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Rachel Sagner Buurma
Swarthmore College, rbuurma1@swarthmore.edu

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Commentary

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The fictionality of topic modeling: Machine reading Anthony Trollope's Barsetshire series

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Abstract

This essay describes how using unsupervised topic modeling (specifically the latent Dirichlet allocation topic modeling algorithm in MALLET) on relatively small corpuses can help scholars of literature circumvent the limitations of some existing theories of the novel. Using an example drawn from work on Victorian novelist Anthony Trollope's Barsetshire series, it argues that unsupervised topic modeling's counter-factual and retrospective reconstruction of the topics out of which a given set of novels have been created allows for a denaturalizing and unfamiliar (though crucially not "objective" or "unbiased") view. In other words, topic models are fictions, and scholars of literature should consider reading them as such. Drawing on one aspect of Stephen Ramsay's idea of algorithmic criticism, the essay emphasizes the continuities between "big data" methods and techniques and longer-standing methods of literary study.

Keywords

Topic modeling, literature, distant reading, literary criticism, novels, machine learning

In the final two paragraphs of *The Last Chronicle of Barset* (1867), the last-published of Anthony Trollope's six-novel series detailing the social lives of country clergymen and the effects of clergymen "on the society of those around them," the authorial narrator says a sad goodbye to the fictional English county of Barsetshire in which all six novels are set:

> And now, if the reader will allow me to seize him affectionately by the arm, we will together take our last farewell of Barset and of the towers of Barchester. I may not venture to say to him that, in this country, he and I together have wandered often through the country lanes, and have ridden together over the too-well wooded fields, or have stood together in the cathedral nave listening to the peals of the organ, or have together sat at good men's tables, or have confronted together the angry pride of men who were not good. I may not boast that any beside myself have so realized the place, and the people, and the facts, as to make such reminiscences possible as those which I should attempt to evoke by an appeal to perfect fellowship. (*The Last Chronicle of Barset*, 2002: 860, 861)

The Trollopian narrator wistfully hopes that, by experiencing all six novels, he and his reader have together constructed a social world more persistent than any world a single novel could create. Published between 1855 and 1867, the six novels are all set in and around the fictional county of Barsetshire and its cathedral town of Barchester. Distinct from one another, separately published, the six novels share a geography, some institutions, and several characters. But relations between the six novels are varied and uneven. Some share a core set of main characters and places (*The Warden* and *Barchester Towers*), while others claim a

Swarthmore College, Swarthmore, PA, USA

Corresponding author:
Rachel Sagner Buurma, Swarthmore College, LPAC 202, 500 College Ave, Swarthmore, PA 19081, USA.
Email: rbuurma1@swarthmore.edu

relation to the other novels in the series only through the presence of a few familiar minor characters and a handful of recurring geographic locations (*Doctor Thorne*).[1] Characters who play a central role in one novel tend to reappear in small supporting roles or as merely mentioned names in others.[2] Taken together, the six novels suggest a capacious and shifting social world with blurry boundaries—a social world under construction, perhaps, one constantly in the process of being conjured into being by the combination of author and reader the narrator fantasizes about at the very end of *The Last Chronicle of Barset*. While Trollope wished for readers with a knowledge of the novels "perfect" enough to allow them to "reminisce" along with the authorial narrator about "the place, and the people, and the facts," I will suggest that the introduction of other kinds of readers—machine and human—who know less rather than more about the history, social world, and formal features of the Barsetshire novels might help critics today read Trollope's series in a new way.

