Complexity and the Place of Translation in Digital Humanities

Tanasescu, Raluca

3 Complexity and the Place of Translation in Digital Humanities

Post-Disciplinary Communities of Practice in the Translation Studies Network

Raluca Tanasescu

UNIVERSITY OF GRONINGEN,[1] THE NETHERLANDS

Introduction

There has been steadily growing interest in multilingualism and translation in the thriving field of digital humanities (hereafter DH) at all levels of scholarly communication since 2013; the interest peaked in 2019 with the creation of a Multilingual DH Special research group.[2] Born in an Anglophone environment, initially operating almost exclusively in the Global North, and typically leveraging tools that use English as the code language, DH has traditionally suffered from lack of linguistic diversity (Fiormonte 2012; Mahony 2018). Today, the spreading community of practitioners work on increasingly multilingual and multi-code corpora and have wonderfully diverse cultural backgrounds. What had initially been a tightly knit circle of like-minded scholars has turned into a much wider community, whose members now ask difficult questions related to race, identity, financing and research management, and so on (Gold 2012). Alan Liu (2020) suggests that, before approaching any identity issues and decolonizing DH, one first, essential step is to develop technical methods for dealing with multilingualism, that is, tools, tutorials, and code that meet the needs of scholars working in languages other than English. Nevertheless, in spite of the need for translation expertise in DH, translation studies (hereafter TS) has been almost immune to the cachet DH has gained across the humanities over the past ten years.[3] Since 2010, the number of presentations focused on translation at the yearly international DH conference organized by the ADHO (Association of Digital Humanities Organizations) has been between two and five, with most scholars coming from the field of literary studies. A simple search run in Benjamin's *Translation Studies Bibliography* with the keyword "digital humanities" returns only four results, none of them actually related to DH. Of course, as we will see in the next section, the interest in new computational research methods is slowly building, but at a much slower pace than in other humanistic fields of inquiry. As Claudia Angelelli notes in her EST2019 keynote address, "[a]lthough we have seen projects

that bring together T&I scholars and Computer Sciences, for example, the gap between these two fields still exists and offers many opportunities for cross-fertilization" (2019, 4).

One may wonder why TS should necessarily board the train of digital scholarship. The answer lies mainly in the complexity framework, which has been gaining more and more ground in translation (Marais 2014; Marais and Meylaerts 2018) and in the lack of operationalization of TS models. Reaching the level of sophistication and in-depth analysis required by complexity thinking is not possible unless one pays proper attention to the harmonious balance between ontological and descriptive complexity (Emmeche 2004). On the one hand, ontological complexity refers to the great number of heterogeneous components of a structure, whose interaction produces a collective behavior that is different from the behavior of the individual components. Descriptive complexity, on the other hand, implies that multiple methods are needed to describe a thing or phenomenon in a reasonably complex way. To achieve all these, I argue, we need to be able to operationalize our research models, be they comparative, processual, or causal (Chesterman 2000), which means being able to offer a representation of the objects of study "in the form of data to process, in order to make objects and observations computable, as well as to analyze, transform and visualise data" (Ciula et al. 2018, 10). Moreover, interdisciplinary approaches are not sufficient for attaining complexity, because they do not necessarily imply the use of computational models, and a step further to transdisciplinarity, and even postdisciplinarity, is needed for continued growth and consolidation. Transdisciplinarity is understood here along the lines of quantum physicist Basarab Nicolescu's third definition (2014)—experimental transdisciplinarity—which is a combination of his three axioms: levels of reality, the principle of the hidden third (an outside element that unifies two different objects, usually science and technology), and complexity. Postdisciplinarity is used in the sense that the Santa Fe Institute complexity scientists describe their way of doing research, by involving scientists irrespective of their disciplinary positioning, with the view to solving the problem at hand.

The first section provides a comparison between the transdisciplinary nature of DH and the interdisciplinary nature of TS, and argues that their joining hands via complexity and computation (the hidden third) will help both to acquire a post-disciplinary status. In doing so, the chapter also provides an overview of DH contributions that have called for language and translation awareness, as well as a synopsis of DH-favorable moments in the history of TS. The third section considers seeing TS knowledge as a semantic network, a nonlinear, operationalized model outside of the theory–practice axis and, as a case in point, analyzes the full corpus of abstracts presented at the 2019 EST Congress in Stellenbosch by means of computational semantic analysis. In doing so, the author seeks to identify all existing DH-inflected presentations and their place in the overall network, along with possible other presentations and research strands that may constitute access points for digital scholarship in TS. The derived networks reveal a series of relationships between topics, which

suggest underexplored communities of practice, such as involving methodologies specific to computational linguistics in the study of literary translation.

Capturing the multiplicity of translation discourses—in the plural—is essential for mapping out the complexity underpinning the discipline of translation, like many scholars before us have rightfully argued. This chapter calls for a more methodologically varied take on any scholarly discourse involving translation: it reflects on the truly appealing collaborative prospects presented by a digital stance, which could beautifully complement the inter-disciplinary nature of TS and make a contribution to the established field of DH in the process.

Mutual Interests and Parallel Histories

This chapter's main tenet is that neither of the two disciplines in question could properly employ complexity thinking without joining forces with the other. In DH, the need for multilingualism points at a gap in descriptive complexity which, in turn, leads to a gap in ontological complexity for all the humanities fields that use digital innovation, because the lack of appro-priate methodologies and tools for less widely used languages impedes the proper exploration of human and cultural diversity. As far as TS is concerned, digital humanism has not marked a shift other than reflecting on how translation as practice and profession has been impacted by technology-driven innovation. Referring to the importance of DH in humanities scholarship, Michael Cronin notes that "[D]igital humanism, […] an attempt to understand the fundamental changes that have occurred in contemporary culture and society with the advent of digital tools, is a movement of critical reflection, rather than a roadshow of cyber cheerleading" (Cronin 2013, 7). However, I argue that digital humanism in relation to translation should be more than that: it should be about new com-munities of scholarly practice that actively promote new digital methods and tools when talking about the complex nature of translation, because critical reflection can certainly achieve ontological complexity, but can only theorize descriptive complexity. But "Digital Humanities is about building things" (Stephen Ramsay cited in Endres 2017, 44), about hands-on coding or hands-on exploration of computational methods that will complement the humanist's grasp of what translation is. Neither of the two fields possesses the perfect tools to acquire complexity alone, however, together they are much closer to attaining the complexity objective.

According to "Manifesto for the Digital Humanities" (Dacos 2010), DH is a *transdiscipline*, a heterogenous field of humanistic, artistic, and social inquiry that uses a wide range of convergent teaching and research practices that are sensitive to technology-driven innovation. Its birthdate is considered to be the year 1949, when Father Busa listed computationally, with the help of IBM, all the words that form the work of Thomas Aquinas into the *Index Tomisticus.* [4] The first manifesto of DH was drawn up in 2010, at ThatCamp in Paris, after more and more humanists became aware of the impact of

technology on their work and object of study.[5] There have been many attempts to adhere to one definition or another of this now established field and no clear consensus has been reached, except that it can be broadly conceived as scholarly work carried out at the intersection of digital technology and humanism. From a strictly humanistic point of view, the field of DH is characterized by two main features: on the one hand, a less pervasive presence of the print as a normative medium, with more and more emphasis on multimediality and multimodality; and, on the other hand, an accent on the collaborative and plural investigation of the production of human culture by leveraging experimental and established computational methods and approaches.

The methodological, processual, and conceptual reach of digital humanities allows the discipline to harbor not only research on humanities topics concerned with technology, but also humanities, arts, and social science research that is carried out using technology. This is exactly what makes it a transdiscipline and what allows for as many definitions as there are fields of humanities, arts, and social sciences. As a transdiscipline, it "addresses and engages disparate subject matters across media, language, location, and history" (Burdick et al. 2012, 24), and offers tools and perspective that come from the field of natural sciences, thus, expanding the traditional ways in which humanists and sociologists have carried their scholarly work. However heterogeneous, DH-aligned research is typically perceived as integrating harmoniously quantitative and qualitative research, as enhancing teaching and fostering research collaboration, as offering practical solutions for interrogating large textual corpora, and as having a real public impact outside university settings, because "the Digital Humanities is unified by its emphasis on making, connecting, interpreting, and collaborating" (Burdick et al. 2012, 24).

According to Matthew Kirschenbaum (2013), DH has historically had a strong footing in English departments, for a number of reasons that gravitate around text and text manipulation: first, text is the most tractable data type for computers; second, computers have traditionally been associated with text composition; third, English studies have always had a manifest interest in building textual corpora and storing them digitally in archives; fourth, there has always been a continued opening to various forms of e-literature, as well as to e-reading and e-readers; and fifth, scholars in English departments have shown an extraordinary opening to cultural studies, for which "computers and objects of digital material culture become the centerpiece of analysis" (Kirschenbaum 2013, 6). An unintended downside, therefore, is the fact that too many visible DH projects are carried out mainly in English. Another limitation is the unbalanced geographic and disciplinary distribution. A study carried out on articles published in the *Computers and the Humanities* journal between 1966 and 2004 (Huggett 2012) indicates that 87% of the articles were related to linguistics and literature. A retrospective bibliometric exploration of DH-related documents on the Web of Science (Wang 2018) shows that this rapidly growing field is associated more with history, literary and cultural heritage, and information and library science than to other humanistic

disciplines. At the same time, out of the 16 languages represented, English continues to be the predominant language of scholarly communication, with most contributions coming from the United States, the United Kingdom, the Netherlands, and Germany. A more recent piece of research into the transdisciplinary nature of DH shows that the field is community-based and that disciplinary distribution is still unbalanced (Yang et al. 2020). With several notable exceptions (mainly related to computational linguistics, e.g., Canavese 2019), TS is one of the disciplines that is severely underrepresented.

The discourse and methods of the digital humanities are an exercise in complexity themselves. Complexity is essential to multiple readings and interpretations in academic research and coding is seen as essential to disentangling multiplicities. As McCarty notes, complexity underpins the economy of plenty, as a fructifying and terrifying cornucopia in contemporary research (2016, 73). Regarding electronic scholarly editing, for instance, Martha Nell Smith notes that complexity in general and coding in particular provide "a healthy self-consciousness" about the circumstances of knowledge creation (2004, 313). Complexity is also permanently sought in charts and maps (Drucker 2016), in preserving the multifariousness of cultural heritage through mapping "the complexity of cities – as embodied, lived in, built, imagined, and represented spaces" (Presner and Shepard 2016, 209), in the study of the human–computer interfaces (Ruecker 2016, 400), in our delegations to technology as in the Internet of Things—through "this process of offloading tasks to the Internet of Things, new possibilities come into being, some as synergetic effects and others as unintended consequences" (Jørgensen 2016, 49), in linked data and semantic web, as essential tools for understanding the complexity of humanists' discourse and of the disciplinary developments in the humanities (Oldman, Doerr and Gradmann 2016, 255), in relation to data storage, hypertextual history, and virtual reality systems.

Nevertheless, complexity in DH has been marred by a lack of institutional and linguistic complexity. While the field is inching towards institutional complexity year after year, with more and more humanities programmes all over the world adopting a computational component, linguistic complexity remains a thorny issue. Reputed DHer Alan Liu (2020), for instance, starts from two simple observations (or propositions), according to which a) linguistically, and also professionally, DH increasingly behave as a single, unified field; b) however, no one community of scholars can standardize the usage of "the digital humanities" or similar field designations. He shrewdly notes that multilingualism and linguistic variation in the humanities makes it impossible to talk about *the* DH, but of DH only in the plural. Moreover, he proposes to replace the metaphor of DH as "a big tent" with that of a "diversity stack" that is instrumental in providing appropriate theoretical strategies, methods and tools to the humanities in its quest to achieve diversity: "From low to high, crucial levels in such a stacked approach include technical methods for dealing with *multilingualism*, multimedia, unrepresentative corpora, geopolitical and temporal organizations of identity, and the theory of identity" (Liu 2020, 30, emphasis mine). Thus, this is a crucial moment for the history of DH, and TS can certainly contribute substantially.

Compared to the methodological, processual, and conceptual opening of a transdiscipline like DH, TS ranks lower in terms of the degree of collaboration among its constituent disciplines. Indeed, although feeding itself from (socio)(psycho)linguistics, literature, cultural studies, and sociology, among others, as a new discipline, TS has maintained an enduring emphasis on its independence (Snell-Hornby 2010). Citing the distinction made by Klaus Kaindl (1999) between multi-, inter-, and transdisciplinarity, Austrian scholar Susanne Göpferich (2011, 5) maintains that TS has only achieved a level of importing interdisciplinarity, because it "uses concepts, methods and theories from [an]other discipline[s] to gain deeper insights within its own field but without giving anything back to the 'donor' discipline (Kaindl 1999: 147)", and that it may never achieve transdisciplinarity. Citing Ursula Hübenthal (1991), Göpferich explains that what Kaindl called "reciprocal inter-disciplinarity"—equal theoretical and methodological partnering for tackling issues of mutual interest—may be the furthest TS may get, because transdisciplinarity actually involves a degree of collaboration with fields from completely different scientific areas, such as the humanities and the natural sciences. As I explained before, transdisciplinarity in the humanities has, over the past decade, already been achieved by successfully partnering traditional fields of humanistic enquiry with disciplines such as natural language processing (NLP), network science, and geographic information systems, to name a few; thus, more and more researchers brand themselves as carrying on research in computational linguistics, digital historical networks, or spatial humanities. Digital translation studies, though, has yet to emerge.

