UPPSALA PAPERS IN HISTORY OF IDEAS – nr 20

Institutionen för idé- och lärdomshistoria, Uppsala universitet
Uppsala 2018

From Folios to Files. Evaluating the Use of Handwritten Text Recognition to Transcribe the Protocols of the Swedish Bureau of Mines 1700–1840

JACOB ORRJE

UPPSALA UNIVERSITET

For over 200-years, the Bureau's clerks and mobile officials meticulously documented the daily activities relating to Swedish metal making. Their total production, encompassing a massive 233 running meters of handwritten folios, is preserved to this day in the Swedish National Archives. The unique detail in which this body of documents cover the governance of metal making, makes it an important cultural heritage not only nationally but also in an international context.

The Bureau's Archive has long been recognised as a key source in several historical fields – not only by Historians of Science and Ideas but also by Economic Historians and in Political History. As shown by numerous studies, the Bureau's archive holds important information about the rise of the modern state, laws, and administration. Its officials were key to the rise of several modern sciences such as mathematics, mechanics, and chemistry. Moreover, as administrators of domestic metal making, the most important export product of early modern Sweden, its officials were involved in numerous activities linked to the emergence of modern industrialism. Also, the Bureau was not only a community of knowledge and material production, but also a judiciary body with its own laws and courts, which presided over Sweden's mining districts. (Almquist, 1909; Lindqvist, 1984; Fors, 2015; Orrje, 2015; Jansson, 2017; Fors and Orrje, 2019) For all its importance, to this date no larger diachronic studies have approached the Bureau's archive. It seems as if the Bureau's archive has been too extensive, detailed, and rich for it to be approachable using traditional historiographical methods. The contents of its hundreds of folios thus to a large degree still awaits to be uncovered.

In recent years Handwritten Text Recognition (HTR) has developed from a problem within computer science, to near-final platforms that can be used in mass-digitization projects. This technology holds the promise of being able to transcribe handwritten archives such as that by the Bureau of Mines using semi-automatic processes. Still, HTR is a new method and early modern historians generally have little knowledge about its effectiveness. We have especially little experience of how to integrate it into our workflows, or how to make it a useful part of our everyday historical toolbox. However, if it would be possible to integrate HTR with other historical methods, it could be a key for interacting with extensive early modern archives in new ways.

Purpose and aims

The purpose of this paper is to explore the feasibility of transcribing the protocols of the Bureau of Mines with the use of HTR technology. Using an iterative approach, I will train models for transcription using nine volumes from the Bureau's protocol series A1 1700–1840. Through statistical analysis of the text, I will evaluate the accuracy of the models, and how the models can be improved by adding a larger number of transcribed pages to the training set. By this methodology, I thus aim to answer these sets of questions:

1) Is it possible to train a useful initial HTR model for transcribing the series using a limited number of manually transcribed pages? Can such a limited model make the transcription additional protocol pages more effective?
2) How can this initial model be improved through an iterative approach that gradually includes more automatically transcribed and manually proof-read pages?
3) What is the effectiveness of already available public HTR models on the Bureau's protocols?

Background – Digital History, digital accessibility, and HTR

As argued by Nanna Bonde Thylstrup, mass digitization has become a defining concept of our time, which has "attained the status of a cultural and moral imperative and obligation." As such, it has enormous implications for the politics of cultural memory, as is "teeming with diverse political, legal, and cultural investments and controversies." (Thylstrup, 2018) Historians have hardly been impervious to these changes. On the contrary, for good and worse, the rising number of digital archives resulting from diverse digitisation efforts, have profoundly changes how we approach historical sources. As pointed out by Lara Putnam, as digitisation expands, and multi-site historical research is expected to answer questions of a "global age", we risk writing a history of the world's past that is an increasingly partial aggregate picture. And while many historians may not readily see themselves as embracing digital methods – a term which perhaps rather evokes more specialised techniques such as text mining or spatial graphing – the fact that most of us discover, and interact with, our sources via digital search has significant consequences for how we formulate research projects, how we make selections among sources, and how we relate to historical representations. (Putnam, 2016)

