AN INTRODUCTION TO NETWORK VISUALIZATION FOR TELEVISION STUDIES: MODELS AND PRACTICAL APPLICATIONS

GIULIA TAURINO

Name Giulia Taurino
Academic centre Università di Bologna, University of Montreal
E-mail address giulia.taurino2@unibo.it

KEYWORDS
Digital Humanities; Television Studies; Network Analysis; Visual Models; Wikidata.

ABSTRACT
With the advent of open-source digital tools, abstract models have been consistently adopted in humanistic research and they have proven to be useful for many purposes: for predictive and descriptive analysis using quantitative or qualitative models, for database management, as in the case of relational models, and for modeling cultural dynamics (Gabora 2008). Among others, television scholars embraced such a trend in cultural analytics and digital humanities, by notably adopting modeling practices for assessing viewers' behaviors (Wonneberger 2009) or for measuring qualitative variations in narrative ecosystems (Pescatore and Rocchi 2018). Drawing upon this digital turn, the following paper aims to discuss the advantages, challenges and limits of adopting visual models for the analysis of large corpora in television studies. Examples of data visualization will be shown here, in application to a sample database of anthology TV series extracted through the Wikidata Query Service. A visual model available on the platform RAWGraph will be proposed as a means to identify flows of production and distribution, by looking at the country of origin and at the industrial players involved in the formation of such a network. I will therefore focus less on actual modeling, and more on model usage for academic research.

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

1. **INTRODUCTION**

With the advent of open-source digital tools, abstract models have been consistently adopted in humanities computing and they have proven to be useful for many purposes: for predictive and descriptive analysis using quantitative or qualitative models, for database management, as in the case of relational models, and for modeling cultural dynamics (Gabora 2008). Among others, television scholars embraced such a trend in cultural analytics and digital humanities, by notably adopting modeling practices for assessing viewer behaviors (Wonneberger 2009) or for measuring qualitative variations in narrative ecosystems (Pescatore and Rocchi 2018). Drawing upon this digital turn, the following paper aims to discuss the advantages, challenges and limits of adopting visual models for the analysis of large corpora in television studies. Network visualizations created using the open-source tool *Palladio*, developed at Stanford University, will be initially generated to evaluate the effectiveness of looking at single serial products as networks. Moreover, examples of data visualization will be shown in application to a larger sample database of anthology TV series extracted from Wikidata through the Wikidata Query Service via a SPARQL API. A visual model available on the platform RAWGraph will be proposed as a means to identify flows of production and distribution, by looking at the country of origin and at the industrial players involved in the formation of such a network. Finally, the dataset will be displayed into a matrix-like design thanks to Polestar, to demonstrate further possibilities for the visualization of networks. Data visualization tools will be additionally considered as ways to track historical changes in the evolution of television series over time, determine the emergence of a genre, or simply explore the data available. The ultimate aim of this paper is to explore the use of network visualizations as models for humanistic research.

2. **VISUAL MODELS AND DISTANT READING**

Visual models differ from other types of models in the way they make visible a set of relationships, rather than offering simulations, running tests or undertaking computational analysis. In this sense, they can be useful for examining networks, understanding relational models, or verifying the completeness of the information and the presence of errors through data discovery processes. Developing an interrelated structure, made of assembled bits of information, implies a cognitive load that risks being demanding. This barrier can be overcome by creating an accessible visual form through knowledge design (Schnapp 2014). In other words, a structural design is often needed to access a given database's "information architecture" (Morville and Rosenfeld 2008). This means that visual models are ultimately necessary not only to process information, but also to externalize it by means of infographic tools that, through color coding and dimension rendering, are able to highlight nodes and links in a network, directional paths, level of connectedness and proximity, degrees of variations and differences. Visualization can therefore lead to meaningful learning – that is to say, the production of a deeper form of knowledge based on understanding the net of connections behind actors or concepts.

While, on the one hand, close textual analysis can be often performed easily without the need for digital tools, on the other hand analyzing cultural production and circulation on a macro-level notably poses problems related to the size and the scale of the corpus, as well as to the distance of the analytical perspective from the text, or texts, taken into consideration. To clarify the different scopes of an analytical reading in digital humanities, in 1999, Franco Moretti proposed to differentiate between a "close reading" and a "distant reading" approach to the study of literature and textual data. In opposition to traditional close reading, he outlines an "abstract model for literary history" (Moretti 2005: 8), to put objects in perspective and create a form of knowledge based on distance.

> It allows you to focus on units that are much smaller or much larger than the text: devices, themes, tropes - or genres and systems. [...] If we want to understand the system in its entirety, we must accept losing something. We always pay a price for theoretical knowledge: reality is infinitely rich; concepts are abstract, are poor. But it's precisely this 'poverty' that makes it possible to handle them, and therefore to know. (Moretti 2000: 57-8)

The level of abstraction, as Moretti himself notes, is directly proportional to the ambition of the analysis, and it comes with losses. However, if the aim is to account for macroscopic dynamics in television studies, losses will be minimized by the ability to marginalize biases and detect large-scale patterns in a more objective way, thanks to the level of abstraction granted by a distant reading. The knowledge produced by visual models ultimately results in a less biased analysis, by enabling a macroscopic and inclusive perspective.

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

In a first formulation of his theory, Moretti begins from an examination of graphs, a tool imported from quantitative analysis, among other data visualizations. When talking about a study of over twenty-thousand novels, he argues precisely that

> a field this large cannot be understood by stitching together separate bits of knowledge about individual cases, because it isn't a sum of individual cases: it's a collective system, that should be grasped as such, as a whole – and the graphs [...] are one way to begin doing this (Moretti 1999: 4)

More recently, Moretti considered complex types of graphs in the form of networks: he analyses networks found within narrative forms (e.g. a network of characters, Moretti 2011). This model for quantifying the plot by observing it as a network can be used in television studies for analyzing complex narrative ecosystems. Patrick Jagoda (2016), for example, made the case of the HBO's series *The Wire*. Following Moretti's view, I will examine television series as non-discrete objects that are part of a complex network in constant evolution.

In the original business structure of linear television, a centripetal circulation of serial narratives was mainly influenced by hierarchic and oligopolistic structures in the industrial pyramid. In the contemporary scenario, however, where linear and non-linear television coexist, this centripetal movement is less evident and often has to deal with a web of peripheral economic mechanisms and coexisting socio-cultural systems. Network visualization therefore seems to be the key for observing the institutional, industrial, and cultural relations that television series foster today. Combined with more traditional forms of analysis, abstract visual models can be successfully implemented in Television Studies as a response to a much more complex transnational media environment. In this global exchange, where many players intervene, a network-based visualization can be performed with great advantages for a more accurate evaluation of the relations that television content establishes at the intersection between different media environments.