In spite of various other disciplines having marked more or less prominent turns across the five decades of the existence of TS, TS has never taken the courageous step of becoming a transdiscipline itself; rather, it has been preoccupied with drawing disciplinary boundaries and with becoming a discipline in its own right. The only attempt at a theoretical conceptualization of transdisciplinarity in translation is Doris Bachmann-Medick's call for a translational turn (2013), which was triggered by the increasing centrality of translation as a process of mediation and transfer and as a medium of exchange and transformation in times of globalization. At least three other turns have been advanced since: a technological turn (O'Hagan 2013), an intercivilizational turn (Robinson 2016), and an outward turn (Bassnett and Johnston 2019). Nevertheless, none of these turns explore uncharted territories in scholarly research outside TS, instead, they keep looking inwards. O'Hagan notes that "an advanced use of translation tools is calling for an understanding of the nature of mediation by technology to uncover the complex relationship being formed between the translator and the tool" (2013, 512), thus, mapping the technological turn onto the impact of established and emerging technologies on professional translators and extending the discussion only to the role of translation in new media. The second turn does address the way scholars carry out research on translation, but only from a purely conceptual point of view; it offers to remove barriers between civilizations and break the "Eurocentric spell" that may prevent dialogues with a culture like

China, thus, critically re-addressing and re-assessing longstanding postcolonial issues. The outward turn proposed by Susan Bassnett and David Johnston uses a different lingo to put forward a very similar proposal to Robinson's (2016, 181), that is, "the recognition of the need for an increasing plurality of voices from across the globe." In other words, scholars who do address the issue of technology in TS limit the discussion to its impact on agents that do the translation, and ignore the impact it may have on the agents that study translation, while scholars who do research on translation, more often than not, ignore the impact of technologies.[6] Far be it for me to criticize in any way the otherwise brilliant and inspiring work by these scholars. I simply use these examples to demonstrate that a technological turn in TS is only partial, and to suggest that, these days, no conceptual discussion about translation is complex enough unless it tackles the issue of computation. Although O'Hagan was right to predict that TS's "next phase of growth arguably could hinge on the stance it takes on technology" (2013, 514) and that "a focus on technology will provide a worthy direction for translation scholars who seek to deepen their understanding of the nature of the translation task in dynamic technologized environments" (2013, 514), exploring the potential of technologies and computational approaches in scholarly research on translation, in and outside technologized contexts, is equally important. To my mind, this is one of the building blocks of critical TS, and DH may play a crucial role in overcoming the unexplainable methodological and processual selectiveness of our discipline. Nevertheless, at the same time, I would like to suggest that DH may benefit just as much from taking TS under its umbrella: while the former may contribute computational know-how and a truly collaborative mindset, the latter may possess the right angles for dealing with "colonial DH." It would be an outward-looking process that may benefit both the ontologies and the methodologies of these two disciplines, thus, leading to ontological and descriptive complexity.

Translation in Digital Humanities: A Tale of Multilingualism and Multimediality

The importance of translation for DH is not a simple intuition, but a reality that is undertheorized and, perhaps, even still largely underestimated. Nevertheless, the expansion of multilingual and cross-lingual research across the humanities and social sciences makes translation an important factor in many DH projects. In recent years, several scattered, but very promising essays have examined the role of translation in small-scale DH projects. It includes Translation Arrays (2012), a database of 50 German translations and adaptations of Shakespeare's *Othello*, which mined information about world cultural variation and change; and the visualization of the Franz Rosenzweig archive at the University of Kassel—one of the many DH projects that contains "salient yet undertheorized moments of translation" (Handelman 2015). Although mainly concerned with (meta)data visualizations and other issues pertaining to German studies, the latter essay is suggestively titled "Digital

Humanities as Translation," and lists a number of hardships related both to the translation of hard copies into a digital archive, and to translation proper. Handelman insightfully argues that, "as much as the digital humanities pave new inroads for research, they also require and return us to critical concepts central to German literary and cultural discourse, such as translation" (2015, 1), and concludes that

> at stake in *bringing the concepts of translation*, cultural criticism, and close and contextualized reading from German Studies *into dialogue with the digital humanities is* less the validity of Rosenzweig's or my specific approach to translation, and *more the visibility and benefit of further discussion*.

> (2015, 17)

Another example of DH-inflected research that could benefit TS scholars' strong grip on moving between and among languages is multilingual data processing—i.e. the topics of finding language-independent ways of automatically preparing, deduplicating, and mining multilingual corpora—which has generated little scholarly attention so far, although it is an increasingly relevant problem. In addition, translation started to receive more and more attention, also from electronic literature scholars, and is increasingly debated during dedicated conferences. The Renderings project at the Massachusetts Institute of Technology in 2014 aimed to translate "highly computational and otherwise unusual digital literature into English" (Marecki and Montfort 2017), thereby to translate electronic literature between programming languages. Manuel Portela, María Mencía, and Søren Pold (2018) approached the topic of the exclusion of a text's mediality and materiality via translation, which are not typically seen as part of the translation problem. The most constant interest in translation comes from stylometry, the computational study of linguistic style by quantitatively evaluating an author's style using various statistical criteria, with tens of articles and presentations (co-)authored by Polish scholar Jan Rybicki (2012; etc.) and Rybicki and Magda Heydel (2013). I will also offer here the example of a multilingual corpus of over 200 Latin, English, French, and German 17th and 18th-century natural science works that I am currently working on[7] in the Faculty of Philosophy at the University of Groningen. Our objective is to find a way to link the works in a network on the grounds of their semantic similarities, and to study them further by means of multilayer network analysis, both from a social point of view, and from a more granulated semantic standpoint. In this context, I was surprised to quickly find out that established DH methods of semantic analysis, such as topic modeling and tf-idf (term frequency-inverse document frequency), can be applied to monolingual contexts only, and that there is only one way in which such a task could be carried out effectively: word embedding using the Facebook-developed tool called fasTText.[8]

Since the international DH2019 conference organized at the University of Utrecht, the need to reshape the field of DH to accommodate multilingualism and to overcome the English-centric bias has been clearly formulated. Multilingual DH, a "loosely-organized international network of scholars using digital humanities tools and methods on languages other than English" has as an objective to raise "the visibility of scholarship in and about many languages" (www.multilingualdh.org). While the first draft of this chapter was in the making in October 2020, two visible online events on the same topic were organized: Quinn Dombrowski's "Multilingual DH and the English Default" talk, hosted by McGill University (Canada), and a panel organized at the Vanderbilt University (United States), titled "Multilingualism, Translation, and Directionality in Global Medieval DH." The groups have signaled the inadequacy of monolingual tools for multinational groups of scholars and have called for setting a series of best practices related to language use in global digital projects. At about the same time, *The Programming Historian*—the reference website for humanists wishing to integrate digital tools and code into their teaching and research—gave extra visibility to their French and Spanish editions and opened a call for new members working in French. Moreover, the Global Outlook: Digital Humanities (GO:DH) special interest group, under the ADHO umbrella, is dedicated to helping "break down barriers that hinder communication and collaboration among researchers and students of the Digital Arts, Humanities, and Cultural Heritage sectors in High, Mid, and Low Income Economies" (ADHO website). Tackling the importance of multilingualism in DH could definitely benefit from the expertise of translation scholars. And all the more so since the latter acknowledge that multilingualism poses a challenge, even to their own discipline (Meylaerts 2012), since translation does not take place between two monolingual realities, but rather within multilingual ones. The interest is, thus, mutual and the need to reflect multilingualism at all levels of scholarship is more stringent than ever.

Digital Humanities Approaches in Translation Studies

One may have expected TS to manifestly embark on the DH journey around the year 2000, when Franco Moretti's concept of distant reading—analyzing large corpora of literary text using computational quantifying and visualization methods and tools (Moretti 2000, 2013; Underwood 2017)—created both hype and indignation among humanists.[9] Concerning a descriptive and corpus-based discipline, one may have entertained hopes that combining close and distant reading would appear as an attractive and promising endeavor for literary translation scholars, just as it was for their peers in literary studies. However, TS was slow to jump on board (St. André 2018) and, while it is very difficult (and also beyond the purpose of this essay) to identify when such DH contribution appeared in TS for the very first time, it appears that it was only as recently as 2018–2019 that DH-inflected research started to gain more and more ground, unquestionably driven by a very fitting and timely complexity paradigm.

Another perfect moment for TS to embark on the computational research journey could have been 2007, when *META: Journal des traducteurs* published a seminal issue on the connection between translation and network studies, curated by Canadian scholars Deborah Folaron and Hélène Buzelin. The presentation offers an excellent overview of the notion of network, and moves across disciplines and schools with a familiarity and gusto that attest not only to the authors' intellectual prowess, but also to the potential natural relationship between the two fields. It was there, and in Buzelin's "Unexpected Allies: How Latour's Network Theory Could Complement Bourdieusian Analyses in Translation Studies" (2005) that the connection between Bruno Latour's relationist sociology and translation—more specifically in relation to the world of literary translation—was explored for the first time. However unexpectedly, actor-network theory became a necessary ally to Bourdieu's sociology, because it opposed Bourdieu's single-world "irreducible, incommensurable, unconnected localities, which then, at a great price, sometimes end in provisionally commensurable connections" (Latour 1996, 371). Besides offering a more complex conceptual base for tackling translation conceptually, the field of network studies comes with a clear and established research methodology, namely network analysis, which is widely used in historical research, sociology, and literary studies, to name only a few of the fields from which TS has been taking its methodological inspiration:

> While network approaches and trends in mathematics, physics and computer sciences, for example, might seek to focus on structures to explain, elucidate and model, the network concept counterparts in the social sciences must be assessed additionally in terms of their capacities to critique and, perhaps to act, transform and improve.
>
> (Folaron and Buzelin 2007, 624)

Although in DH scholars agree that mostly any kind of data can be studied using network analysis (Kaufman et al. 2017), TS scholars have been using this notion mostly conceptually.

In the same issue of *META*, Şehnaz Tahir-Gürçağlar explores the potential of networks to provide a more comprehensive inventory of historical facts related to literary translation, using the case of popular literature in Turkey. She aptly notes that the notion of context has been vaguely defined in TS and that contexts are actually made of layers of contexts, from the micro to the macro level. Citing John Law, who argues that the world cannot be fittingly explained and neatly structured using social categories, because it also contains a high degree of mess ("vague, diffuse, unspecific, slippery, emotional phenomena that do not display much pattern at all" (Law 2004, 2)), Tahir-Gürçağlar advances that TS might mismanage findings in order to make them fall into certain categories, instead of allowing apparent "chaos" (that is, the reality of practice) to generate theories:

> I would like to suggest that the world of translation also involves a high degree of mess, confusion and disorder and that our current critical theoretical frameworks are forcing these conditions into set categories, organizing the disorder into seeming order, sometimes lumping together findings that agree with theoretical expectations and excluding or glossing over those that challenge them.
>
> (2007, 725)

She sees the drawing of network maps as a felicitous method to account for translators' agency, for the set of relationships they develop through their everyday work, as well as for the way certain genres relate in surprising ways with other genres. She adds a visual component to the method proposed by Buzelin (2005), thus furthering the inclusive scope of a similar research agenda. Both scholars zoom in on practices and networks of translators in order to provide a better contextualization for the translation practice, instead of first providing the framework and only subsequently dwelling on individual phenomena.

With scholars like Tahir-Gürçağlar clearly laying out the merits of a network model for providing various points of access to translation phenomena, and in accounting for the mess that is often disregarded by a systemic mode of thinking, one may have expected network analysis to gain traction and become a popular research method among translation scholars; however, it is still very recent and underused.[10] After Anthony Pym's 2007 article[11] in the same issue of *META*, which describes the web of periodical distribution for a certain literary journal at the end of the 19th century, employing networks in cross-cultural context and unearthing an intercultural sub-network of cultural influence, computational network contributions have appeared only recently under the burgeoning complexity framework: a book chapter on the applicability of complex networks, specifically networks of networks and their non-trivial topological features, their behaviour at percolation, and their connectivity and expansion in studying multilingual literary translation networks in digital space (Tanasescu and Tanasescu 2019), a chapter on Iran's literary polysystem (Ashrafi 2019), and a series of articles on randomness playing an important role in the agency of poetry translators coming from small countries within the context of complexity (Tanasescu 2019; Tanasescu 2021). Also related to the sociology of poetry translation, Jacob Blakesley published a chapter on using network analysis for reading distantly modern European poet-translators (2018). Last, but not least, a very active scholar working in the history and sociology of translation from a global, network science, and DH perspective is Diana Roig-Sanz, who maps transnational processes of cultural transformation in Hispanic modernity by dint of network analysis in her European Research Council-funded research, titled Social Networks of the Past: Mapping Hispanic and Lusophone Literary Modernity. Looking at translation from an overt DH perspective is nascent and has more to do with isolated research agendas (Gallitelli 2016; Youdale 2020) than with a general reorientation of the field towards computational approaches. Developing tools for TS research is a completely isolated endeavor, therefore, I feel

compelled to mention here a tool that discovers diachronic trends in translations (Bizzoni, Reboul and Del Grosso 2017).

Analyzing Semantic Networks of Translation Scholarship: The Case of EST2019 Living Translation

How likely is it for these disciplines to get together though? Given the long-standing relationship between DH and linguistics and literary studies, the role TS as a discipline may play in solving the multilingual conundrum in DH may be easily overlooked. Also, on a more practical note, it is less likely for DH scholars from other fields to take part in conferences branded as TS events (unless they specifically work on topics involving translation) and more likely for computationally minded translation scholars to participate in DH events. The answer, thus, is largely in our own field. As a case in point, let us have a look at the 2019 Congress organized by the European Society of Translation Studies at the University of Stellenbosch, titled Living Translation. The objective of this section is twofold: first, to identify such communities of DH practice and to examine their position and reach in the wider network; and, second, to find any possible points of entry for DH scholarship in this network. To this end, we will employ a mixed-method approach: a two-pronged semantic network analysis on the corpus of abstracts and traditional close reading of the said abstracts.

   Conferences organized periodically by international bodies that represent researchers in various fields typically seek to mirror the ontological and episte-mological complexity of the respective field at that given moment. They are perfect candidates for a system manifesting emergence, whose agents poten-tially "interact in multiple ways and follow local rules, meaning there is no reasonable higher instruction to define the various possible interactions" (Johnson 2001, 19). However, managing the ontological complexity of collec-tive knowledge in academic conferences is widely human-dependent, therefore it is heavily conditioned by a small part of the agents involved (the organizers). It is, in Nicolescu's terms (2014), only one of the levels of reality. The organi-zers launch a call for panels and only some of the panels are accepted. Then, a call for panels on specific subfields are put out by individual scholars or by teams of scholars, and guidelines are conceived for individual submissions by researchers whose work does not fall under specific calls. It means that the behavior of the network of researchers taking part in the respective conferences is conditioned, first, by the program chairs, who decide which special tracks are going to be in the program; second, by the organizers of each call, who select the papers in each panel; and, third, by the program chairs again, who decide how to schedule the accepted thematic panels and individual papers. In other words, the emergence of the macro-behavior of the respective body of scholar-ship is conditioned in great part by some of the agents in the system, and so is the self-organization of the network of interacting agents (scholars). The first two types of conditioning, or self-regulation, are obviously necessary to ensure

academic integrity, scientific suitability, and thematic relevance. However, the third step in the self-organization of a conference system has an enormous impact on the emergence of the respective knowledge systems. Simply put, the types of interactions established by the agents in the network can only be limited: scholars working on a certain topic are bound to attend their specific panel, especially if scheduled over the whole duration of the event, inter-disciplinary scholars who work on two or more subfields may experience various time-related conflicts, while scholars presenting individual papers may have a higher degree of liberty in choosing their interactions, but may have a hard time identifying relevant presentations. In other words, maximum emergence may be hard to achieve.