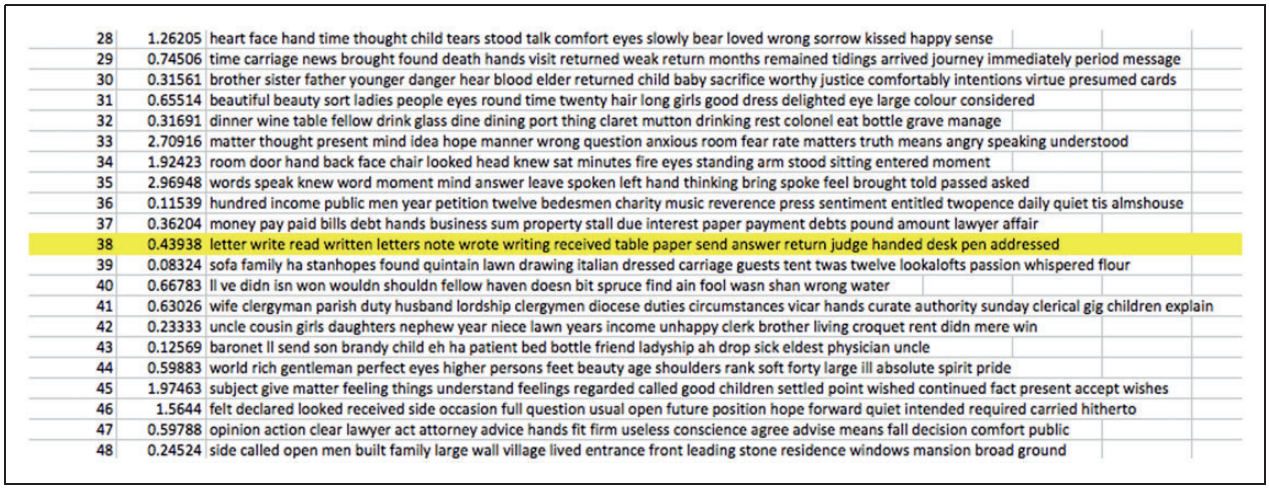
Literary critics have had a particularly difficult time accounting for small groups of related novels like the Barsetshire series, in part because theories of the novel almost always take the single novel as their main unit of analysis. Theories of the Victorian novel also tend to assume (even when they don't assert) that novelists like Trollope seek to represent the singular social world of the individual novel as a finished and stable totality. And from this perspective, the Victorian novel's representation of social totality depends upon its unified, singular, self-enclosed formal totality. Critics imagine this formal totality as secured by a controlling omniscient narrator who sees all, knows all, and describes all from a point above and outside the novel. Such a total coherence clearly can't be the model for the more partial and contingent connections that join the Barsetshire series into a loose group. And yet critics who do deal with groups of novels, such as advocates of "distant reading", seek to identify large-scale patterns across hundreds or thousands of novels—a search that tends to end with the discovery of new varieties of structural totality.[3] So while distant reading offers us some new insights into the study of novels, it is equally unsuited to understanding the kinds of middle-distance questions raised by Trollope's small group.[4]

How might we undo the ingrained habit of reading social totality and formal totality together that both close and distant readings of the novel seem to share? How might we instead find a way of reimagining the forms of the six novels as semi-detached and their social relations as more partial and unfinished? Borrowing technology built for relatively "big" data and turning it on the relatively small 1,396,000-word corpus of the Barsetshire series offers us one path. Running various iterations of the unsupervised latent Dirichlet allocation topic modeling algorithm in MALLET[5] on their collective 314 chapters generates a number of topics that suggest both expected and unexpected connections between the very different novels in the informal series. And these connections, when tracked back into individual chapters and read by humans rather than machines, offer us (among other things) a look at the Barsetshire novels' own encoding of the layered histories of the novel's many attempts to capture social relations and social worlds through testing out different genres.[6]

For example, we can look at the various versions of one topic whose most frequently occurring words are likely to be "letter write read written letters note wrote writing received table paper send answer return judge handed desk pen addressed" (here labeled topic 38) (see Figure 1).[7] Turning to the chapters in which the topic is likely to appear shows that the Barchester series isn't merely full of letters (See Moody, 2003). It is, of course, but the appearance of these letters, notes, addresses, and envelopes suggests not merely an emphasis on correspondence; it also points to a generic revenant, to the series' haunting by the ghost of the epistolary novel, or novel-in-letters. One of the most popular novelistic forms during the middle of the 18th century, by the century's end the epistolary novel had fallen out of favor. By the mid-Victorian moment of the Barchester novels it was a distant—but, as this model helps us see, persistent—memory.