3. **MEDIA ECOSYSTEMS AND NETWORK THEORY**

The concept of network exists in close relationship with that of media as environments, or else ecosystems, a cross-disciplinary metaphor derived from biology. In media ecology this framework found several research outputs, thanks to the work of Marshall McLuhan and Neil Postman, and to more recent publications by Felix Guattari, Gilles Deleuze, Manuel DeLanda and Bruno Latour. Postman, as cited by Niall Stephens, originally suggested that "if in biology a 'medium' is something in which a bacterial culture grows [...], in media ecology, the medium is 'a technology within which a [human] culture grows'" (Stephens 2014: 2035). Similarly, Christine Nostrum had proposed to look at "complex communication systems as environments" (Nystrom 1972: 3). Building on media ecology, I embrace an ecosystemic approach to analyze televisual products at the nexus between different forces (i.e. cultural, industrial, technological dynamics) and players (i.e. production and distribution companies, policy-makers). Much like a business ecosystem, a model first introduced by James F. Moore (1993), a media ecosystem, as I define it here, constitutes a rhizomatic system made of several components and networks of relationships between them. In this sense, media are seen not as mere technological environments acting in the background, but as systems that generate networks between diverse entities.

In more practical terms, a media ecosystem framework is intended to favor a socio-economical perspective on the study of media, with consequent implementation of network theory and data-driven approaches. Within such a network framework, television series are therefore observed as parts of a "cultural forum" (Newcomb and Hirsch 1983), influenced by economic and social norms, among others. The problem of the cultural impact of ever-changing ecosystems represents indeed a fundamental question to understand regularities and tendencies in the creation and diffusion of serialized narrative forms. In key moments of media mutation and assessment on a large scale, such as the transition we are experiencing now between linear and non-linear media or the increasing hybridization of televisual forms, traditional qualitative research might encounter some challenges. How can the evolution of serial narratives be studied in relation to underlying structures and mutating processes in the television industry, which ultimately influence the circulation of content?

What I propose here is to blur the methodological boundaries and set the premises for integrating into Television Studies a quantitative approach centered on network theory, a polysemic concept that needs to be clarified. The necessity of discussing networks in cultural studies notably responds to the emergence of a global society that is increasingly connected. The rise of a "networked society" is widely discussed

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

by Manuel Castells (1996), who addresses topics as varied as technological revolution, dynamics of globalization, new economy, informational flows and virtual culture, to account for a radical shift in the level of interconnectedness between contemporary human communities and systems. A network is notably defined as a set of points, symbolizing actors (individuals, groups, institutions, texts, etc.), and a set of lines, symbolizing the relations between these actors (Beauguitte 2016: 2-3). Laurent Beauguitte (2016) gives a relatively precise description of what constitutes this branch, by defining network theory as the body of methods, notions and concepts used for studying a given relational phenomenon. As he also points out, "analyzing a network does not necessarily involve using network analysis methods, and conversely network analysis methods can be used to study literary works, ecological systems, and so on" (Beauguitte 2016: 1-2, my translation).

For this reason, I suggest here to start exploring networks of serial products through network visualization as a preliminary step to then proceed with further network analysis. Both network analysis and visualization have been discussed as theoretical and methodological tools in human sciences: from sociometry (Moreno 1951) and social network analysis (Wasserman and Faust 1994), to the study of cultural dynamics, with historical (Schich et al. 2014) or industrial perspectives (Yucesoy et al. 2018). The question of a complex structure, in the form of an ecosystem or a network, and of complexity in general, emerges as a central problem also in cultural studies. For instance, building upon network science (Barabási, 2003; Newman, Barabási and Watts, 2006), Caroline Levine (2015), in her neo-formalist approach to the study of narratives, proposes to analyze networks in works of fiction. Before Levine, Franco Moretti (1999) was proposing to use abstract models and artificial constructs, such as graphs, maps and trees, for literary studies.

Following Levine's theorization, and drawing upon Moretti's modeling applications, I suggest the use of network visualization to understand contemporary television seriality, without necessarily opting exclusively for a plot analysis. As demonstrated by many research groups – Stanford University's *Literary Lab* and McGill University's *TXTLAB*, just to name a few – by using notions and visual models traditionally found in network science, scholars in the humanities can pursue a large-scale analysis of cultural phenomena, by systematically observing causalities and links between nodes. Notions borrowed from network theory – like path length, network centrality, hubs, and hinges – can therefore be effectively integrated into an interdisciplinary vocabulary for conducting small- and large-scale analysis in television studies. In the following section, I will give practical examples of how network visualization can be applied to understand intertextual references, transmedia connections, as well as patterns of production and distribution related to television series. A diversity of visual models will be considered as an introduction for media scholars who want to approach a study of networks without necessarily using more complex network analysis.

4. ANALYZING TELEVISION SERIES THROUGH NETWORK VISUALIZATION: PRACTICAL APPLICATIONS

Net-work, much like the textile metaphor of a narrative text, refers to a web of interwoven elements. The concept of plot itself serves as an interdisciplinary term, transitioning between narrative theory and more practical applications in graphic design. Used for defining a graphing technique for presenting some kind of relation between two variables, the term plot was adopted in narratology with regards for the causal and temporal patterns arranged in a story (Kukkonen 2014), in order to stress the global structure of narrative design and its inner connections. Texts and plots can therefore be studied as systems of relations, or else as networks. The metaphor of text as network – or plot – as network is the premise for one of the possible applications of visual models to television studies, where the series *is* the network – that is, the series itself established a narrative network of intertextual references between episodes. Another option is to consider television series as nodes connected to other products orbiting in the same franchise. Finally, television series can be observed as links between different media technologies and environments (e.g. broadcast television-online platforms), media industries (e.g. television-video games) or media markets (e.g. U.S. television-U.K. television).

