Historiography and the Historical Profession

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# History and Virtual Topology: The Nineteenth-Century Press as Material Flow

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1 In cultural and art studies, new materialism and the ideas of Gilles Deleuze and Félix Guattari have become a common resource, but it seems that the historical scholarship still awaits its new materialist turn. It is true that historians have done research on the material dimensions of living conditions for a long time, and the study of material culture has aroused renewed interest in the last few years. Nevertheless, these research interests have been only vaguely related to new materialism. In another field, in the philosophy of history, significant monographs on Deleuze and Guattari's thought have appeared – those of Jay Lampert and Craig Lundy – but even if these are seminal on a theoretical level, they do not elaborate the basic ideas of the French thinkers as an inseparable part of historians' everyday practice.[1] Our aim in this article is to attempt to take the ideas of the virtual, constant becoming, and flow, which are integral to new materialism, and to put them in play in order to experiment with the ways in which historians could use them in their empirical work.

2 The point of embracing new materialism and its basic tenets is not only about gaining new issues or objects of study, the agency of matter, for instance; it is also about changing one's way of representing the world from one based on dualities and linearities into one that experiments with rhizomatic thinking and the nonlinear courses of events. Deleuze and Guattari challenge us to think differently, not along the lines of Western metaphysics with its idea of the transcendence of the immaterial but according to what the former called univocity, that is, the monistic way of seeing things and the whole cosmos.[2] This means that the activities of different kinds of bodies – be they humans, animals, bacteria, nation states, social institutions, computers, insects, or molecules – are the results of their immanent connections and entanglements with each other. Matter has an amazing number of affinities and capacities. For historians, it is important to acknowledge that Deleuze and Guattari were critical of German historicism, the idea of origins, teleological models, and the hierarchy which puts historical contexts prior to their parts. Being aware of these conditions, we will discuss, in concrete terms, the virtual topology in history by looking at certain rhizomatic tendencies of the nineteenth-century Finnish press in its long-lasting material flow.

3 Our article starts by following the trajectory of Deleuze's argument that the virtual must be distinguished from the possible. The concept of the virtual does not emphasise the world as we know it but rather its potential to transform itself beyond its actual forms and configurations. The article continues by exploring the potential of virtual topology to shed light on the actual forces, disruptions and variations that have changed a network or a particular state of affairs in the past. This is carried out through an analysis that focuses on the changes in the production and circulation of millions of texts within the Finnish press in the nineteenth century. The analysis is based on the methodological opportunities offered by recent developments in the digital humanities. In the Computational History and the Transformation of Public Discourse in Finland, 1640–1910 (COMHIS) project, we have studied text reuse, the circulation of information, in the Finnish press using algorithmic methods.[3] The concept of virtual topology can be effectively employed in this kind of analysis. In the Finnish context, this is highly relevant on the grounds that the newspaper corpus from 1771 to 1910 includes two million pages of newspaper material, half of it in Finnish, the other half in Swedish. How did the relationship between these two languages develop at a time when the press, as a cultural force and material flow, was in a state of rapid expansion? Through this elaboration, this article aims to draw attention to the multiple, parallel and complex processes of the past that were in a constant state of flux.

## *Virtual topology*

4 Since the days of Georg Wilhelm Friedrich Hegel and romanticism, history has been a domain of becoming, but Deleuze's definition of the virtual, without being a variant of dialectics, implies some basic differences that make it diverge from established notions of historical change and transformation. The concept of the virtual is the key to Deleuze's understanding of the past. In *Difference and Repetition*, Deleuze presents three syntheses of time in order to argue that the past is virtual. The first synthesis focuses on the present, analysing a common-sense understanding of time as a punctual movement where only the present point of time is accessible to us. However, the result of the first synthesis is an aporia: the present moment is constantly turning into past. The virtuality of the past comes forth in the second synthesis, which is needed to solve this aporia.[4] The argumentation of the second synthesis is sophisticated: Lampert has distinguished 13 different arguments that Deleuze makes to prove that the past is virtual, coexisting with the present.[5] Finally, Deleuze's third synthesis presents the future as the motor of change, as the "search engine", to use Lampert's apt characterisation.[6] The assumptions about the future developments provide incentives to decide which problems of the endless variety of the virtual past could be actualised.

5 Because the past can be actualised in the present in order to generate something new from it, it is important to notice the way in which it differs from the notion of the possible. Without diving too deep into the specifics of the exegesis on Deleuze, it is enough for our purposes to recall that the virtual is a member of a conceptual quartet in which the *possible* is opposed to the *real* and the *virtual* is the opposite of the *actual*. For Deleuze, the possible is merely a representation of the real. The concept of the possible is based on the idea of two worlds, those of the imagination (transcendence) and factuality (immanence). The former merely appropriates what is provided by the latter without producing anything fundamentally new. In contrast to the possible, the virtual is already part of the present. The virtual is not thus a possibility, a missed alternative, which is not yet realised. It is rather something immanent in reality that can actualise itself through divergence and creation.[7] The transformative potential of the present is *actualised* through an endless process of differentiation, but the virtual is not *realised* because it is already real.[8] Thus the past cannot be realised, because it has been real, but we can (and have to) constantly actualise it. Nevertheless, this actualisation of the virtual is never a mere reconstruction of the past "as it was": it generates something new through differentiation.

6 On the other hand, Deleuze does not assume that becoming is an arbitrary change without a direction, because it is manifested as a certain immanent structural development that can be topologically modelled.[9] Deleuze therefore maintains that the "reality of the virtual is structure".[10] However, the actualisation of the virtual structure is not static; it is produced through constant differentiation, which is also the principle behind the emergence of more advanced material forms without any external teleological purposes guiding the process. As Rob Shields has shown, the concept of cultural topology provides a means to illustrate the way in which various virtual structures are constantly present as alternative mappings of space and time. It is important to distinguish topology from three-dimensional Cartesian geometry. For instance, the map of the London Underground is a virtual diagram that presents the schematic relationships between lines that do not reflect the actual geometry of the underground lines. On the other hand, the tube map is not merely hypothetical, potential or transcendental; it is a truthful presentation of the immanent topology of the tube network that can be really used as reliable guidance for traveling and planning the fastest itinerary and at which station to change train. In this sense, a virtual structure cannot be reduced to geometry or actual geography, although it is real. Finally, since it was first created in 1931, the tube map has been constantly changed, thus creating completely new degrees of connectivity.[11]

