis on our own experience in order to consider what could be the transformations of the historian’s craft in the digital age.

We will thus proceed first to a series of conclusions based on our activities in mediation (teaching and blogging), before proposing a typology of the principal

⁹ In December 2006 Michel Volle stated that the value of the hedonic indicator (at constant quality) for the industrial sale of personal computers in France was 0.6 % of what it had been in 1988. VOLLE, Michel, «Évolution du prix des micro-ordinateurs», 25 December 2006, URL: < <http://www.volle.com/statistiques/primicro.htm> > [accessed 18 May 2011].

¹⁰ «Personal computers were only present in 15 % of households [in France, our addition] in the mid-1990s. By the end of 2005 more than half the households are equipped with personal computers and 10 % have at least two». ARTHAUT, Régis, «La consommation des ménages en TIC depuis 45 ans. Un renouvellement permanent», in *Insee Première*, 1101, 09/2006, no 1101, septembre 2006, URL: < http://www.insee.fr/fr/themes/document.asp?ref_id=ip1101®_id=0 > [accessed 9 May 2011].

¹¹ «Just over 64 % of households declare having access to internet at their home in 2010, while in 2008 this was true of only 56 %, and 12 % in 2000». GOMBAULT, Vincent, «Deux ménages sur trois disposent d’internet chez eux», *Insee Première*, 1340, 03/2011, URL: < <http://www.insee.fr/fr/ffc/ipweb/ip1340/ip1340.pdf> > [accessed 9 May 2011].

¹² O’REILLY, Tim, «What Is Web 2.0. Design Patterns and Business Models for the Next Generation of Software», in *O’Reilly*, 30 September 2005, URL: < <http://oreilly.com/web2/archive/what-is-web-20.html> > [accessed 9 May 2011].

¹³ GALLEZOT, Gabriel, ROLAND, Michel, «Enquête sur les pratiques informationnelles des chercheurs: quelques résultats», in *URFIST Info*, 04 March 2011, URL: < <http://urfistinfo.hypotheses.org/1901> > [accessed 19 May 2012].

¹⁴ BRIATTE, François, «Nous sommes une trentaine», in *Polit’bistro: des politiques, du café*, 1 September 2009, URL: < <http://politbistro.hypotheses.org/250> > [accessed 29 May 2012].

¹⁵ Some elements for the American case can be found in: DUFF, Wendy *et al.*, «Historians’ Use of Archival Sources: Promises and Pitfalls of the Digital Age», in *The Public Historian*, 26, 2/2004, pp. 7-22; GRAHAM, Suzanne, «Historians and Electronic Resources: A Second Citation Analysis», in *Journal of the Association for History and Computing*, IV, 2/2001, URL: < <http://quod.lib.umich.edu/cgi/p/pod/dod-idx?c=jahc;idno=3310410.0004.203> > [accessed 29 May 2012] – cited by RYGIEL, Philippe, «Les sources de l’historien à l’heure d’Internet», in *Hypothèses*, 2003, pp. 341-354.

evolutions. We will conclude with a certain number of propositions as far as training of historians is concerned.

1. Observations from our teaching in Paris and our blogging experience

Our point of view is that of PhD students in history who teach methodology, historiography and IT tools for historians. At the same time we blog at *La boîte à outils des historiens* (<http://www.boiteaoutils.info/>) in order to provide information on similar questions. This makes us both users and mediators of IT tools and digital resources. We intend to use this double point of view in order to reflect on these transformations of the historian's craft.

1.1 Teaching IT tools to research masters students in history

Over the course of our teaching experience we found we were often approached over questions of IT usage and it was thus that we came up with the idea of putting in place methods training for first year master students who would encounter the most important tools just as they embarked on their own research. With the support of the history department at the EHESS¹⁶, we were able to implement a week-long programme, itself inspired by training sessions we ourselves had attended¹⁷.

Between 2009 and 2012 we thus trained 160 students (mainly at master level, with a couple of PhD students mixed in) who ranged in ability from raw beginners in computer usage to experienced LaTeX¹⁸ users. We introduced them to a wide range of resources and four main software tools for historical research. Our aim was emphatically to provide more than IT training: an introduction to good practice in a research setting.

Our main objective was to ensure that all participants attained a threshold level using the most essential tools, so that they could then progress, either on their own or

¹⁶ We are very grateful to Stéphane Audoin-Rouzeau and Vincent Duclert who trusted us and let us develop our programme as we felt best, as well as Marie-Claude Barré whose help, as usual, was indispensable.

¹⁷ In particular the seminar series "L'histoire et l'historien face au quantitative" organised in Paris by Claire Lemerrier and Claire Zalc since 2007 and the summer school "Méthodologie de la recherche en histoire sociale" organized in Louvain-la-Neuve by Frédéric Vesentini in 2008.

¹⁸ LaTeX is a powerful document preparation system. See <http://www.latex-project.org/> for more informations [accessed 29 May 2011].

in specific training sessions to more advanced use cases. Each day was organised around a fundamental aspect of work in historical research:

Finding documentation on-line. The first stage of the training session aimed to familiarise the students with the digital resources applicable to their domain. The EHESS has a virtual learning environment which streamlines access both to freely available documentation and to institutional subscriptions, be those journals, encyclopaedias or archival depots. Library catalogues and meta-catalogues and their powerful advanced research options were a further important element of the first day.

Writing. On the second day we focused on the different stages of the writing process. Students first discovered a series of tools: physical research notebooks, mind maps, software for iterative writing processes...¹⁹ The message we aimed to convey was that each student needs to find the best way for him/herself to work, even if that takes a little trial and error in the first months. The greatest part of the session was then devoted to various aspects of using a word processor to produce large scale academic writing. Style sheets and index creation are areas often ignored even by confident users of word processors.

Data capture and processing. The spreadsheet is probably the tool our students most struggled to recognise as immediately useful to them. As well as teaching the basics (tables, simple functions and graphs), we used the third session to present examples of how a spreadsheet can be a more powerful data capture tool than a word processor. We included a brief introduction to the construction of databases using the «ten commandments of data capture» by Claire Lemerrier and Claire Zalc as a starting point²⁰.

Presentations. Being able to use presentation software is not sufficient in order to give successful presentations in a research setting. We began the fourth day with general considerations on the principles which should apply to all good presentations (adapting to the public, articulating projected material to reinforce and illustrate the spoken words rather than substitute or contradict it). Only then did we move on to the more technical aspects relating to the use of presentation software.

Bibliography. We devoted the last day of our session to a truly indispensable tool for budding researchers in history: bibliography managers. With their help, students can begin to constitute a database of references and notes (digital equivalent of traditional boxfiles) but also reuse these references in the writing process by having

¹⁹ See the presentation available online: HEIMBURGER, Franziska, “Le Processus d’écriture”, *Prezi*, October 26, 2010, URL: < <http://prezi.com/svykhopbmnu/le-processus-decriture/> >.