Anders Pedersson has likewise argued that the accessibility offered both by printed editions of sources, and even more so by recent mass digitisation, is profoundly political. He points to how the availability of *Swedish State Public Reports* (*Statens Offentliga Utredningar*, SOU) have made them the go-to empirical material for studies focused on a range of historical processes related to Swedish 20th-century politics. While the accessibility of these reports thus has made possible several in-depth studies, it has resulted in a tendency to omit several other categories of sources, such as parliamentary or administrative protocols or records. (Pedersson, 2019) Moreover, the politics of accessibility also have a temporal aspect. With the rise of efficient technology for Optical Character Recognition (OCR), printed digitised material has become fully searchable – making it possible quickly to find occurrences of words, concepts, or historical actors in vast databases of historical sources. While databases such as Eighteenth-Century Collections Online (ECCO), Gallica, and Google Books also have made older printed sources available in a similar way, the fact that the records of early modern administrators, courts, or politics generally are handwritten (and therefore not possible to interpret through OCR), have made them radically more difficult to work with, compared to modern-day counterparts. In the light of the different work-loads between material that has been digitised and made searchable (printed, preferably modern, sources) and what has not (handwritten sources), it is unsurprising that there has been a tendency to desert deserted older periods for a more narrow focus on 20th-century history. Moreover, what has been digitised, and sometimes manually transcribed, from older periods show a striking similarity to the fragmented and partial aggregate picture in global history that Putnam has warned for.

While historians hence must consider how we make selections of sources in a digital age, and how digitised representations of historical documents change the way we contextualise the past (see e.g. Zaagsma, 2013), for early modern historians much would also be won by making massive handwritten archives more accessible. In some cases, this has been accomplished, as seen be, e.g., by mass-digitisation projects involving manual transcription, such as the *Linnaeus Correspondence*, the *Franklin Papers* or the *Sloan Letters*. However, while these projects have been successful, the cost of making such collections available painfully underline the problematic differences between large-scale manual transcriptions and mass-digitisation of printed material using OCR.

Handwritten Text Recognition (HTR) should *not* be seen as a quick fix for improving our understanding of early modern history, and while techniques of mass-digitisation always introduce new methodological problems (as pointed out above). Still, if feasible, HTR would make it possible to approach some categories of early modern historic material in new ways, and in the effect to bring these categories of older records more into parity with modern-day equivalents. Research in HTR has a history ranging back to the mid-20th century. At first, the technology was closely linked to work on OCR, used to turn scanned images of printed text into machine-encoded text by comparing individual characters to prototypes. The recognition of handwritten text however turned out to be a radically more complex computational task, as well as the variation found among different hands. Not until the development of deep neural networks, in the 2000s and 2010, did it start to look feasible to use HTR to transcribe historical documents. (Muehlberger *et al.*, 2019, pp. 955–956) Now, it is time for historians to investigate whether this near-production-ready technology can be integrated with more traditional historiographical methods.

Method

As pointed out above, the Bureau's archive consists of a staggering 233 running meters. The protocols, A1 consists of 297 volumes, and occupies approximately 38,5 running metres). Compared to other parts of the archive, the protocols contain a relatively consistent handwriting over time, and a small number of hands. To reduce the complexity of this preliminary evaluation of HTR in the Bureau's archive, I thus limit the investigation to the protocols.

The first volume of the Bureau's protocols covers 1642–48, and the last (volume 297) consisting of indexes for 1847–57. Except for during 1642–70, when the protocols are sparser and often cover several years, generally there consist one or two volumes for each year between 1670–1857. All these volumes written by hand, and the handwriting naturally changes over time. In the 17th century, the handwriting is less consistent and less clear. By the 1710s, the handwriting clears up, and the protocols consist of a legible Gothic script, mixed with names and foreign words written in Antiqua, in a way that is typical of the time. By the late 18th century, the handwriting gradually changes to consist only of modern-day handwritten Antiqua.