7 To sum up, we do not assume either that the past could be objectively described "as it was" or that history is only a result of human interpretation. In contrast, we propose that the past is constantly constructed, but this ongoing becoming is not entirely a result of human interpretation. Various kinds of material flows, environmental conditions and other nonhuman processes contribute to the construction of the past inasmuch as our subjective categories of meaning-making. Deleuze's concept of the virtual describes this modality present in topological networks, including spontaneous variation and new surprising connections, which restructure the entire architecture of the network. However, in order to research the virtual in history, we need to find an approach for actualising it on the basis of empirical data. Deleuze's concept of the virtual has been discussed in ontology and the philosophy of history, but it is important to take into account that Deleuze and Guattari saw the role of the scientist as being different from that of the philosopher. In *What is Philosophy?*, they argue that, in contrast to ontology, sciences must have a point of reference. The role of science is to actualise the virtual by creating a freeze-frame of it.[12] If we apply this to historiography, the historian cannot present the past based on pure thought or analytic concepts; he or she needs primary sources and other references. In this article our aim is to show how these kinds of freeze-frame can be made in order to actualise the topological becoming of the Finnish newspaper network by applying the methods of the digital humanities.

## *Matter as flow: The expansion of the press in the nineteenth century*

8 The development of the nineteenth-century press is an appropriate subject for our purposes. It was a huge material flow, comprising tons and tons of paper and plenty of printing ink, which was regularly published, distributed and consumed by a wide audience, even on a national scale. In this article, we do not see it only as a passive medium, a reflective surface for human meaning-making and practical information, but also as an active agent which had its own tendencies and transformative potential.

9 Even though newspapers were already published in the seventeenth and eighteenth centuries, the next hundred years or so formed the most expansive era of their development, prior to the rise of the electronic media of radio and television. Actually, the nineteenth century as a whole was an era of expansion. The dynamics of industrialisation and the monetary economy, together with political upheavals, opened up new opportunities for social interaction and differentiation and increased the use of material and intellectual resources. It also made people travel and move, contributed to the growth of the cities, and, eventually, created a new sense of living in a world that was going through huge changes. "All fixed, fast-frozen relations, with their train of ancient and venerable prejudices and opinions are swept away," as Karl Marx and Friedrich Engels phrased it in *The Communist Manifesto*.[13] To a great extent, this dynamic expansion was due to capitalism. Deleuze and Guattari connect capitalism explicitly with the notion of the virtual. For them, capitalism and its constant flows of desires, products, resources and assemblages of bodies are tantamount to the tendency of the matter itself.[14] Capitalism was born of the encounter of two sorts of flows: the decoded flows of production in the form of money-capital, and the decoded flows of labour in the form of the "free worker". Hence, unlike previous social formations, the capitalist mode of production is incapable of providing a code that will apply to the whole of the social field. However, by substituting money for the very notion of a code, it has created an axiom of abstract quantities that moves continually further and further in the direction of the confusion and reorganisation of the social sphere.[15]

10 To describe the expansion of the nineteenth-century press as a linear or sometimes even exponential development with a constant growth of resources, volume and coverage is accurate, generally speaking, but also quite superficial. The press was more than just a success story of the rising bourgeoisie; it was a network, a huge body, which had its own speed, its own movements, and critical thresholds. Pertaining to the last- mentioned concept, for example, one could make an inquiry into one of the intensive properties of the press, that is, speed. One could follow the continuous growth of the news material in several newspapers and observe at a certain point whether or when the frequency of publication increases due to the demands of the textual mass, which constantly piles up. In this way, one would be able to locate a critical threshold after which the speed of the press changes its rhythm. There are good grounds for doing this. In German newspapers, the proportion of news less than a day old rose from 11 percent in 1856 to 95 percent in 1906.[16] Presumably, this change also increased readers' expectations for topicality on the pages and their resonance with the immediate present. Before rushing on with questions such as these, however, let us first have a brief look at some structural features of the constant flow of the press material.

11 Around the year 1800, the steam press invented by German Friedrich Koenig made printing much more rapid. Together with the rise of cheap paper produced from wood pulp, it made possible an era of mass communication; in the nineteenth century, newspapers reached more people on a regular basis than ever before.[17] Having established itself in Germany, Britain and the United States, a dynamic press quickly developed in Canada, Australia and New Zealand, too. In Canada, a country with a population of 4.3 million, around 30 million newspapers were sent through the mail in 1880. An English visitor to Melbourne in the late 1850s was amazed to see a newspaper in every doorway when she went for a morning stroll. The press also adopted advanced communication technology. Information routes were greatly enhanced when the electrical overland telegraph came into use in 1844. The first durable underwater cable was laid across the English Channel in 1851, and a permanent transatlantic link was established in 1866.[18]

12 These changes quickly turned the press into a network, which gained a rhizomatic nature. News, stories, announcements and anecdotes spread with accelerating pace all over the globe. This flow was nonlinear and uncontrolled. Since there was no international copyright agreement prior to Berne Convention for the Protection of Literary and Artistic Works of 1886, quoting, translating and paraphrasing texts in a liberal spirit became a standard procedure in newspapers.[19] For instance, Finnish author, professor and journalist Zacharias Topelius (1818–98), who edited *Helsingfors Tidningar*, one of the most famous newspapers in Finland in the 1840s and 1850s, diligently used many foreign newspapers as his sources. In the first half of the 1850s, he quoted and paraphrased news and other materials from the *St. Petersburgische Zeitung*, *Post- och Inrikes Tidningar*, *Augsburger Allgemeine Zeitung*, *Journal de St. Pétersbourg*, *L'Indépendance Belge*, *La Presse*, *Le Siècle* and *Journal des Débats*, among others.[20] The verification of the stories and news published was not of primary importance; dissemination had priority. Understandably, rumours spread. In the development of the press, the communicative function has always dominated. Little wonder that in the 1830s, before Topelius was hired as editor, *Helsingfors Tidningar* was already referred to as a *sqvallertidning*, a tabloid.[21]

13 Textual recycling made the press material extremely heterogeneous and has characterised it ever since. As Benedict Anderson puts it aptly, "reading a newspaper is like reading a novel whose author has abandoned any thought of a coherent plot".[22] There are no organising centres or hierarchies in the flow (or they are very temporary), but there are material forces and tendencies which constitute the extensive and intensive properties of the press: volume, coverage, speed, density and concentration, to name the most obvious. In this article, the actualisation of the virtual is made discernible by detecting reused texts in this flow of information. It enables us to analyse the topological network of the nineteenth-century press.