How likely is it, then, for a researcher working on literary translation, translation history, or translation quality assessment, for instance, to interact with scholars currently working on translation technologies or computational linguistics, who would provide the right computational tools and methods for an interdisciplinary, DH-inflected approach? Probably quite unlikely, because our history of placing scholarship about translation in neatly defined categories has deepened the gap between scholars using translation technologies, and the traditionally "non-technical" scholars. The event under scrutiny reunited four keynote presentations, 126 presentations organized in 20 thematic panels, nine posters, and 59 individual papers. Table 3.1 summarizes all these numbers and Figure 3.1 shows visually the distribution of the 198 contributions by themes and presentation categories. (The abbreviations in Table 3.1 will be used throughout the chapter to indicate the category of a presentation in the program of the conference.)

The most densely populated panel was the one dedicated to cognition, with 12 papers treating topics related to the experiential level of translation, followed by the panels on complexity (Panel 6), conflict (Panel 12), and transnationalism (Panel 20), each containing ten presentations. The least populated one was the panel on Bible translations (three presentations), followed by those engaging with feminism, translation in time of crisis, legal translation, and diaspora, with four abstracts each. Specifically engaging the issue of digital methods in doing translation history, the panel on big data approaches in translation history, unsurprisingly, also ranks low in terms of number of presentations, with only four. If we consider the papers and panels dedicated to methodology in general and digital methodology in particular, things start to look up. The five speakers in Panel 4 examined issues related to translation processes and strategies in a world dominated by English, but none of them engaged with the way this monolingual reality impacts the way they, as scholars, broach such topics. The seven speakers in Panel 19, on the other hand, engaged fully with the latest digital methods in translation and with the ways they can be exploited in creative contexts. However, the discussion was mostly concerned with the technological aspects of the processes involved in translation. Finally, Panel 10, focused on the future of translators in the digital age, approached the topic of digitalization from the point of view of translation professionals only, with no attention shown to translation scholars.

Table 3.1 The Structure of the EST2019 Congress

Abstract category	Abbreviation	#
Keynote presentations	keynote	4
Panel 1_60 years after Jakobson: new directions in inter-semiotic translation	Jakobson	6
Panel 2_Big translation history: The use of data mining and big data approaches	bigdata	4
Panel 3_Cognition live! The dynamic interaction with the environment	cognition	12
Panel 4_Empirical translation studies in a monolinguistic world: theoretical and methodological challenges	empirical	5
Panel 5_Expanding conversations on feminist and queer translation	gender	4
Panel 6_Exploring the implications of complexity thinking for translation studies	complexity	10
Panel 7_Indirect translation in the world we live in	indirect	6
Panel 8_Language rights in public service interpreting and translation	lgrights	7
Panel 9_Living translation as translaboration	translaboration	7
Panel 10_Living translation in transition: the human translator in the next decade	transition	7
Panel 11_Living translation when crisis strikes: policy, training, technology, and ethics	crisis	4
Panel 12_Re-thinking the role of the interpreter in conflict-related scenarios	conflict	10
Panel 13_Research in legal translation	legal	4
Panel 14_Translating minority voices in a globalized world	minority	5
Panel 15_Translation and diaspora: the role of translation in immigrant communities	diaspora	4
Panel 16_Translation as empowerment: new Bible (re) translations	Bible	3
Panel 17_Translation ergonomics: interfaces, interactions and interrelations between people, processes and products	ergonomics	6
Panel 18_Translation support policies vs. book industry practice in non-English settings	policies	5
Panel 19_Translation technologies for creative-text translation	creativetech	7
Panel 20_Transnational image-building and reception: linking up translation studies, reception studies and imagology	transnational	10
Individual papers	hors	59
Poster presentations	poster	9
Total number of abstracts		**198**

Figure 3.1 Word Cloud of the EST2019 Individual Presentations and Posters

Except for Panel 2, mentioned before, the only scholars who engaged with the digitalization of scholarly research and with the impact of digitalization on key concepts in TS were the ones working on complexity, specifically Audrey Canalès and her talk on how transmediality affects the way we think about the hierarchical distinction between source and target texts; Felix do Carmo and his analysis of the way in which the development of neural networks in machine translation invites a redefinition of translation process research; Cesuur Cohen, with a presentation on how the semiosphere of an IT project challenges the traditionally static meanings of the terms involved; and a talk in absentia that provided the blueprint of the present chapter.

The titles of the panels and the number of papers in each panel do tell us something about the state of the art of TS in Europe and beyond. However, establishing connections between these presentations outside their respective panels is remarkably difficult. Moreover, the 59 individual presentations and nine posters appear as an opaque mass of knowledge that is even more difficult to decipher in terms of connections and possible communities of practice outside the institutional ones. Instead of analyzing the body of knowledge presented at the EST2019 conference in the format it was delivered, I will examine it as a network, a non-linear model of translation scholarship that develops a different kind of emergence from the linearity and predictability of traditional conference panels:

> The network map will always appear more chaotic and complex than a 'finished' system carrying a hierarchical organization. Yet this will help

expand the scope of the field under study and bring out border areas, highlight elements that escape categorization and phase out some of the binarisms inherent in systems theory. In other words, it will capture the 'mess' that is normally discarded.

(Tahir-Gürçağlar 2007, 727)

Therefore, I will rely on a computational model that will, very likely, provide a new perspective on the semantic relationships within TS scholarship and that will also fully integrate more 'peripheral' DH-inflected contributions, without any recourse to an a priori theoretical stance.

A semantic network model of translation scholarship is an exploratory model in which the relationships (links) between the targets (modeled objects, i.e., abstract-nodes) are implicit and become explicit (manifest), first computationally and subsequently via close reading. In an implicit model, "the assumptions are hidden, their internal consistency is untested, their logical consequences are unknown, and their relation to data is unknown" (Epstein 2008, web). In network science, the assumptions become manifest computationally and any change in the elements that make up the network will lead to different results. If we remove an abstract from a conference panel, the configuration of the conference and the way knowledge is presented are unperturbed. The links in the network are conditioned by the way in which each scholar uses the respective concept and is dependent on the context in which the concept is used. If we remove one abstract from the corpus, many other links will be refor-mulated. Thus, non-linearity and multilayeredness are key in building and analyzing such a model, as is the initial disorder (or lack of structure) of the knowledge to be modeled. As long ago as 1990, Katherine N. Hayles argued, in *Chaos Bound*, that "[the] paradigm of orderly disorder may well prove to be as important for the second half of the century as the 'field' concept proved for the first half" (1990, xiii). Indeed, the interwar period marked a shift, from a focus on the dissipative energy within chaos, to an ambiguity with order. That led to yet another shift, this time in the humanities, in the 1960s and the 1970s, towards a more local and frag-mented mode of analysis of their objects of study. Concomitantly, Hayles explains, boundaries were admitted as arbitrary constructs and highly permeable membranes. They were regarded as sensitive to historical, lin-guistic, and cultural variables. This shift was corroborated with an increasing attention dedicated to stochastic variables in the cultural field, to random fluctuations in complex systems, and generally with an aware-ness that chaos plays an important role in the life of such systems. This new realization led scholars to perceive chaos as presence, rather than absence: that is, rich in information rather than poor in order.

Instead of dealing with chaos and messiness, TS has been dealing with a slew of binaries and metaphors, although

the world of translation also involves a high degree of mess, confusion and disorder and that our current critical theoretical frameworks are forcing these conditions into set categories, organizing the disorder into seeming order, sometimes lumping together findings that agree with theoretical expectations and excluding or glossing over those that challenge them.

(Tahir-Gürçağlar 2007, 725)

Tahir-Gürçağlar's astute observation is a consequence of TS relying mainly on theoretical models. Whenever we define something, we venture a projection of it, or an *explicit* model (Epstein 2008), in which assumptions about what translation is are laid out in detail, consequences are predictable, and results are replicated. They can be tested against historical case studies, as well as against current data, and may enroll the best domain expertise for rigorous scholarship. More importantly, models are said to be "autonomous in that they are not placed between a theory and the physical world but rather *outside the theory-world-axis*, enabling models to mediate effectively between the two" (Ciula et al. 2018, citing Morrison and Morgan 1999, emphasis mine). However, TS models have been defined as "a kind of empirical *theory* which aims to show some kind of isomorphic relation with its object" (Chesterman 2012, 108), therefore, very much dependent on the theory–world axis, not outside of it. I suggest that such theory- and reality-conditioning of the models in TS do not allow for the full manifestation of emergence. In our case, the models do not seem to uncover an emerging penchant for digital methods in carrying out research on translation, or an inclination for collaborations that foster transdisciplinary innovation-driven projects, although these collaborations certainly exist.

Conference panels are meant to make the conference models more tractable, which is a typical reductionist behavior. While I recognize such a model is necessary, for obvious practical reasons, it is, unfortunately, proliferated outside translation event management. The main characteristic is that we do not know anything a priori about the main topic of each conference abstract[12] and about the type of relationships that may establish between any two of them. Instead, I will consider it to be an unstructured aggregate of textual information that manifests emergent properties. Therefore, this dataset relies on a hidden network design (or model) that will reveal itself (or emerge) during the analysis, instead of the researcher adjusting the analysis to a pre-established idea about the design of the dataset. In defining emergence in complex educational phenomena, Demerath and Suarez ask a very valid question:

If the aggregate is more than the sum of its parts, where is that extra element coming from? One way of thinking about this is by recognizing that there is *an element of 'design' that is lost* when we try to define an aggregate as a simple collection of atoms or agents, without reference to how they are organized.

(2019, 226, emphasis mine)

Thus it would be short-sighted to define the current research agenda of a flagship translation event such as EST2019 as the sum of its parts (panels) for two main reasons: on the one hand, because we don't know much about the research strands and methods used by the researchers in the opaque category "individual presentations and posters" and, on the other hand, because the design of the 20 panels is an artificial construct, which does not favor spontaneous relationships and diverse behaviour, that is, the emergence of new research strands and communities of translation practice. Any conference is first and foremost a *social* academic event, and pigeon-holing participants as doing "cognitive TS" or "empirical TS" impedes on the model's social dynamics, and only makes it more tractable, or more manageable.

Our scrutiny of a corpus of 198 abstracts does not and cannot immediately offer a comprehensive image of all possible connections among their authors and of the dynamics resulting from such connections. Therefore, the network is modeled as a series of implicit semantic relationships that are automatically retrieved from unstructured text data using two popular natural language processing methods (tf-idf and topic modeling, explained below). In these networks, the nodes are the abstracts and the links are the semantic relationships between them, established on the ground of the two previously mentioned, unsupervised methods. The analysis of the network will make such connections explicit. Semantic networks have served as a basis of knowledge modeling and representation since the late 1960s (Quillian 1968) and gained more and more traction in the 1990s and the 2000s. They allow for the effective modeling of semantic relationships within corpora of unstructured textual information and the visual representation of such relationships in graphs (networks) comprising labelled nodes and edges.

I shall first report on an information retrieval and text mining method called tf-idf, which measures the specificity of terms in a document in a collection of documents. The weight of a word increases proportionally with the number of times the respective word is used in a document and, at the same time, it is offset by the number of times it is used in the whole corpus (Manning, Raghavan and Schütze 2008). For instance, an abstract that manifests a high term frequency for "translatio" will not necessarily be ranked highly, because translation is quite a common term for all the abstracts in the corpus (and, therefore, has a very low inverse document frequency). To the contrary, an abstract with a high term frequency for the word "digital" is likely to rank highly, because of the high inverse document frequency, since only a few of the presentations were concerned with this aspect. Thus, I will build a semantic network on the grounds of the tf-idf document vectors to explore textual similarity between abstracts and to reveal hidden connections that may favor the emergence of new communities of practice. Stated more technically, I will convert a collection of raw documents to a matrix of tf-idf features using the tfi-df vectorizer contained by the Scikit-learn package in Python. The ensuing similarity matrix will point at textual similarity between documents, irrespective of other topic categorizations. For instance, in the networks derived in this

chapter, the most correlated two abstracts are the one by Van Egdom et al., "Ergonomic Quality in Trainer-to-trainee Revision Processes: A Pilot Study" (Node 18) and an individual presentation by Alta Van Rensburg, titled "Translation Revision: Which Procedure Should Revisers Follow to Ensure Quality Revision Products?" (Node 133). While tf-idf is not likely to indicate any surprising correlations between scholars working on very different strands in TS, it will definitely connect scholars who participated in thematic panels to scholars who participated individually.

The second method is called topic modeling, which is a text mining method of unsupervised automatic classification/clustering of documents, a type of statistical modeling that is used to uncover abstract topics (or hidden patterns) in large corpora of texts. The most common algorithm is called Latent Dirichlet Allocation (LDA) and follows two principles, according to which a) each document contains a mixture of abstract topics; and b) each topic contains a series of keywords.[13] To understand this better, let us take a look at Meihua Song's abstract, titled "Understanding Contemporary Tibetan Literature and Their English Translations with Complexity" (Node 127). The LDA algorithm suggests that it contains a combination of two topics: 55% Topic 5 (keywords: literary, translation, English) and 44% Topic 4 (keywords: research, data, English, methods), which means that the presentation was concerned with applying the new research framework of complexity thinking to translations of Tibetan literature into English. In our semantic networks, this abstract will, thus, connect to a) abstracts that have the same topic configuration; b) abstracts that have a predominant Topic 5; and c) abstracts that have a predominant Topic 4. The purpose of this analysis was twofold. On the one hand, I sought to determine the hidden pattern structure in the 59 individual papers and nine poster presentations that had been scheduled. What was their main scholarly concern? Did they raise any new issues in TS that should, perhaps, gain more visibility in a future conference? And, related and more importantly for the purpose of this chapter, are any of the presentations concerned with integrating mixed-method approaches in their research? On the other hand, I wanted to investigate if the topics identified by the algorithm match the topics of the panels and whether the whole corpus of abstracts reveals any possible communities of practice that are not otherwise apparent from the structure of the 20 proposed panels.

The processing and the formal analysis of the elements and structure of such a network—and of any network, for that matter—were carried out using graph theory (Diestel 2000) and network analysis (Newmann 2010). The analysis focused mainly on structural characteristics and employed a series of computational algorithms to determine the size of the network, the ranking of the nodes according to various criteria, the nature of the relationships established between the nodes, and so on. Three centrality measures were used to determine the importance of each abstract node in the network according to various parameters. The first one is called degree, and it is equal to the number of edges (links) departing from a node. A degree of ten means

that a node is connected to ten other nodes. The higher the number of abstracts a given abstract is related to, the more important it is for the network and the higher its potential to function as a hub. The second measurement is called the Eigenvector centrality and it takes into account a node's edges in combination with the number of edges of its neighboring nodes; that is, an abstract with a high degree (with many links) is likely to rank lower than another abstract with fewer links, but which is connected to hubs. This measurement was especially important for our analyses, because it points at the nodes that can convey the information in the network the fastest (i.e., well-connected authors spread the news most effectively). Lastly, betweenness centrality looks at the shortest paths that go through a node, thus, being an effective way of connecting two otherwise disparate parts of the network. In the notation of the nodes, I used the following structure: Author's name_panel name/category_location (cf. Table 3.1, e.g., Marais_complexity_Bloemfontein). In the case of multiple authors, the first author's name is followed by et al.; in the case of two authors, both last names are used, joined by ampersand. In the case of multiple affiliations and a single author, the first indicated affiliation is used; in the case of co-authoring and multiple affiliations, both affiliations are indicated. In the preprocessing phase, each file was cleaned by removing the reference list, keywords, and authors' names and affiliations. Only the title and the text of the abstracts were kept.

