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Introduction: "Speaking to the Eyes"— Reassessing the Enlightenment in the Digital Age

Ileana Baird

On inspecting any one of these Charts attentively, a sufficiently distinct impression will be made, to remain unimpaired for a considerable time, and the idea which does remain will be simple and complete.
—William Playfair, *The Commercial and Political Atlas* (1786)

The greatest value of a picture is when it forces us to notice what we never expected to see.
—John W. Tukey, *Exploratory Data Analysis* (1977)

I start my argument about the necessity of this book by imagining a dialogue of sources, almost two hundred years apart. Writing in 1786 on the expressive power of his revolutionary charts, William Playfair argued for

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their usefulness in a manner typical of Enlightenment rationalism, which is predicated on the belief that empirical knowledge is grounded in our senses. His language is notably reminiscent of this belief: the visual "impression" his charts make is "distinct," "unimpaired," "simple," "complete," and lasting.[1] They convey the message vividly, clarify beyond doubt, and stand the test of time. To this description of scientific certainty John W. Tukey adds the element of surprise: a good picture is that in which what we "see" is forced upon us almost against our will. Playfair's focus on the attentive "inspection" of a picture is shifted in Tukey's assessment to an unexpected epiphany, or sudden "notice," of something that we could not see before.[2] The seeing is no longer believing but serendipitously discovering something new.

Simply and effectively defined by Andy Kirk as "the representation and presentation of data to facilitate understanding,"[3] data visualization allows the researchers to perceive, comprehend, and interpret data in new and innovative ways, based on their preexisting knowledge. Its aim is not only *to convey* information in a visually memorable way, as Playfair suggested, but also *to make visible* information that otherwise would be buried in large amounts of data. Patterns, trends, relations, absences even—are all brought to the fore, suddenly noticed, and, as a result, explored and their possible implications unveiled. The advent of computational methods has changed, in other words, the very way in which we think about the object of our study.

For scholars of the Enlightenment, the opportunities created by conducting their work in a Golden Age of data graphics have been momentous. Institutional projects, digital humanities centers, and individual initiatives in the field of eighteenth-century studies, some of which are attentively discussed in the afterword to this book, have flourished in recent years, many of them placing data visualization at the center of their endeavors. In the past decade, all major national and international conferences in the field have hosted panels, workshops, or roundtable discussions that focused on the use of digital methods to shed new light on the "big data" made available by important digital archives, such as *Early*

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[1] William Playfair, *The Commercial and Political Atlas: Representing, by Means of Stained Copper-Plate Charts, the Exports, Imports, and General Trade of England, at a Single View* (London: Printed for J. Debrett et al., 1786), 4.

[2] John W. Tukey, *Exploratory Data Analysis* (Reading, MA: Addison-Wesley, 1977), vi.

[3] Andy Kirk, *Data Visualization: A Handbook for Data Driven Design* (London: Sage, 2016), 19.

English Books Online (EEBO) or *Eighteenth-Century Collections Online* (ECCO). Such academic venues have been hotspots of significant digital work: the *Digitizing Enlightenment* symposium series at the University of Australia, for instance, sprang from a conversation that took place at the annual meeting of the Society for French Historical Studies in 2014, and materialized recently in the publication of an edited collection with the same title.[4] More recently, the 15th Congress of the Enlightenment, organized by the International Society for Eighteenth-Century Studies (ISECS) in Edinburgh in 2019, hosted an impressive number of panels that discussed the new affordances of digital technologies and the novel ways in which eighteenth-century researchers can communicate their findings by using such methods. This interest culminated in a day-long special event organized by The Voltaire Foundation on the use of digital methods in our discipline, an event that gathered a significant number of presenters, many of whom supported their arguments with suggestive visualizations. Our own collection stemmed from a roundtable discussion on *Data Visualization in Eighteenth-Century Studies* organized at the 49th Annual Meeting of the American Association of Eighteenth-Century Studies (ASECS) in 2018 and from ongoing conversations that ensued in two ISECS panels: *The Digital Eighteenth-Century: Directions and Opportunities*, and *Digital Approaches to Eighteenth-Century Studies.*

This is not to say that the strides made by data visualization in our discipline and beyond have come without challenges. Chart junk, distortions in presenting data, illegibility when too much data is translated in visual form, biases or access limitations in collecting data, a lack of tools to represent data in a meaningful way by humanist measures, and even loss of work due to digital tools or programming languages being constantly upgraded are all real. Moreover, as Johanna Drucker cautions, "graphical tools are a kind of intellectual Trojan horse": we should be constantly reminded to put techniques of graphical display on a foundation that is humanistic in nature and able to reflect not only existing information but also interpretive complexity. As Drucker explains, this means that, "[a]t the very least, humanists beginning to play at the intersection of statistics and graphics ought to take a detour through the substantial discussions of the sociology of knowledge and its developed critique of realist models of

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[4] Simon Burrows and Glenn Roe, eds., *Digitizing Enlightenment: Digital Humanities and the Transformation of Eighteenth-Century Studies* (Liverpool: Voltaire Foundation in association with Liverpool University Press, 2020).

data gathering. At best, we need to take on the challenge of developing graphical expressions rooted in and appropriate to interpretative activity."[5] Or, as practitioners like Franco Moretti point out, what we do with these visualizations is sometimes lacking: "so much can be generated visually in such captivating ways, in such enormously information-rich ways, that too little time is spent analyzing what can be produced."[6]

Placed at the intersection of digital humanities and Enlightenment studies, this collection explores the new interpretive possibilities created by using data visualizations to communicate large or complex information. Such visualizations include tabulations, charts, *k*-means clustering, topic modeling, social network graphs, data mapping, and/or other illustrations of patterns of social or intellectual exchange. As compellingly demonstrated by our contributors, these are invaluable methods that help researchers interpret large amounts of data, or data that is structurally embedded in texts but not immediately legible when using traditional methods of investigation. They are also methods, we argue, that allow eighteenth-century scholars to start thinking of the Enlightenment in ways that are not only more encompassing but also more solidly based on quantitative data extracted from existing repositories or texts. While superb recent work in our field has increasingly drawn attention to the need to think outside Eurocentric views and recognize the "constellations of global synchronicity"[7] that the Enlightenment is, or to acknowledge the existence of "plural Enlightenments"[8] and their global interconnectivity, digitization has opened up new avenues of inquiry that are equally exciting. To claims about the need to broaden the temporal or spatial *breadth* of the Enlightenment it adds the opportunity to increase the *depth* of our study of the Enlightenment corpus and reassess existing master narratives with the new tools afforded by the digital age.