²⁰ ZALC, Claire, LEMERCIER, Claire, *Méthodes quantitatives pour l'historien*, cit., p. 41.

then automatically formatted and inserted in the word processor they use. The training session on bibliography management using Zotero was by far the most popular in terms of student numbers.

Furthermore, we wished to use these training sessions to show students examples of more advanced use of digital tools for historians. We did this by ending each day with a presentation based on a particular use case or project. Over the course of three years, fifteen presentations covered topics ranging from scientific blogging to XML-TEI encoding²¹ and including databases and cartography. In a way, and with our modest means, we were able to present a panorama of the possibilities currently offered to history by Digital Humanities methods²² (see document 1).

²¹ The Text Encoding Initiative uses an XML (eXtensible Markup Language) language to structure text. It has its origins in a project of normalisation of digital encoding supported by a consortium of research structures and actors founded in 1987. See URL: < <http://www.tei-c.org/index.xml> > [accessed 29 May 2011].

²² Some starting points on Digital Humanities: DACOS, Marin, "Manifeste des Digital humanities", in *ThatCamp Paris 2010*, URL: < <http://tcp.hypotheses.org/318> > [accessed 29 August 2011]; GUILLAUD, Hubert, "Qu'apportent les Digital Humanities?", in *La feuille*, URL: < <http://lafeuille.blog.lemonde.fr/2010/07/22/quapportent-les-digital-humanities/> > [accessed 29 May 2011]; MOUNIER, Pierre, "Qu'apportent les digital humanities? Quelques exemples (1/2)", in *Homo numericus*, URL: < http://homo-numericus.net/spip.php?breve1011&var_mode=recalcul >, [accessed: August 29, 2011]; WILLIAMS, George, "Starting Points in the Digital Humanities", in *ProfHacker. Tips aboute teaching, technology, and productivity*, URL: < <http://chronicle.com/blogs/profhacker/getting-started-in-digital-humanities/35153> > [accessed 29 May 2011].

Document 1: List of topics and speakers at our training sessions 2009-2012.

Speaker(s)	Topic
François Briatte (2009 & 2010), Joël Gombin (2009) and Martine Sonnet (2010)	Benefits of scientific blogging for research in the humanities and social sciences
Claire-Charlotte Butez (2010)	Using GIS in history – projects developed at the LARHRA laboratory
Frédéric Clavert, Benoît Kermoal and Martine Sonnet (2011)	Blogs and social networks – tools for historians?
Benjamin Deruelle and Sophie Cinquin (2011)	Using lexicometry in historical research
Pierre-Olivier Dittmar (2010)	The databases of the GAHOM laboratory : Thema & Images
Nicole Dufournaud, Valérie Gratsac-Legendre and François-Xavier Petit (2010)	The GRIHI laboratory, TEI and the Marillac project.
André Gunthert (2012)	Benefits of using digital tools in research in visual history
Claire Lemercier (2009, 2010 & 2011)	Overview of possible uses of IT tools at different stages of the research process
Claude Motte and Marie-Christine Vouloir (2009)	Excel as a research tool : the Cassini project
Martine Sonnet (2012)	Evolutions in the writing process
Cécile Soudan (2009)	Evolutions in the use of digital tools and methods in a lab: the GRIHL
Nicolas Verdier (2012)	Using cartography tools in historical research

2. On line continuation: the historian's toolbox

During the first edition of the training sessions – and to a large extent due to the convincing presentation by François Briatte and Joël Gombin on scientific blogging²³ – we developed the idea of establishing a blog to continue our training sessions year round on a virtual platform. One of the main objectives, at least initially, was to reach those who had not been able to take part in the session or access material on the EHESS learning platform. During its first year of existence, our blog attracted 4 300 visits (by 2900 individual visitors)²⁴.

Document 2: The Historian's Toolbox (screenshot March 25th 2012).

²³ GOMBIN, Joël, “À propos de l’usage des blogs dans la recherche en SHS”, in *Polit’bistro: des politiques, du café*, 05 November 2009, URL: < <http://politbistro.hypotheses.org/332> > [accessed 29 May 2012]; BRIATTE, François, “Blogging scientifique”, in *Polit’bistro: des politiques, du café*, 27 October 2010, URL: < <http://politbistro.hypotheses.org/710> > [accessed 29 May 2012].

²⁴ All statistics obtained by Google Analytics. On the distinction between visits, visitors, etc., see: URL: < <http://adwords.google.com/support/aw/bin/answer.py?hl=fr&answer=57164> > [accessed 29 May 2012].

During this period, the majority of posts concerned digital resources useful for historians (online journal, digitisation of source material, etc...) but advice on good practice more generally and tutorials were also represented²⁵. During our second training session, in 2010, we decided to make all our training material available via the blog. This included the tools specifically taught during the training session as well as an introduction to publication and events monitoring. We had not been able to fit this element into the 5-day-session and realised over the course of the years that few students knew about essential elements such as RSS feeds which could easily keep them up to date on their subject²⁶. With ten detailed tutorials²⁷ now available on the blog, the second year saw a significant increase in Web traffic: 41.000 visits (from 29 000 visitors) between 1st November 2010 and 25th March 2012.

These figures – fairly modest on the scale of the Web – are interesting because they point to a real interest in information and training so far as these tools are concerned, especially for introductions to the basics, which is what we covered in priority.

3. “Digit natives” are not born researchers

These very real needs for training were confirmed by the results of a survey, which we administered in March 2011 to all history master students at the EHESS. By March 14th 2011 the questionnaire (distributed by e-mail) had received 53 replies (26 first-years, 22 second-years). Despite this relatively small population, the results seem to show very clearly that the use of IT tools has progressively attained the population of master students in History, while creating significant needs in training.