The corpus could be interrogated in multiple ways, but I wished to identify existing or possible communities of DH practice, by looking, first, at the corpus of individual papers and abstracts, and then at the whole corpus of abstracts. In addition, the case study pays particular attention to the papers with a high betweenness centrality: a measure of a node in a graph based on the shortest paths that pass through that node. A paper with a high betweenness is not necessarily well connected to other nodes—that is, it is not necessarily concerned with topics that are of main interest to the network as a whole—but is very likely to quickly influence the network in one way or another, because such a paper contains elements that connect other papers that would otherwise be very far apart within the graph. The working hypothesis is that many such papers are more concerned with methodology and/or combine topics in uncommon ways compared to other nodes.

The 68 files in the subcorpus of individual presentations and posters were first uploaded to Overview,[14] which allowed a fast manipulation of documents: sorting by keywords, easy visualization of content, etc. A simple word cloud created with this software (Figure 3.1), shows that it is predominantly concerned, as perhaps expected, with interlingual translation, as well as with interpreting and the professionalization of translators' work, as indicated by the frequency-sized terms below. The prevalent concern, though, lies with the research processes underlying translations of any nature. In addition, most of the very frequent words, such as 'text,' 'analysis,' 'literary,' 'social,' 'image' and 'corpus' reflect topics that, outside TS, are now commonly treated using mixed-method approaches.

Almost half the presenters were explicitly engaged with research processes; however, only seven of them mentioned digital technologies (mainly machine translation), while only one showed concern with wider research in the humanities, and two with interdisciplinarity. The way the elements in this corpus[15] correlate is presented in Figures 3.2 and 3.3, according to each NLP method used.

Figure 3.2 presents the correlation network of the tf-idf vectors in the same corpus of 68 presentations (68 nodes and 4 108 links), and shows an almost maximal density and triadic closure[16] (both at 0.99). Typically, tf-idf produces "lower scores for high frequency function words and increased scores for terms related to the topical signal of a text" (Lavin 2019), therefore, it is used as a complementary exploratory tool to topic modeling in the early stages of the research. While the latter indicates broad categories or communities of texts, tf-idf presents a more homogenous network based on statistical word similarity. It, thus, makes sense to refer to it first and to interpret what appears to be a very homogenous network, in which each node is linked to absolutely all the other 67 nodes. The difference in the way the abstracts are linked comes from the weighted degree, that is, the number of links for each node, but pondered by the weight of each link. The highest-ranking papers in terms of weighted degree are related to a maximum of four others (4.31) and a minimum of one (1.39). These values are reflected in the size of the nodes in Figure 3.2 (and also in Figure 3.5, which reflects the whole corpus). The first two most correlated pairs of abstracts engage with the issue of translation revision (Helle Dam Jensen & Anja Vesterager – "Translation as A Revision
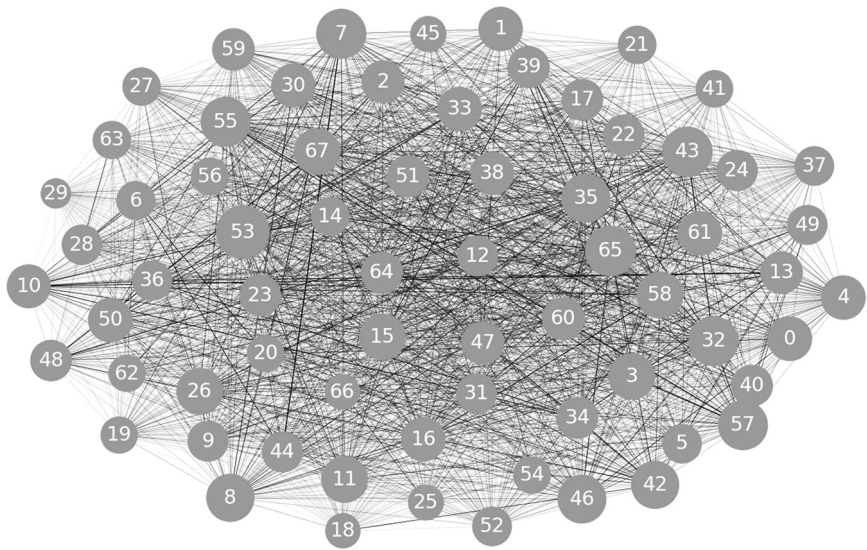
Figure 3.2 The Semantic Network of the EST2019 Individual Papers and Posters cf. tf-idf Vector Correlation and Weighted Degree
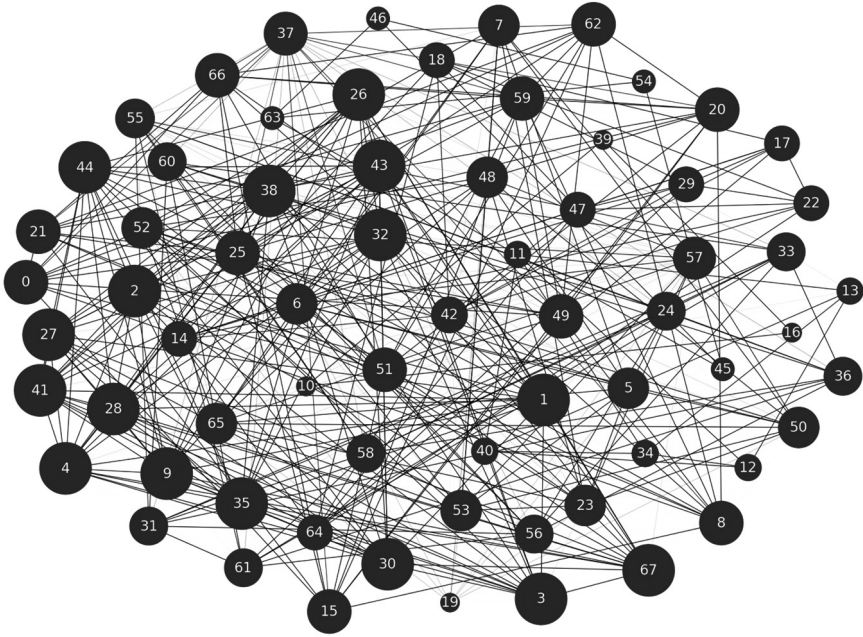
Figure 3.3 The Semantic Network of the EST2019 Individual Papers and Posters cf. Topic Models

Tool" and Alta van Rensburg – "Translation Revision: Which Procedure Should Revisers Follow to Ensure Quality Revision Products?"), as well as with literary translation and national image building (Serena Talento – "Literary Translation and the Intellectual Patriot in Socialist Tanzania" and Duygu Tekgul – "The Work of Literary Agents: Translation, (Inter)cultural Intermediation and National Image Building"). From the point of view of the topics, however, the correlations these four presentations establish is different: Jensen and Vesterager and Tekgul correlate on the grounds of their interest in translation quality, while Van Rensburg and Talento connect via their concern with research practices in translation.

The dominant textual types are those related to interlingual translation, but also to translation as a process, literary translation history, and translators' status (cf. Table 3.2).

Nodes with the highest betweenness centrality (cf. Table 3.3), therefore, nodes with little textual similarity to other nodes (or the most peculiar textual types), but which are strategically placed to influence the network by linking disparate elements of it, are presented in Table 3.2, together with the number of shortest paths on which they are located. The high number of paths attests to the textual uniformity of the corpus.

The abstract by Mary Nurminen (Node 19), from the University of Tampere, on the machine translation of patents, scored among the lowest in terms

Table 3.2 The Most Connected Nodes in the EST2019 Individual Abstract and Poster Network cf. tf-idf Vectors

Node	Eigenvector (rank)	Degree	Author(s), category, affiliation Title	Topic and keywords
53	0.184 (#1)	4.31	Malta_hors_Brasilia *Modeling the Process of (Re) translation under a Cognitive Perspective*	1: language, revision, sign, management, minority, rights
43	0.169 (#2)	3.84	Zehnalová & Kubátová_hors_ Olomouc *Can (Literary) Translation Practice Speak?*	7: translation, source, language, text, literary, quality, analysis
65	0.168 (#3)	3.91	Schaeffner_hors_Birmingham *Translation Ethics under Communism*	1: language, revision, sign, management, minority, rights
55	0.165 (#4)	3.78	Ozbot_hors_Ljubljana *Literary Multilingualism, Language Relationships and Translation: Observations from a Case Study*	6: gestures, language, hand, speakers, comprehension, multimodal, cognition
32	0.165 (#5)	3.77	Wiedenmayer & Lamprou_-hors_Thessaloniki *Translators' Portraits and the Visibility of Translators*	7: translation, source, language, text, literary, quality, analysis

Table 3.3 The Least Connected Nodes in the EST2019 Individual Abstract and Poster Network

Node	Betweeness (rank)	Paths	Authors, category, affiliation Title
36	0.117 (#1)	518	Sogiba_poster_Stellenbosch *Empowerment and Disempowerment: A Descriptive Analysis of Parliamentary Interpreters*
29	0.114 (#2)	508	Orrego Carmona & Richter_hors_Birmingham_Berlin *Using Non-professional Subtitle Consumption Patterns to Explore Global Media Flows*
45	0.112 (#3)	496	Norberg_hors_Stockholm *Translating the Audible – Paralinguistic Features in Translated Audiobooks*
14	0.106 (#4)	472	Wehrmeyer_hors_Potchefstroom *When the Going Gets Tough the Tough Start Slipping: Phonological Errors in Simultaneous Signed Media Interpreting*
66	0.102 (#5)	452	Lindqvist_hors_Stockholm *Bibliomigration from Periphery to Semi-Periphery Contemporary Spanish Caribbean Literature in Swedish Translation as a Case in Point*
13	0.097 (#6)	432	Van Zyl-Bekker_hors_Stellenbosch *Self-reflection in Educational Interpreting: Clarifying the Role and Improving Ethic*

of weighted degree (2.08), being related to Nodes 26 (Jiang_hors_Beijing – "Translation *Policy* at an *Institutional Setting:* A *Bibliometric Study* of China Foreign Languages Bureau from 1949 to 1999") and 27 (Asimakoulas_hors_Surrey – "Translation of a *Translation: Comic Branding, Politics* and the '*Graphic Novel Face*' of Aristophanes")—two very different abstracts in terms of topics, but similar from the point of view of terms used. The textual similarity comes from Nurminen's and Jiang's reference to the concepts of network and machine translation, with a low representation in this subcorpus, and from Nurminen's and Asimakoulas' concern for research process in general. This digitally inflected presentation has a high betweenness centrality compared to many other nodes, and is on the shortest paths between 14 other papers. For instance, it connects a paper on the complexity of emotional levels in interpreting (Node 17) to one tackling the issue of machine translation in multilingual healthcare contexts (Node 18). And it connects the latter paper to a DH-inflected one dealing with linguistic variations using multifactorial statistics (Node 24, Kruger_hors_Sydney). An abstract ranked almost equally with Nurminen's is Node 20, by Mikel L. Forcada, which approaches the topic of neural machine translation. Forcada has a higher betweenness centrality and is placed between the shortest paths between 42 other papers. The first two listed by the program used are Nodes 4 (Basalamah_hors_Ottawa) and 40 (Rodríguez Muñoz_hors_Cordoba). While the first paper broaches the topic of a necessary philosophy of translation via the concept of phenomenological transformation; the second deals with translation of multimodality and materiality of literature, which are central issues in DH.

These examples and computational rankings invite two considerations. First, that a grouping of such papers on the grounds of their direct or indirect focus on methodology promises to be much more fruitful than lumping them together due to and in spite of their wonderful diversity. Grouping them according to one theme or another would necessarily reduce the peer dialogue to the respective theme and the issue of methodology would become secondary, when, in reality, the concern with methodology and research processes is central to this corpus. Second, the papers that engage with computational methods typically connect papers that treat complex translation issues, although they do not engage specifically with complexity thinking. There is a proven bijective relationship between complexity thinking and computational methodology outside TS. In our case, this relationship is covert, but revealed by the papers ranking high in betweenness centrality. It is exactly these 'peculiar' papers and the papers raising the issue of (computational) method that hold the network together and facilitate the internal flows. From the point of view of traditionally conceived TS topics, they belong in very different categories, but so do they according to computationally derived topic models, which we will discuss next. The difference between the two perspectives lies in the broadness of the dialogue they generate. Acknowledging the need to approach the complexity of translation with the appropriate tools and methods is an essential first step toward post-disciplinarity.

Table 3.4 List of Topics in the EST2019 Individual Abstract and Poster Network

#	Topic	Eigenvector	# of abstracts
7	Translation process research	0.28	16
1	(Quality of) interlingual translation	0.026	10
5	Cognitive processes	0.0008	1
6	Literary multilingualism	0.0007	1
3	Language services	0.0006	8
8	Translation and/in the media	0.0005	12
2	Education and research management	0.0004	5
4	Agency in translation	0.0003	4
9	Translation ethics	0.0002	3

Figure 3.3 reveals a maximally dense network (density = 1) of 68 nodes and 8 046 links, built on the grounds of the nine topics presented in Table 3.4 and Addendum, with a maximum triadic closure. The highest-ranking topic is the one dedicated to translation process research, made up of a cohesive group of 16 presentations with an Eigenvector of 0.28, each linked to 15 other papers. Among them, the presentation by Salah Basalamah (Node 4), "Translating Living Beings: Conceptualizing Existential Translation," ranks first, strongly and very surprisingly connected to Nodes 2 (Cunha et al_hors_Belo Horizonte – "Paraphrase Corpus as a User-Centred Approach to Support Translators' Decision-making") and 30 (Weissbrod & Kohn_hors_Ramat Gan – "Anne Frank's Diary – The Graphic Adaptation: From Translation to Adaptation"). The strongest correlation is between Christiane Nord's abstract (Node 21, "Paving the Way to the Text: Book Titles as a Functional Unit in Translation") and a poster presentation (Hijjo_poster_Stellenbosch – "Translation Quality Assessment for the Media Narratives on Terror and Refugee Crisis"), on the grounds of their concern with text translation, and between Nord's presentation and a presentation from Spain (Garcia_hors_Castilla-La Mancha – "Who is Isabelle de Charrière, Why Should We Analyze and Translate her Epistolary Novels from French to Spanish, and How?").