## *Analysing material flow through text reuse detection*

14 The early nineteenth century is fruitful for the analysis of not only matter as flow but also of the underlying diagram of forces that continuously produced and maintained the rhizomatic operations of the press. The multiplicity of press discourses gave room for parallel, even opposing, developments. This multiplicity was an actualisation of the virtual that was impossible to grasp for contemporaries simply because so many rhizomatic processes and chains of events were going on simultaneously. It is essential, then, to consider which kinds of methods could be employed to unfold the many entangled trajectories that were emerging at the same time. Since the 1990s, newspaper collections have been digitised and opened up for researchers in numerous countries worldwide. Newspapers represented big data in the nineteenth century, and now they can serve as a basis for text mining. The digitised collections offer access to the many cultural, economic, political and social transformations that took place during the first half of the nineteenth century. In the 1840s, English politician and author Sir Edward Bulwer-Lytton argued that the newspaper is "the chronicle of civilisation, the common reservoir into which every stream pours its living waters, and at which every man may come and drink".[23]

15 What is compelling from the perspective of virtuality is that it not only enables the exploration of this vast range of material but also the development and refinement of methods for detecting connections within the datasets without knowing beforehand what these connections might be. This enables the data itself to "propose" relations that otherwise would not have come to the fore. There is a wider epistemological aspect in this setting: What kinds of methods would enable us to grasp the past as a process of becoming and to assess the plethora of past phenomena, conditions for later evolutions, or dead ends that later, perhaps, became activated?

16 When the parallel trajectories of news items are at stake, an especially fruitful method is to try to trace reprinted texts, or fragments of texts, and analyse how the chains of these repetitions emerge, intertwine and, eventually, amplify or disappear. This involves two parts: first, the detection of reprinted texts and, second, the clustering[24] of these similar texts so that their itineraries can be studied in detail, both temporally (how the chains evolved in time and how long they lasted) and spatially (how the chains spread in geographical terms). Both of these operations draw on computational, algorithmic methods. This requires that the entire dataset is available as a data dump that contains all necessary metadata and the actual corpus either as XML or JSON files. In the case of Finnish newspapers, all issues from 1771 until 1910 are available for research.[25] The COMHIS project has processed Finnish newspaper material with algorithmic methods that draw on bioinformatics. The project has applied Basic Local Alignment Search Tool (BLAST) software, which traces regions of similarity between sequences. It is often used in the study of nucleotide or protein sequences, but it can be effectively employed to identify similarities in textual material.[26] When these similarities have been clustered, in total eight million passage clusters containing around 49 million repeating passages have been tracked.[27]

17 Finnish literary culture in the nineteenth century was radically changed by the newspaper business. Therefore, the spread of copying offers a particular insight into this process. It can be assumed that the changes in the amount and interrelatedness of clusters, decade by decade, will shed light on how the explosion of the press took place in the end. Furthermore, it may give an impression of how the proportions between the Swedish- and Finnish-language press changed over time. If we emphasise history as a process of becoming, this cannot be viewed, however, as a linear process, or as a development that retrospectively seems to have a certain end.

18 Indeed, the extraction of clusters of reused texts offers a way to analyse the early nineteenth-century press as an open process. It offers an avenue for exploring horizontal, simultaneous states of affairs, and also for identifying changes that might have had profound effects in the long run. In the social sciences, complexity theory has been employed, for example, to analyse social systems as dynamic rather than static and as something evolving into domains of instability and emerging into new structures.[28] John McKim Malville, for example, has interpreted pilgrimage as a social phenomenon from the perspective of complexity and self-organisation, where nonlinear processes in the end make the system depart from its equilibrium. The amplification of small fluctuations results in a "stress-releasing avalanche-like movement of people to pilgrimage centers".[29]

19 Following these thoughts, we may conclude that the study of text reuse and the clusters of the digitised newspaper collections enable us to see how changes took place in early nineteenth-century culture and how they were amplified through the press. Interestingly, within the press, particular themes or items received a specific gravitation through the nonlinear process of reprinting texts from paper to paper, in an infectious manner. Thus, there was a quality of self-amplification within the system.[30] These fluctuations might have led to radical changes in the network. From the perspective of the early nineteenth-century Finnish press, it is important to find ways of describing, for example, how the development of the Finnish-language press, in relation to the Swedish-language one that was dominant at the time, changed the topology of the network.

## *Material flow organised: a topology of Finnish newspapers*

20 In the nineteenth century, many modern topological structures, such as the railroad network and telegraph lines, were either created or radically expanded. Historical research can use computational methods to track down the topologies of various systems of the past, in our case the newspaper network. This becomes obvious as the publication years of the press titles and their circulation are well known, but they do not tell us anything about the interaction between various newspapers. We argue that the application of BLAST, the text reuse detection algorithm mentioned in the previous section, enables the charting of a blueprint of a past communications system, such as the topology of early nineteenth-century newspapers, when combined with network analysis.

21 After the clustering of the BLAST results, we used Gephi – a standard network analysis software – to illustrate the topological relationships between the newspapers. By assuming that the titles of the newspapers and the reprinted texts are *nodes* (points in space) and shared stories are *edges* (lines connecting the points), we can import these results into a graph that illustrates the varying topology of this network.[31] The edges are necessary for the calculation of the figure, but because of the enormous number in our data, they are not included in the figures in order to ensure readability.

22 Figure 1 shows a two-dimensional projection of the topological space of the Finnish press from 1825 to 1830. The size of the nodes reflects the volume of republished texts between a specific newspaper title and all other newspapers in the network. In other words, the larger the node, the more power the title had during that time. The small dots represent the individual text items that were reprinted. When it comes to volume, the Swedish-speaking papers *Åbo Tidningar* and *Åbo Underrättelser*, based in Turku, were the most significant distributors of texts in the network. Turku was still the most populous Finnish city until the 1840s, although Helsinki was made the capital of the Grand Duchy of Finland in 1812: higher administration moved there from Turku in 1819 and the university in Turku followed in 1828.