To further reduce the complexity of this study, I did not evaluate the protocols before 1700, as these first 37 volumes contain less consistent handwriting, and the strategies for transcribing them using HTR therefore will need to be evaluated separately. As a basis for this study, I thus took digital photos of a sample of pages from nine volumes, ranging from 1700–1740, each separated by 20 years except for volume A1/48 (1710), which I used as a starting point for transcription (for an overview of the volumes, see figure 1 on the following page). Each of the analysed volumes are extensive, comprising of hundreds of pages.

I thus started by photographing 55 pages from volume A1/48, which would the basis for an initial manual transcription and a first HTR model. The volume had a clear and legible handwriting. Using a larger and more general model for transcribing 18th-century Swedish handwriting, which I had trained on material from the same decade as part of a parallel project, I made an initial crude transcription. 43 of these photographs were proof-read (12 saved for further evaluation), and they we created the basis for a first version of the HTR-model, specialized for transcribing the Bureau's protocols.

In a second stage, I photographed a smaller number of pages from eight other volumes, from 1700–1840 Using the initial model, I transcribed these volumes. I then manually proof read the pages, volume by volume, and included each manually proof-read volume in a new version of the HTR model. The method used for training the HTR models can thus be described as an iterative approach (as depicted by figure 2 on the following page).

Volume	Year	#pages
A1/38	1700	20
A1/48	1710	43
A1/58	1720	23
A1/85	1740	20
A1/127	1760	21
A1/166	1780	23
A1/206	1800	24
A1/246	1820	17
A1/280	1840	20

Figure 1. The volumes, and the number of pages transcribed from each volume.

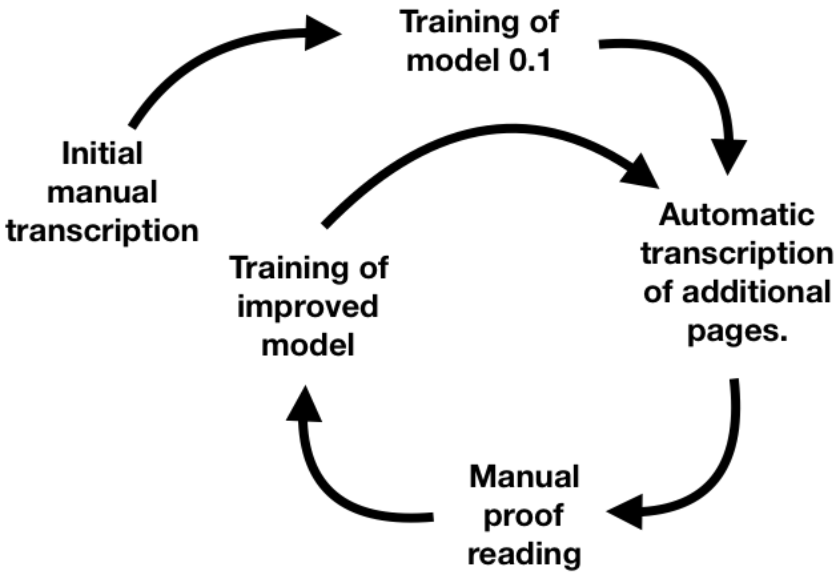

Figure 2. A semi-automatic iterative workflow for training HTR-models.

However, because of how the handwriting of the clerks changed historically, I quickly realized that our initial model displayed very poor performance for the volume from 1700, as well as for the volumes after 1760. I therefore started the iterative approach on volume A1/85 (1740), then continued both backward and forward in time, with A1/58 (1720), then A1/126 (1760) and finally A1/38 (1700). For the volumes from the late 1700s and from the nineteenth century, I instead tried a model trained on court records from 1800 to 1880, made publicly available by the project "Making a modern archive" at the National Archive of Finland (NAF).

Finally, I evaluated the HTR models using statistical analysis together with the quality assurance tools made available in the Transkribus platform. By comparing the manual proof-read version with the results of the different versions of the HTR model, the program could provide the Character Error Rate (CER) and Word Error Rate (WER) of each page. Using these results, it was possible to calculate the mean CER and WER of each volume. These results were analysed statistically, by calculating the variance and standard error deviation, as well as 95% confidence intervals for the accuracy of each version of the HTR model on the different volumes. The results of this statistical analysis could then be used to assess whether there was a statistically significant (with 95% certainty) improvement of each new version, when transcribing a volume.