Another interesting example is Node 55, the presentation titled "Literary Multilingualism, Language Relationships and Translation: Observations from a Case Study," by Martina Ozbot, which also forms Topic 4.6 (multilingual networks in literary translations) on its own, but which is connected to eight other papers, with the Eigenvector in the first half. Both this paper and the one by Mary Nurminen, mentioned before, have a strong interdisciplinary profile and connect different topics across the corpus. The same concern for methodology is presented by the best-placed paper in terms of betweenness centrality, "Methods and Strategies of a New Approach to the Historiography of Translation from the Ottoman Period to the Present," by Sevil Celik Tsonev from the University of Graz, which is found on 758 shortest paths between other node pairs. The

second ranked is the paper of Christopher Mellinger, whose presentation, titled "The Role of Translation and Interpreting during Informed Consent: Ethical and Methodological Considerations," is another multi-topic presentation, but one which is only on 12 shortest paths between other papers. All these examples are concerned with methodologies and are perfect candidates for DH approaches, as their topics are often explored computationally outside TS. It is relevant to see how these presentations rank and where they appear within the wider network, so we will get back to them shortly.

The word cloud for the whole corpus of 198 abstracts (Figure 3.4) is not very different from the one of individual presentations and posters (Figure 3.1). It reveals a general interest in interlingual translation and translators' work as a profession, as well as an underlying preoccupation with research methods and for literary translation. There are 16 abstracts that engage with multilingualism and ten use the concept of network, mostly from a conceptual point of view. Ten papers engage with digitality in one form or another, and out of 57 abstracts containing the word 'data,' only three engage with data mining. Complexity gains visibility as a keyword compared to the previous corpus, with ten abstracts outside the dedicated complexity panel.

The network[17] built using tf-idf vector correlations (Figure 3.5) shows that the most and best connected nodes in the network are a series of abstracts pertaining to the panels on technologies for creative-text translation, complexity, cognition, and indirect translation. Besides being textually similar, they are connected to nodes that also occupy prominent positions in the network and, in spite of their clustering in four different panels, they all actually fall under the same predominant topic in
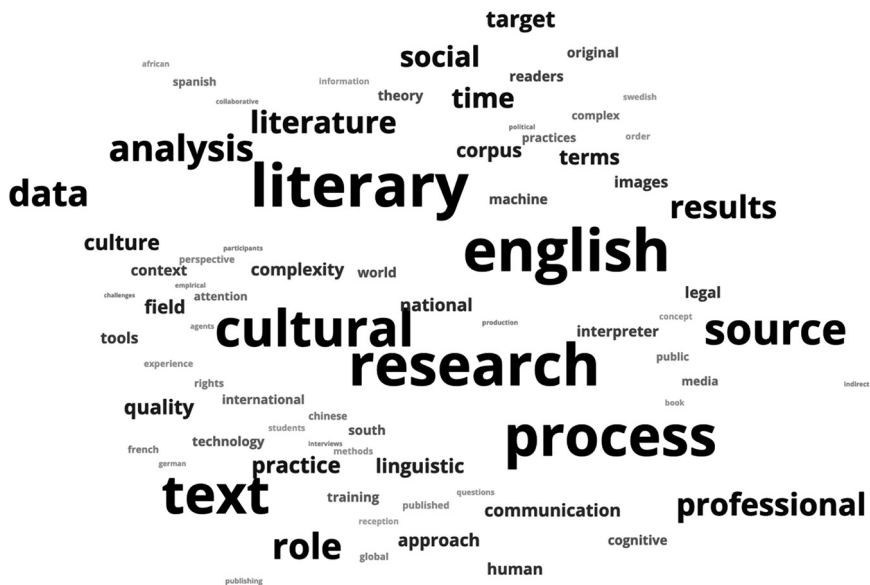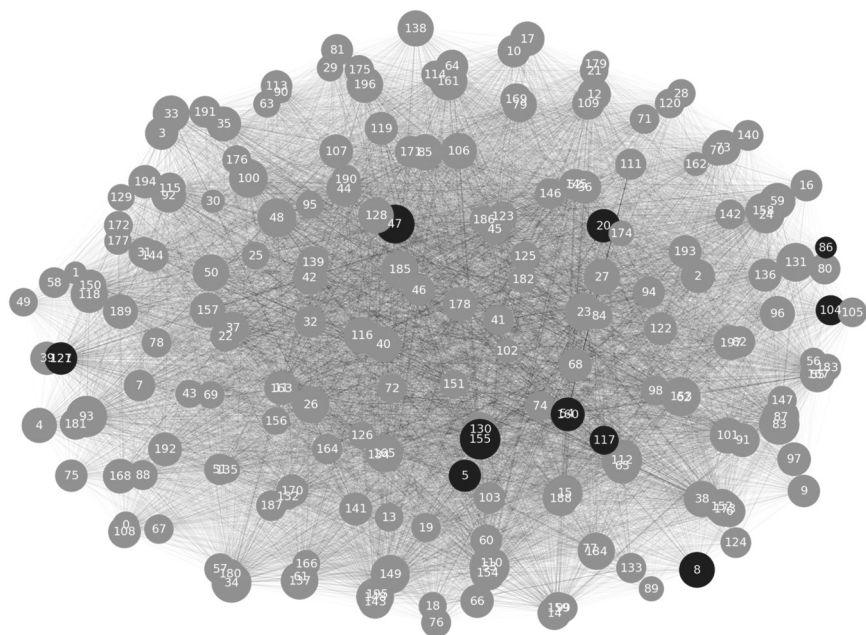

Figure 3.4 Word Cloud of the Whole EST2019 Abstract Corpus

Figure 3.5 The Semantic Network of the Whole EST2019 Corpus of Abstracts cf. tf-idf Vector Correlations, Highlighting the Papers on the Complexity Panel (in Blue)

the wider network (cf. Table 3.5 and Figure 3.6): Topic 5 (keywords: translation studies, language, research, text, literary, English).

Analyzed as a separate topic network, they present five different topics of their own:

Topic 1: translation, text, English, access, Catalan
Topic 2: translation, institutional, different, studies, translators
Topic 3: translation, signed, interpreting, process
Topic 4: translation, literary, text, translators
Topic 5: translation, literary, translators, technology, tools

What actually unites them is an interest in the methodologies behind text translation, be it literary, signed translation, or translation in institutional contexts. Moreover, the fact that members of such a distinctive panel as Panel 19 (Translation technologies for creative-text translation) are clustered together with researchers working in such different strands, and also connected to more prominent nodes that are concerned with so-called traditional TS, means that these DH-minded scholars do not speak a different language. Therefore, they possess the right means to form technology-driven communities of translation practice.

Table 3.5 The Highest-ranking Nodes in the tf-idf Network and their Topic Clustering in the Whole Corpus

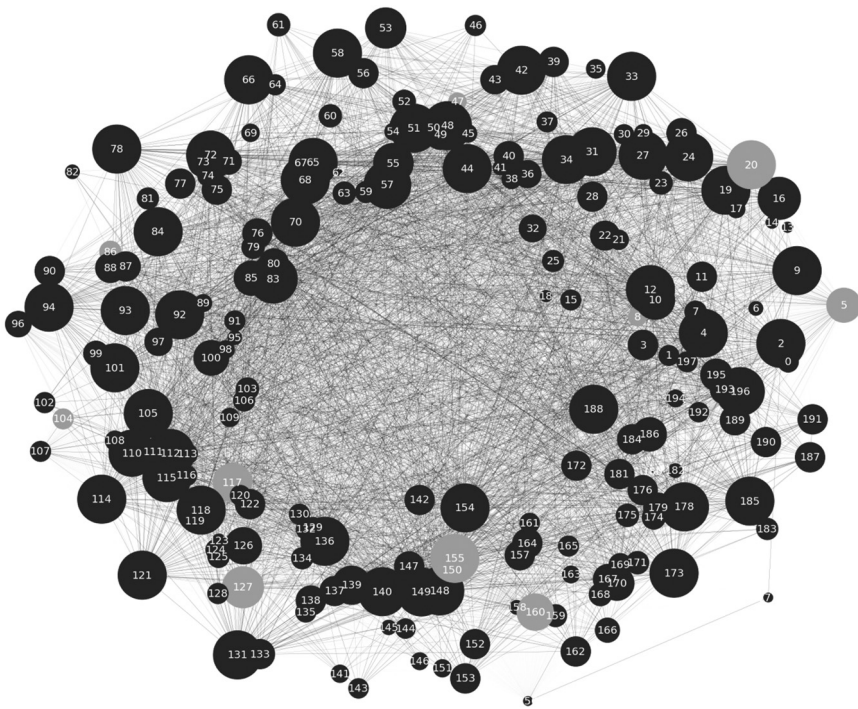| Node	Eigenvector	Abstract	Predominant topic
83	0.112	Daems_creativetech_Ghent	5 (99%)
112	0.112	**Simon_indirect_Tarragona**	5 (99%)
93	0.111	Wallmach & du Toit_cognition_Stellenbosch	5 (99%)
34	0.111	Taivalkoski-Shilov_creativetech_Turku	5 (99%)
155	0.109	Ma_complexity_Beijing	5 (99%)
53	0.108	Arenas & Toral_creativetech_Dublin Groningen	5 (51%) and 14 (48%)

Figure 3.6 The Semantic Network of the Whole EST2019 Corpus of Abstracts cf. Topic Models, Highlighting the Papers on the Complexity Panel (in Red).

The topic model network contains 198 nodes linked on the grounds of 17 relevant topics.[18]. There are 20 most connected nodes, each with links to 55 other papers, and with a predominant Topic 5 (keywords: translation studies, research, English, literary) (cf. Table 3.6).

Table 3.6 Nodes with the Highest Eigenvector in the Whole Corpus Network

72: Nord_hors_Bloemfontein	19: Vale de Gato_hors_Lisbon
93: Wallmach & Du Toit_cognition_-Stellenbosch	94: Sun_cognition_Beijing
173: Dayter_empirical_Basel	65: Prieto Ramos_legal_Geneva
84: Garcia_hors_Castilla-La Mancha	20: Tanasescu_complexity_Groningen
44: Hu_transnationalism_Melbourne	112: Simon_indirect_Tarragona
4: Massey & Wieder_transition_Zurich	105: Sattchai & Kenny_hors_Dublin
121: Riggs_hors_Geneva	154: Van der Watt_transnationalism_-Stellenbosch
33: Botha_lgrights_Potchefstroom	
136: De Baets_empirical_Ghent	196: Vine & Huertas Barros_-transition_London
155: Ma_complexity_Beijing	70: Zeng & Cui_cognition_Durham
	188: Angelelli_keynote_Edinburgh

In the previously analyzed dataset, papers concerned largely with methodology are the most prominent and most connected in the network. If we look at the nodes most strategically placed to influence the flow of information in the network, there are only four, but they have a total number of over 7 600 shortest paths (cf. Table 3.7).

Maura Radicioni's presentation, titled "Cultural Differences in Interpreter-Mediated Medical Encounters in Complex Humanitarian Settings," which was part of the panel on translation in conflict, is the one that has the potential to influence the network the most, due to her combination of topics that are relevant, from a cultural complexity perspective, to a large part of the corpus. Far fewer shortest paths pass through Nodes 89, 117, and 17, which approach the translation problem from a more angled perspective.

Table 3.7 List of Nodes with High Betweenness Centrality in the Overall Network

Node	Between-ness	Abstract	Shortest paths	Pre-domi-nant topic	Keywords
82	0.33	Radicioni_con-flict_Geneva	7158	15 (99%)	cultural, replication, translation, text, mediators
89	0.006	Ergun_gender_Ch-arlotte	254	10 (98%)	interpreting, translation, cognitive
177	0.005	Arbona & See-ber_cognition_Geneva	206	6 (99%)	gestures, language, hand, speakers, comprehension
17	0.002	Basala-mah_hors_Ottawa	10	16 (99%)	translation, process, system

Looking specifically at the panel dedicated to complexity (Table 3.8), we can clearly see that the most connected nodes are those that examine literary translation from a multilayered perspective, as well as those that combine complexity with research methodology (Nodes 155 and 20). The presentations that combine two topics are also well connected (Nodes 127, 117, 5, and 160). Among them, the more balanced the distribution of topics, the higher their ranking.

The same trend is easy to see in the panel dedicated to big data in translation history (Table 3.9)—the only panel overtly employing DH-inflected methods. Roig-Sanz and Folica (Node 139), whose presentation combines literary translation, translation history, big data, and text mining, ranks first within the panel and connects to 35 other papers.

More important than rankings are actually the connections they establish, and it is particularly relevant to see what other presentations these four DH abstracts connect to, because those could possibly be additional points of entry for DH scholarship in TS. In terms of topics, Node 139 connects best to a series of 20 abstracts, with correlation scores between 0.99 and 0.50 and spanning a wide range of research interests, cf. Table 3.10.