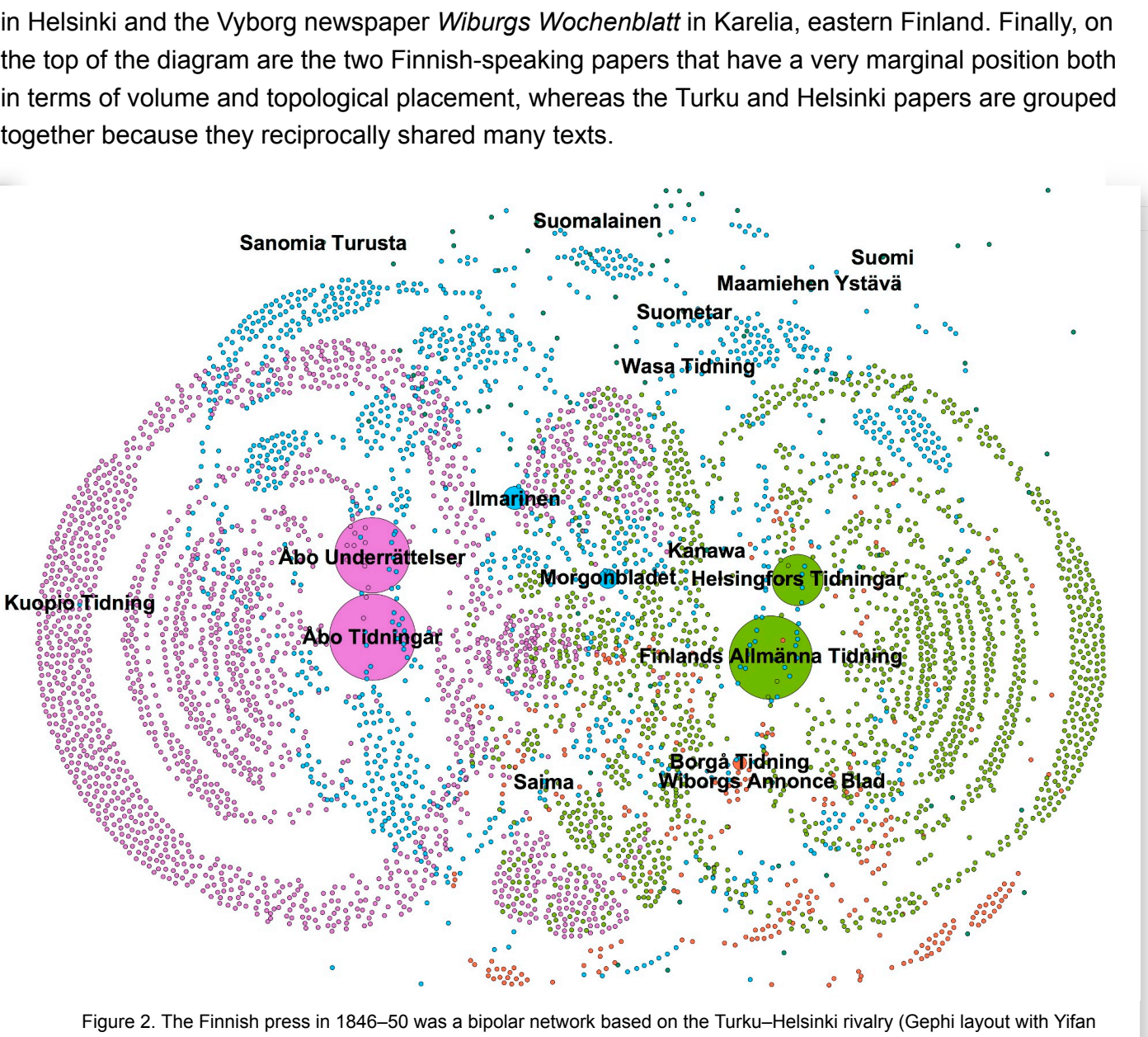

Figure 1. Finnish newspapers in 1825–30 were centralised around the official *Finlands Allmänna Tidning* (Gephi layout with Yifan Hu algorithm)

23 However, from the point of view of network analysis, the topology of the network is more significant than the mere volume. The placement of the nodes represents their position in the network as communication hubs: the influential titles are located in the centre, the more marginal ones on the side, and closely associated titles are grouped together. The official paper *Finlands Allmänna Tidning* based in Helsinki is located as the hub between the dual nodes of Turku papers and the small nodes of two local newspapers, *Helsingfors Tidningar* and *Tidningar ifrån Helsingfors*, in Helsinki and the Vyborg newspaper *Wiburgs Wochenblatt* in Karelia, eastern Finland. Finally, on the top of the diagram are the two Finnish-speaking papers that have a very marginal position both in terms of volume and topological placement, whereas the Turku and Helsinki papers are grouped together because they reciprocally shared many texts.