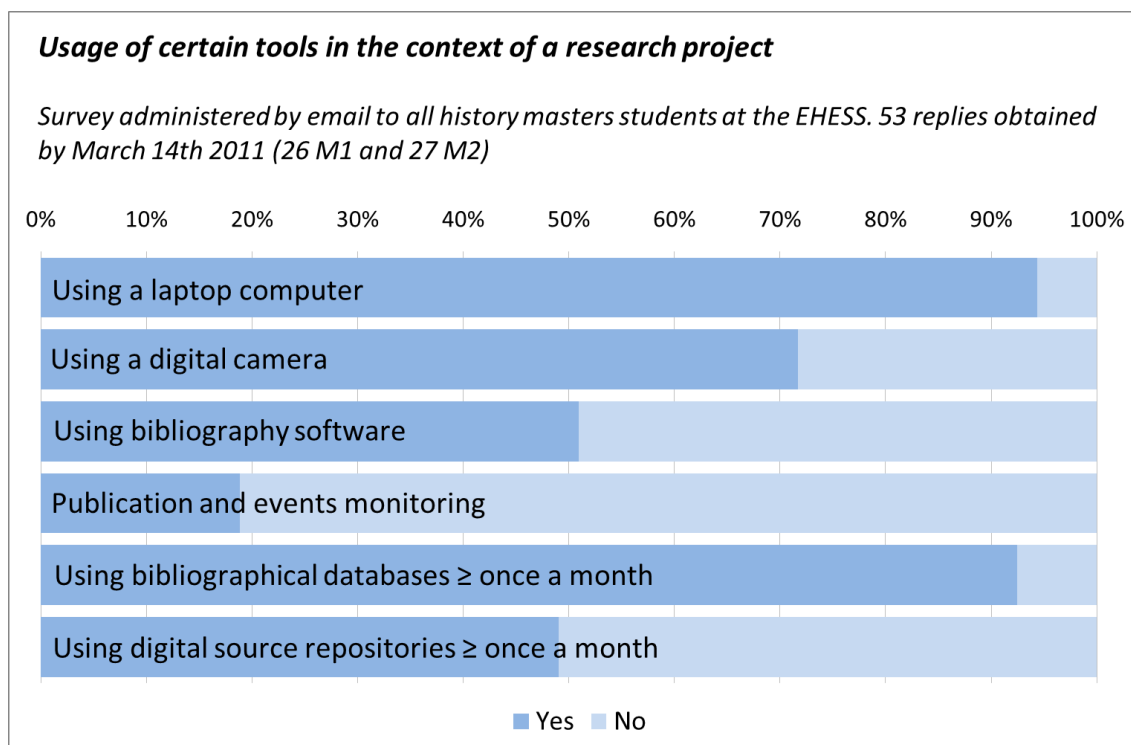
²⁵ See, for example: RUIZ, Émilien, “De l’histoire médiévale 2.0”, in *La boîte à outils des historiens*, October 19, 2009, URL: < <http://www.boiteaoutils.info/2009/11/de-lhistoire-medievale-20.html> >; HEIMBURGER, Franziska, “European History Primary Sources”, *La boîte à outils des historiens*, November 08, 2009, URL: < <http://www.boiteaoutils.info/2009/11/european-history-primary-sources.html> > [accessed 29 May 2012]; HEIMBURGER, Franziska, “Les bonnes résolutions... ou comment mettre en place un système complet et automatique de sauvegarde”, in *La boîte à outils des historiens*, 11 January 2010, URL: < <http://www.boiteaoutils.info/2010/01/les-bonnes-resolutions-ou-comment.html> > [accessed 29 May 2012]; HEIMBURGER, Franziska, “Zotero: une introduction pour historiens”, in *La boîte à outils des historiens*, October 06, 2009, URL: < <http://www.boiteaoutils.info/2009/11/zotero-une-introduction-pour-historiens.html> > [accessed 29 May 2012]; recently updated for Zotero 2.1; see RUIZ, Émilien, “Découvrir Zotero 2.1: de l’installation à la bibliographie collaborative”, in *La boîte à outils des historiens*, 8 June 2011, URL: < <http://www.boiteaoutils.info/2011/06/decouvrir-zotero-21-de-linstallation-la.html> > [accessed 29 May 2012]. A new version of the tutorial is being prepared for Zotero 3.0.

²⁶ RUIZ, Émilien, “Initiation à la veille documentaire sur Internet”, in *La boîte à outils des historiens*, 19 December 2010, URL: < <http://www.boiteaoutils.info/2010/12/initiation-la-veille-documentaire-sur.html> > [accessed 29 May 2012].

²⁷ URL: < <http://www.boiteaoutils.info/search/label/Tutoriels> > [accessed 29 May 2012].

Document 3 thus shows that the use of a laptop²⁸, a digital camera and bibliographical databases is almost universal. Half the students use bibliography software and online source repositories and the only tool which is little used is publication and events monitoring.

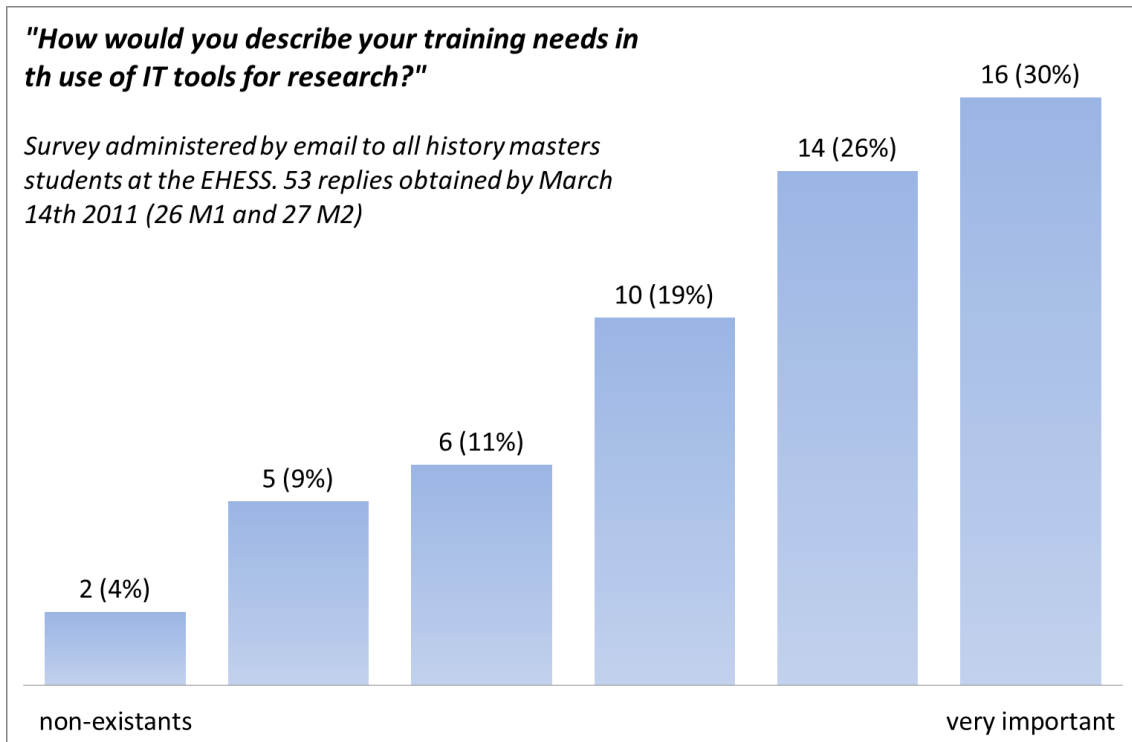
Fig. 3: Considerable usage of certain tools.