These are all topics that are particularly suitable to examine via the DH approaches and tools, therefore, scholars working on literary translation,

Table 3.8 Distribution of Topics in the Complexity Panel

Node	Abstract	Dominant topic and topic distribution				Degree	Eigenvector score and rank
117	Canales_complexity_Montreal	T5	57%	T1	31%	35	0.085
104	Cohen_complexity_Amsterdam	T8	99%	n/a	n/a	9.8	0.0001
47	do Carmo_complexity_Dublin	T16	99%	n/a	n/a	7.5	0.0008
155	Ma_complexity_Beijing	T5	99%	n/a	n/a	55	0.138 #1
5	Marais_complexity_Bloemfontein	T14	79%	T5	19%	28	0.031
160	Reviers et al_complexity_Antwerp	T5	52%	T3	46%	32	0.075
86	Robinson_complexity_Hong Kong	T13	99%	n/a	n/a	11	0.010
127	Song_complexity_Shanghai	T4	44%	T5	55%	40	0.078
8	Suurmond_complexity_Arnhem	T16	93%	n/a	n/a	7.8	0.0007
20	Tanasescu_complexity_Groningen	T5	99%	n/a	n/a	55	0.138 #2

Table 3.9 List of Nodes with High Betweenness Centrality in the Overall Network

Node	Abstract	Eigen-vector	Degree	Pre-domi-nant topic	Keywords
139	Roig-Sanz & Folica_-big data_Barcelona	0.0786	35	Topic 5 (55%) Topic 4 (44%)	translation studies, literary, translators, data, research, language, English
43	Elgül_big data_. Istanbul	0.0178	19	Topic 2 (67%)	translation, process, work, text, deaf, biography
67	Zubakova_big data_Olomouc	0.0016	12	Topic 2 (99%)	
166	Steinbach-Hüther et al_big /data_Leipzig	0.0010	14	Topic 4 (48%)	translation studies, research, data, English

Table 3.10 Abstracts with Strong Correlations (0.90–0.55) to Panel 4 (Big Translation History)

Nord_hors_Bloemfontein	Paving the Way to the Text: Book Titles as a Functional Unit in Translation
Wallmach & Du Toit_cognition_Stellenbosch	Dynamic Collaboration as a Stopgap: Approaching the Process of South African Sign Language Translation
Dayter_empirical_Basel	Explaining Variation Between Interpreted and Non-Interpreted English and Russian: Constrained Language Variables
Garcia_hors_Castilla-La Mancha	Who is Isabelle De Charrière, Why Should We Analyze and Translate Her Epistolary Novels from French to Spanish, and How?
Hu_transnationalism_Melbourne	Do Readers Trust Translations? The Reception of China's Foreign-Affairs Discourse
Massey & Wieder_transition_Zurich	Educating for Ergonomics: Building Translators' Awareness In and Beyond the Curriculum
Riggs_hors_Geneva	(Mis)translation of Culture? Journalistic Style in Online Reporting About a Violent Attack Abroad
Botha_lgrights_Potchefstroom	Tokenistic Language Rights and Social Barriers: Translation and Language Rights in the South African Context
De Baets_empirical_Ghent	Semantic Stability in Translation: A Behavioral-Profile Analysis of the Semantic Field of Inchoativity in Original Dutch and Dutch Translated from English and French
Ma_complexity_Beijing	Study of Rewi Alley's Translation of Chinese Poetry Into English: A Complexity Theory Approach

Nord_hors_Bloemfontein	Paving the Way to the Text: Book Titles as a Functional Unit in Translation
Vale de Gato_hors_Lisbon	Fall, Poppies, Forgetfulness, and the (Re)surgent Lives of Translations and Translators
Sun_cognition_Beijing	Measuring the User Experience of Computer-Aided Translation Tools
Prieto Ramos_legal_Geneva	Contextualize, Classify, Measure: An Evidence-Based Approach to Defining Institutional Legal Translation
Tanasescu_complexity_Groningen	Chaosphere and Entropy. Complexity and the Place of Translation in (the) Digital Humanities
Vine & Huertas Barros_transition_London	Transcreation as a Paradigm for New Approaches to Translator Education: Defining New Roles for Humans Translators
do Carmo & Moorkens_transition_Dublin	Translation's New Shapes, as Moulded by Future Interactive Tools
do Carmo_complexity_Dublin	Neural Networks and the Complexity of the Translation Process
Gentile_-transnationalism_Leuven	The Image(s) of the Low Countries in Italy. Focus on the Selection, Reception and Image-Building of Dutch Language Literature Translated into Italian (2000–2018)
Petroniene_poster_Kaunas	The Translation of National Image of Lithuania in Public Discourse
Reviers et al_complexity_Antwerp	Towards an Encompassing, Adaptable and Future-Oriented TS Framework: Some Methodological Explorations
Forcada_hors_Alicante	What do They Mean When They say Neural Machine Translation and why Should I Care?
Taivalkoski-Shilov_creativetech_Turku	On Sustainability in Translation Technologies for Creative Text Translation
Folaron_transition_Montreal	Digitalizing Translation
Weissbrod & Kohn_hors_Ramat Gan	Anne Frank's Diary – The Graphic Adaptation: From Translation to Adaptation
Yu_gender_Ningbo	Queer In Translation: From The West To The East, From Theory To Activism
Simon_indirect_Tarragona	Testing Indirect Translation with Novice Translators
Matushita_empirical_Tokyo	Moving Beyond English: Challenges and Opportunities in Expanding a Japanese-English Parallel Corpus to Include Chinese and Spanish
Linares_minority_Cork	Landscapes of Translation: New Perspectives on Galician Literature in a Globalized World
Pokorn_diaspora_Ljubljana	The Role of Literary Translations in Immigrant Periodicals in the USA: Cultural Image Making and Identity Building Through Translation

Nord_hors_Bloemfontein	*Paving the Way to the Text: Book Titles as a Functional Unit in Translation*
Ergun_gender_Charlotte	Translating Affect as an Act of Transnational Feminist Solidarity: Kindred in Turkish
Marais_keynote_Bloemfontein	Translating Time: Modelling The (Re)processing of Emerging Meaning
Guo & Long_indirect_Chengdu	A Socio-Political Perspective on Lu Xun's Indirect Translation
Bednárová-Gibová_ergonomics_Presov	Ergonomics of Translation and its Impact on Agency. Translators' Happiness at Work
Jensen & Vesterager_hors_Aarhus	Revision as a Learning Tool
Ahrens_hors_Cologne	Emotions in Interpreting – Implications for People and Process
Todorova_conflict_Hong Kong	Interpreting for Refugees: Empathy and Activism
Nurminen_hors_Tampere	Patent Professionals and 'Gist' Machine Translation: A Case of Situated Cognition
Zheng & Weng_cognition_Durham	Measuring Time Pressure in Translation: A Usability Test of Physiological and Psychometric Methods
Pereira_minority_London	Deaf Translations in Music
Tardel et al_cognition_Mainz	Attention Distribution During the Subtitling Process – Following the Gaze of Subtitlers

empirical translation studies, cognitive processes, sociology of translation, and translation technologies are all playing an important role in shaping the digital future of TS. In addition, the topics mentioned above are mapped out perfectly onto the most stringent topics in DH, which paves the way for smooth cross-disciplinary collaboration.

The network analysis of the abstracts presented at the 2019 Congress of the European Society of Translation Studies shows that scholars' interest in the research methods underlying discourses on translation is far-reaching, yet the communities of DH practice are few, and the scholars who employ computational methodologies tend to be isolated. Scholars are well aware of the impact digitality has on translation and on the work of the translators, but they do not project these observations on their own scholarly work and on the ways in which they approach their datasets. Collaboration is, to some extent, common but does not go often beyond disciplinary boundaries. Nevertheless, the configuration of the field is extremely favorable to digitally inflected approaches, and the high triadic closure of its scholarship network, as well as the high average number of links per node (99.5), encourage the proliferation of existing DH-inflected methodologies.

Conclusion

The analysis of the EST data provided in this chapter invites several conclusions. While only textually manifest links were taken into account in the study's methodology and the wider contexts in which the authors work were not included, the textual network analysis opened new exploratory avenues for a corpus that was ontologically handled, with very few exceptions, via long-standing disciplinary divisions. Though many of the fields with which TS has historically established interdisciplinary connections have embraced digital approaches, TS, excluding machine assisted translation and machine translation, has remained a profoundly humanistic discipline. The appearance of complexity thinking presents a unique chance for the field, because it problematizes not only its ontological configuration, but also the way scholars examine translation. The post-disciplinary way of doing research required by complexity compels us to look beyond the boundaries of our own discipline, as well as beyond traditional interdisciplinarity, because the latter has actually had a strong impact on ontologies, but little actual influence on methodologies.

As the multilingual nemesis looms large on digital humanists, who deal with increasingly multilingual corpora and with very few computational tools finetuned for such corpora, it is a very timely moment for translation scholars to join the DH community and leverage their expertise outside their comfort zones. The learning curve might be steep and intimidating during acquisition of the necessary skills, but the benefits far outweigh the efforts. The dialogue with the computer science specialists that could join such post-disciplinary projects may be less smooth than intradisciplinary dialogues, but the field of DH possesses the necessary know-how for fruitful and effective collaboration. The place of translation in DH is central and we must not shy away from making an essential contribution, because the return on investment will be equally beneficial. By employing a wide range of research methods and tools that are equally used in the humanities and in natural sciences, DH presents truly appealing interdisciplinary and collaborative prospects. In addressing the advantages of a cross-disciplinary approach, Willard McCarty does not see DH as disruptive, but as an enabler of change, because "disciplines are autonomous epistemic cultures from which explorations begin and to which they usually return, bringing change with them" (2015, 75). By resorting to novel methodologies and collaborative research, change is what the full-fledged transdiscipline of DH may bring to TS. To echo Matthew Kirschenbaum (2013) and his conclusion on the role played by DH in the English departments: who would not want this for TS?

Notes

1 This research was funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme, grant agreement No. 801653 *NaturalPhilosophy*.

2 www.multilingualdh.org

3 The only two conferences dedicated to the intersection between translation and DH were organized by the Chinese University of Hong Kong. The proceedings of the 2017 event were published in a special issue of the *Journal of Translation Studies* in June 2018 ("Translation and the Digital"). The 2019 conference ("Translation Studies and the Digital Humanities") was cancelled because of the political unrest in the region, but a dedicated special issue of the *Journal of Translation Studies* is due to appear in June 2021.

4 At about the same time, Warren Weaver, a mathematician and generally considered to be the father of machine translation, was among the first to acknowledge the complex nature of translation tasks (Weaver 1948).

5 The growth of DH between 2000 and 2011 is quantified in the following material drawn up at the UCL Centre for Digital Humanities: https://www.ucl.ac.uk/infostudies/melissa-terras/DigitalHumanitiesInfographic.pdf

6 There are certainly several exceptions, the most relevant and consistent in the direction of this essay being Anthony Pym, referred to further on.

7 This is part of the European Research Council Starting Grant "The Normalization of Natural Philosophy: How Teaching Practices Shaped the Evolution of Early Modern Science" (https://thenormalisationofnaturalphilosophy.wordpress.com/).

8 https://fasttext.cc/. The tool is based on a library of multilingual vectors in 157 languages and was developed by a team of researchers working for Facebook.

9 For the most recent such debate, see Nan Z. Da's piece, titled *The Computational Case against Computational Literary Studies*, and the ensuing ripostes at https://critinq.wordpress.com/2019/03/31/computational-literary-studies-a-critical-inquiry-online-forum/

10 For instance, no contribution to the latest issue of *Translation Studies*, titled "Agents and Networks," employs a network analysis methodology.

11 Pym was the first to explore a possible intersection with mathematics in a quantitative analysis of translation flows (Pym and Chrupała 2005).

12 The method proposed by the chapter does not make assumptions related to the theme of an abstract. Instead, it treats them as a "bag of abstracts" (cf. "bag of words" in natural language processing) and the algorithm establishes relations between them. Topics in topic modelling are not identical to what we traditionally understand by "topics." Instead, they are a collection of keywords that are prevalent in a set of documents.

13 The algorithm identified nine topics, with the following keywords: Topic 1: translation, text, language, source, literary, process, quality, work; Topic 2: language, interpreters, study, management, text, English, educational, research; Topic 3: interpreters, translators, communication, service, emotions, subtitles; Topic 4: translation, model, history, original, transfer, agents, methods; Topic 5: patent, professional, understanding, cognition, machine translation; Topic 6: translation, images, text, interpreter, role, source; Topic 7: translation studies, research, process, literary translation; Topic 8: translation, Spanish, analysis, titles, research, public, media; Topic 9: professional, interpreting, consent, ethics, disfluences, stress.

14 www.overviewdocs.com, an open-source platform for reading and analyzing thousands of documents in a fast, visual workflow.

15 The nodes are the following: 0: 'Hofeneder_hors_Graz.txt', 1: 'Kourouni_hors_Thessaloniki.txt', 2: 'Cunha et al_hors_Belo Horizonte.txt', 3: 'Talento_hors_Bayreuth.txt', 4: 'Basalamah_hors_Ottawa.txt', 5: 'Vale de Gato_hors_Lisbon.txt', 6: 'Yamada & Hiraoka_poster_Osaka.txt', 7: 'Jensen & Vesterager_hors_Aarhus.txt', 8: 'Korning Zethsen & Dam_hors_Aarhus.txt', 9: 'Hove Solberg_hors_Mellom.txt', 10: 'Adler_poster_Stockholm.txt', 11: 'Nitzke & Hansen-Schirra_hors_Mainz.txt', 12: 'Valero-Garces_hors_Madrid.txt', 13: 'Van Zyl-Bekker_hors_Stellenbosch.txt', 14:

'Wehrmeyer_hors_Potchefstroom.txt', 15: 'Ehrensberger-Dow & Albl-Mikasa_hors_ Zurich.txt', 16: 'Mellinger_hors_Charlotte.txt', 17: 'Ahrens_hors_Cologne.txt', 18: 'Van Praet et al_hors_Ghent.txt', 19: 'Nurminen_hors_Tampere.txt', 20: 'Forcada_hors_Alicante.txt', 21: 'Nord_hors_Bloemfontein.txt', 22: 'Jacobsen & Schjoldager_hors_Aarhus.txt', 23: 'Sarto Szpak & Alves_hors_Belo Horizonte.txt', 24: 'Kruger_hors_Sydney.txt', 25: 'Garcia_hors_Castilla-La Mancha.txt', 26: 'Jiang_hors_Beijing.txt', 27: 'Asimakoulas_hors_Surrey.txt', 28: 'Kundu_hors_Kolkata.txt', 29: 'Orrego Carmona & Richter_hors_Birmingham_Berlin.txt', 30: 'Weissbrod & Kohn_hors_Ramat Gan.txt', 31: 'Sattchai & Kenny_hors_Dublin.txt', 32: 'Wiedenmayer & Lamprou_Thessaloniki.txt', 33: 'Nwachukwu_hors_Gidan Waya.txt', 34: 'Deysel_poster_Stellenbosch.txt', 35: 'Ndhlovu_hors_Grahamstown.txt', 36: 'Sogiba_poster_Stellenbosch.txt', 37: 'Riggs_hors_Geneva.txt', 38: 'Hokkanen_hors_Tampere.txt', 39: 'Hubscher-Davidson_hors_Milton Keynes.txt', 40: 'Rodríguez Muñoz_hors_Cordoba.txt', 41: 'Olalla-Soler_hors_Barcelona.txt', 42: 'Stengers_hors_Brussels.txt', 43: 'Zehnalová & Kubátová_hors_Olomouc.txt', 44: 'Van Rensburg_hors_Stellenbosch.txt', 45: 'Norberg_hors_Stockholm.txt', 46: 'Tsonev_poster_Graz.txt', 47: 'Pitkäsalo et al_hors_Tampere.txt', 48: 'Parkins-Maliko_hors_Johannesburg.txt', 49: 'Petroniene_poster_Kaunas.txt', 50: 'Dorer_hors_Mannheim.txt', 51: 'de Riddier et al_hors_Stockholm.txt', 52: 'Currie_hors_Ljubljana.txt', 53: 'Malta_hors_Brasilia.txt', 54: 'Wendland_hors_Stellenbosch.txt', 55: 'Ozbot_hors_Ljubljana.txt', 56: 'Havnen_poster_Oslo.txt', 57: 'Tekgul_hors_Istanbul.txt', 58: 'Deng_hors_Beijing.txt', 59: 'Hijjo_poster_Stellenbosch.txt', 60: 'Li_hors_Beijing.txt', 61: 'Chen_hors_Taipei.txt', 62: 'Shan_poster_Leeds.txt', 63: 'Levin_hors_Tel Aviv.txt', 64: 'Pirouznik_hors_Tarragona.txt', 65: 'Schaeffner_hors_Birmingham.txt', 66: 'Lindqvist_hors_Stockholm.txt', 67: 'Marais E. et al_hors_Bloemfontein.txt'.