To give a more detailed description of the applications that follow, one option when doing network visualization is to look at the information architecture and structure of each series. A second option, if the series-network expands through the addition of new nodes, as in the Barabási–Albert model (1999), is to determine dynamics of growth and preferential attachment within the network - i.e. which season, episode or element of the series is more likely to generate a franchise-effect. Otherwise, we could also find ourselves in front of a static model, where the number of

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

nodes, *N*, is fixed and time invariant, such as theorized by the Erdos-Renyi model (1959). Depending on the case study and the main question, one could then use network visualization as a basis for pursuing a more complex network analysis, by evaluating degree dynamics, degree distribution, clustering coefficient. Here I will mainly address visual models in network theory, leaving network analysis for future investigations. I will notably focus more closely on the third paradigm to analyze the circulation of content across television industries and markets on a large scale. In order to examine television series as links using a visual model, a database is needed, since I am working on a corpus of several "texts" with contextual information attached, and not on a single textual unit.

For further clarifications, I will start by saying that networks can be of different types, which I will list here and then refer to with the aim of classifying the visualizations generated from this model: networks can be directed (with directions assigned to the links) or undirected (with no specific direction assigned), bipartite (between two separate sets of nodes), multigraph (multiple edges between two nodes), temporal (for each node/edge, information on the time when it appeared in the network), or labeled (containing labels like weights or attributes on nodes and/or edges). No matter which typology of network we are observing, in order to begin with a network-based methodology, and be able to proceed in the visualization with a clearer scope, we need to ask the following questions:

— What are the nodes and links?
— How can the data be collected?
— What is the size of the network (number of nodes and links)?
— What are the questions asked?
— Why is this network relevant?

To facilitate the understanding of visual models as a starting point for consequent network analysis, I will briefly evaluate the three applications mentioned above by using the visualization tool Palladio, developed at Stanford University, and then by using RAWGraph. The three case studies examined will be: television series as networks (case A); television series as nodes (case B); television series as links (case C). I notably focus on the case of the anthology series in the wake of a larger research project which I carried out as part of my Doctorate. The specific examples I give here (*Black Mirror* and *The Twilight Zone*) are therefore a selection from the limited corpus I used for my dissertation. However, each case is meant to serve as an overview on possible applications of network visualizations for all corpora in Television and Media Studies.

> Case A. **Television series as networks**

This first application considers network visualization for plot analysis of television series. The case study for this visualization will be the series *Black Mirror* (Channel 4, 2011–2014; Netflix 2016-). The case of *Black Mirror* is particularly rel-

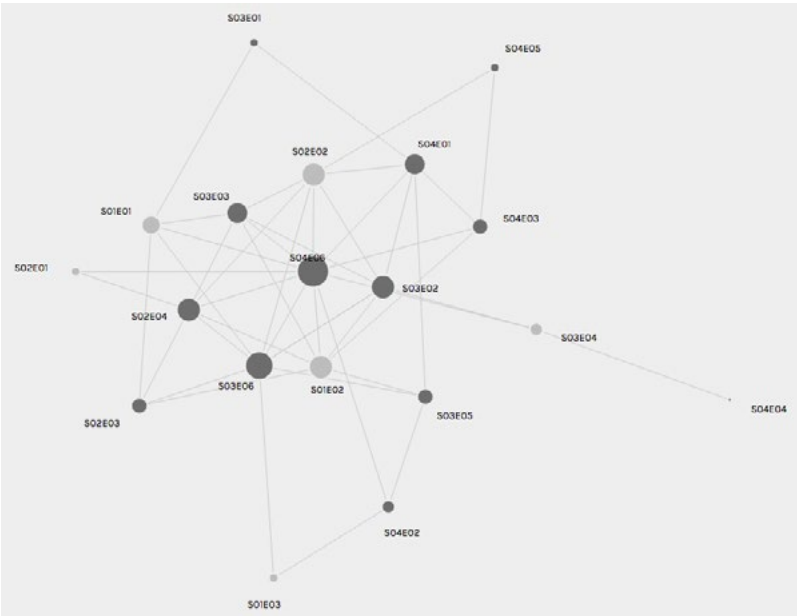

FIG.1. DIRECTED NETWORK OF BLACK MIRROR'S INTERTEXTUAL REFERENCES WITH LABELED NODES
(size of the dots= number of references; dark grey dots = referencing episodes; light grey dots = referenced episodes)

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

evant because some episodes contain allusions to one or more other episodes, thus challenging a rigid definition of television anthology. Despite them being nothing more than subtextual references at the very margin of the main plot, they helped nourish a debate on whether *Black Mirror* is a shared universe or not. The list of answers in response to the questions previously listed is as it follows:

— Nodes: episodes; links: intertextual references;
— Data can be collected directly from the series;
— The size of the network is 19 nodes and 47 links;
— How many intertextual references can be found in the series *Black Mirror*?

This network is relevant for assessing the level of interconnectedness and serialization in the plot.

I traced each intertextual reference manually, with the aid of information found online[1]. Here I use the definition "intertextual references" with regard to effects of intertextual dialogism between episodes through allusions and the repetition of specific elements of the plot in more than one episode. Based on the structure of the network visualization generated thanks to Palladio *(Fig. 1)*, *Black Mirror*, compared to other examples of anthology series, might appear at a first glance as an interconnected universe. Moreover, some episodes contain a greater density of connections to other episodes, as it can be seen from the size of the dots in the graphs. In a platform perspective, given that *Black Mirror* is part of the Netflix library, this visualization might suggest a better indexing of such episodes in the platform ecosystem. This visual model also uses dots' colors, other than their size, to give information. Darker colors mark episodes that reference and lighter colors mark those that are referenced.

Such a distinction is useful to show how some episodes function as hubs that strengthen the anthology principle, which does imply some sort of connection to justify the creation of a whole collection. What we can observe from this visualization, however, is that, compared to early anthology series, today's anthologies are more fluid as far as the intertextual dialogism between episodes. Fig. 1 also shows that contemporary anthology series might foster processes in which certain episodes (or seasons) emerge over more peripheral ones. It could be interesting to check if this phenomenon has an effect on actual reception: is "Black Museum" (4.06), for one example, more watched than other episodes or it simply works, from a production standpoint, to reinforce the whole anthology-network, without necessarily causing imbalances in consumption? With this question I want to point out that using the lenses of network theory through a visual model for plot analysis does not necessarily help us to noticing microscopic dynamics inside the text, which might be easier to grasp with a textual analysis, but solicits the adoption of a macroscopic perspective of the dynamics outside the text. It creates the necessary bridge between textual, narrative analysis, and cultural, social, economic analysis by pointing at the patterns of emergence, convergence or divergence that we should investigate further. I will demonstrate this point again in case B and C.