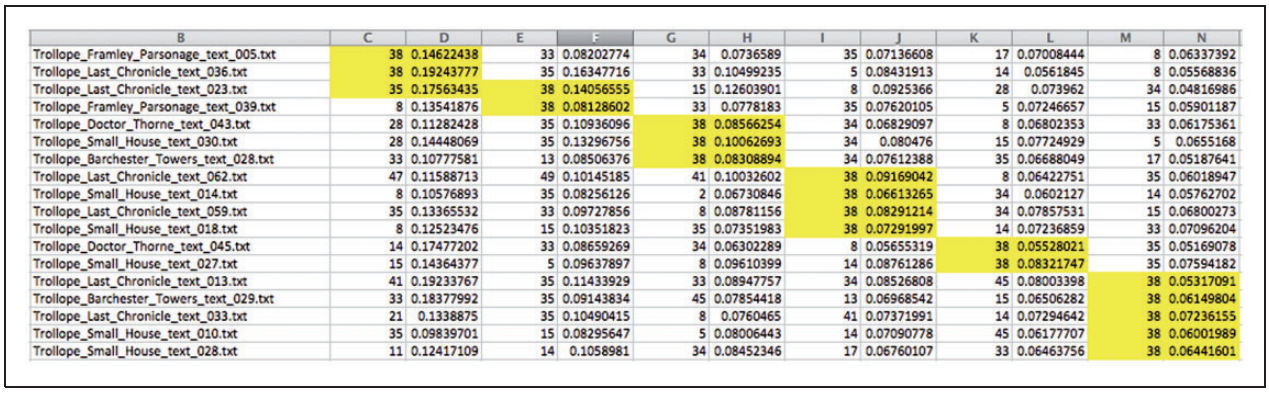
A relatively low-density topic, distributed in drips and drabs throughout the Barchester novels, the "letter write read written letters note" topic thus addresses itself to the past epistolary novel genre trapped inside; we glimpse it in outline, like a bricked-up window in a Victorian renovation of a Georgian house.[8] Read alone, the topic can't tell us anything about this generic fossil; it suggests only the idea that letter exchange and correspondence is a recurring topic or theme, a part of the novels' "contents." But when we examine the "topics in documents" output, we realize that the chapters in which characters exchange letters and worry about unsent notes gesture to that earlier genre and even proffer an alternative configuration for the novel (see Figure 2). The topics in documents output even points to one chapter in which the narrator announces that for the moment he will regress to the genre of the epistolary novel for the length of the chapter.[9]

The generative uncertainty of topic modeling is crucial here, and stems from the enabling assumptions of topic modeling—the counter-factual assumptions upon which the topic modeling algorithm is explicitly and deliberately based. Topics are probabilistically created formations, and the algorithm that generates topic models is based on the enabling—but crucially,



28	1.26205	heart face hand time thought child tears stood talk comfort eyes slowly bear loved wrong sorrow kissed happy sense
29	0.74506	time carriage news brought found death hands visit returned weak return months remained tidings arrived journey immediately period message
30	0.31561	brother sister father younger danger hear blood elder returned child baby sacrifice worthy justice comfortably intentions virtue presumed cards
31	0.65514	beautiful beauty sort ladies people eyes round time twenty hair long girls good dress delighted eye large colour considered
32	0.31691	dinner wine table fellow drink glass dine dining port thing claret mutton drinking rest colonel eat bottle grave manage
33	2.70916	matter thought present mind idea hope manner wrong question anxious room fear rate matters truth means angry speaking understood
34	1.92423	room door hand back face chair looked head knew sat minutes fire eyes standing arm stood sitting entered moment
35	2.96948	words speak knew word moment mind answer leave spoken left hand thinking bring spoke feel brought told passed asked
36	0.11539	hundred income public men year petition twelve bedesmen charity music reverence press sentiment entitled twopence daily quiet tis almshouse
37	0.36204	money pay paid bills debt hands business sum property stall due interest paper payment debts pound amount lawyer affair
38	0.43938	letter write read written letters note wrote writing received table paper send answer return judge handed desk pen addressed
39	0.08324	sofa family ha stanhopes found quintain lawn drawing italian dressed carriage guests tent twas twelve lookalofts passion whispered flour
40	0.66783	ll ve didn isn won wouldn shouldn fellow haven doesn bit spruce find ain fool wasn shan wrong water
41	0.63026	wife clergyman parish duty husband lordship clergymen diocese duties circumstances vicar hands curate authority sunday clerical gig children explain
42	0.23333	uncle cousin girls daughters nephew year niece lawn years income unhappy clerk brother living croquet rent didn mere win
43	0.12569	baronet ll send son brandy child eh ha patient bed bottle friend ladyship ah drop sick eldest physician uncle
44	0.59883	world rich gentleman perfect eyes higher persons feet beauty age shoulders rank soft forty large ill absolute spirit pride
45	1.97463	subject give matter feeling things understand feelings regarded called good children settled point wished continued fact present accept wishes
46	1.5644	felt declared looked received side occasion full question usual open future position hope forward quiet intended required carried hitherto
47	0.59788	opinion action clear lawyer act attorney advice hands fit firm useless conscience agree advise means fall decision comfort public
48	0.24524	side called open men built family large wall village lived entrance front leading stone residence windows mansion broad ground