[5] Joanna Drucker, "Humanities Approaches to Graphical Display," *DHQ: Digital Humanities Quarterly* 5, no. 1 (2011): 1, http://www.digitalhumanities.org/dhq/vol/5/1/000091/000091.html

[6] Ruben Hackler and Guido Kirsten, "Distant Reading, Computational Criticism, and Social Critique: An Interview with Franco Moretti," *Le Foucaldien* 2, no. 1 (2016): 13, https://doi.org/10.16995/lefou.22

[7] Sebastian Conrad, "Enlightenment in Global History: A Historiographical Critique," *American Historical Review* 117, no. 4 (2012): 1016, https://doi.org/10.1093/ahr/117.4.999

[8] David T. Gies and Cynthia Wall, eds., *The Eighteenth Centuries: Global Networks of Enlightenment* (Charlottesville: University of Virginia Press, 2018).

EIGHTEENTH-CENTURY PRECURSORS
TO DATA VISUALIZATION

Data visualization arguably started in the eighteenth century with the work of the Scottish engineer and political scientist William Playfair (1759–1823), the creator of the first statistical graphs.[9] Playfair invented visualization techniques that are in standard use today: pie and bar charts, line graphs, and circle graphs. His *Commercial and Political Atlas* (1786) was the first book to contain statistical charts[10] and his *Statistical Breviary* (1801) the first work ever to contain a pie chart.[11] As Playfair memorably stated, "the best way to capture the imagination is to speak to the eyes."[12] His visualizations are, indeed, quite telling: they are high-quality copperplate engravings colored by hand in three or four colors that convey meaning and chart multivariate data.[13] In a chart showing the population and revenue of the main countries in Europe in 1804, for instance, Playfair represented each country as a circle (using green and red to suggest maritime or land powers), the country's population in millions as a line (left), the taxes collected in millions of pounds sterling as a line (right), and he connected population and taxes by using a sloping line to show which one is higher (Fig. 1.1). In another example, Playfair used a bar chart to show Scotland's imports and exports from and to seventeen countries in 1781 by using coordinates of revenue and location that allow for clear comparison (Fig. 1.2). Finally, in a line graph published in *Chronology of Public Events and Remarkable Occurrences* (1824),[14] Playfair used color-coded lines to visualize fluctuations in revenue (brown), expenditure (green), debt (red), price of stocks (blue) and bread (yellow), imports (dark blue) and exports (purple) over time (Fig. 1.3). These examples show Playfair's

[9] For details, see Jurgen Symanzik, William Fischetti, and Ian Spence, "Commemorating William Playfair's 250th Birthday," *Computational Statistics* 24, no. 551 (2009): 551–66, https://doi.org/10.1007/s00180-009-0170-z

[10] This book was published in a revised edition as *Lineal Arithmetic* (London: Printed for the Author, 1798) which contained thirty-three charts.

[11] Cf. Edward R. Tufte, *The Visual Display of Quantitative Information* (Cheshire, CT: Graphics Press, 2001), 44.

[12] William Playfair, *Elemens de statistique* (Paris: s.n., 1802), xx.

[13] See Jefferson Bailey and Lily Pregill, "'Speak to the Eyes': The History and Practice of Information Visualization," *Art Documentation: Journal of the Art Libraries Society of North America* 33, no. 2 (2014): 168–91, https://doi.org/10.1086/678525

[14] William Playfair, *Chronology of Public Events and Remarkable Occurrences within the Last Fifty Years; or from 1774 to 1824* (London: Printed for G. and W. B. Whittaker, 1824).
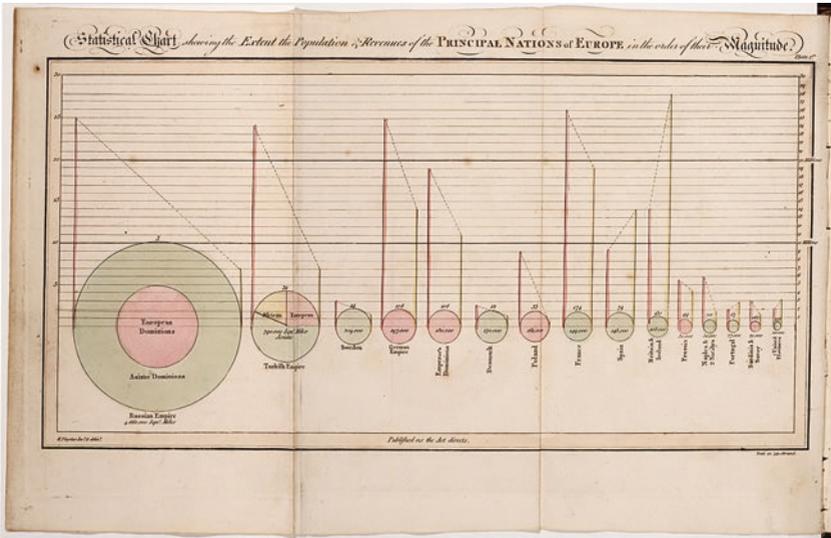
Fig. 1.1 "Chart Representing the Extent, Population & Revenue of the Principal Nations in Europe in 1804." William Playfair, *An Inquiry into the Permanent Cause of the Decline and Fall of Wealthy and Powerful Nations* (London, 1805). (Courtesy of the Thomas Fisher Rare Book Library, University of Toronto)

ability "to select perceptual attributes that would best support efficient cognitive operations,"[15] such as color-coded categories, slopes to compare trends, length and circles to code quantities, and so on.

Such work was not singular during the "Age of Reason": throughout the century, data visualization was variously employed by other Enlightenment intellectuals as well. In 1701, Edmond Halley created the first contour map to show curves of equal magnetic declination.[16] In *Systema Naturae* (1735), Carl Linnaeus relied on tabular notations to classify plants, animals, and minerals in a grid-like manner. Jacques Barbeu-Dubourg's *Machine chronologique* (1753) used a gridded graphic method to capture historic events, and François Quesnay's *Tableau économique* (1758) contained an economic chart interweaving three economic

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[15] Ian Spence, "William Playfair and the Psychology of Graphs," in *JSM Proceedings* (Alexandria, VA: American Statistical Association, 2006), 2431.