The relative ease with which the generation of “digital natives” was assumed to use digital tools has begun to be questioned²⁹ and our results in document 4 confirm that these individuals are not as comfortable with IT tools as was long assumed.

²⁸ On this general topic, see: BRIATTE, François, “Ordinateurs et prise de note en cours magistral”, in *Polit'bistro: des politiques, du café*, 20 July 2010, URL: < <http://politbistro.hypotheses.org/553> > [accessed 29 May 2012]; BRIATTE, François, “Ordinateurs et prise de notes, suite”, in *Polit'bistro: des politiques, du café*, 2 August 2010, URL: < <http://politbistro.hypotheses.org/582> > [accessed 29 May 2012].

²⁹ KOLOWICH, Steve, “What Students Don't Know”, in *Inside Higher Education*, 22 August 2011, URL: < http://www.insidehighered.com/news/2011/08/22/erial_study_of_student_research_habits_at_illinois_university_libraries_reveals_alarmingly_poor_information_literacy_and_skills > [accessed 29 May 2012]; THOMAS, Michael (ed.), *Deconstructing Digital Natives: Young People, Technology, and the New Literacies*, Hoboken, Routledge, 2011; JONES, Chris, *Networked Learning, Stepping Beyond the Net Generation and Digital Natives*, in DIRCKINCK-HOLMFELD, Lone, HODGSON, Vivien, MCCONNELL, David (eds.), *Exploring the Theory, Pedagogy and Practice of Networked Learning*, New York, NY, Springer New York, 2012, pp. 27-41.

Fig. 4: Considerable training needs.

We are thus faced with a population of budding researchers who feel they have adopted IT tools without the necessary technical skills to use them fully and well. The urgency which Jean-Pierre Genet wrote of at the beginning of the 1990s³⁰ very much remains intact in 2010: serious training in the use of IT tools and digital resources is still crucially necessary³¹. These results as well as our experience in teaching and using these tools thus lead us to consider that we are at the very beginning of an important transformation of the historian's craft rather than at the end of a revolution.

4. Attempting typology

The growing use of IT tools and digital resources in historical research has led to three main forms of transformation. They concern the emergence of new practices in documentation, the apparition of new modes of diffusion of scholarly work and the arrival of new types of scientific and pedagogical exchange.

³⁰ GENET, Jean-Philippe, "La formation informatique des historiens en France: une urgence", in *Mémoire vive*, 9, 1993, pp. 4-8.

³¹ HEIMBURGER, Franziska, RUIZ, Émilien, "Les "digital natives" ne naissent pas chercheurs... formons-les!", in *Archimag. Stratégies et ressources de la mémoire et du savoir*, 250, 2011. Also online: URL: < <http://www.boiteaoutils.info/2011/12/les-digital-natives-ne-naissent-pas.html> > [accessed 29 May 2012].

4.1 New practices in documentation

This is probably the most noticeable transformation: new documentary practices have concerned historians as they accelerate some stages of research and delocalise some physical workplaces. This transformation originates in the increasing accessibility of documentation, the rise of available corpora and the automation of certain tasks. Via the Internet, historians can now access several millions digitised documents, vast numbers of archival indices and practically all library catalogue data. At the same time, certain tasks can be automatized by bibliography software and monitoring strategies. Finally, archival work in itself has been transformed since the appearance of digital cameras in the historian's equipment.

Easy access is what makes the real difference. Scientific journals are a very good example. In 1999, when he started www.revues.org Marin Dacos described the crisis of scientific publishing and the possibilities offered by the Internet as «a horizon to be conquered»³². Over ten years later, [revues.org](http://www.revues.org) hosts close to three hundred journals and practically all French journals in History are now accessible via various academic portals. An example: all volumes of the *Revue Historique* from 1875 to 2006³³ are freely accessible online while the issues published since 2007 are available via paid offers to which all higher education institutions have subscribed for their students and staff.

Such changes have also changed the accessibility of source material, at least for certain periods and subjects. A good example is the electronic edition of the reports by the *Militärbefehlshaber Frankreich* and the report summaries from French *Préfets* from 1940 to 1944 which give direct access not only to a corpus of crucial sources for the history of the Second World War, but also to a body of notes making them intelligible³⁴.

In a different domain, 1988 saw an appeal by *Radio France* for its readers to send in letters by First World War soldiers. This corpus of over 8000 letters was used to publish several collections of extracts³⁵, but the originals languish in hard-to-access

³² DACOS, Marin, "Le numérique au secours du papier. L'avenir de l'information scientifique des historiens à l'heure des réseaux", in *Cahiers d'histoire*, 44, 1/1999, URL: < <http://ch.revues.org/index48.html> > [accessed 29 May 2012].

³³ Via the portals www.persee.fr and www.cairn.info .

³⁴ BARUCH, Marc-Olivier, MARTENS, Stefan (eds.), "La France dans la Deuxième Guerre mondiale. Édition croisée des rapports du *Militärbefehlshaber Frankreich* et des synthèses des rapports des préfets de l'État français, 1940-1944", in the site of Institut d'histoire du temps présent & Institut historique allemand à Paris, URL: < <http://www.ihtp.cnrs.fr/prefets> > [accessed 29 May 2012].

³⁵ GUÉNO, Jean-Pierre *et al.*, *Paroles de Poilus: Lettres de la Grande Guerre*, Paris, Tallandier, 1998.

archives³⁶. Just twenty years later, the University of Oxford launched an appeal for the massive digitisation of First World War artefacts by their owners. This project proposed a new web interface specially created to receive these digital submissions³⁷. Over the course of only three months this small-scale project (originally six part-time positions) collected over 6500 digital archival submissions available via the project website. Document 5 thus shows the example of a postcard whose two sides have been digitised and which can be printed, downloaded etc. A contributor has provided contextual information such as the indication that the card was assembled by her grandfather for Christmas 1917 using a picture taken during a reconnaissance mission for his unit, the 82nd Squadron RFC.

Fig. 5: Example of a digitised source on the First World War Poetry Digital Archive.

The screenshot displays the 'The First World War Poetry Digital Archive' website. The main heading is '82nd Squadron Christmas Card 1917'. The page features a search bar, a navigation menu on the left, and a document viewer. The document viewer shows a handwritten Christmas card with the following text:

*Dear Mother
 Hope you & Father
 and all the family
 the best wishes for
 Xmas & New Year
 I designed the card
 Best of love
 from
 [Signature]*

The card also includes a photograph of a soldier in a trench and the address: *131 Pentonville Rd, London, N.*

³⁶ MARIN, Coralie, *Les recueils de correspondances des poilus, vers une mémoire collective française de la Grande Guerre*, M.A., Université de Montréal, Montréal, 2009.