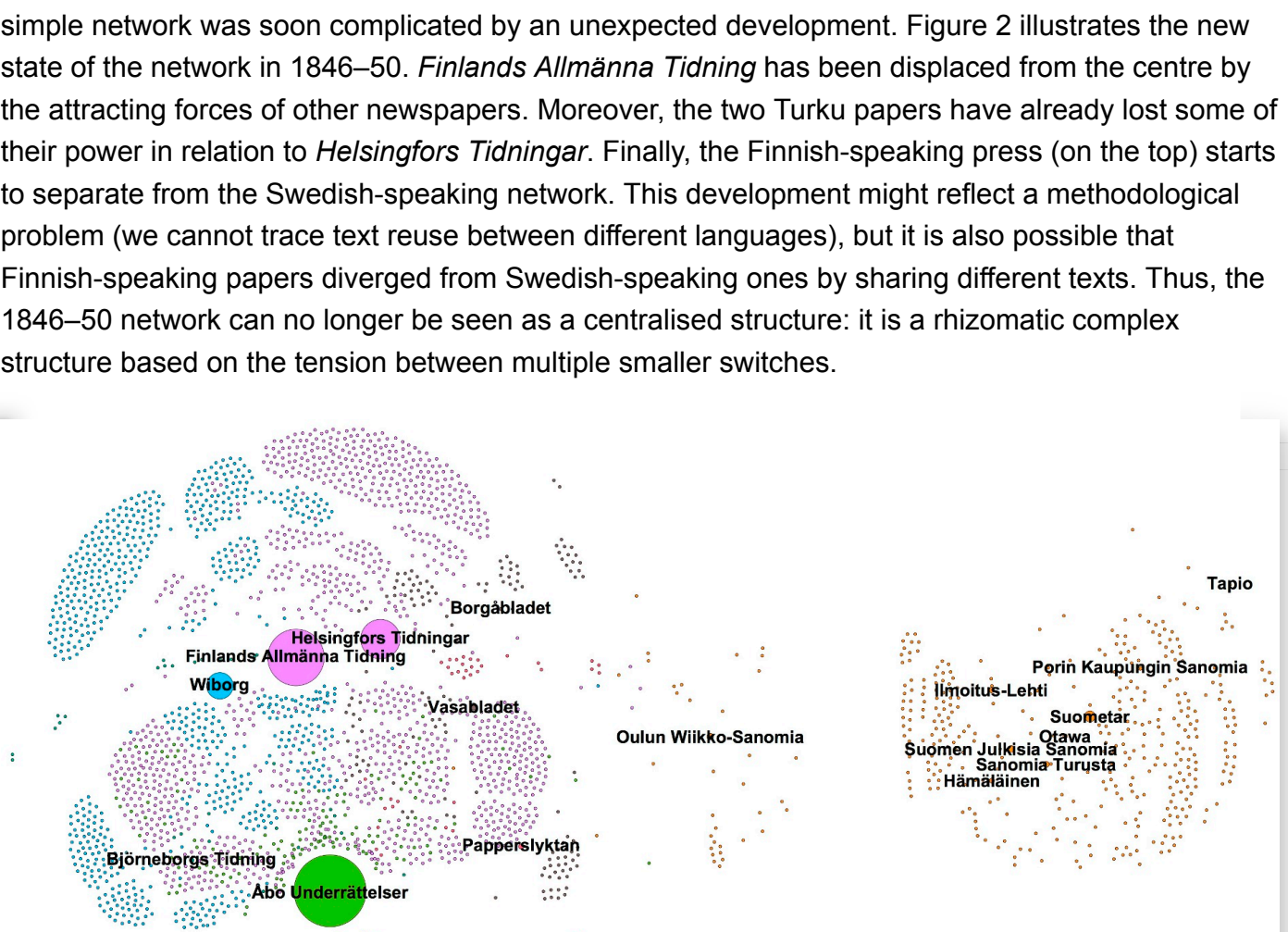

Figure 2. The Finnish press in 1846–50 was a bipolar network based on the Turku–Helsinki rivalry (Gephi layout with Yifan Hu algorithm)

24 The 1820s network was still highly centralised around the official newspaper *Finlands Allmänna Tidning*: it was located in the centre as a connection hub serving the circulation of texts to local papers. In Deleuzian terms, it could be described as a rigid molar order of official power. Deleuze and Guattari argue that two types of forces coexist in reality, molar and molecular: while the molar constitutes wholes, molecular forces tend to animate reverse movements.[32] However, this relatively simple network was soon complicated by an unexpected development. Figure 2 illustrates the new state of the network in 1846–50. *Finlands Allmänna Tidning* has been displaced from the centre by the attracting forces of other newspapers. Moreover, the two Turku papers have already lost some of their power in relation to *Helsingfors Tidningar*. Finally, the Finnish-speaking press (on the top) starts to separate from the Swedish-speaking network. This development might reflect a methodological problem (we cannot trace text reuse between different languages), but it is also possible that Finnish-speaking papers diverged from Swedish-speaking ones by sharing different texts. Thus, the 1846–50 network can no longer be seen as a centralised structure: it is a rhizomatic complex structure based on the tension between multiple smaller switches.