Evaluation of iterative HTR training on 18th-century material

The initial model (model 0.1), based on 43 transcribed pages from volume A1/48 (1710) proved to the very reliable on a small test-set of pages from the same volume, with a CER of only 3.05%. Already at this stage, we can thus see that we can train very reliable models relatively quickly, if the scope of their expected use small. For a large mass-digitisation project, however, manually transcribing 40 pages of each volume of the Bureau's protocols would be a substantial task, (40 pages x 297 volumes = 11880 pages). It is therefore important to evaluate not only what accuracy this model has for transcribing other pages of the volume it has been trained on, but also how useful it is for transcribing the rest of series A1.

Unsurprisingly, this small and narrow model 0.1 was less effective when transcribing a broader range of volumes. On the sample pages from volume A1/85 (1740), the CER of model 0.1 was 13.67%±1.68% and the WER 45.71%±4.52%. This is average results, and would require extensive manual proof reading for acceptable transcriptions. However, the effort of proof reading the provided results still required less time than manually transcribing the pages from scratch. We can thus draw the conclusion that using this model could increase the speed of transcription somewhat.

Using the proof-read pages from volume A1/85 (1740), together with the pages already included in the previous version, I trained a new HTR model in *Transkribus* (version 0.2). I then compared proof-read pages from volume A1/58 (1720) against transcriptions provided both by model 0.1 and 0.2. Model 0.1 performed worse on A1/58 (1720), than on A1/85 (1740). The mean CER was 17.71%±1.37% and the WER was 56.26%±3.43%, which is statistically significantly worse than on the previous volume. It thus seems as if factors such as the quality of the handwriting, and perhaps of the photographs, are more important to the HTR results than the distance in time between the training set and the text that is transcribed. However, the results of model 0.2 was substantially better, showing a mean CER of 10.45%±1.02% and WER of 39.71%±3.23%. The result was thus significantly better than how model 0.1 had performed both on volume A1/85 (1740) and A1/58 (1720). This result shows that the advanced machine-learning algorithms of *Transkribus* can make a substantially better model using only a very limited sample of text (in this case 20 pages), which can handle a wider scope of texts from the same archive. This result indicates that an iterative approach, gradually including more volumes in the model, could be highly useful for a larger mass-digitisation project.

Again, I used the corrected pages from volume A1/58 (1720), together with the pages from model 0.2 to train a new version of the HTR model (version 0.3). I then compared proof-read transcriptions of the sample pages in volume A1/127 (1760) against the results of all the three versions of the HTR model. The CER of model 0.1 were comparable to how the same model had performed on volume A1/58 (1720) (CER: 17.36%±2.86%, WER: 55.27%±5.29%). Model 0.2 was significantly better (CER: 9.87%±2,07%, WER: 38.45%±5.76%). Finally, model 0.3 performed marginally better, although the improvement was not statistically significant (CER: 8.79%±1.73%, WER: 34.25%±5.43%). The modest gains from model 0.2 to 0.3 indicate that further gains in accuracy may require a more substantial training-set than the transcriptions supplied in this limited preliminary evaluation. Moreover, they also indicate that a more efficient approach to transcribing the archive might be to train narrower models, perhaps covering a 40-year period each.

The corrected pages from volume A1/127 (1760) were once more included in a new version of the HTR model (version 0.4). When the performance of all HTR models were compared on volume A1/38 (1700), all models displayed poor results. Version 0.2 again rendered a statistically significantly better results compared to version 0.1 (CER 22.86%±2,22% as compared to 33.68%±1.82%). However, the performance of version 0.4 was comparable to that of version 0.2 (CER 23,00%±1.83% as compared to 22.86%±2,22%). Generally, it would be quicker to manually transcribe the pages of A1/38 (1700) than to proof read the results of the HTR.