[16] Edmond Halley, *The Description and Uses of a New, and Correct Sea-Chart of the Whole World, Shewing Variations of the Compass* (London: Printed for the Author, 1701).
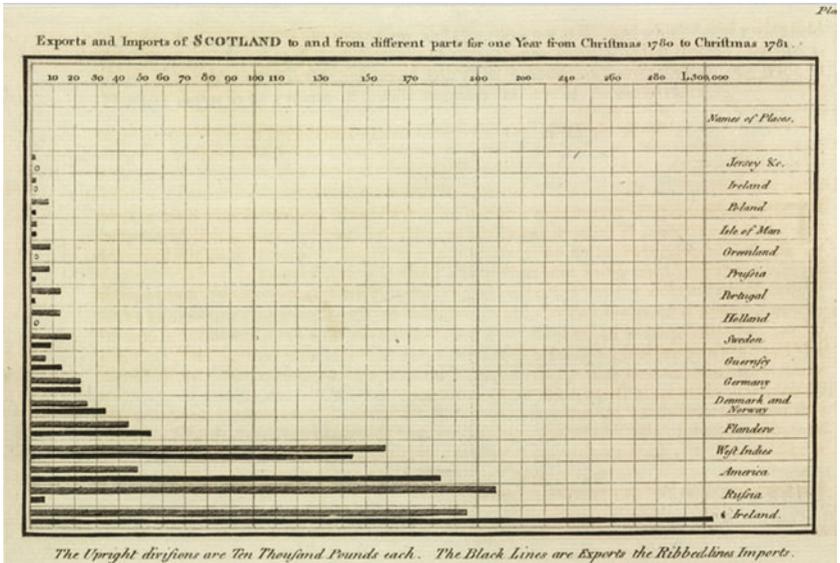
Fig. 1.2 "Exports and Imports of Scotland to and from different parts for One Year from Christmas 1780 to Christmas 1781." William Playfair, *The Commercial and Political Atlas* (London, 1786)

stakeholders to highlight their relationship of exchange.[17] Directly influenced by Ephraim Chambers' *Cyclopaedia* (1728), Denis Diderot and Jean-Baptiste Le Rond d'Alembert's monumental *Encyclopédie*[18] (1751–1772) contained 2,569 plates, including some of the first "do-it-yourself" diagrams ever to be created. As John Bender and Michael Marrinan aptly put it, they are the expression of a new "culture of diagram" that used visual correlation as a form of knowledge: "[t]he plates materialize the sensuous feel of engraved printing while mapping correlations among people, places, and things to produce a fulsome, extra-optical

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[17] These three examples of data visualization are discussed in detail by Jakub Zdebik in the chapter "The Grid and the Visualization of Abstract Information: Three Eighteenth-Century Models" included in this collection.

[18] Denis Diderot and M. D'Alembert, *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, 17 vols. (Paris: Briasson et al., 1751–1765).
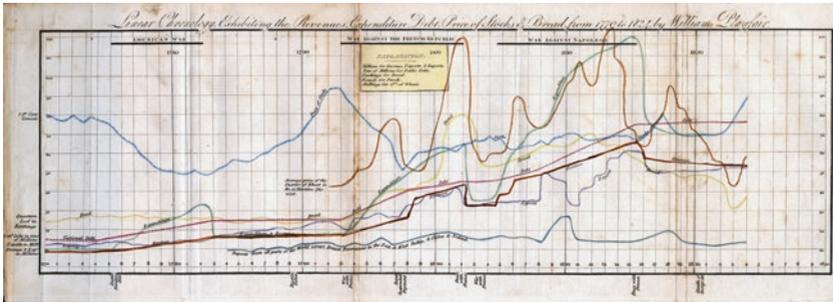
Fig. 1.3 "Linear Chronology, Exhibiting the Revenues, Expenditure, Debt, Price of Stocks & Bread, from 1770 to 1824." William Playfair, *Chronology of Public Events and Remarkable Occurrences within the Last Fifty Years; or from 1774 to 1824* (London, 1824)

understanding of the practices, métiers, and products of contemporary life."[19]

Later in the century and beyond, developments in representing data visually followed in rapid succession. Playfair himself may have been influenced by Joseph Priestley's timeline charts (1765)[20] and James Watt's indicator diagrams (1796).[21] In 1770, the French Academy's *Mémoires de mathématique et de physique* included a timeline bar graph by Philippe Buache that suggestively plotted data showing month-by-month Seine water levels for the period 1760–1766.[22] In *Pyrometrie* (1779), Johann Heinrich Lambert, "the only scientist in the eighteenth century to use

[19] John Bender and Michael Marrinan, *The Culture of Diagram* (Stanford: Stanford University Press, 2010), 17.

[20] Between 1765 and 1769, Joseph Priestley created the first timeline charts to illustrate eminent persons' lifetime spans in *A Chart of Biography* (London: Published for J. Johnson, 1765), and the world's most important historical moments and their distribution in space in *A New Chart of History* (London: Published for J. Johnson, 1769). For details, see James R. Beniger and Dorothy L. Robyn, "Quantitative Graphics in Statistics: A Brief History," *The American Statistician* 32, no. 1 (1978): 1–11, https://www.jstor.org/stable/2683467

[21] See H. Gray Funkhouser, "Historical Development of the Graphical Representation of Statistical Data," *Osiris* 3 (1937): 289, https://www.jstor.org/stable/301591; and Thomas L. Hankins, "Blood, Dirt, and Nomograms: A Particular History of Graphs," *Isis* 90, no. 1 (1999): 50–80, www.jstor.org/stable/237474

[22] "Extrait des Profils qui represent la Crue et la Diminution des Eaux de la Seine." For details, see Ronald K. Smeltzer, "One for the History Books: An Early Time-Line Bar Graph," *Chance* 23, no. 2 (2010): 54–56, https://doi.org/10.1007/s00144-010-0024-z

graphs extensively,"[23] created the first graphical representations of variations in soil temperature and solar warming over time.[24] In 1782, Charles de Fourcroy used proportional figures to compare demographic data in superposition,[25] and August Friedrich Wilhelm Crome created the first statistical map, showing the geographic distribution of fifty-six European commodities.[26]At the turn of the century, *The Philosophical Transactions of the Royal Society of London* had already started to show meteorological data in a tabular and graph form; one such example is Dr. Buxton's 1794 graph of barometric variations.[27] In 1795, Louis-Ézéchiel Pouchet designed the first graph table to represent three variables at once by using a family of curves.[28] Later on, in *Carte figurative* (1844), the French engineer Charles Joseph Minard used casualty data to illustrate the fate of Napoleon's army in Russia during the 1812 campaign in a graph displaying a complex, multivariate time-space story considered by Edward R. Tufte as "the best statistical graph ever drawn."[29]

As this brief overview suggests, during the eighteenth century data visualization becomes an important expression of visual thinking that will lay the foundations for the radical developments in the next century and beyond. From tabular recording of information to timeline charts to statistical graphics to diagrams and graphical tables, eighteenth-century visualizations indicate the growing importance of gathering data "in large and periodic series … and the usefulness of these bodies of data for planning, for governmental response, and as a subject worthy of study in its own right."[30]

[23] Hankins, "Blood, Dirt, and Nomograms," 56.