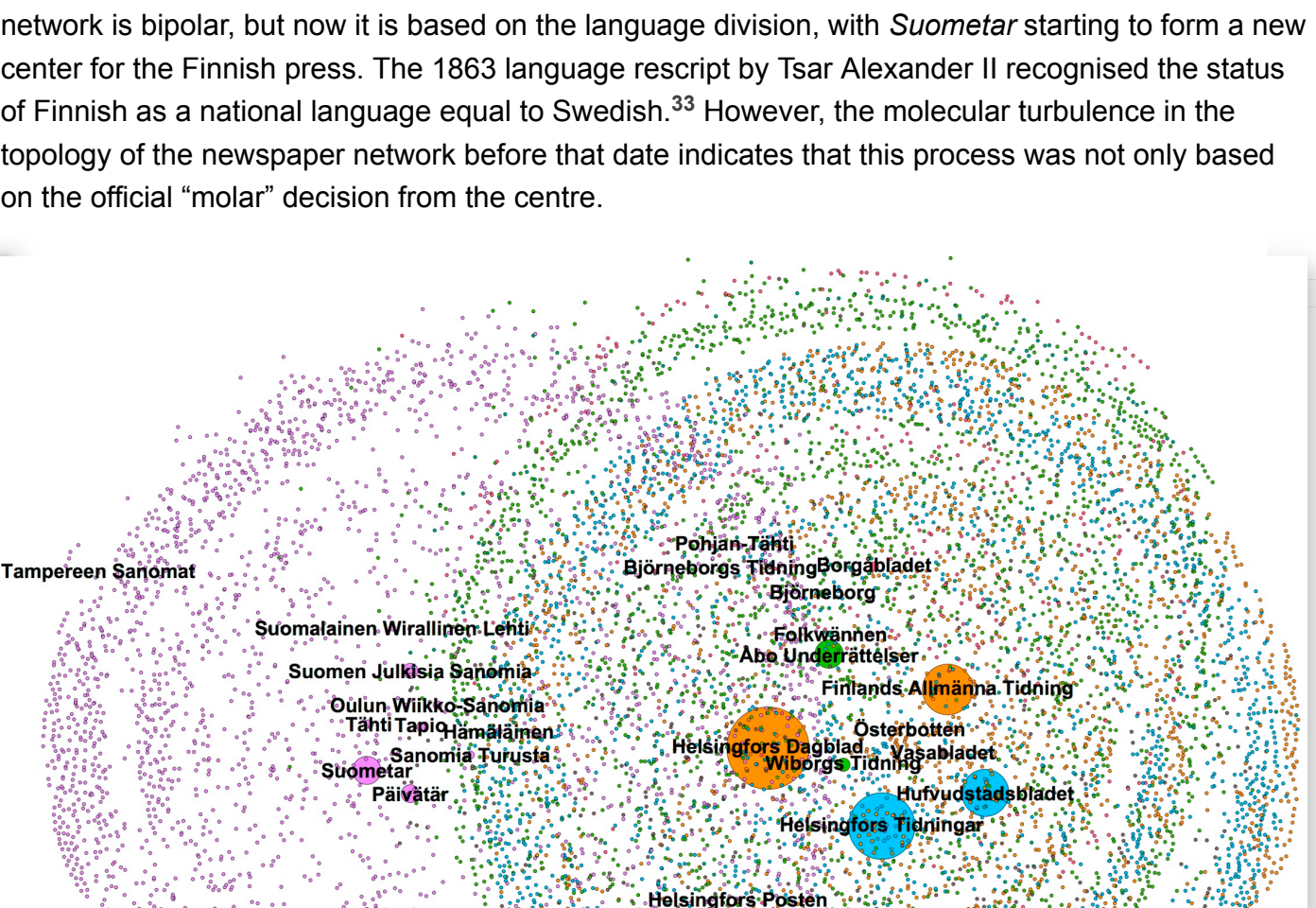

Figure 3. The turbulent phase of the press in 1860 (Gephi layout with Yifan Hu algorithm)

25 The Finnish newspaper network had become even more complex by 1860, as is shown in Figure 3. The Swedish-speaking network is still divided into two centers based on the Turku–Helsinki rivalry, but the old Swedish-speaking network and the emerging Finnish one are only thinly connected by the small hub of *Oulun Wiikko-Sanomia* located in between them. Geographically, the paper was the most northern one, published in the city of Oulu. Although we cannot confirm the actual amount of relations between papers published in different languages, the emergence of the Finnish-speaking network is nevertheless interesting, because it appears to be a molecular network without a clear molar center or a single powerful hub: for example the nodes of *Oulun Wiikko-Sanomia* or *Suometar* have too little a volume to be considered as such. The final result of the process – a state of new temporary stability – is indicated in Figure 4 concerning 1865. Again, the network is bipolar, but now it is based on the language division, with *Suometar* starting to form a new center for the Finnish press. The 1863 language rescript by Tsar Alexander II recognised the status of Finnish as a national language equal to Swedish.[33] However, the molecular turbulence in the topology of the newspaper network before that date indicates that this process was not only based on the official "molar" decision from the centre.

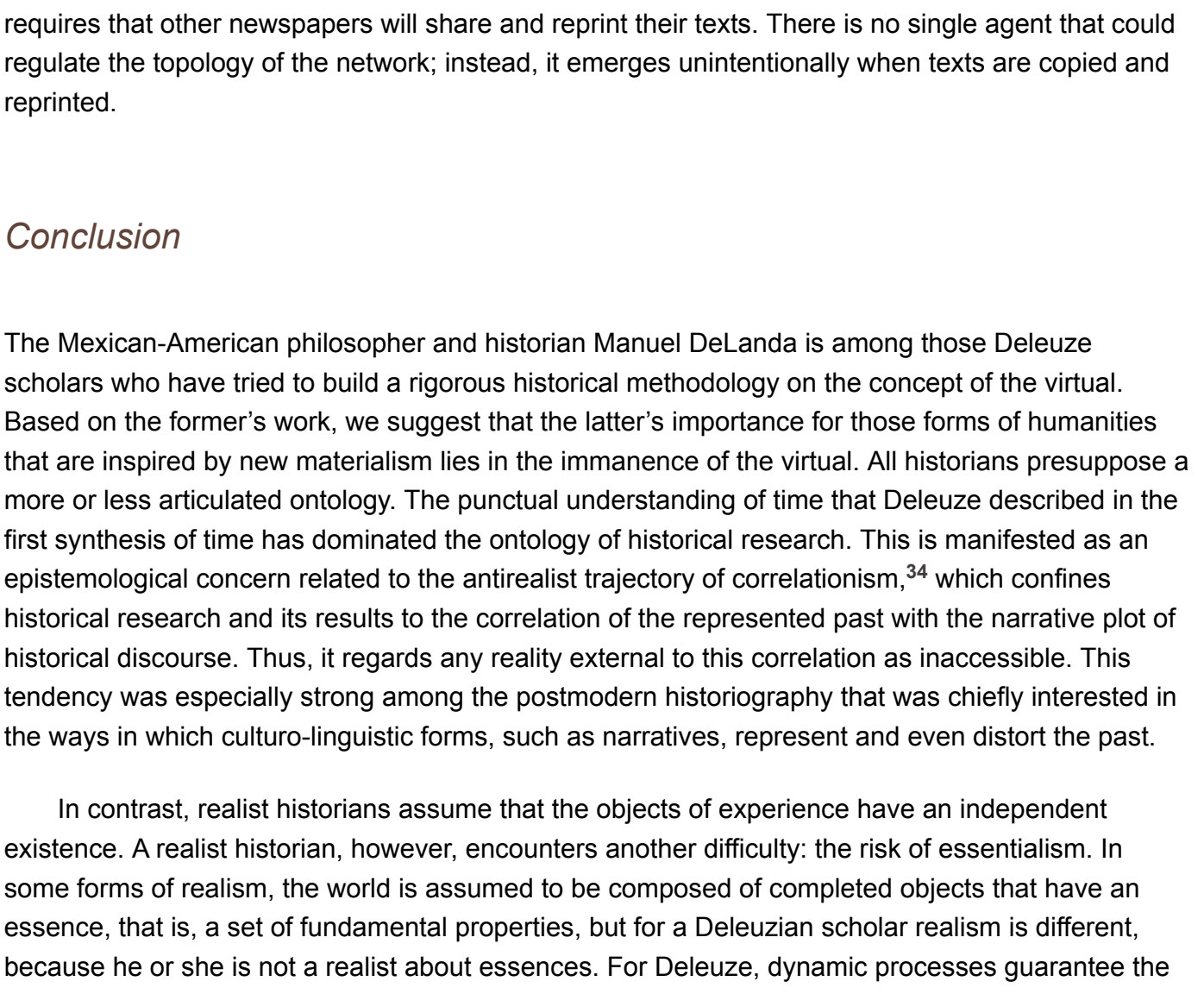

Figure 4. The new bipolar stability in 1865 was based on the Swedish–Finnish language divide (Gephi layout with Yifan Hu algorithm)

26 As we have shown above, the network analysis of the Finnish press is able to provide a new and interesting perspective on the virtual topology of nineteenth-century newspapers and the way in which it dynamically changed over the decades. When the connectivity of the network increases, its topology becomes more and more complex and nonhierarchical. Because of this, it is important to recognise that the individual papers cannot control the complete network: gaining influence in it requires that other newspapers will share and reprint their texts. There is no single agent that could regulate the topology of the network; instead, it emerges unintentionally when texts are copied and reprinted.