> Case B. **Television series as nodes**

A second application can be envisaged when observing television series as nodes in a network. This approach turns out to be useful in the case of macro-anthologies, as well as with television series that entail a "transmedia storytelling" (Jenkins 2006) effect, or else other televisual forms that contain a system of references to other products, such as media franchises. In this case, nodes would be television series or other textual occurrences (films, videogames, books, radio programs), whereas links would be traced by transmedia connections via franchise agreements, but one could also define a larger network of intertextuality (Kristeva 1980) via citations, shared themes or genres and assign a value, or else assign a "weight" to each tie, thus creating a weighted network and measuring the overall network strength (Barrat et al. 2004). The case study for this application will be *The Twilight Zone* (Original series: CBS, 1959-1964; First revival: CBS, 1985-1989; Second revival: UPN network, 2002-2003; Third revival: CBS All Access, 2019), which I define as a macro-anthology subjected to franchising dynamics.

— Nodes: *The Twilight Zone* "franchise"; links: license or franchise agreement;
— Data can be collected through archival and historical research, when references cross different time-frames, or through mapping different licensing agreements from reliable online sources. In this case, I used both forms of data collection;
— The size of the network is 16 nodes and 21 links;
— How far does the macro-anthology extend as a fran-

1 Bradley, Laura (2018). "All the Easter Eggs You Might Have Missed in Black Mirror Season 4." *Vanity Fair*, January 2, 2018. https://www.vanityfair.com/hollywood/2018/01/black-mirror-easter-eggs-cameos-callbacks (last accessed 18-06-19).

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

chise, in terms of trans-historical and trans-media evolutions?

This network is relevant to evaluate the limits of the contemporary anthology form, which is often thought to be a relatively rigid product because of its production norms that seem to marginalize transmedia proliferations. This original assumption might not be true for cult anthology series that survived several television eras, such as *The Twilight Zone*.

In the following visualization (*Fig.2*), as I showed in case A, darker dots represent products that reference to other products, while lighter dots are the products that are being referenced. The size of the dots indicates the number of references: the higher the number, the bigger the dot. Dots are disposed accordingly to what seems to be the structure of the network, which in this case is highly centralized around the first product of the franchise in a chronological order.

This is what *The Twilight Zone* franchise's network looks like:

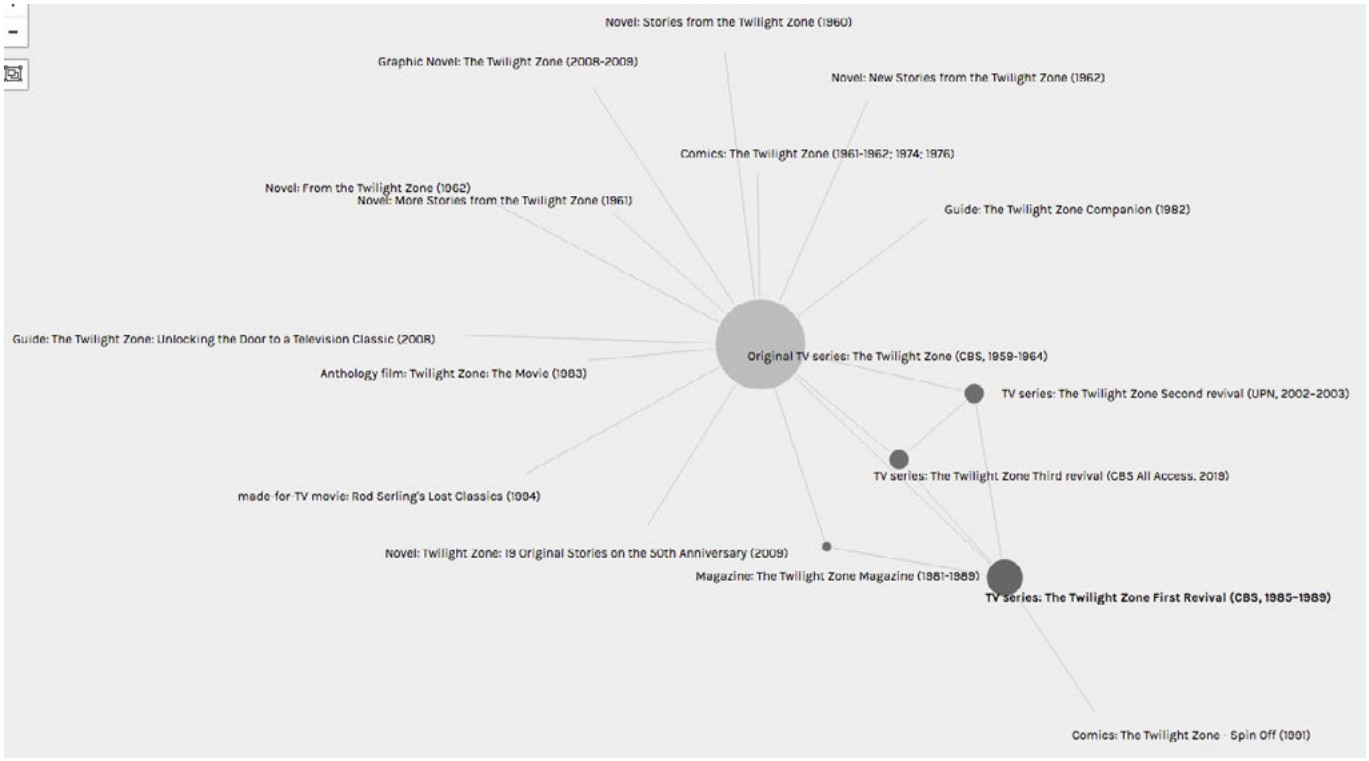

FIG.2. DIRECTED NETWORK OF THE TWILIGHT ZONE FRANCHISE'S INTERTEXTUAL AND INTERMEDIAL REFERENCES WITH LABELED NODES
(size of the dots= number of references; dark grey dots = referencing episodes; light grey dots = referenced episodes)

This visualization gives a comprehensive view of the way anthology series can generate a trans-historical and trans-media conversation creating a network. For instance, this visual model underlines the importance of revivals not only for enhancing an intergenerational dialogue, but also for expanding the discursive space of the original series. Revivals tend to generate connections. Unfortunately, the actual outcomes of the last revival cannot be collected, as it has not yet been released. Furthermore, transmedia operations in this case do not seem necessarily linked to a narrative strategy for broadening the text. Here, transmedia storytelling mainly responds to an industrial strategy: it creates a micro-economy, a small-scale market, the economy of *The Twilight Zone*.