The problematic result when working on model A1/38 (1700) could be explained on two levels. The handwriting differs from later-day protocols, which is the immediate reason for why the HTR models perform poorly on it. The relatively sharp different between the handwriting in this volume – compared to the protocols of 1710 that worked as a useful basis for models for transcribing 18th-century handwriting – can also be related to the changing organization of the 18th-century Bureau of Mines. As shown by previous studies, the early 1700s was when the Bureau developed an auscultatory system. An educational system – comparable to a modern-day trainee program – in which young men learned by participating in the Bureau's activities. The auscultators were encouraged to copy handwritten manuscripts stored in the Bureau's archive, including protocols. During this time, the Bureau thus consciously started to shape and to standardize the writing of its officials. (Orrje, 2015, pp. 110–113) The results from this evaluation of HTR could be an indication that these efforts, which were part of a broader trend of professionalisation in the mining administration, relatively quickly made the handwriting of the protocols more homogenous and consistent over time.

Faced with the poor results on volume A1/38 (1700), I trained a new version of the HTR model, that included manual transcriptions of the first 8 pages of this volume, together with the training-set of version 0.4. This new version (0.41) performed radically better than the other versions on the remaining pages of the volume (CER 13.01%±2.83%). The radical improvement, given the small number of added manually transcribed pages, show the strength of the Transkribus platform. Moreover, it shows the effectiveness of an iterative workflow when using HTR technology.

By making statistical evaluations of how the HTR models perform on specific volumes, it is possible to adapt the approach used to transcribe them. Whereas some volumes can be transcribed relatively easily using broader models, other volumes – such as those pre 1710 – might require specialised models trained on parts of the specific volumes. Through such a mixed approach, it will be possible to find a balance between quality in the transcriptions, and effectivity in transcribing a large set of pages such as the Bureau's 200-year worth of protocols.

Finally, I used the broad version of the model (0.41) to transcribe the remaining 12 pages from volume A1/48 (1710), and compared it to the transcriptions of the narrow version 0.1, which only includes pages from that volume in the training set. Interestingly, the broader model performed comparable, and slightly better results on the pages, though it could not be determined to be statistically significantly better using the limited sample size (2.79%±0.53% for model 0.41 and 3.7%±0.63% for model 0.1). This indicates that both too narrow and too broad models could produce worse accuracy, and that the scope thus continuously needs to be evaluated as the scope of the models are extended. Moreover, this result indicates that a broad model could be highly effective for transcribing the protocols from 1710–60, but that it needs to include larger training sets to provide highly efficient results.

Evaluation of NAF models for 19th-century handwriting

By the late 18th century, the handwriting in the protocols of the Bureau changed from an early modern Gothic script, to a more modern Antiqua. This means that the model trained on the 18th-century material is less suitable for transcribing the protocols from 1780. However, as luck would have it, the National Archive of Finland (NAF) have trained models a model based on court records in Swedish from 1800–80, which are now publicly available through the Transkribus platform.

I used this model to transcribe the volumes from 1780–1840, and evaluated its effectiveness compared to proof-read pages. As seen from figure 3, despite not being trained on the Bureau's protocols, this model was highly effective when transcribing the 19th-century volumes, and it is likely that the results could be improved further by using these models as the base for more specialised models trained on proof-read pages from the 19th-century protocols. When inspecting the transcriptions of the NAF-model manually, it is evident that many of the mistakes are related to words specific for the mining community and that are

Volume	Year	Mean CER	Mean WER
A1/167	1780	9.11%±1,35%	29.89%±3.28%
A1/206	1800	10.19%±2.19%	30,01%±3.80%
A1/246	1820	9.39%±1.17%	28.28±2.56%
A1/280	1840	4.51%±0.70%	17.95%±2.14%

Figure 3: Results from using NAF model on volumes from 1780–1840.

repeated throughout the protocols (e.g., "Bergz", "Collegium", "Cammereraren", or "Jern"). It reasonable to assume that a model, based on the NAF model, but which is also trained on proof-read pages from the 19th-century protocols, would handle these words better and that the CER and WER thus could be improved further with a minimal effort.