## *Conclusion*

27 The Mexican-American philosopher and historian Manuel DeLanda is among those Deleuze scholars who have tried to build a rigorous historical methodology on the concept of the virtual. Based on the former's work, we suggest that the latter's importance for those forms of humanities that are inspired by new materialism lies in the immanence of the virtual. All historians presuppose a more or less articulated ontology. The punctual understanding of time that Deleuze described in the first synthesis of time has dominated the ontology of historical research. This is manifested as an epistemological concern related to the antirealist trajectory of correlationism,[34] which confines historical research and its results to the correlation of the represented past with the narrative plot of historical discourse. Thus, it regards any reality external to this correlation as inaccessible. This tendency was especially strong among the postmodern historiography that was chiefly interested in the ways in which culturo-linguistic forms, such as narratives, represent and even distort the past.

28 In contrast, realist historians assume that the objects of experience have an independent existence. A realist historian, however, encounters another difficulty: the risk of essentialism. In some forms of realism, the world is assumed to be composed of completed objects that have an essence, that is, a set of fundamental properties, but for a Deleuzian scholar realism is different, because he or she is not a realist about essences. For Deleuze, dynamic processes guarantee the tangibility of objects and these morphogenetic processes are always immanent. Finally, DeLanda maintains that these material processes have a virtual structure, which is almost always nonlinear, linear developments being more an exception than a rule.[35] Respectively, our topological models of the nineteenth-century press have shown the way in which the impact of a relatively small event, a publication of a text, might have major consequences in the communication network, if that text is copied and disseminated massively. This can be compared to a feedback loop, where input is amplified through the recursive operation of the system.

29 Our research frame juxtaposes human meaning-making and intentional activities with material flows. In this scheme, which can be seen either in dualistic or monistic terms (and the latter is preferred here), our methodological agenda is based on the assertion that the virtual is not only a concept for philosophers, theorists and cultural critics, but that it can be explored and made tangible in a historical context as well. Naturally, focusing on the virtual topology and computational methods is just one option out of many, since almost everything can be studied from the perspective of material flow by drawing on different kinds of methods and approaches. Studying the virtual is not merely, or primarily, a matter of computation, even though recent developments in data processing have given a special twist to this issue.

30 As far as the digital humanities are concerned, they are themselves an outcome of a process in which the complexity of the binary system run by various electronic devices has increased to a point where the actualisation of the virtual can be grasped, as we have done, by text reuse detection. The rhizomatic processes of the press, far too extensive to discern and identify for a single scholar or even a large group of scholars, are thus approached through algorithmic methods by detecting nonhierarchical chains of textual repetition. In this way, the virtual dimension of the source material is entangled, on an immanent level, with the virtual dimension of electronic devices and their capacities. This setting has wider implications. Material interaction beyond human meaning-making and intentionality also enhances the abilities of scholars working on these issues. In order to promote the possibilities and future vistas of the digital humanities, we suggest that the idea of the virtual offers opportunities to bridge the gap between the anthropocentric orientation and those approaches that are based on computational methods and data processing.

NOTES

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[1] Jay Lampert, *Deleuze and Guattari's Philosophy of History* (London: Continuum, 2006); Craig Lundy, *History and Becoming: Deleuze's Philosophy of Creativity* (Edinburgh: Edinburgh University Press, 2012).

[2] Deleuze borrowed the notion of ontological univocity from John Duns Scotus, a late medieval philosopher. For further detail, see Gilles Deleuze, *Difference and Repetition*, trans. Paul Patton (London: Continuum, 2001), 28–69; Nathan Widder, "John Duns Scotus," in *Deleuze's Philosophical Lineage*, eds. Graham Jones and Jon Roffe (Edinburgh: Edinburgh University Press, 2009), 27–43.

[3] The universities of Helsinki and Turku and the National Library of Finland participate in the project, which is funded by the Academy of Finland. For more information, see the project website: http://comhis.fi.

[4] Deleuze, *Difference and Repetition*, 79; Lampert, *Deleuze and Guattari's Philosophy of History*, 28–29.

[5] Lampert, *Deleuze and Guattari's Philosophy of History*, 31–50.

[6] Ibid., 51.

[7] Gilles Deleuze, *Bergsonism*, trans. Barbara Habberjam and Hugh Tomlinson (New York: Zone Books, 1991), 96–97.

[8] Deleuze, *Difference and Repetition*, 211–12.

[9] On topology, see Rob Shields, "Cultural Topology: The Seven Bridges of Königsburg, 1736," *Theory, Culture & Society* 29/4–5 (2012): 43–57.

[10] Deleuze, *Difference and Repetition*, 209. As Manuel DeLanda has shown, this virtual structure can be seen as Henri Poincare's topological space. Manuel DeLanda, *Intensive Science and Virtual Philosophy* (London: Continuum, 2002), 14. On cultural topology, see Celia Lury, Luciana Parisi and Tiziana Terranova, eds., "Topologies of Culture," special issue, *Theory, Culture & Society* 29/4–5 (2012).

[11] Rob Shields, *Spatial Questions: Cultural Topologies and Social Spatialisation* (Los Angeles: Sage, 2013), 453.

[12] Gilles Deleuze and Félix Guattari, *What Is Philosophy?* Translated by Hugh Tomlinson and Graham Burchell (London: Verso, 2009), 117–18.

[13] Karl Marx and Friedrich Engels, *The Communist Manifesto*, trans. Samuel Moore (London: Penguin, 2015), 6.

[14] Claire Colebrook, "Introduction," in *Deleuze and History*, ed. Jeffrey A. Bell and Claire Colebrook (Edinburgh: Edinburgh University Press, 2009), 7–8.