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

With their intrinsic cultural and commercial value, transmedia occurrences of this anthology series serve the purpose of moving the economy of storytelling from one media to another. As shown in the graph, *The Twilight Zone* franchise, despite finding its roots in a traditional, episodic anthology form, created a web of connections between different media, industries, platforms. In this sense, case B could be also represented with other properties associated to the nodes. In such a network, the television industry connects with the film and publishing industry, as much as CBS connects to UPN (showing the presence of a commercial deal). Reflecting on television series as objects that can connect industries, platforms, or even countries and cultures broadens the spectrum of the analysis to interesting observations about the cultural capital of television series as popular products. Case C represents a preliminary study of such an industrial network, designed to be expanded in application to bigger datasets.

> Case C. **Television series as links**

One of the most interesting applications of network theory and visual models for the analysis of television series can be tested with regard to the cultural interactions they foster. Let us imagine a network of institutional entities where television series are the links. This application can be adopted for the analysis of a single case study or for the analysis of a much bigger corpus. In the event of a large enough corpus, the network is the database itself made of links and nodes and following a relational model which I will discuss in the next paragraph. Beneath a platform like the IMDb, for example, lies the structure of a network. Here I will provide a small-scale example of a network visualization model where television series are links.

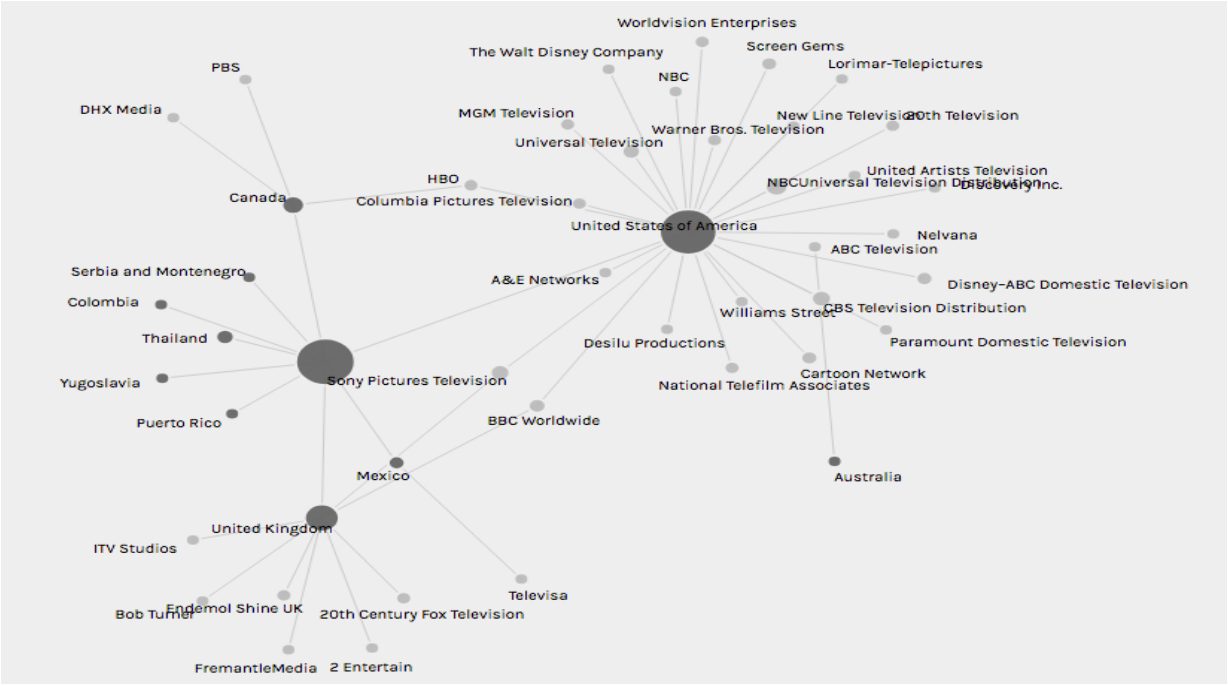

FIG.3. DISTRIBUTION NETWORK OF *THE TWILIGHT ZONE*'S SERIES (ORIGINAL AND REVIVALS) WITH LABELED NODE
(size of the dots = number of industrial connections; dark grey dots = original series and revivals; light grey dots = distribution companies/institutions)[2]

- Nodes: countries, institutions, television channels or platforms; links: anthology series (*The Twilight Zone*);
- Data can be collected from Wikipedia, IMDb, Television Archives;
- The size of the network is 41 nodes and 45 links;
- How many institutional entities were involved in the production and distribution of *The Twilight Zone*?

2 This image is a screenshot from a dynamic visualization made on Palladio's platform. A better visualiza-tion of the image is possible through the platform itself and using a large screen.

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

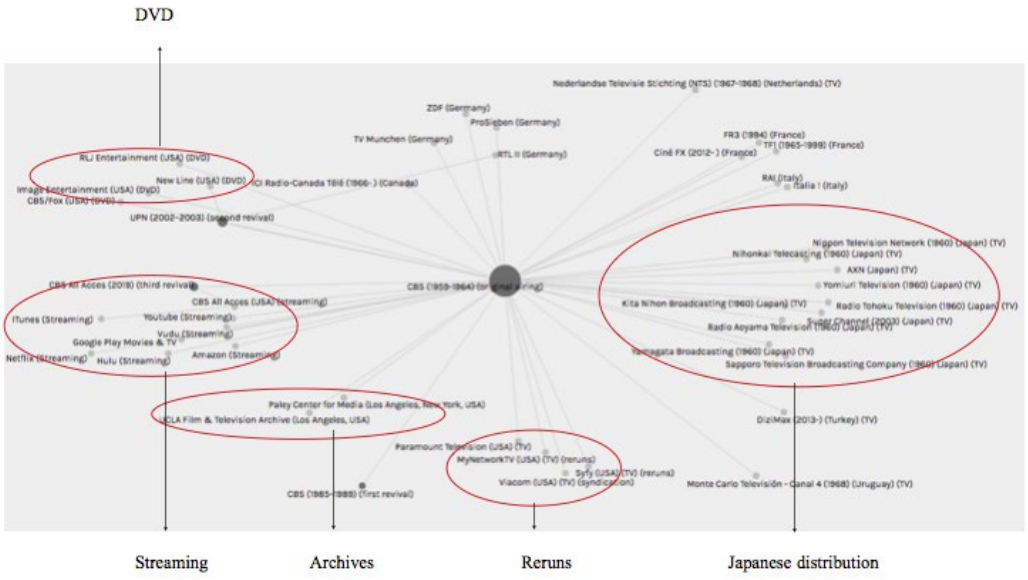

FIG.4. DISTRIBUTION NETWORK (DIRECTED AND LABELED) OF A CORPUS OF ANTHOLOGY SERIES
(size of the dots = number of connections; dark grey dots = country of origin; light grey dots = distribution companies)[3]

3 This image is a screenshot from a dynamic visualization made on Palladio's platform. A better visualiza-tion of the image is possible through the platform itself and using a large screen.