Figure 1. Topic key for 50 topics, topic 38 highlighted.



B	C	D	E	F	G	H	I	J	K	L	M	N
Trollope_Framley_Parsonage_text_005.txt	38	0.14622438	33	0.08202774	34	0.0736589	35	0.07136608	17	0.07008444	8	0.06337392
Trollope_Last_Chronicle_text_036.txt	38	0.19243777	35	0.16347716	33	0.10499235	5	0.08431913	14	0.0561845	8	0.05568836
Trollope_Last_Chronicle_text_023.txt	35	0.17563435	38	0.14056555	15	0.12603901	8	0.0925366	28	0.073962	34	0.04816986
Trollope_Framley_Parsonage_text_039.txt	8	0.13541876	38	0.08128602	33	0.0778183	35	0.07620105	5	0.07246657	15	0.05901187
Trollope_Doctor_Thorne_text_043.txt	28	0.11282428	35	0.10936096	38	0.08566254	34	0.06829097	8	0.06802353	33	0.06175361
Trollope_Small_House_text_030.txt	28	0.14448069	35	0.13296756	38	0.10062693	34	0.080476	15	0.07724929	5	0.0655168
Trollope_Barchester_Towers_text_028.txt	33	0.10777581	13	0.08506376	38	0.08308894	34	0.07612388	35	0.06688049	17	0.05187641
Trollope_Last_Chronicle_text_062.txt	47	0.11588713	49	0.10145185	41	0.10032602	38	0.09169042	8	0.06422751	35	0.06018947
Trollope_Small_House_text_014.txt	8	0.10576893	35	0.08256126	2	0.06730846	38	0.06613265	34	0.0602127	14	0.05762702
Trollope_Last_Chronicle_text_059.txt	35	0.13365532	33	0.09727856	8	0.08781156	38	0.08291214	34	0.07857531	15	0.06800273
Trollope_Small_House_text_018.txt	8	0.12523476	15	0.10351823	35	0.07351983	38	0.07291997	14	0.07236859	33	0.07096204
Trollope_Doctor_Thorne_text_045.txt	14	0.17477202	33	0.08659269	34	0.06302289	8	0.05655319	38	0.05528021	35	0.05169078
Trollope_Small_House_text_027.txt	15	0.14364377	5	0.09637897	8	0.09610399	14	0.08761286	38	0.08321747	35	0.07594182
Trollope_Last_Chronicle_text_013.txt	41	0.19233767	35	0.11433929	33	0.08947757	34	0.08526808	45	0.08003398	38	0.05317091
Trollope_Barchester_Towers_text_029.txt	33	0.18377992	35	0.09143834	45	0.07854418	13	0.06968542	15	0.06506282	38	0.06149804
Trollope_Last_Chronicle_text_033.txt	21	0.1338875	35	0.10490415	8	0.0760465	41	0.07371991	14	0.07294642	38	0.07236155
Trollope_Small_House_text_010.txt	35	0.09839701	15	0.08295647	5	0.08006443	14	0.07090778	45	0.06177707	38	0.06001989
Trollope_Small_House_text_028.txt	11	0.12417109	14	0.1058981	34	0.08452346	17	0.06760107	33	0.06463756	38	0.06441601