[24] Johann Heinrich Lambert, *Pyrometrie oder vom Maaße des Feuers und der Wärme mit acht Kupfertafeln* (Berlin: Bey Haude & Spenser, 1779).

[25] Charles de Fourcroy, *Essai d'une table poléométrique, ou amusement d'un amateur de plans sur les grandeurs de quelques villes* (Paris: M. Dupain-Triel pere, 1782).

[26] August Friedrich Wilhelm Crome, *Europens Produkte. Zum Gebrauch der neuen Produkten-Karte von Europa* (Dessau: Verfasser, 1782).

[27] *The Philosophical Magazine* (London: Printed by Davis, Taylor, and Wilks, 1800), 7:357. Cf. Funkhouser, "Historical Development of the Graphical Representation of Statistical Data," 289. In 1794, Buxton also invented the printed graph paper with a rectangular coordinate grid.

[28] Louis-Ézéchiel Pouchet, *Échelles graphiques des nouveaux poids, mesures et monnaies de France, comparées avec celles des pays les plus commerçants de L'Europe* (Rouen: Guedra, 1795).

[29] Tufte, *The Visual Display of Quantitative Information*, 40. See also Bailey and Pregill, "'Speak to the Eyes'," 171–73.

[30] Michael Friendly, "Milestones in the History of Thematic Cartography, Statistical Graphics, and Data Visualization," (2008): 1, http://www.math.usu.edu/~symanzik/teaching/2009_stat6560/Downloads/Friendly_milestone.pdf. For more details, see also

DATA VISUALIZATION IN EIGHTEENTH-CENTURY STUDIES:
A BRIEF SURVEY OF THE FIELD

The modern origins of the field go back to the 1950s, when computer graphics were first generated. Interactive statistical applications developed by E. B. Fowlkes and M. A. Fishkeller, among others, led to the spread of high-resolution graphics in the 1970s.[31] The publication of the National Science Foundation's report on "Visualization in Scientific Computing" in 1987 marked the emergence of data visualization as a new specialization in the field of computer graphics. From then on, the term "data visualization" started to apply to visualizations in both the scientific and information visualization fields,[32] branching into statistical graphics and thematic cartography. Information graphics, a closely related field whose emphasis is on representing data in visually striking ways, emerged during the same time. Nigel Holmes' creation of the first infographics or, as he called them, "explanation graphics,"[33] was an important milestone in representing data visually.

In the humanities, the growing interest in information analysis and the increasing accessibility of large datasets have led to what Jefferson Bailey and Lily Pregill called "a visualization renaissance … with information analysis and visualization literacy recognized as fundamental skills in the academy."[34] This renaissance built upon the seminal work of Jacques Bertin, whose *Semiologie graphique* (1967) was the first book to organize

Michael Friendly, "A Brief History of Data Visualization," in *Handbook of Data Visualizations*, ed. Anthony Unwin, Chun-houh Chen, and Wolfgang K. Härdle (Berlin: Springer-Verlag, 2008), 15–56.

[31] Cf. Friendly, "A Brief History of Data Visualization," 40.

[32] *Scientific visualizations* refer to 3D visualization of architectural, biological, or other type of scientific data, with an emphasis on realistic renderings of volumes, surfaces, sources, etc. In its broadest sense, *information visualization* refers to any display that organizes the information in a way that allows for finding relations among heterogenous elements; examples include tables, graphs, maps, and even texts. As a new research field, information visualization was launched in the early 1990s and describes the "visual representation of large-scale collections of non-numerical information, such as files and lines of code in software systems, library and bibliographic databases, networks of relations on the Internet, and so forth." Cf. Friendly, "Milestones in the History of Thematic Cartography, Statistical Graphics, and Data Visualization," 2.

[33] See, for instance, Nigel Holmes, *Designer's Guide to Creating Charts and Diagrams* (New York: Watson-Guptill, 1984) and *Pictorial Maps: History, Design, Ideas, Sources* (New York: Watson-Guptill, 1991), to give just a couple of examples.

[34] Bailey and Pregill, "'Speak to the Eyes'," 169.

graphic visual elements according to features and relations in data,[35] and Edward R. Tufte, whose influential volume, *The Visual Display of Quantitative Information* (1983), provided a working theory and rules of good practice in data visualization. In Tufte's words, "graphical excellence consists of complex ideas communicated with clarity, precision, and efficiency."[36] This involves using "well-designed presentation of interesting data," giving the viewer "the greatest number of ideas in the shortest time with the least ink in the smallest space," considering multivariate data, and telling the truth about the data.[37] Data visualization designers like David McCandless, on the other hand, have called attention to the aesthetic dimension of such visualizations and the importance of "making information approachable *and* beautiful"[38] [emphasis added] as an essential way to convey meaning. Moreover, as Johanna Drucker correctly pointed out, a humanistic approach to graphical display of information also involves constructive moves that should account for ambiguity and uncertainty, as well as a "recognition of the *interpretive* nature of knowledge"[39] [emphasis in original]:

> The humanistic aspect of this approach should be obvious: that knowledge created with the acknowledgement of the constructed nature of its premises is not commensurate with principles of certainty guiding empirical or realist methods. Humanistic methods are counter to the idea of reliably repeatable experiments or standard metrics that assume observer-independent phenomena. By definition, a humanistic approach is centered in the experiential, subjective conditions of interpretation. Phenomena and their observers are co-dependent, not necessarily in equal measure.[40]

With the advent of new digital tools in recent years, such analytical possibilities have increased significantly, allowing researchers of the Enlightenment to revisit, among other things, the history of the novel,

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[35] Bertin considers seven visual variables: position, form (shape), orientation, color (hue), texture, value (lightness or darkness of color), and size and develops a visual semantics for linking data attributes to visual elements. See Jaques Bertin, *Semiology of Graphics: Diagrams, Networks, Maps*, trans. William J. Berg (Madison: University of Wisconsin Press, 1983).

[36] Tufte, *The Visual Display of Quantitative Information*, 51–53.

[37] Ibid.

[38] David McCandless, *Information Is Beautiful* (London: Collins, 2009), n.p.

[39] Johanna Drucker, *Graphesis: Visual Forms of Knowledge Production* (Cambridge, MA: Harvard University Press, 2014), 128–29.

[40] Ibid., 130.

networks of intellectual exchange, or the notion of canonicity itself. Period-related studies have made use of tabulated data, scatterplots, maps, trees, dendograms, network diagrams, and histograms for their explanatory power and ability to represent a whole corpus at one glance. Stylometry,[41] computational stylistics,[42] topic modeling,[43] agent-based modeling,[44] social network analysis,[45] geospatial mapping,[46] and studies in authorship attribution[47] have all employed visualizations that aid in the

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[41] John Burrows, *Computation into Criticism: A Study of Jane Austen's Novels and an Experiment in Method* (Oxford: Clarendon Press, 1987).