³⁷ "About the Great War Archive", in *First World War Poetry Digital Archive*, URL: < <http://www.oucs.ox.ac.uk/wwilit/gwa/about.html> > [accessed 29 May 2012].

This digitisation project is now being extended to other countries via the European digital library initiative *Europeana*. They use the framework tested in Britain and hold special open days, most recently in Germany, where members of the public could bring an object to have it digitised by the project's historians³⁸.

Large-scale digitisation projects by various institutions have made a mass of documents accessible from a personal computer with an internet connection. We will not be able to develop many examples here, but it is important to note that *Gallica*, the digital library of the *Bibliothèque Nationale de France* gives access to over a million printed documents while *Mandragore*, its database of illuminated manuscripts contains more than 170.000 entries and over 80.000 digitised images. The *ngram viewer* based on Google's vast book-scanning enterprise works with a corpus of 500 billion words from 5 million books published worldwide since the 16th century³⁹. The main difficulty is now to keep abreast of this flood of digitised documents, available via a wide range of sites, portals and online libraries. A very promising initiative was launched in December 2010: the research platform *ISIDORE* which currently draws upon over 1.200.000 documents from over 1000 sources. The European framework project DARIAH⁴⁰ has mobilised European Research Council funding to launch a portal project for access to archival documents, starting with in-depth work on medieval and First World War sources.

In parallel, the massive arrival of digital cameras on the market (14.000 sold in France in 1996, over 5 million in 2010⁴¹) has transformed our work habits in the archives. Pencil and paper are increasingly abandoned in favour of these tools, which enable a single researcher to capture several hundred documents in each day at the

³⁸ "Europeana Erster Weltkrieg - World War One in pictures, letters and memories", URL: < <http://www.europeana1914-1918.eu/en> > [accessed 29 May 2012].

³⁹ MICHEL, Jean-Baptiste et al., "Quantitative Analysis of Culture Using Millions of Digitized Books", in *Science*, 331, 6014, 2011, URL: < <http://www.sciencemag.org/content/331/6014/176.abstract> > [accessed 29 May 2012]; CHATEAURAYNAUD, Francis, DEBAZ, Josquin, "Prodiges et vertiges de la lexicométrie", in *Socio-informatique et argumentation*, 23 December 2010, URL: < <http://socioargu.hypotheses.org/1963> > [accessed 29 May 2012]; RUIZ, Émilien, "Google labs Books Ngram Viewer: un nouvel outil pour les historiens?", in *La boîte à outils des historiens*, 29 November 2010, URL: < <http://www.boiteaoutils.info/2010/12/google-labs-books-ngram-viewer-un.html> > [accessed 29 May 2012]; PECCATTE, Patrick, "L'interprétation des graphiques produits par Ngram Viewer", in *Déjà vu*, 11 January 2011, URL: < <http://culturevisuelle.org/dejavu/469> > [accessed 29 May 2012].

⁴⁰ URL: < <http://www.dariah.eu> > [accessed 29 May 2012].

⁴¹ According to figures from the French federation for photographic imagery and communication, URL: < www.sipec.org > [accessed 29 May 2012].

archives⁴². While the digitisation of public archival holdings is currently progressing more slowly than that of university libraries⁴³, we are faced with the fact that historians now digitise a considerable number of documents by taking hundreds of photos in the archives. What is to become of all these pictures once the projects for which they were taken are completed? We do not have answer yet, but the historians of the future will need to find one⁴⁴.

A service like *Zotero Commons*⁴⁵ might be a possible solution to the profusion of metadata standards in individual researchers' databases, which are unusable by others. By archiving their photos on the Internet Archive servers with standard metadata, a researcher obtains durable storage and makes them available to the entire user community. For the time being there is however a significant obstacle to this kind of practice: the researcher must hold the rights to the images he/she wishes to deposit. This is not the case in most archival centres, which only allow photography for personal research use. The developments in the field of digital humanities thus pose once more old question of citation in pedagogical and research contents⁴⁶ – which is even more complex for some sources such as images and songs, for example⁴⁷.

4.2 New channels of distribution

Internet has given rise to a diverse range of avenues for scientific publication. Be they personal websites, blogs, online journals or open archives – new channels of distribution have appeared. At the very least, they enlarge the potential readership for

⁴² For general ideas on handling archival photography see: HEIMBURGER, Franziska, “La photographie numérique des sources - conseils, astuces, méthodes”, in *La boîte à outils des historiens*, August 31, 2011, URL: < <http://www.boiteaoutils.info/2011/08/la-photographie-numerique-des-sources.html> > [accessed 29 May 2012].

⁴³ POTIN, Yann, “Institutions et pratiques face à la numérisation. Expériences et malentendus”, in *Revue d'histoire moderne et contemporaine*, 58, 4/2012, pp. 57-69.

⁴⁴ There is a framework for large-scale group enquiries: MÜLLER, Bertrand, “Archiver, partager les données. Le réseau Quételet”, in *ArchSHS*, 17 August 2011, URL: < <http://archshs.hypotheses.org/536> > [accessed 29 May 2012].

⁴⁵ RMZELLE, “Commons [Zotero Documentation]”, in *Zotero.org*, 18 March 2011, URL: < <http://www.zotero.org/support/commons> > [accessed 29 May 2012].

⁴⁶ There are several interesting blogs on this question: S.I.Lex – URL: < <http://scinfolex.wordpress.com/> > [accessed 29 May 2011] – by Lionel Maurel; Commons/Commons – URL: < <http://paigrain.debatpublic.net/> > [accessed 29 May 2012] – by Philippe Aigrain.

⁴⁷ As stated by: GUNTHERT, André, “Le droit de citation redéfini par les Digital Humanities”, *L'Atelier des icônes*, 1 September 2011, URL: < <http://culturevisuelle.org/icones/1958> > [accessed 29 May 2012]; BARUCH, Marc-Olivier, “Chanter la Nation, 1900-1945”, Communication à la journée d'étude AHMOC: *Histoire nationale, histoire globale: la formation de l'historiographie contemporaine*, Paris, EHESS, 2 juin 2009.

historical scholarship, they overcome some limits inherent to paper publications and they reduce the delay in making results available.