16 Triadic closure is the property among three nodes A, B, and C, that if the connections A–B and B–C exist, there is a tendency for the new connection A–C to be formed. It is a natural mechanism to make new connections, especially in social networks.

17 0: 'Hess & Fitchett_conflict_New York.txt', 1: 'Oyali_Bible_Abuja.txt', 2: 'Hofeneder_hors_Graz.txt', 3: 'Kourouni_hors_Thessaloniki.txt', 4: 'Massey & Wieder_transition_Zurich.txt', 5: 'Marais_complexity_Bloemfontein.txt', 6: 'Cunha et al_hors_Belo Horizonte.txt', 7: 'Albachten_minority_Istanbul.txt', 8: 'Suurmond_complexity_Arnhem.txt', 9: 'Canales_transnationalism_Montreal.txt', 10: 'Kappus & Dow_ergonomics_Zurich.txt', 11: 'Teixeira_creativetech_Dublin.txt', 12: 'Borg_cognition_Malta.txt', 13: 'Seeber & Arbona_ergonomics_Geneva.txt', 14: 'Nordman & Siltaloppi_lgrights_Helsinki.txt', 15: 'Talento_hors_Bayreuth.txt', 16: 'Hedberg_policies_Uppsala.txt', 17: 'Basalamah_hors_Ottawa.txt', 18: 'van Egdom et al_ergonomics_Utrecht Leuven.txt', 19: 'Vale de Gato_hors_Lisbon.txt', 20: 'Tanasescu_complexity_Groningen.txt', 21: 'Yamada & Hiraoka_poster_Osaka.txt', 22: 'Filmer_conflict_Pisa.txt', 23: 'Jensen & Vesterager_hors_Aarhus.txt', 24: 'do Carmo & Moorkens_transition_Dublin.txt', 25: 'Milton_Jakobson_Sao_Paolo.txt', 26: 'van Egdom et al_translaboration_Utrecht Antwerp Leuven.txt', 27: 'Korning Zethsen & Dam_hors_Aarhus.txt', 28: 'Devlin_crisis_Belfast.txt', 29: 'Midgley_keynote_Stellenbosch.txt', 30: 'Catteau et al_Jakobson_Paris.txt', 31: 'Hove Solberg_hors_Mellom.txt', 32: 'Adler_poster_Stockholm.txt', 33: 'Botha_lgrights_Potchefstroom.txt', 34: 'Taivalkoski-Shilov_creativetech_Turku.txt', 35: 'Nitzke & Hansen-Schirra_hors_Mainz.txt', 36: 'Valero-Garces_hors_Madrid.txt', 37: 'Downie et al_policies_Edinburgh.txt', 38: 'Ivaska_indirect_Turku.txt', 39: 'Alfer & Zwischenberger_translaboration_London & Graz.txt', 40: 'Sütiste_Jakobson_Tartu.txt', 41: 'Van Beveren_empirical_Ghent.txt', 42: 'Baer_diaspora_KentUS.txt', 43: 'Elgül_big data_.Istanbul.txt', 44: 'Hu_transnationalism_Melbourne.txt', 45: 'Massey & Heeb_ergonomics_Zurich.txt', 46: 'Ayvazyan_

lgrights_Tarragona.txt', 47: 'do Carmo_complexity_Dublin.txt', 48: 'Pieta_indirect_Lisbon.txt', 49: 'Snauwaert_transnationalism_Leuven.txt', 50: 'Bednárová-Gibová_ergonomics_Presov.txt', 51: 'Barea_conflict_Geneva.txt', 52: 'Van Zyl-Bekker_hors_Stellenbosch.txt', 53: 'Arenas & Toral_creativetech_Dublin Groningen.txt', 54: 'Wehrmeyer_hors_Potchefstroom.txt', 55: 'Ehrensberger-Dow & Albl-Mikasa_hors_Zurich.txt', 56: 'Ponomareva_Jakobson_London.txt', 57: 'Mellinger_hors_Charlotte.txt', 58: 'Costa_gender_Sao Paolo.txt', 59: 'Zhao_cognition_Vienna.txt', 60: 'Ahrens_hors_Cologne.txt', 61: 'Pereira_minority_London.txt', 62: 'Van Praet et al_hors_Ghent.txt', 63: 'Nurminen_hors_Tampere.txt', 64: 'Pokorn_diaspora_Ljubljana.txt', 65: 'Prieto Ramos_legal_Geneva.txt', 66: 'Poposki et al_Jakobson_Hong Kong.txt', 67: 'Zubakova_big data_Olomouc.txt', 68: 'Linares_minority_Cork.txt', 69: 'Forcada_hors_Alicante.txt', 70: 'Zeng & Cui_Cognition_Durham.txt', 71: 'Katan_transition_Lecce.txt', 72: 'Nord_hors_Bloemfontein.txt', 73: 'Tesseur_crisis_Dublin.txt', 74: 'Probirskaja_diaspora_Helsinki.txt', 75: 'Cadwell et al_crisis_Dublin_London.txt', 76: 'Jacobsen & Schjoldager_hors_Aarhus.txt', 77: 'Takeda_conflict_Tokyo.txt', 78: 'Sarto Szpak & Alves_hors_Belo Horizonte.txt', 79: 'Marais_keynote_Bloemfontein.txt', 80: 'Kruger_hors_Sydney.txt', 81: 'Kovacs_transnationalism_Budapest.txt', 82: 'Radicioni_conflict_Geneva.txt', 83: 'Daems_creativetech_Ghent.txt', 84: 'Garcia_hors_Castilla-La Mancha.txt', 85: 'Saeedi_translaboration_Melbourne.txt', 86: 'Robinson_complexity_Hong Kong.txt', 87: 'Desjardins_transition_Winnipeg.txt', 88: 'Pavlovic et al_crisis_Zagreb Dublin.txt', 89: 'Ergun_gender_Charlotte.txt', 90: 'Temmerman_translaboration_Brussels.txt', 91: 'Maatta_lgrights_Helsinki.txt', 92: 'Jiang_hors_Beijing.txt', 93: 'Wallmach & du Toit_cognition_Stellenbosch.txt', 94: 'Sun_cognition_Beijing.txt', 95: 'Asimakoulas_hors_Surrey.txt', 96: 'Klabal_legal_Olomouc.txt', 97: 'Bandia_keynote_Montreal.txt', 98: 'Guo_minority_Edmonton.txt', 99: 'Kundu_hors_Kolkata.txt', 100: 'Folaron_transition_Montreal.txt', 101: 'Heilmann et al_empirical_Aachen.txt', 102: 'Orrego Carmona & Richter_hors_Birmingham_Berlin.txt', 103: 'Weissbrod & Kohn_hors_Ramat Gan.txt', 104: 'Cohen_complexity_Amsterdam.txt', 105: 'Sattchai & Kenny_hors_Dublin.txt', 106: 'Wiedenmayer & Lamprou_Thessaloniki.txt', 107: 'Wehrmeyer & Antunes_cognition_Potchefstroom.txt', 108: 'Nwachukwu_hors_Gidan Waya.txt', 109: 'Pateinari_conflict_Thessaloniki.txt', 110: 'Robert et al_transition_Antwerp.txt', 111: 'Wehrmeyer_cognition_Potchefstroom.txt', 112: 'Simon_indirect_Tarragona.txt', 113: 'Dievenkorn_Bible_SantiagodeChile.txt', 114: 'Zhang_translaboration_Bristol.txt', 115: 'Deysel_poster_Stellenbosch.txt', 116: 'Matushita_empirical_Tokyo.txt', 117: 'Canales_complexity_Montreal.txt', 118: 'Ndhlovu_hors_Grahamstown.txt', 119: 'Rosendo_conflict_Geneva.txt', 120: 'Sogiba_poster_Stellenbosch.txt', 121: 'Riggs_hors_Geneva.txt', 122: 'Hokkanen_hors_Tampere.txt', 123: 'Ruegg_policies_Uppsala.txt', 124: 'Hubscher-Davidson_hors_Milton Keynes.txt', 125: 'Rodríguez Muñoz_hors_Cordoba.txt', 126: 'Olalla-Soler_hors_Barcelona.txt', 127: 'Song_complexity_Shanghai.txt', 128: 'Stengers_hors_Brussels.txt', 129: 'Valero-Garces_lgrights_Madrid.txt', 130: 'Zapata_creativetech_Ottawa.txt', 131: 'Zehnalová & Kubátová_hors_Olomouc.txt', 132: 'Ziemann & Dębicka-Borek_transnationalism_Cracow.txt', 133: 'Van Rensburg_hors_Stellenbosch.txt', 134: 'Norberg_hors_Stockholm.txt', 135: 'Maskaliuniene_diaspora_Vilnius.txt', 136: 'De Baets_empirical_Ghent.txt', 137: 'Brodie_indirect_London.txt', 138: 'Tsonev_poster_Graz.txt', 139: 'Roig_Sanz & Folica_big data_Barcelona.txt', 140: 'Pitkäsalo et al_hors_Tampere.txt', 141: 'Parkins-Maliko_hors_Johannesburg.txt', 142: 'Petroniene_poster_Kaunas.txt', 143: 'Dorer_hors_Mannheim.txt', 144: 'Naude & Naude_Bible_Bloemfontein.txt', 145: 'Schwartz & Edfeldt_policies_Stockholm Falun.txt', 146: 'de Riddier et al_hors_Stockholm.txt', 147: 'Currie_hors_Ljubljana.txt', 148: 'Tieber_translaboration_Graz.txt', 149: 'Ruffo_creativetech_Edinburgh.txt', 150: 'van Royen_indirect_Bloemfontein.txt', 151:

'Valero-Garces & Lopez_conflict_Madrid.txt', 152: 'Frerot & Landry_ergonomics_Grenoble.txt', 153: 'Malta_hors_Brasilia.txt', 154: 'Van der Watt_transnationalism_Stellenbosch.txt', 155: 'Ma_complexity_Beijing.txt', 156: 'Wendland_hors_Stellenbosch.txt', 157: 'Ekberg_minority_Turku.txt', 158: 'Pilliere_Jakobson_Marseille.txt', 159: 'Berber & Grundström_conflict_Turku.txt', 160: 'Reviers et al_complexity_Antwerp.txt', 161: 'Ozbot_hors_Ljubljana.txt', 162: 'Yu_gender_Ningbo.txt', 163: 'Havnen_poster_Oslo.txt', 164: 'Gao & Raido_lgrights_Auckland.txt', 165: 'Tekgul_hors_Istanbul.txt', 166: 'Steinbach-Hüther et al_big data_Leipzig.txt', 167: 'Amos et al_cognition_Geneva Edinburgh.txt', 168: 'Deng_hors_Beijing.txt', 169: 'Hijjo_poster_Stellenbosch.txt', 170: 'Li_hors_Beijing.txt', 171: 'Todorova_conflict_Hong Kong.txt', 172: 'Guo & Long_indirect_Chengdu.txt', 173: 'Dayter_empirical_Basel.txt', 174: 'Zheng & Weng_cognition_Durham.txt', 175: 'Tardel et al_cognition_Mainz.txt', 176: 'Valero-Garcés et al_lgrights_Madrid.txt', 177: 'Arbona & Seeber_cognition_Geneva.txt', 178: 'Chen_hors_Taipei.txt', 179: 'Shan_poster_Leeds.txt', 180: 'Levin_hors_Tel Aviv.txt', 181: 'Pirouznik_hors_Tarragona.txt', 182: 'Torres-Simón_transnationalism_Tarragona.txt', 183: 'Biel_legal_Warsaw.txt', 184: 'Kenny & Winters_creativetech_Dublin Edinburgh.txt', 185: 'Schaeffner_hors_Birmingham.txt', 186: 'Lindqvist_hors_Stockholm.txt', 187: 'Vimr_policies_Bristol.txt', 188: 'Angelelli_keynote_Edinburgh.txt', 189: 'Loogus & van Doorslaer_transnationalism_Tartu.txt', 190: 'Zhang_transnationalism_Leeds.txt', 191: 'Guo_gender_Edmonton.txt', 192: 'Castro & Linares_policies_Warwick Cork.txt', 193: 'Halverson & Munoz_cognition_Agder_Las Palmas de Gran Canaria.txt', 194: 'Gentile_transnationalism_Leuven.txt', 195: 'Risku et al_translaboration_Vienna.txt', 196: 'Vine & Huertas Barros_transition_London.txt', 197: 'Marais E. et al_hors_Bloemfontein.txt'.

18 Topic 1: language, revision, sign, management, minority, rights, Swedish; Topic 2: translation, process, work, text, deaf, biography; Topic 3: literature, English, Korean, Swedish, Spanish, authors, literary, consecration; Topic 4: translation, English, translator, research, data; Topic 5: translation, studies, research, English, literary, language; Topic 6: gestures, hand, speakers, comprehension, multimodal, cognitive, task, interpreter; Topic 7: translation, source, text, literary, quality, analysis; Topic 8: literary, south, Bible, Ikwerre, work, terms; Topic 9: model, transfer, original, agents, reception, culture, critical, Israeli; Topic 10: interpreting, cognitive, phonological, errors, Lithuanian; Topic 11: English, healthcare, multilingual, consultation, non-native, German, service, providers; Topic 12: professional, translation, Russian, community, immigrant, different; Topic 13: interpreting, literary, text, terms; Topic 14: translation, images, process, social, literary, national; Topic 15: cultural, replication, mediator, humanitarian, culture, support, narrativity; Topic 16: translation, system, complexity, neural, world; Topic 17: interpreter, emotion, lawyers, legal, local, impact, linguist, role.

References

Angelelli, Claudia. 2019. "Minding the Gaps: Translation and Interpreting Studies Crossing Interdisciplinary Boundaries." *EST 2019 Abstract Book*, 4. https://bit.ly/3kOVimY.

Ashrafi, Nasrin. 2019. "The Complexity of Iran's Literary Polysystem: An Interdisciplinary Study." In *Complexity Thinking in Translation Studies. Methodological Considerations*, edited by Kobus Marais and Reine Meylaerts, 216–237. New York, Routledge.

Bachmann-Medick, Doris. 2013. "Translational Turn." In *Handbook of Translation Studies* Vol. 4, edited by Yves Gambier and Luc van Doorslaer, 186–193. Amsterdam: John Benjamins.