[42] Anne Bandry-Scubbi, "Chawton Novels Online, Women's Writing 1751–1834, and Computer-Aided Textual Analysis," *ABO: Interactive Journal for Women in the Arts, 1640–1830* 5, no. 2 (2015): 1–54, https://doi.org/10.5038/2157-7129.5.2.1

[43] See Jeffrey M. Binder and Collin Jennings, "Visibility and Meaning in Topic Models and 18th-Century Subject Indexes," *Literary and Linguistic Computing* 29, no. 3 (2014): 405–11, https://doi.org/10.1093/llc/fqu017, and "'A Scientifical View of the Whole': Adam Smith, Indexing, and Technologies of Abstraction," *ELH* 83, no. 1 (2016): 157–80, https://doi.org/10.1353/ELH.2016.0001; Glenn Roe, Clovis Gladstone, and Robert Morrissey, "Discourses and Disciplines in the Enlightenment: Topic Modeling the French *Encyclopédie*," *Frontiers in Digital Humanities* 2 (2016): 1–8, https://doi.org/10.3389/fdigh.2015.00008; and David J. Newman and Sharon Block, "Probabilistic Topic Decomposition of an Eighteenth-Century American Newspaper," *Journal of the American Society for Information Science & Technology* 57, no. 6 (2006): 753–67, https://doi.org/10.1002/asi.20342

[44] Michael Gavin, "Agent-Based Modeling and Historical Simulation," *DHQ: Digital Humanities Quarterly* 8, no. 4 (2014): 1–18, http://www.digitalhumanities.org/dhq/vol/8/4/000195/000195.html

[45] Two chapters in Chloe Edmondson and Dan Edelstein, eds., *Networks of Enlightenment: Digital Approaches to the Republic of Letters* (Liverpool: Voltaire Foundation in association with Liverpool University Press, 2019) provide suggestive social network visualizations: Chloe Edmondson's "Julie de Lespinasse and the 'Philosophical' Salon," 139–72, and Charlotta Wolff's "'Un admirateur des philosophes modernes': The Networks of Swedish Ambassador Gustav Philip Creutz in Paris, 1766–1783," 173–200. See also, Ileana Baird, "The Strength of Weak Ties: Eliza Haywood's Social Network in *The Dunciad in Four Books* (1743)," *ABO: Interactive Journal of Women in the Arts, 1640–1830* 9, no. 2 (2019): 1–36, https://doi.org/10.5038/2157-7129.9.2.1202

[46] See, for instance, *The Grub Street Project*, a digital edition of eighteenth-century London that maps its print culture, literature, and trades, at http://grubstreetproject.net/. Some of these maps are discussed in Allison Muri, "Graphs, Maps, and Digital Topographies: Visualizing *The Dunciad* as Heterotopia," *Lumen* 30 (2011): 79–98, https://doi.org/10.7202/1007717ar. An important study is also James Raven's *Bookscape: Geographies of Printing and Publishing in London before 1800* (London: The British Library, 2014).

[47] See, for instance, John Burrows, "Who Wrote *Shamela*? Verifying the Authorship of a Parodic Text," *Literary and Linguistic Computing* 20, no. 4 (2005): 437–50, https://doi.org/10.1093/llc/fqi049; Lisa Pearl, Kristine Lu, and Anousheh Haghighi, "The Character in the Letter: Epistolary Attribution in Samuel Richardson's Clarissa," *Digital Scholarship in the Humanities* 32, no. 2 (2017): 355–76, https://doi.org/10.1093/llc/fqw007; and

organization and interpretation of data, or that bring to light relations between units of information otherwise hidden in the larger corpus.

Many of the studies applying data visualization methods to the field of eighteenth-century studies are the product of major institutional projects. Stanford University's *Mapping the Republic of Letters*, the most ambitious enterprise to date, is a collaborative project started in 2008 that aims at unveiling the correspondence networks created by scientists, *salonnières*, or travelers during the Enlightenment. With case studies including charting the movement of intellectuals and socialites between salons, mapping the social spaces of the Grand Tourists who visited Italy during the eighteenth century, tracing the epistolary and publication networks of the Enlightenment, and outlining the production and circulation of the scientific knowledge during pre-modern era, this initiative uses sophisticated visualization tools to show how such networks facilitated a transnational circulation of ideas, people, and things.[48] University of Virginia's Sciences, Humanities, and Art Network of Technological Initiatives (SHANTI) provides a suite of tools that make it easy to create interactive, web-based visualizations, some of which have been employed in period-specific projects.[49] Under the directorship of Laura Mandell, The Center of Digital Humanities Research (CoDHR) at Texas A&M University hosts a Humanities Visualization Space that supports the liberal arts and humanities research community by providing visualization technologies and workshops, many of them relevant to our field. Similarly, *18thConnect: Eighteenth-Century Scholarship Online* offers access to *The Eighteenth-Century Poetry Archive* (ECPA), a digital archive which provides visualization and modeling tools to augment close readings of poems, and will soon offer access to Voyant, a web-based reading and analysis environment for digital texts whose benefits are attentively discussed in her chapter by one of the contributors of this book.[50]

Other important initiatives include University of Oxford's *Cultures of Knowledge* project, which focuses on reassembling and interpreting the

A. Abdul-Rahman et al., "Constructive Visual Analytics for Text Similarity Detection," *Computer Graphics Forum* 36, no. 1 (2017): 237–48, https://doi.org/10.1111/cgf.12798

[48] For more details about participants, goals, and case studies, see http://republicofletters.stanford.edu/index.html

[49] Shanti Interactive, University of Virginia, accessed April 1, 2020, http://www.vis-eyes.org/

[50] See Courtney A. Hoffman's chapter, "Exploring Data Visualization: Time, Emotion, and Epistolarity in Frances Brooke's *The History of Emily Montague*."

correspondence networks of the early modern period (1550–1750),[51] providing suggestive visualizations of letter frequency and distribution in space and time in their collection of *Early Modern Letters Online*. The *French Book Trade in Enlightenment Europe* (FBTEE) database, an award-winning project currently hosted at Western Sydney University, maps the production, marketing, dissemination, and reception of books and ideas during the late eighteenth century, illustrating the trade of the Swiss publishing house Société Typographique de Neuchâtel in suggestive visualizations.[52] HELDIG, a Finnish research network approaching problems in the humanities and social sciences with computational methods, has been engaged in several projects involving the global Enlightenment that employ data visualization.[53] Another award-winning online collection hosted by the Bodleian Library, *Electronic Enlightenment* (EE), attempts to recast our understanding of the period by making available over 77,000 letters by over 10,000 correspondents, linking them to their source location, and providing images of historical maps at the country level.[54] The *ARTFL Project*, a collaboration between the French government and the University of Chicago, is a consortium-based service that provides its members with access to North America's largest collection of digitized French resources; besides ongoing digitization projects, it includes a variety of projects that employ data visualization tools to report their findings.[55] The *Comédie-Française Registers Project* (CFRP), the result of a partnership between the Bibliothèque-Musée de la Comédie-Française and five leading French and North American universities (Université Paris Nanterre, Université Paris-Sorbonne, MIT, Harvard University, and University of Victoria), has developed several data exploration and visualization tools, creating register statistics, visual displays of performance frequency, office box data for authors and plays, or ticket sales during