Figure 2. Lines from topics in documents MALLET output showing chapters with relatively high percentages of topic 38.

counter-factual—"assumption that documents have multiple topics" (Boyd-Graber et al., 2014: 4). By looking at the documents we offer it, the algorithm generates topics that, in given proportions, compose each document. (Or, rather, it generates the probability that a certain percentage of words in every given document were generated by a given particular topic.) Topics, of course, don't actually exist prior to the documents that generate them; they don't actually exist independently in the same way the documents (in this case, our chapters of novels) exist at all. They are, in a certain sense, fictions—they might have existed, they are the kind of thing that could exist given the existence of the document set in question. This deceptively simple point can seem obvious, or like a minor technical detail. And for some applications of topic modeling, it may well be. But the fictionality of topics is crucial to remember for literary-critical uses of topic modeling, for it reminds us that these models offer us a view of our document set radically at odds with any other more literal sources of a novel we might use—such as an author's notes towards a novel, or a catalog of the virtual or actual library of books a novelist brings to the writing table, or even the looser sense of social "discourses" that exist prior to novels and which we might imagine in part "composing" a novel.[10]

So the topic modeling algorithm knows nothing about letters, nothing about narrative form, nothing about Trollope. All it can tell us is that 1) this string of tokens (in our case, words) co-occur together more than we would expect, all things being equal, and 2) some particular documents (in this case, chapters) are composed of a certain number of tokens (words) with a relatively high probability of belonging to this topic. But the algorithm's lack of knowledge of semantic meaning, and particularly its lack of knowledge of the Victorian novel as a form or genre, lets it point us to a

very different model of the social than the kind of formal totalities held out to us by the novel theory we currently possess. As a kind of reader who knows nothing at all about the rich historical, formal, and social contexts within which the Barsetshire novels (like any novels) are embedded, the algorithm offers us a new view—not a more accurate one, but a different one that lets us see and interpret our novels in a denaturalized and different light. Rather than suspending us in a totalizing system or network, it decomposes our novels, taking us backwards into a fictional composition history, towards the other potential, unwritten novels the Barchester series might have been. The algorithm helps us imagine the way any given novel contains within it many unfinished and impossible versions of itself—versions no Victorian author would or could have written. More specifically, in my example, it lets us see how the ghostly epistolary connections that stretch within and between novels in the series could replace or contradict any totalizing vision of the social, any model relying on a formal totality secured by the idea of an omniscient narrator of a single novel. In so doing, it jettisons any finished and final version of the fiction in favor of what we might think of as a kind of counterfactual set of notes. In some sense, we might imagine topics as the notes a (fictional) narrator might have taken towards writing the novel it (or she, or he, or even they) inhabits and over which it so often claims authorial agency.

I've offered a brief and particularly reflexive example of the way a topic model can point us not to the existing "contents" of novels imagined as represented worlds, but rather to the kinds of writing that prepared for or generated the Barsetshire novels. In the context of literary study, I argue, we should train ourselves to read topic models as notes written by nobody rather than "contents" merely poured into fictional form. I want to suggest, that is, that all topics generated from literary corpuses can help take us back to earlier imaginary forms and versions—discarded drafts that authors might have written but didn't, outmoded genres that are fragmentarily recycled within new forms. Topic modeling may be most useful for humanists when we use it this way, as a kind of uncanny, shifting, temporary index to the works we know best, rather than trying to imagine it, as we too often do, only as telling us something about the stable "contents" of large literary corpora. Closely linked to older traditions of indexing literature (from Victorian Bible concordances to Caroline Spurgeon's index to all of Shakespeare's figural language in *Shakespeare's Imagery* to Roberto Busa's *Index Thomisticus*), the algorithm's machinic, non-semantic, probabilistic characteristics can help denaturalize our relationship to literature and our attachments to the assumptions—about the sociality of literary form, in my example—baked into our favorite theories of the novel.