This network is relevant for evaluating how the lineage of the series *The Twilight Zone* colonized the industrial and cultural space.

Fig. 3 gives a glimpse of how the network might look, with clusters based on the country in which the content is distributed (e.g. Japan) and the way it is accessed by the audience (public broadcasting, cable TV, streaming services, Archives, DVD and so on).

The visualization above (fig.3) expands radially from the original producer (CBS), which represents the source-hub. Such a centric structure was already detected in case B, where the original series appears to be the main product in the franchise generating transmedia dynamics of preferential attachment towards other products. Not much else can be said about this temporary visualization at the current stage, except that it gives interesting hints on how to use visual models for detecting institutional networks. To better explain this third approach, I extracted a larger database from Wikipedia thanks to the Wikidata Query Service.

5. **WORKING WITH WIKIDATA AND RAWGRAPH**

The Wikidata Query Service allows to automatically extract linked open data from the Wikipedia platform. The data extracted contain information on a sample database of over three hundred anthology series (title, country of origin, production company, distribution company). Using Palladio, a network visualization of Wikipedia data about both early and contemporary anthology series takes the shape shown in Fig. 4.

This graph helps define the main production "hubs" of anthology series, which turn out to be the United States, United Kingdom, Canada (without counting the big unlabeled node that puts together several small markets like Serbia or Puerto Rico). However, it is evident that this dataset contains anomalies and it needs to be filtered and combined with a more complete list. To detect errors (e.g. blank columns) one could initially opt for a different visual model that is more efficient in delivering the information needed.

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

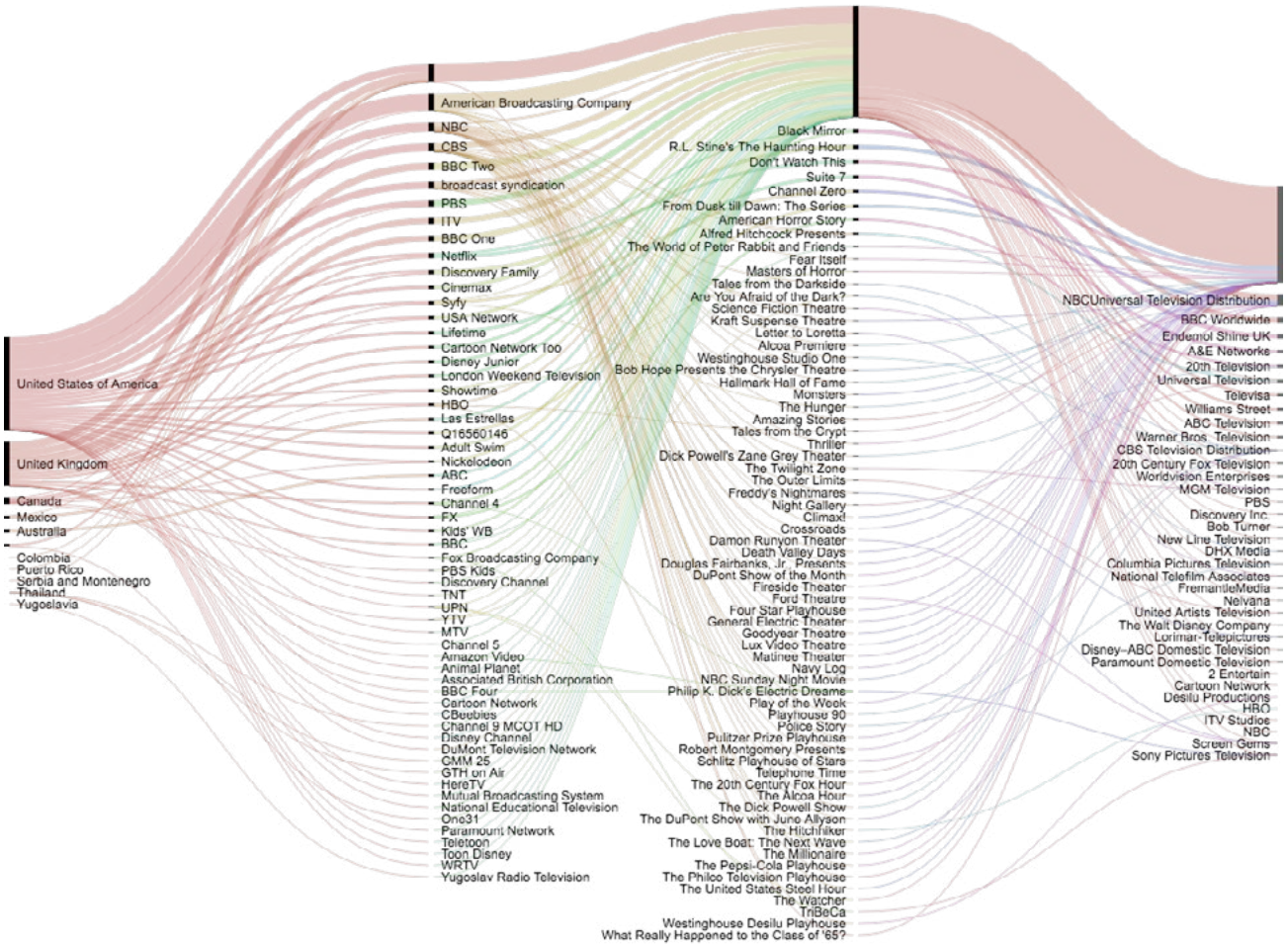

FIG.5. ALLUVIAL DIAGRAM (RAWGRAPH) OF ANTHOLOGY SERIES FROM A WIKIPEDIA SAMPLE DATABASE

The same data concerning institutional networks can be visualized using other visual models and opting for matrices or alluvial diagrams. Thanks to the open source data visualization tool *RawGraphs*, I was able to visualize clusters: in *fig. 3*, I found clusters in the circulation of content, grouped by type as platforms, archives, DVD distribution and others. Additionally, I underlined flows from a sample database of anthology series, by following their paths from production to distribution and by detecting tendencies or major data-filtering errors. For this visualization, I used the alluvial diagram model. "Alluvial diagrams [...] represents weighted flows among nodes. [...] We will call 'nodes' the black rectangles. We will call 'flows' the colored areas linking nodes. We will call 'steps' the vertical groups of nodes."[4]

A visual model in the form of an alluvial diagram turns out to be particularly useful, even before data analysis, for data discovery, since it connects otherwise scattered information into a series of common itineraries traced by the circulation of content from the country of origin (first column), to the producer (second column), the title of the content produced (third column) and the distributor (fourth column). In the data-discovery process that this visual model allows for, we clearly see that null values and missing information are causing problems in the analysis of the dataset, generating ambiguity. Data discovery is therefore fundamental, and other visual models can be associated to this alluvial diagram to make sure the undefined section is properly signaled.