[51] *Cultures of Knowledge: Networking the Republic of Letter, 1550–1750*, University of Oxford, accessed April 1, 2020, http://www.culturesofknowledge.org

[52] *FBTEE: The French Book Trade in Enlightenment Europe. Mapping the Trade of the Société Typographique de Neuchâtel, 1769–1794*, Western Sydney University, 2014, http://fbtee.uws.edu.au/main/

[53] Helsinki Center for Digital Humanities, University of Helsinki, 2020, https://www.helsinki.fi/en/helsinki-centre-for-digital-humanities

[54] *Electronic Enlightenment Project*, Bodleian Libraries, University of Oxford, 2008–2019, https://www.e-enlightenment.com/. Currently, this is the most wide-ranging online collection of edited correspondence of the early modern period.

[55] *The Project for American and French Research on the Treasury of the French Language* (ARTFL), The University of Chicago, accessed February 20, 2020, https://artfl-project.uchicago.edu/content/about-artfl

particular theater seasons, to name just a few.[56] Similar initiatives that use quantitative methods applied to eighteenth-century datasets or texts have bourgeoned in the past years globally, resulting in a growing number of publications that employ data visualization as a methodological tool.

Among them, several recent edited collections have made a significant contribution to expanding our field. Chloe Edmondson and Dan Edelstein's *Networks of Enlightenment: Digital Approaches to the Republic of Letters* assembles data-driven scholarship related to the study of the correspondence, social, and knowledge networks that made the Enlightenment possible in an effort to create a sense of a "European" identity. The case studies included here range from Catherine the Great's epistolary networks and Voltaire's correspondence to Casanova's French coteries and Samuel Johnson's lexicographic networks in his *Dictionary*. Five of its chapters contain suggestive epistolary, social, and knowledge network visualizations that illustrate promotional strategies, salon demographics, trajectories of intellectual transmission, hubs of French academic networks, science super-connectors, citation frequency, or semiotic clusters.[57] In *Reassembling the Republic of Letters in the Digital Age: Standards, Systems, Scholarship*, Howard Hotson and Thomas Wallnig gather work by scholars involved in creating a digital framework for multilateral studies on early modern letter-writing (1500–1800).[58] The outcome of a COST-funded project (European Cooperation in Science and Technology), this volume considers the challenges of planning a state-of-the art digital system that can collect highly granular data on the Republic of Letters, and the need for emerging technologies to build a workable, pan-European institutional infrastructure. Chapters in this collection employ data visualizations to illustrate preliminary results, such as event distribution, event-based letter models, geographical and social network visualizations of library metadata, letter and place name distribution, epistolary itineraries, isopleth maps, and Minard diagrams of best postal routes between regions.

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[56] *The Comédie-Française Registers Project* (CFRP), accessed February 20, 2020, https://www.cfregisters.org/en/

[57] Cheryl Smeall, "'He Belonged to Europe': Francesco Alagarotti (1712–1764) and His European Networks," 75–106; Edmondson, "Julie de Lespinasse and the 'Philosophical' Salon"; Wolff, "Un admirateur des philosophes modernes'"; Melanie Conroy, "The Eighteenth-Century French Academic Network," 225–50; and Mark Algee-Hewitt, "The Principles of Meaning: Networks of Knowledge in Johnson's *Dictionary*," 251–78.

[58] Howard Hotson and Thomas Wallnig, eds., *Reassembling the Republic of Letters in the Digital Age: Standards, Systems, Scholarship* (Gottingen: Gottingen University Press, 2019).

Finally, in *Digitizing Enlightenment: Digital Humanities and the Transformation of Eighteenth-Century Studies*, Simon Burrows and Glenn Roe collect contributions that chart the development of several interrelated digital projects that have played a transformative role in the way the history and culture of the eighteenth century is viewed. The studies included here describe major digital humanities research initiatives in eighteenth-century studies, such as the *ARTFL Encyclopédie*, *Electronic Enlightenment*, and *Mapping the Republic of Letters*. Especially in its second section, "Digital Methods and Innovations," this collection discusses methods and technologies developed during these projects, digital tools and resources used by its contributors, and the role played by digital models and visualizations in uncovering evidence and building arguments. Including visualizations ranging from correspondence networks, book sale destinations, and geospatial mapping to topic distribution, histograms, and social networks of eighteenth-century French salonnières, *Digitizing Enlightenment* provides a suggestive view on how such methods can contribute to the "reinvention and transformation of scholarly practices in the humanities at the dawn of the digital age."[59]

Although works of exemplary scholarship that bring together contributions by authors involved in important digital projects, these studies do not make their goal to highlight the role played by data visualization *per se* in reassessing the Enlightenment. Moreover, not all chapters included in these collections employ visualizations, or a significant sample of them, in building their argument. They also focus mainly on network analysis, addressing to a lesser extent other types of visualizations, their limits, or their potential for pedagogical use. Reporting mainly on large ongoing projects, they rarely include samples of smaller projects developed by individual researchers at institutional level, or, with only one exception, case studies focused on particular texts that employ data visualization as a methodological tool.[60]

Our collection aims to fill in these gaps by providing a representative sample of both large and small projects that illustrate the variety of the work done in eighteenth-century studies employing quantitative methods. The chapters included here present groundbreaking research by leading and emerging scholars in the field that involves the use of visualizations in

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[59] Simon Burrows and Glen Roe, introduction to Burrows and Roe, *Digitizing Enlightenment,* 24.

[60] I refer here to Algee-Hewitt's chapter, "The Principles of Meaning," cited above.

analyzing texts and/or cultural trends emerging from data mined from existing databases or other aggregates of sources. This approach does not only provide, as Moretti suggested, a new "model of the narrative universe" by highlighting "hidden patterns" of contact and exchange[61] but also unveils connections between various pieces of data—about an individual, about individuals in relation to others, about circulation of knowledge, and about spatial or temporal dynamics. By including digital projects undertaken by eighteenth-century scholars from various disciplines (visual arts, history, musicology, literary studies), this collection addresses both the benefits and challenges of the digital humanities scholarship in our field.