This shorter evaluation also underlines that HTR, using the Transkribus platform, is a community effort. A larger endeavour to transcribe the Bureau's archive would thus benefit for close collaborations with other projects that use HTR to transcribe similar material from the same time periods. For example: a close collaboration with the National Archive of Finland would be essential to improve the efficiency of models for transcribing Swedish handwriting from the 19th century.

Conclusions

In this preliminary evaluation of the use of HTR technology to transcribe documents from the Bureau of Mines, I have only analysed a small sample from the Bureau's archive. Still, we can draw some preliminary conclusions about how best to approach an early modern handwritten archive, such as that of the Bureau of Mines, using HTR technology.

First, we can see that it is possible to train a useful initial HTR model for transcribing the series A1, using a limited number of manually transcribed pages. While the quality of the results certainly is not enough for publishing the transcriptions without proof reading, in many cases it can contribute to a more efficient semi-automatic transcription process. However, it is also evident that models based on larger training sets would improve the transcriptions significantly.

Second, we see that an iterative workflow, that integrates a continuous statistical evaluation of the results, could be a highly fruitful approach to transcribing the series. If combined with larger training sets, such an approach could produce acceptable to excellent results in just a small fraction of the time of a manual transcription. The most important aspect of such a workflow, as evident from this evaluation, would be to be sensitive to the specific qualities of the hands of the diverse volumes, and to adapt the scope of the trained models depending on their characteristics. Interestingly, there are also indications that too narrow models might perform worse than models with a broader scope. Hence, training individual models for each volume in the series might actually be counterproductive – as it may be more beneficial with larger training sets with slightly more heterogenous hands. Both the scope and the accuracy of the models thus continuously need to be evaluated, as the series is transcribed.

Third, as seen from the use of NAF models on the protocols from the 19th century, pre-existing HTR models can be a huge help when transcribing the protocols. Whereas these models do not offer perfect results, for example they have problems with words that are specific to the mining community, they offer a very effective starting point for generating text that can be proof read and used for training more specialised models in an iterative workflow.

From the discussions above it is evident that HTR, at this stage, is not a fully automatic process. Instead, it relies on its users to be both proficient readers of historic handwritten text, and to adapt their workflow to the material they are working with. As seen from this preliminary evaluation, even in a single series, volumes from different eras, and in various hands, may require diverse approaches. However, if approached correctly, and by continuously evaluating how we train HTR models, this technology could have an important role for how early modern historians approach massive archives. In the process, if used correctly, it could greatly improve the accessibility of a category of sources that are key to understand early modernity. Consequently, it could also make older history a more attractive object of study for both students and researchers.

Bibliography

Almquist, J. A. (1909) *Bergskollegium och Bergslagsstaterna 1637–1857. Administrativa och biografiska anteckningar*. Stockholm: Norstedt (Meddelanden från svenska Riksarkivet).

Fors, H. (2015) *The limits of matter: chemistry, mining, and Enlightenment*. Chicago: The University of Chicago Press.

Fors, H. and Orrje, J. (2019) 'Describing the World and Shaping the Self: Knowledge-Gathering, Mobility and Spatial Control at the Swedish Bureau of Mines', in Schilling, L. and Vogel, J. (eds) *Transnational Cultures of Expertise: Circulating State-Related Knowledge in the 18th and 19th centuries*. Berlin, Boston: De Gruyter Oldenbourg.

Jansson, M. (2017) *Making Metal Making : Circulation and Workshop Practices in the Swedish Metal Trades, 1730–1775*. Uppsala: Acta Universitatis Upsaliensis.

Lindqvist, S. (1984) *Technology on trial: the introduction of steam power technology into Sweden, 1715–1736*. Uppsala (Uppsala studies in history of science).

Muehlberger, G. *et al.* (2019) 'Transforming scholarship in the archives through handwritten text recognition: Transkribus as a case study', *Journal of Documentation*. Emerald Publishing Limited, 75(5), pp. 954–976.

Orrje, J. (2015) *Mechanicus: performing an early modern persona*. Uppsala: Acta Universitatis Upsaliensis.

Pedersson, A. (2019) 'Om relationen mellan politik och tillgänglighet: Exemplet Statens offentliga utredningar', in. *Digital History – a Field, a Method or just a Phase? 2nd Digital History in Sweden Conference*, Gothenburg.