[15] Gilles Deleuze and Félix Guattari, *Anti-Oedipus: Capitalism and Schizophrenia*, 10th ed., trans. Robert Hurley, Mark Seem and Helen R. Lane (Minneapolis: University of Minnesota Press, 2000), 33.

[16] Jürgen Osterhammel, *The Transformation of the World: A Global History of the Nineteenth Century*, trans. Patrick Camiller (Princeton: Princeton University Press, 2014), 30.

[17] Peter Burke, *A Social History of Knowledge*, vol. 2, *From the Encyclopédie to Wikipedia* (Cambridge: Polity Press, 2012), 97–98.

[18] Osterhammel, *Transformation*, 31, 37.

[19] On the globalisation of media space, see, for example, Hannu Salmi, "Viral Virtuosity and the Itineraries of Celebrity Culture," in *Travelling Notions of Culture in Early Nineteenth-Century Europe*, ed. Hannu Salmi, Asko Nivala and Jukka Sarjala (New York: Routledge, 2016), 145.

[20] Jukka Sarjala, *Musiikkimaun normitus ja yleinen mielipide: Musiikkikritiikki Helsingin sanomalehdistössä 1860–1888* (Turku: Turun Yliopisto, 1994), 65.

[21] See August Schauman, *Från sex årtionden i Finland*, vol. 1, *Upptecknade lefnadsminnen* (Helsingfors: G. W. Edlund, 1892), 49.

[22] Benedict Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism*, rev. ed. (London: Verso, 2006), 33.

[23] "Diffusion of Newspaper Knowledge, &c." (Bulwer's address at the opening of Lincoln News-room), *The Odd Fellows' Magazine*, n.s., April 1839, 294.

[24] Clustering is an essential area in data mining, the task of grouping a set of objects together, in this case on the basis of their similarity. On cluster analysis, see Boris Mirkin, *Clustering: A Data Recovery Approach*, 2nd ed. (Boca Raton: CRC Press, 2013), xiii.

[25] The 1771–1874 dataset is available from the National Library of Finland: The Newspaper and Periodical OCR Corpus of the National Library of Finland (1771–1874), http://urn.fi/urn:nbn:fi:lb-2015051201, accessed 24 April 2018. On the opening of the complete 1771–1910 dataset, see Tuula Pääkkönen, Jukka Kervinen, Asko Nivala, Kimmo Kettunen and Eetu Mäkelä, "Exporting Finnish Digitized Historical Newspaper Contents for Offline Use," *D-Lib Magazine* 22/7–8 (2016), https://doi.org/10.1045/july2016-paakkonen, accessed 24 April 2018. In Finland, newspapers were also published in German and Russian, but the main corpus is in Swedish and Finnish.

[26] Aleksi Vesanto, Asko Nivala, Heli Rantala, Tapio Salakoski, Hannu Salmi and Filip Ginter, "Applying BLAST to Text Reuse Detection in Finnish Newspapers and Journals, 1771–1910," *Proceedings of the NoDaLiDa 2017 Workshop on Processing Historical Language*, ed. Gerlof Bouma and Yvonne Adesam (Linköping: Linköping University Electronic Press, 2017), 54–58, http://www.ep.liu.se/ecp/133/010/ecp17133010.pdf; Aleksi Vesanto, Asko Nivala, Tapio Salakoski, Hannu Salmi and Filip Ginter, "A System for Identifying and Exploring Text Repetition in Large Historical Document Corpora," *Proceedings of the 21st Nordic Conference of Computational Linguistics*, ed. Jörg Tiedemann (Linköping: Linkoping University Electronic Press, 2017), 330–33, http://www.ep.liu.se/ecp/131/049/ecp17131049.pdf. Our method differs from previous projects on text reuse detection. Cf. Ryan Cordell, "Reprinting, Circulation, and the Network Author in Antebellum Newspapers," *American Literary History* 27/3 (2015): 417–45; David A. Smith, Ryan Cordell and Abby Mullen, "Computational Methods for Uncovering Reprinted Texts in Antebellum Newspapers," *American Literary History* 27/3 (2015): E1–E15.

[27] All hits and clusters can be browsed in our database. See Aleksi Vesanto, Filip Ginter, Hannu Salmi, Asko Nivala, Reetta Sippola, Heli Rantala, Petri Paju, *Text Reuse in Finnish Newspapers and Journals, 1771–1910*, http://comhis.fi/clusters.

[28] Kenyon B. De Greene, "Field-Theoretic Framework for the Interpretation of the Evolution, Instability, Structural Change and Management of Complex Systems," in *Chaos Theory in the Social Sciences: Foundations and Applications*, ed. L. Douglas Kiel and Euel Elliott (Ann Arbor: University of Michigan Press, 1997), 273–76.

[29] John McKim Malville, "Complexity and Self-organization in Pilgrimage Systems" (paper presented at the Pilgrimage and Complexity conference, Indira Gandhi National Centre for the Arts, New Delhi, 5–9 January 1999), http://www.colorado.edu/Conferences/pilgrimage/papers/Malville-Pap/kimpap1.html, accessed 3 May 2016.

[30] On self-amplification, see Glen A. Mazis, *Humans, Animals, Machines: Blurring Boundaries* (New York: State University of New York Press, 2008), 116.

[31] On Gephi, see https://gephi.org. On network analysis, see Ian McCulloh, Helen Armstrong, and Anthony Johnson, *Social Network Analysis with Applications* (Hoboken: Wiley, 2013).

[32] See, for example, Anne Sauvagnargues, *Deleuze and Art*, trans. Samantha Bankston (London: Bloomsbury Press, 2013), 120–21.

[33] Lars Landgren, "Kieli ja aate – politisoituva sanomalehdistö 1860–1889," in *Suomen lehdistön historia*, vol. 1, *Sanomalehdistön vaiheet vuoteen 1905*, ed. Päiviö Tommila (Kuopio: Kustannuskiila, 1988), 270.

[34] See Quentin Meillassoux, *After Finitude: An Essay on the Necessity of Contingency*, trans. Ray Brassier (London: Continuum, 2009).

[35] DeLanda, *Intensive Science and Virtual Philosophy*, 3, 13. See also, Manuel DeLanda, *A Thousand Years of Nonlinear History* (New York: Swerve, 1997).