The enlarged readership is particularly visible in the case of scientific journals. The *Cahiers du Centre de Recherche Historique* were founded in 1988 with the aim to «deliver rapidly the results of collective research projects of the *Centre de Recherche Historique*, EHESS Paris». This journal, published in 600 copies, received no publicity before the creation of website in 2005. Sales through subscriptions amounted to 231 between 2003 and 2009 (between 20 and 50 per year). The journal website on the *revues.org* platform⁴⁸ has made all volumes from 1988 to 2005 accessible. In 2010 it received over 11.000 visitors⁴⁹.

There is a wide range of use cases where the limits of the paper format can be overcome. We will simply cite several representative cases of what one might call augmented online publications. The most obvious case is that of annexes which an editor would refuse to include in a paper publication but which can be made available online. One such example is the work conducted by Alain Chatriot on the Carnegie series. It was first published in short format in an edited volume in 2005⁵⁰, and then in an enriched version online with all the annexes and the notes, giving the reader access to the complete list of the 174 titles published by the foundation between 1918 and 1940⁵¹. A digital annexe can also enrich the publication of text books, thus giving further information and up-to-date indications on publications and events⁵². Finally, a digital annexe can make data available which by its nature (sound or animated images, for example), cannot be published on paper⁵³.

These new channels of distribution also reduce the delay in communicating results in historical research. PhD theses and French second-book *habilitations* can be deposited by their authors as soon as they are defended on open platforms such as

⁴⁸ URL: < <http://ccrh.revues.org/> > [accessed 29 May 2012].

⁴⁹ We are grateful to Cécile Soudan and Nadja Vuckovic for giving us access to these figures.

⁵⁰ CHATRIOT, Alain, *Comprendre la Guerre. L'histoire économique et sociale de la Guerre mondiale, les séries de la dotation Carnegie pour la paix internationale*, in BECKER, Jean Jacques (ed.), *Histoire culturelle de la Grande Guerre*, Paris, Armand Colin, 2005, pp. 33-44.

⁵¹ CHATRIOT, Alain, "Une véritable encyclopédie économique et sociale de la guerre. Les séries de la Dotation Carnegie pour la Paix Internationale (1910-1040)", in *L'Atelier du Centre de recherches historiques*, 3, 1/2009,

URL: < <http://acrh.revues.org/413> > [accessed 29 May 2012].

⁵² Such as in the case of <http://www.quantihmc.ens.fr/>, digital annexe to: ZALC, Claire, LEMERCIER, Claire, *Méthodes quantitatives pour l'historien*, cit.

⁵³ See, for example BRIAN, Éric, JAISSON, Marie, *Le sexisme de la première heure: Hasard et sociologie*, Paris, Liber, 2007; and the website which present statistical simulations BRIAN, Éric, JAISSON, Marie, *S1h*, URL: < <http://s1h.blogspot.com/> > [accessed 29 May 2012].

TEL⁵⁴. Similar services exist for hosting audio or video captures of seminars, workshops or other scientific encounters⁵⁵. This also applies to texts which have already been published as their authors can deposit them on open archive platforms like HAL-SHS⁵⁶. This move towards open-access to scientific publication⁵⁷ considerably facilitates access to papers published in journals whose paper copies can be difficult in access.

Finally, scientific blogging makes partial results and work-in-progress papers available. Research blogs on current projects have thus appeared, in large part thanks to the platforms *Hypotheses.org*⁵⁸ and *CultureVisuelle.org*⁵⁹. In this incarnation, the scientific blog can constitute the missing link between a researcher's personal notes and a scientific publication⁶⁰. This new format has given rise to a new kind of writing (both in form and in content)⁶¹, but it also helps to break down disciplinary and hierarchical boundaries and establish new forms of scientific and pedagogical exchange⁶².

4.3 New forms of pedagogical and scientific exchange

Mailing lists, collaborative writing tools, blogs and wikis are only a small number of the tools which make collaborative work easier. They encourage methodological

⁵⁴ URL: < <http://tel-archives-ouvertes.fr/> > [accessed 29 May 2012]; there are few theses in history available on this platform at the moment.

⁵⁵ See, for example, the EHESS platform: < <http://www.rap.prd.fr/ressources/vod.php?videothèque=ehe> > [accessed 29 May 2012].

⁵⁶ URL: < <http://halshs.archives-ouvertes.fr/> > [accessed 29 May 2012].

⁵⁷ On this topic, see: MOUNIER, Pierre, “Libre accès: entre idéal et nécessité, un débat en mutation”, in *Hermès*, 57, 10/2010, pp. 23-30; MUKHERJEE, Bhaskar, NAZIM, Mohammad, “Open Access Institutional Archives: A Quantitative Study (2006-2010)”, in *DESIDOC Journal of Library & Information Technology*, 31, 1/2011, pp. 317-324.

⁵⁸ URL: < <http://hypotheses.org/> >. Originally French-speaking with a couple of exceptions in English – now includes a Spanish – URL: < <http://es.hypotheses.org/> > – and a German – URL: < <http://de.hypotheses.org/> > sub-domain. This platform is run by Centre for Open Electronic Publishing (Cléo/CNRS-EHESS-Aix-Marseille Université and the Université d'Avignon) which also provides *revues.org* – URL: < <http://www.revues.org/> > – and *Calenda* – URL: < <http://calenda.revues.org/> > – [all accessed 29 May 2012].

⁵⁹ URL: < <http://culturevisuelle.org/> > [accessed 27 May 2012]. Founded by André Gunthert and run by Laboratoire d'histoire visuelle contemporaine (Lhivic/EHESS).

⁶⁰ This has even been qualified as a “French exception”: RICHTER, Wenke, “Warum bloggen so wenige Nachwuchswissenschaftler in Deutschland?”, in *Wissenschaft und neue Medien*, 2 September 2011, URL: < <http://digiwis.de/blog/2011/09/02/warum-bloggen-so-wenige-nachwuchswissenschaftler-in-deutschland/> > [accessed 29 May 2012].

⁶¹ A good example of this practice by a grad student at the EHESS is KERMOAL, Benoît, *Enklask/Enquête*, URL: < <http://enklask.hypotheses.org/> > [accessed 29 May 2012].

⁶² DACOS, Marin, MOUNIER, Pierre, “*Les carnets de recherche en ligne, espace d'une conversation scientifique décentrée*”, in JACOB, Christian (dir.), *Lieux de savoir*, t. 2, *Gestes et supports du travail savant*, Paris, Albin Michel, 2010, pp. 185-192; KÖNIG, Mareike, GRAF, Klaus, “Une blogosphère à fort potentiel: petit tour des blogs d'histoire germanophones”, in *Digital Humanities à l'HA*, 13 December 2011, URL: < <http://dhiha.hypotheses.org/425> > [accessed 29 May 2012].

exchange and collective procedures. Collective research projects in the social sciences raise a number of questions of institutional, relational and epistemological nature⁶³. The digital tools that have appeared with the *web 2.0* seem at least to have removed a certain number of technical obstacles. The generalisation of the use of email and international mailing lists⁶⁴ had already made international exchanges easier. With the tools now at our disposal – especially in collaborative bibliography⁶⁵ and collective writing – we can go even further. Once again, we cannot include a full list of the possibilities here. Wikis⁶⁶ and collective blogs⁶⁷, but also collaborative database construction⁶⁸ and social networking⁶⁹ open up new perspectives. Collaborative source transcription projects are a particularly good example⁷⁰. They make source images accessible online and then count on volunteers to transcribe the documents and thus make them exploitable via keyword search or lexicometrical treatment.