Bassnett, Susan and David Johnston. 2019. "The Outward Turn in Translation Studies." *The Translator* 25 (3): 181–188. doi:10.1080/13556509.2019.1701228.

Bizzoni, Yuri, Marianne Reboul and Angelo Del Grosso. 2017. "Diachronic Trends in Homeric Translations." *Digital Humanities Quarterly* 11 (20). http://www.digitalhumanities.org/dhq/vol/11/2/000297/000297.html.

Blakesley, Jacob. 2018. "Reading Distantly Poetry Translation: Modern European Poet-Translators." In *Sociologies of Poetry Translation*, edited by Jacob Blakesley. Bloomsbury Press.

Burdick, Anna, Johanna Drucker, PeterLunenfeld, ToddPresner, and Jeffrey Schnapp. 2012. *Digital_Humanities*. Cambridge: MIT Press.

Buzelin, Hélène. 2005. "Unexpected Allies. How Latour's Network Theory Could Complement Bourdieusian Analyses in Translation Studies." *Translation Studies* 11 (2): 193–218.

Canavese, Paolo. 2019. "LEX.CH.IT: A Corpus for Micro-Diachronic Linguistic Investigations of Swiss Normative Acts in Italian." *Comparative Legilinguistics* 40: 44–65. doi:10.14746/cl.2019.40.3.

Chesterman, Andrew. 2000. "A Causal Model for Translation Studies." In *Intercultural Faultlines: Research Models in Translation Studies 1. Textual and Cognitive Aspects*, edited by Maeve Olohan, 15–27. London: Routledge.

Chesterman, Andrew. 2012. "Models in Translation Studies." In *Handbook of Translation Studies*, vol. 3, edited by Yves Gambier & Luc van Doorslaer, 108–114. Amsterdam: John Benjamins.

Ciula, Arianna, Øyvind Eide, Cristina Marras, and Patrick Sahle. 2018. "Modelling: Thinking in Practice; An Introduction." *Historical Social Research, Supplement* 31: 7–26. https://doi.org/10.12759/hsr.suppl.31.2018.7-29.

Cronin, Michael. 2013. *Translation in the Digital Age*. New York: Routledge.

Dacos, Marin. 2010. "Manifesto for the Digital Humanities." *Hypotheses*26 August. Academic blog. https://tcp.hypotheses.org/411.

Demerath, Loren and Dante E. Suarez. 2019. "Teaching Complexity as Transdisciplinarity." In *Complex Adaptive Systems. Views from the Physical, Natural, and Social Sciences*, edited by Ted Carmichael, Andrew J.Collins, and Mirsad Hadžikadić, 235–250. New York City: Springer.

Diestel, Reinhard. 2000. *Graph Theory*. New York City: Springer-Verlag.

Drucker, Johanna. 2016. "Graphical Approaches to the Digital Humanities." In *The New Companion to Digital Humanities*, edited by Susan Schreibman, Raymond G. Siemens, and John Unsworth, 238–250. Chichester: John Wiley & Sons.

Emmeche, Claus. 2004. "At Home in a Complex World: Lessons from the Frontiers of Natural Science." In *The Significance of Complexity. Approaching a Complex World through Science, Theology, and the Humanities*, edited by Kees van Kooten Niekerk and Hans Buhl, 21–46. Burlington, VT: Ashgate.

Endres, Bill. 2017. "A Literacy of Building: Making in the Digital Humanities." In *Making Things and Drawing Boundaries: Experiments in the Digital Humanities*, edited by Jentery Sayers, 44–54. Minneapolis: University of Minnesota Press.

Epstein, Joshua M. 2008. "Why Model?" *Journal of Artificial Societies and Social Simulation* 11 (4): 12. http://jasss.soc.surrey.ac.uk/11/4/12.html.

Fiormonte, Domenico. 2012. "Towards a Cultural Critique of the Digital Humanities." *Historical Social Research* 37 (3): 59–76.

Folaron, Deborah and Hélène Buzelin. 2007. "Introduction. Connecting Translation and Network Studies." *META: Journal des traducteurs* 52 (4): 605–642.

Gallitelli, Eleonora. 2016. "Digital Humanities come risorsa per i translation studies" [Digital Humanities as Resource for Translation Studies]. *Status Quaestionis. Language, Text, Culture* 10: 53–72.

Gold, Matthew. 2012. "Introduction: The Digital Humanities Moment." *Debates in the Digital Humanities*, edited by Matthew Gold, ix–xvi. University of Minnesota Press.

Göpferich, Susanne. 2011. "From Multidisciplinarity to Transdisciplinarity: The Investigation of Competence Development as a Case in Point." *MikaEL1Kääntämisen ja tulkkauksen tutkimuksen symposiumin verkkojulkaisu. Electronic Proceedings of the KäTu Symposium on Translation and Interpreting Studies* 5: 1–24.

Handelman, Matthew. 2015. "Digital Humanities as Translation: Visualizing Franz Rosenzweig's Archive." *Transit* 10 (1): 1–20.

Hayles, Katherine N. 1990. *Chaos Bound. Orderly Disorder in Contemporary Literature and Science.* New York: Cornell University Press.

Hübenthal, Ursula 1991. *Interdisziplinäres Denken: Versuch einer Bestandsaufnahme und Systematisierung.* Stuttgart: Steiner.

Huggett, Jeremy. 2012. "Core or Periphery? Digital Humanities from an Archaeological Perspective." *Historical Social Research/Historische Sozialforschung: Controversies around the Digital Humanities* 37 (3): 86–105.

Johnson, Steven. 2001. *Emergence: The Connected Lives of Ants, Brains, Cities.* New York: Scribner.

Jørgensen, Finn Arne. 2016. "The Internet of Things." In *The New Companion to Digital Humanities*, edited by Susan Schreibman, Raymond G. Siemens and John Unsworth, 42–53. Chichester: John Wiley & Sons.

Kaindl, Klaus 1999. "Interdisziplinarität in der Translationswissenschaft: Theoretische und methodische Implikationen" [Interdisciplinarity in Translation Studies: Theoretical and Methodological Implications]. In *Modelle der Translation: Grundlagen für Methodik, Bewertung, Computermodellierung*, edited by Alberto Gil, Johann Haller, Erich Steiner and Heidrun Gerzymisch-Arbogast, 137–155. Frankfurt: Lang.

Kaufman, Micki, Zoe LeBlanc, Matthew Lincoln, Yannick Rochat and Scott B. Weingart. 2017. "Visualizing Futures of Networks in Digital Humanities Research." *DH2017. Access/Accès*, 93–95. Université de Montréal. https://yro.ch/wp-content/uploads/2015/03/DH2017_kaufman_et_al.pdf.

Kirschenbaum, Matthew G. 2013. "What is Digital Humanities and What's it Doing in English Departments?" In *Defining Digital Humanities: A Reader*, edited by Melissa Terras, JulianneNyhan and Edward Vanhoutte, 195–204. Farnham: Ashgate.

Lavin, Michael J. 2019. "Analyzing Documents with TF-IDF." *The Programming Historian*. https://programminghistorian.org/en/lessons/analyzing-documents-with-tfidf#how-the-algorithm-works.

Latour, Bruno. 2005. *Reassembling the Social: An Introduction to Actor-Network Theory.* Oxford; New York: Oxford University Press.

Latour, Bruno. 1996. "On Actor-Network Theory: A Few Clarifications." *Soziale Welt* 47: 369–381.

Law, John. 2004. *After Method: Mess in Social Science Research*. New York: Routledge.

Liu, Alan. 2020. "Toward a Diversity Stack: Digital Humanities and Diversity as Technical Problem." *PMLA* 135 (1): 130–151. https://doi.org/10.1632/pmla.2020.135.1.130.

Mahony, Simon. 2018. "Cultural Diversity and the Digital Humanities." *Fudan Journal of Humanities and Social Sciences* 11: 371–388.

Manning, Christopher D., Prabhakar Raghavan, and Hinrich Schütze. 2008. *Introduction to Information Retrieval*. Cambridge: Cambridge University Press.

Marais, Kobus. 2014. *Translation Theory and Development Studies. A Complexity Theory Approach*. New York: Routledge.

Marais, Kobus and Reine Meylaerts (Eds.). 2018. *Complexity Thinking in Translation Studies. Methodological Considerations*. New York: Routledge.

Marecki, Piotr and Nick Montfort, 2017. "Renderings: Translating Literary Works in the Digital Age." *Digital Scholarship in the Humanities* 32 (1): i84–i91.

McCarty, Willard. 2016. "Becoming Interdisciplinary." In *The New Companion to Digital Humanities*, edited by Susan Schreibman, Raymond G. Siemens and John Unsworth, 69–83. Chichester: John Wiley & Sons.

Meylaerts, Reine. 2012. "Multilingualism as a Challenge for Translation Studies." In *The Routledge Handbook of Translation Studies*, edited by Carmen Millán and Francesca Bartrina, 519–533. New York: Routledge.

Morrison, Margaret and Mary S. Morgan. 1999. "Models as Mediating Instruments." In *Models as Mediators*, edited by Mary S. Morgan and Margaret Morrison, 10–37. Cambridge: Cambridge University Press.

Moretti, Franco. 2000. "Conjectures on World Literature." *New Left Review* 1: 54.

Moretti, Franco. 2013. *Distant Reading*. New York: Verso Books.

Newmann, Mark E. J. 2010. *Networks: An Introduction*. Oxford: Oxford University Press.

Nicolescu, Basarab. 2014. "Methodology of Transdisciplinarity." *World Futures* 70 (3–4):186–199. doi:10.1080/02604027.2014.934631.

O'Hagan, Minako. 2013. "The Impact of New Technologies on Translation Studies. A Technological Turn?" *The Routledge Handbook of Translation Studies*, edited by Carmen Millán and Francesca Bartrina, 503–518. New York: Routledge.

Oldman, Dominic, Martin Doerr and Stefan Gradmann. 2016. "Zen and the Art of Linked Data: New Strategies for a Semantic Web of Humanist Knowledge." In *The New Companion to Digital Humanities* edited by Susan Schreibman, Raymond G. Siemens and John Unsworth, 251–273. Chichester: John Wiley & Sons.

Portela, Martin, María Mencía and Søren Pold. 2018. "Creating New Constraints: Toward a Theory of Writing as Digital Translation." *Electronic Book Review*, May 30. https://doi.org/10.7273/wa3v-ab22.

Presner, Todd and David Shepard. 2016. "Mapping the Geo-Spatial Turn." In *The New Companion to Digital Humanities*, edited by Susan Schreibman, Raymond G. Siemens and John Unsworth, 201–212. Chichester: John Wiley & Sons.

Pym, Anthony. 2007. "Cross-Cultural Networking: Translators in the French-German Network of *Petites Revues* at the End of the Nineteenth Century." *META: Journal des traducteurs* 52 (4): 744–762.

Pym, Anthony and Grzgorz Chrupała. 2005. "The Quantitative Analysis of Translation Flows in the Age of an International Language." In *Less Translated*

Languages, edited by Albert Branchadell and Lovell Margaret West. Amsterdam: John Benjamins.

Quillian, M. Ross. 1968. "Semantic Networks." In *Semantic Information Processing*, edited by Marvin L. Minsky. Cambridge, MA: MIT Press.

Robinson, Douglas. 2016. *Exorcising Translation. Towards an Intercivilizational Turn*. New York City: Bloomsbury Academic.

Ruecker, Stan. 2016. "Interface as Mediating Actor for Collection Access, Text Analysis, and Experimentation." In *The New Companion to Digital Humanities*, edited by Susan Schreibman, Raymond G. Siemens and John Unsworth, 397–407. Chichester: John Wiley & Sons.

Rybicki, Jan. 2012. "The Great Mystery of the (Almost) Invisible Translator." In *Quantitative Methods in Corpus-Based Translation Studies: A Practical Guide to Descriptive Translation Research*, edited by Michael P. Oakes and Meng Ji, 231–248. Amsterdam: John Benjamins.

Rybicki, Jan and Magda Heydel. 2013. "The Stylistics and Stylometry of Collaborative Translation: Woolf's Night and Day in Polish." *Literary and Linguistic Computing* 28 (4): 708–717.

Smith, Martha Nell. 2004. "Electronic Scholarly Editing." In *A Companion to Digital Humanities*, edited by Susan Schreibman, Raymond G. Siemens and John Unsworth, 306–322. Malden, MA: Blackwell Publishing.

Snell-Hornby, Mary. 2010. "The Turns of Translation Studies." In *Handbook of Translation Studies*, vol. 1, edited by Yves Gambier and Luc van Doorslaer, 366–370. Amsterdam: John Benjamins.

St. André, James. 2018. "Introduction: Translation Studies and the Digital." *Journal of Translation Studies* 2 (1): 1–4.

Tahir-Gürçağlar, Şehnaz. 2007. "Chaos before Order: Network Maps and Research Design in DTS." *Meta: Journal des traducteurs, Special Issue, Connecting Translation and Network Studies* 52 (4): 724–743.

Tanasescu, Raluca. 2019. "Chaos out of Order: Translations of American and Canadian Contemporary Poetry into Romanian before 1989." *Chronotopos* 2, 64–94. doi:10.25365/cts-2019-1-2-5.

Tanasescu, Raluca. 2021. Forthcoming. "Literary Barters: A Network Science Approach to Agency in Translation." *Journal of Translation Studies* 5 (1): 1–29.

Tanasescu, Raluca and Chris Tanasescu. 2019. "*Translator Networks of Networks in Digital Space. The Case of Complexity Thinking in Translation Studies: In Search of a Methodology*, edited by Kobus Marais and Reine Meylaerts, 128–151. New York: Routledge.

Terras, Melissa. 2012. "*Quantifying Digital Humanities*." Infographic. UCL Centre for Digital Humanities.

Underwood, Ted. 2017. "A Genealogy of Distant Reading." *Digital Humanities Quarterly* 11 (2). http://www.digitalhumanities.org/dhq/vol/11/2/000317/000317.html.

Yang, Menghui, Man Wang, Hanlin Wang, Guancan Yang and Hua Liu. 2020. "Exploring the Transdisciplinary Nature of Digital Humanities." *JCDL '20: Proceedings of the ACM/IEEE Joint Conference on Digital Libraries in 2020*, 553–554. https://doi.org/10.1145/3383583.3398552.

Youdale, Roy. 2020. *Using Computers in the Translation of Literary Style: Challenges and Opportunities*. New York: Routledge.

Wang, Qing. 2018. "Distribution Features and Intellectual Structures of Digital Humanities: A Bibliometric Analysis." *Journal of Documentation* 74 (1): 223–246.

Weaver, Warren. 1948. "Science and Complexity." *American Scientist* 36: 536.

Websites

www.python.org
https://adho.org/global-outlookdigital-humanities-godh