Putnam, L. (2016) 'The Transnational and the Text-Searchable: Digitized Sources and the Shadows They Cast', *The American Historical Review*, 121(2), pp. 377–402.

Thylstrup, N. B. (2018) *The Politics of Mass Digitization*. Cambridge, Mass.: MIT Press.

Zaagsma, G. (2013) 'It's the context stupid', 14 July. Available at: http://www.gerbenzaagsma.org/blog/14-07-2013/it%E2%80%99s-context-stupid (Accessed: 27 February 2020).

DIXI - Arbetsrapporter från Institutionen för idé- och lärdomshistoria, Uppsala universitet. ISSN 1651-5285

1. Johan Östberg, *Frisinnets krig*: *Den kulturradikala svenska opinionen under första världskriget* (2002)

2. Tobias Dahlkvist, *Pudelns kärna – och pudelägarens: Om Schopenhauers medlidandebegrepp* (2003)

3. Louise Nilsson, *Voyeurismen i vetenskapen: Foucault, blicken och sekelskiftets sexologi* (2003)

4. Annika Berg, *Döda kroppar i vetenskapens tjänst: Om anatomiska dissektioner och utsatta människors rättigheter i 1920-talets Sverige* (2003)

5. Maria Björk, *Fånge i det kött hon föraktar: En analys av kultursjukdomen anorexia nervosas karriär* (2003)

6. Emma Nygren, *Äreminnen; Minnesbilder, meningsskapande och tolkningsprocesser omkring självmord i svensk dagspress 1932, 1941 och 1954* (2004)

7. Lars Garpenhag, *”En mot naturen stridande otuktslast”. Talet om avvikande manlig sexualitet inom svensk rättspsykiatrisk praktik 1911–15* (2005)

8. Petter Tistedt, *SVEA RIKE. Kunskap, publiker och lärande på Stockholmsutställningen 1930* (2005)

Arbetsrapportserien DIXI ersattes 2007 av Uppsala Papers in History of Ideas

UPPSALA PAPERS IN HISTORY OF IDEAS
ISSN 1654-2592

Redaktör: Sven Widmalm

9. Anders Ekström, *Samverkan som universitetspolitik. Historia, förnyelse, kunskapskultur* (2007)

10. Maria Björk, *Samtidens martyrer. Unga kvinnor, självskadande och media* (2007)

11. Andreas Rydberg, *Viljebegreppet och psykologin. En studie av psykologins framväxt som vetenskap i Sverige genom en analys av viljebegreppets betydelseförändring* (2008)

12. Karin Johannisson, red. *Sjukdomshistorier. Åtta korta essäer om medicin och kultur* (2008)

13. Anders Ekström, Solveig Jülich, Frans Lundgren och Per Wisselgren, *Vetenskapernas mediehistoria – kall eller varm? En forskningspresentation* (2010)

14. Peter Josephson, *Skriftfabriken. Om introduktionen av skriftställarskap som akademisk merit i Tyskland, 1750-1810* (2010)

15. Frans Lundgren, *Mediating the welfare state: Social museums, documentary film, and the education of the public in the 1940s* (2012)

16. Peter Josephson, *Universitetet, den lärde och den självlärde: Lärd identitetsbildning och pedagogiska reformdiskussioner i Tyskland, 1768–1810* (2013)

17. Benjamin G. Martin, *Computer-assisted research on cultural treaties: A methodological inquiry for the history of international ideas* (2016)

18. Thomas Karlsohn, *Digital Technology and Rhetoric in Swedish Educational History* (2018).

19. Ylva Söderfeldt, Karl Berglund, Matts Lindström, *Towards mining the history of the active patient. A mixed-methods discourse analysis of the journal Allergia, 1957–1990* (2019)

20. Jacob Orrje, *From Folios to Files. Evaluating the use of Handwritten text recognition to transcribe the protocols of the Swedish Bureau of Mines 1700–1840* (2020)

Institutionen för idé- och lärdomshistoria
Box 629
751 26 Uppsala

info@idehist.uu.se