Just one example of such a project: UCL has used collaborative transcription to begin establishing the text of Thomas Bentham's diary, the original being conserved in their university archives⁷¹. By signing up for an account on their website, volunteers could transcribe the journal and even conserve specific aspects of the manuscript such as marginal notes by encoding in XML-TEI⁷². Document 6 shows an example of one

⁶³ On this question, see: ROSENTAL, Paul-André (ed.), "Pour une histoire de la recherche collective en sciences sociales. Réflexions autour du cinquantenaire du Centre de recherches historiques", in *Cahiers du Centre de recherches historiques*, 36, 2005, URL: < <http://ccrh.revues.org/3034> > [accessed 29 May 2012].

⁶⁴ For example H-Net; URL: < <http://h-net.org/> > [accessed 29 May 2012].

⁶⁵ HEIMBURGER, Franziska, "New collaborative bibliography of First World War Studies", in *International Society for First World War Studies*, 13 March 2012, URL: < <http://www.firstworldwarstudies.org/?p=973> > [accessed 29 May 2012].

⁶⁶ For example the American Historical Association Archives wiki. URL: < <http://archiveswiki.historians.org/> > [accessed 29 May 2012].

⁶⁷ As RENNEVILLE, Marc, *Criminocorpus, le blog*, URL: < <http://criminocorpus.hypotheses.org/> > a collective blog in legal history; or RUIZ, Émilien, *Devenir historien-ne*, URL: < <http://devhist.hypotheses.org> > on methodological considerations about history making [all accessed 29 May 2012].

⁶⁸ Such as the Système modulaire de gestion de l'information historique (SyMoGIH) developed at the LARHA lab in Lyon. URL: < http://larha.ish-lyon.cnrs.fr/Pole_Methodes/SyMoGIH_fr.php > [accessed 29 May 2012].

⁶⁹ CLAVERT, Frédéric, "Quel réseau social pour les chercheurs en histoire?", in *La boîte à outils des historiens*, 15 July 2011, URL: < <http://www.boiteaoutils.info/2011/07/quel-reseau-social-pour-les-chercheurs.html> > [accessed 29 May 2012].

⁷⁰ For a good overview, see: BRUMFIELD, Ben W., "Collaborative Manuscript Transcription: 2010: The Year of Crowdsourcing Transcription", in *Collaborative Manuscript Transcription*, February 02, 2011, URL: < <http://manuscripttranscription.blogspot.com/2011/02/2010-year-of-crowdsourcing.html> > [accessed 29 May 2012].

⁷¹ University College London, Transcribe Bentham: Transcription Desk. URL: < http://transcribe-bentham.da.ulcc.ac.uk/td/Transcribe_Bentham > [accessed 29 May 2012].

⁷² On historians' uses of coding: CLAVERT, Frédéric, "Le code et l'historien contemporainiste – pensées éparsees", in *Www.clavert.net*, 7 September 2011, URL: < <http://www.clavert.net/wordpress/?p=385> > [accessed 29 May 2012].

such transcription. As the project progresses, the completed elements of the corpus are made available on the website.

Fig. 6: Collaborative transcription using TEI/XML.

The screenshot shows the 'Transcribe Bentham' website interface. At the top, there is a navigation bar with 'UCL Home » Transcribe Bentham » Transcription Desk' and 'Log In / Create Account'. Below this is a 'Navigation' menu with links like 'Transcription Desk', 'Transcription Guidelines', 'Select a Manuscript', 'Blog', 'Discussion Forum', 'Recent changes', 'Random page', 'Contact Us', and 'Help'. A 'Search' bar is also present. The main content area displays a document titled 'JB/027/001/001' with a 'Click Here To Edit' link. The document text is shown in a grid format, with a blue box highlighting a specific section. The text includes 'PREFAT.', 'The department province of letters, so extensive as hand & as', 'happy concurrence of circumstances has rendered it in this country abounds with active & X enlightened & penetrating geniuses[?]', 'who wait for nothing but a proper impulse: [----]', 'a treasure, which governments Legislators are too little in the habit of turning to the account of their own desires.', 'It is in this, as in so many other subjects, that the main difficulties of the tasks rest upon the first beginnings.', 'refer [...] approaches', 'The force of public [intelligence] once roused into activity action will go grow on in an increasing ratio to the burthen.', 'genius', 'I might have garnished my discourse with the unintelligible [...] of the [...] Plato', 'Had it been my place to My path was plain and easy I might have consulted: Index — I might have filled garnished my pages with erudition — I might have proved from Hence that there were more [...]. Last and drink'.

5. What about the digital revolution?

To put it bluntly: we do not have the impression that the “digital revolution” will lead to a change in the fundamental epistemology of historical research. That said, the historian’s craft is changing and it is subject to profound evolution in the practices we have mentioned. Researchers and teachers need to recognise that there is a very real deficit in training for young and not-so-young colleagues as far as IT tools are concerned and this leads to a number of future risks. First of all, extremely useful tools might simply be overlooked or abandoned. Time is always short, both for the professional historians and for students, and the effort necessary to learn to use a specific tool may prove too discouraging if this effort has to be individual and isolated.

Secondly, inappropriate use of such tools can have very serious consequences. This risk takes two main shapes:

- The tool chosen may not be well suited to the task (such as establishing a database where a spreadsheet would have been better; using a GIS instead of a cartography tool).
- These tools can be fetishized to an extent which detracts from historical criticism of the documents.

We need to remember that, while these tools do enable us to save time in accessing documentation and treating information, the aim is not to make research happen more quickly. The objective is to be able to devote more time to actual historical analysis. The training in IT tools which we consider to be essential must therefore be closely linked to more general training in methodology and disciplinary epistemology.

The challenge which the discipline currently faces is that of training historians – both those embarking on the first independent project and those supervising their work. This is not a question of generations – both in the past and today the adoption and transmission of new tools has been the reserve of a passionate minority. The recurrent discourse on “digital natives” has an unfortunate tendency of obscuring the very real training needs.