Not something a human would ever create, a topic model nevertheless perhaps has more in common than we might at first suspect with the probabilistic, counterfactual, human-created fictions we think we know. Although topics can look at first glance like a preexisting "discourse," that is, what topics generated from novels actually offer us is the ultimate formalist fantasy of the components of the novel's representation of a social world—a set of "topics" that make up the "contents" of a corpus with no leftovers, a nearly perfect correspondence between the materials of the work and the finished work itself.[11] As Stephen Ramsay argues in *Reading Machines*, using algorithms need not propel us towards applying an ersatz scientific and scientistic evidentiary standard to literary interpretation, but rather should reveal and perhaps help amplify our already part-algorithmic literary-critical reading practices, the regular sets of protocols and procedures of analog literary criticism with which we are very—perhaps sometimes too—familiar (Ramsay, 2011: 14).[12] It is as fantasies of formalist reading practices, perhaps, that topic models of literary texts can be most helpful to human readers—as denaturalizing indexes or suggestive counter-factual maps that open up new interpretive possibilities.

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Notes

1. Trollope did not plan the six novels as a formal series from the beginning, but rather belatedly shaped them into a group. Scholars differ on when Trollope, his reviewers, and readers, began to recognize all six as a set; see Poovey (2010).
2. For work towards computational approaches capable of capturing some of the ambiguity and complexity of the

"formal" and "referential" identity of characters within and across novels, see Bamman et al. (2014). For an overview of the literary-critical significance of this work, see an abstract of the same title at http://www.ark.cs.cmu.edu/literaryCharacter/ (accessed 2 October 2015).

3. On the distant reading of novels see, for example, Franco Moretti (2000a, 2000b); Style, Inc. (2009); David Elson et al. (2010); Jockers and Mimno (2013); Underwood et al. (2013); Piper and Algee-Hewitt (2014); and Dewitt (2015). Also see Special issue on topic models and the cultural sciences, John Mohr and Petko Bogdanov (eds) http://dx.doi.org/10.1016/j.poetic.2013.08.005 (accessed 2 October 2015).
4. For a different argument about novel theory and social totality in the Barsetshire novels, see Poovey (2010).
5. See: http://mallet.cs.umass.edu/
6. For more on MALLET and LDA topic modeling, see the *Journal of Digital Humanities*' special issue on topic modeling 2:1 (Winter 2012), especially David Mimno's "The Details: Training and Validating Big Models on Big Data." Available at: http://journalofdigitalhumanities.org/2-1/ (accessed 2 October 2015). See also Underwood (2012).
7. The results to which I refer in the article were created with the same corpus using latent Dirichlet allocation in the MALLET topic modeling tool. The models I refer to here are not finished results, but early (and, close readers will note, messy) snapshots from part of a larger in-progress project. For reference, here is a set of the Barsetshire novels loaded into an implementation of latent Dirichlet allocation in javascript written by David Mimno: http://rachelsagnerbuurma.org/Barsetshire/topics.html. For the stopword list and documents used, see: https://github.com/rbuurma/BarchesterAssumptions. To use Mimno's software yourself, see: https://github.com/mimno/jsLDA
8. For an approach with related goals that uses computation to trace linguistic "topologies" that allow us to visualize "a latent sense of one text's presence in another" (p. 156), "not to make definitive pronouncements about absolute affinities or positions but to identify relative connections that could be otherwise" (p. 159), see Piper and Algee-Hewitt (2014).
9. Note also that the single chapter is composed of only .05 percent of this topic—in some visualizations of these topics across a larger corpus it might not appear at all (another argument in favor of topic modeling as a technique for indexing middle-distance sets of texts).
10. As Boyd-Graber et al. note, "Topic models are based on a generative model that clearly does not match the way humans write. However topic models are often able to learn meaningful and sensible models" (2014: 15).
11. For a comparison between the technique of keyword search as a way to locate "discourses" across multiple texts and the technique of topic modeling as a way of tracking "discourses" see Underwood (2014: 66).
12. See also Piper and Algee-Hewitt on how their algorithmically enabled identification of related clusters of pages from a subset of the works of Goethe is "not a replacement of hermeneutic reading but its facilitator—part of the long history of technologically informed reading practices" (2014: 162).

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