In fact, since data analysis is often introduced in Cultural Studies to minimize potential biases derived from an individual perspective, it is important to make sure that the database available is accurate, or at least to be aware of its gaps.

4 https://rawgraphs.io/learning/how-to-make-an-alluvial-diagram/

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

When a database is extracted through the Wikidata Query Service, it comes as a relational model, where tabular data are stored in a *.csv* file. While a relational model, which takes the shape of a table and describes a series of relations, can be used for data storing and processing, a visual model contributes to a better understanding of the database. It facilitates the observation of the links between objects and helps detect issues or anomalies. At this stage, further research was required in order to clean data extracted from Wikidata through the Wikidata Query Service and merge them with data from IMDb. For this purpose, I used Python and the fuzzy matching algorithm. The merged datasets can be visualized using the graphical user interface Polestar (fig. 6) accessible directly from the Wikidata Query Service, in order to verify the number of undefined elements in a separate and labeled row. Here, I present, in the form of a matrix microscope (Schich 2010), a visualization of a corpus of anthology series, listing the country of origin on the y axis and the genre on the x axis.. Additional information can be visualized in this graph as we proceed into further cleaning of the data with Python, such as the production company (color of the dots) or the number of seasons (size of the dots).

CONCLUSION

In this paper, I considered networks that are bipartite, directed and labeled (fig. 1, fig. 2, fig. 3, fig. 4). By doing so, I showed that visualizing television series as networks, nodes, or links through visual models can offer a guidance not only for putting the text into context, but also for learning about our data. Cleaning data, solving anomalies and introducing information from peripheral television markets – or at least acknowledging what is missing – opens up for new perspectives on media industries. In an oligopolistic market, subjected to dynamics of media imperialism, it was quite intuitive to guess which television company was the most powerful and influential. As the old oligarchic industrial structure increasingly loses its power and dynamics of "asymmetric interdependence" (Straubhaar 1991) prevail to a binary model, detecting overlapping networks on a transnational level is not quite obvious, and we risk focusing only on content already "exposed" in television markets. With the global trade in television, it now seems obsolete to discuss a simplistic friction between dominant *versus* dominated industrial players. Furthermore, in a "long tail economy" (Anderson 2006), even

FIG.6. MATRIX VISUALIZATION OF ANTHOLOGY SERIES FROM A WIKIPEDIA/IMDB'S DATASET USING POLESTAR[5]

5 This image is a screenshot of the Polestar's work environment in order to show the process that eventually leads to meaningful visualization. Here, I opted for a screenshot that can be better integrated within an article in compliance with editing needs. However, the full final visualization can be exported directly from the platform and visualized on a larger screen space.

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

less popular products can make a difference in niche markets. Both large and small networks are important.

The cases described above can contribute to reach interesting conclusions, by adopting a methodological framework that overcomes the biases of looking mostly at commercially successful content. Working on a subgroup of anthology series, but still admitting the possibility of working on a larger corpus, facilitated this introductory application of visual models for understanding television products and industries. In case A, I observed that contemporary anthology television series can incorporate internal references without necessarily creating a whole, interconnected narrative world. Case B further demonstrated that contemporary anthology series can generate transmedia effects as part of the same universe, even without expanding the same world, by generating parallel worlds instead, in a sort of "parallel world-building". Finally, case C inserts anthology series in the surrounding media ecosystem, showing how they can be part of a global trade through cross-cultural, cross-historical, cross-country, cross-platform movements. By tracking dynamics of cultural exchange, researchers can isolate the hubs that export the most and have a higher impact, or those nodes that help to connect several countries.

Each entity from the tabular form was mapped using several visual models: graphs made of vertices and edges, alluvial diagrams made of directional flows and matrices. To this point, it is interesting to note that nodes and links as self-existent, unconnected units do not tell us much when it comes to the plot of anthology series or to their cultural and industrial value. On the contrary, they do assume a meaning when visualized as networks on a macroscopic level, showing that "network" is not simply a metaphor, but a full methodology for data visualization, manipulation, discovery and analysis. With their ability to trace and make visible cultural transactions, network visualizations improve our understanding of major industrial dynamics and can be scaled-up or down depending on the type of reading one needs to perform (distant or close). Combining visual models of networks represents an interesting interdisciplinary strategy through which researchers can acquire a more objective perspective on ongoing industrial, economical and socio-cultural dynamics related to the circulation of televisual content. Even more concrete results are expected as media scholars gain access to larger and more complete digital archives and databases, which allow to perfect these visual models and create useful information.

REFERENCES

Anderson, Chris (2006). *The Long Tail: Why the Future of Business Is Selling Less of More.* New York: Hyperion.

Barabasi, Albert-Laszlo and Albert Reka (1999). "Emergence of Scaling in Random Networks." *Science* 286(5439): 509-12. https://doi.org/10.1126/science.286.5439.509

Barabási, Albert-Laszlo (2003). *Linked: The new science of networks.* New York: Basic Books. Barrat, Alain, Marc Barthelemy, Romualdo Pastor-Satorras and Alessandro Vespignani (2004). "The architecture of complex weighted networks." *Proceedings of the National Academy of Sciences* 101(11): 3747-52. https://doi.org/10.1073/pnas.0400087101.

Beauguitte, Laurent (2010). "Graphes, réseaux, réseaux sociaux: vocabulaire et notation." *Groupe f.m.r. (flux, matrices, réseaux)–*. http://halshs.archives-ouvertes.fr/halshs-00541898.

Bradley, Laura (2018). "All the Easter Eggs You Might Have Missed in Black Mirror Season 4." *Vanity Fair*, January 2, 2018. https://www.vanityfair.com/hollywood/2018/01/black-mirror-easter-eggs-cameos-callbacks (last accessed 18-06-19).