The first step needs to be an agreement on a common level of IT competency for all historians. This is very much the idea which guided our training sessions at EHESS Paris. The aim is not to train IT experts, but to familiarise historians with the tools they need in order to be operational in their research. Base IT competency for us means those tools everyone should know and be able to use at the end of a research masters degree or by the first year of a PhD – regardless of the subject or period specialisation. We separate them into three domains, linked by a number of tools for collaborative work:

- Documentation. Meta-catalogues, digital portals and libraries, open archives and journal databases
- Data collection & exploitation. Bibliography tools, source capture via spreadsheets, use of graphs and basic databases.
- Presenting and communicating. Writing tools, note-taking, handling large manuscripts, presentation software, basics of cartography

We have consciously excluded more advanced tools from this definition of common base knowledge for historians. Once the basics are in place, a researcher will be able to explore more specific needs for a give project: network analysis, text encoding in XML-TEI, databases, lexicometry, statistical software like SAS, SPSS, R, etc. Our role is to

make students aware of the possibilities to enable them to pursue them if their sources are suited to this type of exploration.

In order to avoid both rejection and fetishizing of the available IT tools, all training must be part of more general training strategies in the methodology and epistemology of the historical discipline. This ensures that the tools are used to serve historical analysis, not the other way around. On this point, a comparison with quantitative methods is particularly enlightening. One of the reasons why quantitative methods were rejected in the 1980s is probably the extent to which quantitative data was fetishized in the 1960s and 1970s. Following the 1990s debates⁷³, the gradual return of quantitative reasoning in the 2000s is due in large part to a «refusal at once of fetishizing and fascination with numbers and of their historiographical isolation in order to fully integrate them in cultural and political history»⁷⁴. Quantitative methods were quite simply recontextualised as tools among others in the historian's toolbox, figures were once again a source among many others⁷⁵. It is therefore solid training in source criticism which is needed for the use of IT tools to become generalised. Researchers who can submit sources to rigorous internal and external criticism, select documentation, fill in gaps in their material etc. are well-equipped to explore large-scale corpora. Once these basics are in place, the new tools and resources mentioned above can be effectively employed, and their results intelligently contextualised. A historian's use of Google's ngram viewer or of the WikiLeaks documentation is indeed possible⁷⁶.

As Bernard Lepetit stated in 1990, «a discipline is not only a way of structuring the description of reality», it is also «a craft, i.e. a collection of established procedures that

⁷³ WEBER, Florence (ed.), "Histoire et statistiques. Questions sur l'anachronisme des séries longues", in *Genèses*, 9, 1/1992, pp. 90-119.

⁷⁴ ROSENTAL, Paul-André, "L'argument démographique. Population et histoire politique au 20e siècle", in *Vingtième Siècle. Revue d'histoire*, 95, 2007, pp. 3-14 [our translation].

⁷⁵ As in: LABBÉ, Morgane, *La population à l'échelle des frontières. Une démographie politique de l'Europe contemporaine*, Paris, Éd. de l'EHESS, 2000; ROSENTAL, Paul-André, DEVINCK, Jean-Claude, "Statistique et mort industrielle. La fabrication du nombre de victimes de la silicose dans les houillères en France de 1946 à nos jours", in *Vingtième Siècle. Revue d'histoire*, 95, 2007, pp. 75-91 BRIAN, Éric, JAISSON, Marie, *Le sexisme de la première heure: Hasard et sociologie*, Paris, Liber, 2007.

⁷⁶ SEMO, Marc, "Des scoops un peu trop bruts pour les historiens [entretien avec Annette Wiewiorka]", in *Libération*, 30 Novembre 2010, URL: < <http://www.liberation.fr/monde/01012305264-des-scoops-un-peu-trop-bruts-pour-les-historiens> > [accessed 29 May 2012]; ASSOULINE, Pierre, "Wikileaks est-il vraiment le rêve de l'historien?", in *La république des livres*, 25 February 2011, URL: < <http://passouline.blog.lemonde.fr/2011/02/25/wikileaks-est-il-vraiment-le-reve-de-l-historien/> > [accessed 29 May 2012]; MONTAGNE, Renée, "Historian Relishes WikiLeaks Cable Dump [entretien avec Timothy Garton Ash]", in *National public radio*, 1 December 2010 URL: < <http://www.npr.org/2010/12/01/131719047/historian-relishes-wikileaks-cable-dump> > [accessed 29 May 2012].

serve to guarantee a coherent discourse»⁷⁷. In these digital times, IT tools are no longer an auxiliary science to history. Integrating them into the “established procedures” has got to be the major challenge facing the discipline in the coming years.

⁷⁷ LEPETIT, Bernard, “Propositions pour une pratique restreinte de l’interdisciplinarité”, in *Revue de synthèse*, 111, 3/1990 [our translation].

*** The authors**

Franziska Heimburger is a PhD student at the EHESS Paris working under the joint supervision of Christophe Prochasson (EHESS Paris) and John Horne (Trinity College Dublin). Her thesis *Language questions in the Allied coalition on the Western Front during the First World War*, focus on military interpreters and, more generally, on languages in Allied coalition warfare during the First World War. She held a French government “allocation de recherche” from 2008 to 2011 and she is currently Attaché Temporaire d’Enseignement et Recherche at the EHESS. The multidisciplinary approach leading her research allowed her to intervene in various international conferences on history and humanities, such as the International Society for First World War Studies 6th Biennial Conference (Innsbruck, 2011). Among her forthcoming publications: *Fighting Together: Language Issues in the Military Coordination of First World War Allied Coalition Warfare*, in *Languages at War. Policies and Practices of Language Contacts in Conflict*, Basingstoke, Palgrave Macmillan, forth.

URL: < <http://studistorici.com/progett/autori/#Heimburger> >

Emilien Ruiz is a PhD student in Contemporary History at the Ecole des Hautes Etudes en Sciences Sociales. His thesis *Trop de fonctionnaires? La question des effectifs de l’État dans la France du XXe siècle* focus on different aspects of the evolution of government officials in France from 1880 to 1980. He taught methodology of historical research, contemporary history and informatics for history at the EHESS at the Paris Diderot University. From 2012 he works as assistant of Professor Paul-André Rosental at the Institut of Political Sciences of Paris. He cofounded (with Franziska Heimburger) “La Boite à Outils des Historiens”, a blog on informatics’ tools for history and maintains the blog Devenir historien-ne, about methods of historical research and historiography. Among his recent publications: «Compter: l’invention de la statistique des fonctionnaires en France (années 1890-1930)», in Philippe Bezes et Odile Join-Lambert (dir.), «Comment se font les administrations», *Sociologie du Travail*, 52, 2/2010, pp. 212-233.

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