In organizing this collection, we have focused on the use of quantitative methods both for *distant reading* of large datasets or digitized collections and for *close reading* of particular texts. Challenging existing opinions that "literature is not data" and, even more, that "literature is the opposite of data,"[62] we have set as our goal to demonstrate the huge potential that exploring literature *as data* can have in advancing our field. As evidenced by our contributors, distant readings of large datasets can reveal trends in literature and criticism, disciplinary directions, dissemination patterns, canon formation processes, genre- or gender-specific ebbs and flows over time, or othering strategies. On the other hand, close readings of texts or images can highlight plot trajectories, artistic influences, defamatory or prestige-building strategies, social, sentimental, and chrono-spatial networks, or less obvious textual meanings. Finally, this *distant/close* dichotomy has been a conceptual focus as well: although this collection is necessarily Eurocentric given its engagement with the Enlightenment as an eighteenth-century European intellectual movement, it has been our goal to broaden its spatial expanse by including contributions that address the Enlightenment authors' interest in non-European cultures, or that discuss texts falling outside a strict Western-European context. In doing so, we have aimed to acknowledge the universalizing impulse that is a hallmark of the Enlightenment, and its global circulation of ideas and texts.

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[61] Franco Moretti, *Graphs, Maps, Trees: Abstract Models for a Literary History* (New York: Verso, 2005), 54.

[62] Stephen Marche, "Literature Is Not Data: Against Digital Humanities," *Los Angeles Review of Books*, October 28, 2012, https://lareviewofbooks.org/article/literature-is-not-data-against-digital-humanities/

Our first section, *Digital Enlightenment: Representing Big Data*, includes four studies resulting from major, ongoing institutional projects that focus on large corpora of texts and engage in various ways with the idea of canonicity. The chapters included in this section address, in turn, the tensions between the "high Enlightenment" canon and popular best-sellers, construct a new, data-driven canon based on quantitative approaches to large-scale datasets, engage with Eurocentric views of "the other" to highlight perceived differences between canonical and peripheral cultures, and reassess the place of poetry in the Enlightenment canon in general, and in contemporary critical discourse in particular. As highlighted by our contributors, computational methods and data visualization can offer exciting tools for analysis that can significantly revise and even dismantle existing ideas about the period.

Simon Burrows' chapter, "In Search of Enlightenment: From Mapping Books to Cultural History," discusses the philosophy, methodology, conceptual dilemmas, and findings of the AHRC-funded *French Book Trade in Enlightenment Europe* (FBTEE) project. Currently based at Western Sydney University, this project aims at creating an interpersonal-relational database that maps the pan-European book trade of the celebrated *Société typographique de Neuchâtel* (STN), a large-scale Swiss wholesale publisher that operated between 1769–1794 and that is, to date, the richest source on the international book trade of the later Enlightenment. In this chapter, the author showcases how careful database design, customized digital tools, and an intuitive online interface allow users to compensate for complexities, biases, and gaps in the STN archive and argues that, by using these tools, one can create datasets that can stand proxy for the wider European book trade of the late eighteenth century. By using suggestive visualizations of sales destinations, transaction volumes, leading STN authors, and circulation of illegal bestsellers during the *ancien régime*, to name just a few, this chapter creates a vivid sense of the reception, transmission, and transformation of the Enlightenment ideas across space and time.

In "Examining the Early Modern Canon: *The English Short Title Catalogue* and Large-Scale Patterns of Cultural Production," Mikko Tolonen, Ali Zeeshan Ijaz, Ville Vaara, Mark J. Hill, and Leo Lahti present the findings of an ongoing digital project focused on the history of eighteenth-century book publication funded by the Academy of Finland. As part of the Helsinki Computational History Group at Helsinki Centre for Digital Humanities (HELDIG), the authors have created a

historical-biographical database based on *The English Short-Title Catalogue* (ESTC), a standard source for analytical bibliographic research holding close to half a million titles, to construct a data-driven canon that considers changes over time, subject-topics, top-works, authors, publishers, publication place, and materiality. This chapter provides methodological and historical insights into the development of the Enlightenment print culture and demonstrates the huge analytical potential of harmonized metadata catalogs. While quantitative analyses of the history of the book trade have been done before, this is the first attempt to engage with the complex process of canon formation at such a large scale. In building their argument, the authors use a significant number of visualizations, ranging from tabular records of top canonical works and graphic representations of frequency variations of the most common subject-topics in the canon to reprint patterns, book distribution, publication places, and gendered trends. The authors' work highlights the decisive role played by publishers in the process of canon formation, and the epistemological shift started at the end of the seventeenth century, when religious works lost their dominant position within the canon, being increasingly replaced by literary works. As the authors compellingly argue, this shift in the production and consumption of print allowed for a reinvention of the canon during the eighteenth century.

In "Europe and Its 'Others': Visualizing Lexical Relations between Western and Non-Western Locations of the Enlightenment in *The Eighteenth-Century Collections Online*," John Regan complicates the discussion of Enlightenment Eurocentrism by looking at the ideological structures emerging from the Enlightenment literature itself when placed within a broader, global context. The author investigates how the names of continents interacted across three historical periods of the ECCO corpus in order to assess how British authors wrote about Europe versus its colonies, the Orient, the Indies, or the Americas. Using a custom-designed measure of word co-association developed by the members of the Concept Lab at the Cambridge Centre for Digital Knowledge, Regan makes visible associations between geographical designators in the early, middle, and late eighteenth century, creating semantic network diagrams that visualize the often surprising ways in which global place names and attributes kept company within sentences in the historical corpus. By using semantic networks and tabular records of lexical bindings, this chapter makes visible how knowledge about "Asia," "Africa," "America," and "Europe" was structured and how these place names associated with each other in the

vast, impersonal, aggregated repository of the corpus. Thus, this chapter reconstructs the most common ways in which the printed anglophone century understood relations between "Europe" and its others, suggesting a complementary story about Enlightenment othering that would have remained closed off without the affordances of the digital.

In the last chapter of this section, "Text Mining and Data Visualization: Exploring Cultural Formations and Structural Changes in Fifty Years of Eighteenth-Century Poetry Criticism (1967–2018)," Billy Hall uses quantitative methods to identify thematic shifts in the critical reception of eighteenth-century poetry. The author employs computational tools to examine trends in current criticism, as reflected by essays published in two flagship journals in the field, *Eighteenth-Century Studies* and *The Eighteenth Century: Theory and Interpretation.* By using algorithmic manipulation, *k*-means clustering, LDA topic modeling, network graphs of dominant genres, and topic distribution over time, Hall examines patterns in attention to various texts and/or poets, identifies trending topics, and makes inferences about disciplinary focus, direction of disciplinary practice, and the impact of gender on the poetic canon. As the first ever attempted quantitative approach to contemporary poetry criticism in eighteenth-century studies, this study demonstrates the expanding interpretive possibilities afforded by digitization.