Castells, Manuel (1996). *The Rise of the Network Society, The Information Age: Economy, Society and Culture Vol. I.* Oxford, UK: Blackwell.

Erdos, Paul, and Alfred Renyi (1959). "On Random Graphs." *Publicationes Mathematicae* 6: 290-97.

Gabora, Liane (2008). "Modeling cultural dynamics." *Proceedings of the Association for the Advancement of Artificial Intelligence (AAAI) Fall Symposium 1: Adaptive Agents in a Cultural Context,* Nov 7-9, The Westin Arlington Gateway, Arlington VA. Menlo Park, CA: AAAI Press.

Hesmondhalgh, David (2002). *The Culture Industries*. London: Sage.

Jagoda, Patrick (2016). *Network Aesthetics*. Chicago: University Of Chicago Press.

Jenkins, Henry (2006). *Convergence Culture: Where Old and New Media Collide.* New York: New York University Press.

Kristeva, Julia (1980). *Desire in language: a semiotic approach to literature and art.* New York: Columbia University Press.

Kukkonen, Karin (2014). "Bayesian narrative: Probability, plot and the shape of the fictional world." *Anglia* 132(4): 720–39. https://doi.org/10.1515/ang-2014-0075.

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X

Levine, Caroline (2009). "Narrative Networks: Bleak House and the Affordances of Form." *Novel: A Forum on Fiction* 42(3): 517-23. https://doi.org/10.1215/00295132-2009-050.

— (2015) *Forms: Whole, Rhythm, Hierarchy, Network*. Princeton: Princeton University Press.

Lotz, Amanda D. (2004). "Using 'network' theory in the post-network era." *Screen* 45(4): 423-39.

— (2007). *The Television Will Be Revolutionized*. New York: NY University Press.

— (2016). "The Paradigmatic Evolution of U.S. Television and the Emergence of Internet-Distributed Television." *Icono 14 Journal of Communication and Emergent Technologies* 14(2): 122-42. http://10.7195/ri14.v14i1.993.

— (2017). *Portals: A Treatise on Internet-Distributed Television*. Ann Arbor: Michigan Publishing.

Meirelles, Isabel, Maximilian Schich and Malina Roger (2014). "Arts, Humanities, and Complex Networks", in *Encyclopedia of Social Network Analysis and Mining*, edited by Reda Alhajj and John Rokne. NY: Springer.

Moreno, Jacob Levi (1951). *Sociometry, experimental method and the science of society*. Ambler, PA: Beacon House.

Moretti, Franco (2005). *Graphs, Maps, Trees: Abstract Models for a Literary History*. London and New York: Verso.

— (2011). "Network theory, plot analysis." *A Stanford Lit Lab Pamphlet*. https://litlab.stanford.edu/LiteraryLabPamphlet2.pdf.

— (2013) *Distant Reading*, London and New York: Verso.

Morville, Peter and Louis Rosenfeld (2008). *Information Architecture for the World Wide Web, 3rd Edition. Designing Large-Scale Web Sites*. Sebastopol: O'Reilly Media.

Newcomb, Horace M. and Paul M. Hirsch (1983). "Television as a cultural forum: implications for research." *Quarterly Review of Film Studies* 8(3): 45-55. http://doi.org/10.1080/10509208309361170.

Newman, Marc, Duncan J. Watts and Albert-László Barabási (2006). *The Structure and Dynamics of Networks*. Princeton: Princeton University Press.

Nystrom, Christine (1973). *Towards a Science of Media Ecology: The Formulation of Integrated Conceptual Paradigms for the Study of Human Communication Systems*. Doctoral dissertation. New York: New York University.

Pescatore, Guglielmo (2018). *Ecosistemi Narrativi. Dal fumetto alle serie TV*, Roma: Carocci.

Pescatore, Guglielmo and Veronica Innocenti (2012) "Information Architecture in Contemporary Television Series". *Journal of Information Architecture*, 4(1-2): 57-72.

Postman, Neil (2006). "Media Ecology Education." *Explorations in Media Ecology* 5(1): 5-14. https://doi.org/10.1386/eme.5.1.5_1.

Schich, Maximilian (2010). "Revealing matrices.". In *Beautiful visualization*, edited by Julie Steele, and Noah Iliinsky, 227-54. Sebastopol: O'Reilly.

Schich, Maximilian, et al. (2014). "A network framework of cultural history." *Science* 345(6196): 558-62. http://doi.org/10.1126/science.1240064.

Schnapp, Jeffrey (2014) "Knowledge Design," Herrenhausen Lectures pamphlet series, Hannover: Volkswagen Foundation.

Scolari, Carlo A. (2012). "Media ecology: Exploring the metaphor to expand the theory." *Communication Theory* 22(2), 204–25. https://doi.org/10.1111/j.1468-2885.2012.01404.x

Stephens, Niall P. (2014). "Toward a More Substantive Media Ecology: Postman's Metaphor Versus Posthuman Futures." *International Journal of Communication* 8: 2027–2045. https://ijoc.org/index.php/ijoc/article/view/2586 (last accessed 26-06-19).

Straubhaar, Joseph (1991). "Beyond Media Imperialism: Asymmetrical Interdependence and Cultural Proximity." *Critical Studies in Mass Communication* 8(1): 39-59. https://doi.org/10.1080/15295039109366779.

Wasserman, Stanley and Katherine Faust (1994). *Social Network Analysis Methods and Applications*. Cambridge: Cambridge University Press.

Wonneberger, Anke, Klaus Schoenbach and Lex van Meurs (2009). "Dynamics of Individual Television Viewing Behavior: Models, Empirical Evidence, and a Research Program." *Communication Studies* 60(3): 235-52, http://doi.org/10.1080/10510970902955992 .

Yucesoy, Burcu et al. (2018). "Success in books: a big data approach to bestsellers." *EPJ Data Science* 7(7): 1-25. http://10.1140/epjds/s13688-018-0135-y https://doi.org/10.1140/epjds/s13688-018-0135.

TV series cited

Black Mirror (Channel 4, 2011–2014; Netflix 2016-in corso)

The Twilight Zone (Original series: CBS, 1959-1964; First revival: CBS, 1985-1989; Second revival: UPN network, 2002-2003; Third revival: CBS All Access, 2019)

DOI https://doi.org/10.6092/issn.2421-454X/8975
ISSN 2421-454X