The second section of the book, *Data Visualization and the Eighteenth-Century Corpus: Case Studies*, gathers chapters that are the result of smaller-size projects that employ visualizations for *close reading* of particular works. They look at eighteenth-century visualizations that anticipate postmodern forms of graphic design, employ computational tools to bring to the fore less obvious information within texts, or analyze in a data-driven fashion paratextual materials, such as subscription lists, footnotes, and other apparatus, to draw conclusions about processes of diffusion, association, and prestige building. The visualizations used here shed light, on the one hand, on the importance of the grid as the underlying structure operative in data visualization during the eighteenth century and beyond and, on the other hand, on the benefits of such visualizations in providing a view of the data that "highlights potentially interesting patterns"[63] within a text. These case studies show the payoffs of close

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[63] S. Janicke, G. Franzini, M. F. Cheema, and G. Scheuerman, "Visual Text Analysis in Digital Humanities," *Computer Graphics Forum* 36, no. 6 (2017): 228, https://doi.org/10.1111/cgf.12873

reading primary sources with digital tools which, when coupled with the reader's expert knowledge of their context of production, can provide invaluable insights into such texts.

In "The Grid and the Visualization of Abstract Information: Three Eighteenth-Century Models," Jakub Zdebik looks at the grid as an organizational device that helps convey information for scientific inquiry. The author discusses three eighteenth-century cases: Jacques Barbeu-Dubourg's *Machine chronologique* (1752), where the grid is used to organize time, François Quesnay's *Tableau économique* (1758), where the grid is used to represent economic exchange among various stakeholders, and Carl Linnaeus's *Regnum Lapideum* (1768), where the grid is used as a display method for comparative purposes. These eighteenth-century instances of data visualization are analyzed in light of contemporary art history theories to demonstrate their lasting impact on contemporary artists like Francine Savard, Hans Haacke, and Luce Meunier, whose work mirrors the patterns of these early modern graphic designs. As the author convincingly argues, the eighteenth-century method of mingling the visual and the textual in visualizations of abstract knowledge anticipates postmodern methods of artistic expression.

Courtney A. Hoffman's chapter, "Exploring Data Visualization: Time, Emotion, and Epistolarity in Frances Brooke's *The History of Emily Montague*," elaborates on the author's use of data visualization as a tool for textual analysis and considers the affordances of three software programs: Voyant, Tableau, and Palladio. The author examines the textual analysis capabilities of these programs by using data related to the epistolary exchanges of the characters in Frances Brooke's 1769 novel, *The History of Emily Montague*. Voyant has helped the author identify specific word-use frequency throughout the text, Palladio has created maps that visualize the progress of the letters over space and the characters' geospatial location, and Tableau has generated displays that order letters by date, rather than by appearance in the text. Hoffman illustrates the potential for graphic production of these programs, their usefulness when examining the temporal aspects of the novel's epistolary structure, and their pitfalls in both research design structure and text selection. Thus, this chapter narrates the process by which such visualizations can lead to new interpretations of the source text that are significant in themselves or can point to new directions of analysis and highlights their potential for use in the classroom.

In "Outliers, Connectors, and Textual Periphery: Visualizing John Dennis's Social Network in *The Dunciad in Four Books*," Ileana Baird uses social network analysis to visualize the fields of relations involving John Dennis, the most important critic of the first half of the eighteenth century, with Alexander Pope's "dunces," and the nature of these affiliations. Using visualizations generated by GraphViz, a program that creates topological graphs from sets of dyadic relations, and ShivaGraph, a tool that helps visualize large networks and navigate through them as through a map, the author brings to light data that is structurally embedded in Pope's poem but not immediately legible given the amount and complexity of the information. In Dennis's case, they reveal the competing stories told by the poem and the apparatus and the critic's prominent role as the uncrowned king of *The Dunciad*'s textual periphery. The graphs also highlight Dennis's essential position as a network connector, his camp affiliations, the role played by peripheral characters in the plot network of the poem, and the identity of the main dunces targeted by Pope, or the poem's "hall of infamy."

Simon D. I. Fleming's chapter, "Publishing Music by Subscription in Eighteenth-Century Britain: The Case of Charles Avison," considers one of the most valuable resources available to researchers of eighteenth-century social history: the subscription lists attached to various publications. In the musical field, these lists shed considerable light on the connections individual composers forged with other like-minded individuals, the support they received from members of the middle and upper classes, and gendered trends in purchasing musical prints. In this data-driven study, the author employs visualizations ranging from tabulated data to scatter maps of subscriber locations to pie charts showing the types and the gender of Avison's subscribers, highlighting Avison's growth into one of England's lead musicians and the importance of the connections he forged with particular groups or individuals. This chapter underscores the role played by Avison's extensive networking through subscription in building prestige, as well as the benefits of a data-driven approach to subscription lists in unveiling cultural trends and gendered practices during the Georgian era.

Finally, in the afterword, "Novel Knowledge, or Cleaning Dirty Data: Toward Open-Source Histories of the Novel," Emily C. Friedman discusses "the most important, most under-rewarded, and most unsexy aspect of data visualization: the production and/or usage of reliable underlying data." Starting from the premise that visualizations are only as

good as their underlying evidentiary base, the author discusses the contributions of digital projects in eighteenth-century fiction that have laid the foundation for such practices, including massive multi-institution projects like *Orlando*, mid-size projects like *The Early Novels Database* (END), or small-scale projects like her own *Manuscript Fiction in the Age of Print* (MFAP)*,* which creates meaningful metadata about unpublished manuscript fiction during the period. Cautioning against the potentially disastrous effects of creating visualizations from partial or "dirty data," Friedman proposes a set of guidelines for best practices in working with or creating large datasets so that amendable, transformable visualizations can be produced, built on collective knowledge.

As suggested by this outline, this collection is a truly interdisciplinary effort that showcases the significant digital humanities work done in the field of eighteenth-century studies and its potential to transform our disciplinary practices. By addressing fundamental period-related themes—from issues of canonicity, intellectual history, and book trade practices to novel ways of exploring canonical authors and texts, gender roles, and public sphere dynamics—, this collection also makes a broader argument about the necessity of expanding the very notion of "Enlightenment" not only spatially but also conceptually, by revisiting its very tenets in light of new data. By translating these new findings in suggestive visualizations, the contributors to this collection unveil unforeseen patterns, trends, connections, or networks of influence that could potentially revise existing master narratives about the period and the ideological structures at the core of the Enlightenment.

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