4. Analysing the Inner Structure of Episodes in *House, M.D.* through Network Analysis

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ABSTRACT

Dialogues in TV series are crucial as they drive the narrative, revealing character motivations and relationships while enhancing the emotional depth of the story, keeping viewers engaged and invested in the unfolding plot. Their structure (i.e., the network resulting from the interaction of characters) may reveal some stylistic signature of the series. In this chapter, we investigate the presence of regularities in the patterns observed in dialogue structures. For that purpose, we consider the series *House, M.D.* which is one of the most widely followed medical drama TV series. The results show a large prevalence of the star structure, where a character acts as the main speaker and, in turn, talks to one of the other speakers involved in the scene.

KEYWORDS

TV series; medical dramas; *House, M.D.*; episode structure; network analysis.

Introduction

Dialogues have a long story in culture. Aristotle, in his Poetics, which is first extant philosophical treatise to focus on literary theory, states that the structure of classical tragedy was based on dialogues from Aeschylus on, since Aeschylus introduced a second actor into a dialogue with the narrator (see volume 1, part 2 of the work by Easterling and Knox, 1985). A further innovation was introduced by Sophocles, who introduced a third actor, which became the standard structure, where one of the three actor predominates over the other two, as reconstructed by Else (1945).

Dialogues are also the main form employed by Plato to describe Socrate's method, where the philosopher activated the dialogue with his students to receive a response in a two-way dialogue, where the dialogue was always between him and a single student, no matter how many were present (Seeskin 1987).

Many linguists have investigated dialogues in TV series. A major example is Bednarek (2018), who introduced the concept of expressive character identity for relevant character traits. A wide range of linguistic features can contribute to what can be expressed through dialogues, e.g. conversational structure, affective language, lexical richness/diversity, terms of address, syntactic structure, accent/dialect, impoliteness strategies, and (non-)adherence to conversational maxims. She defined speech by the number of involved speakers, distinguishing among monologues, asides, voice-over narration (where just one speaker is involved), dyadic interactions (between two speakers), and multiparty interactions.

The distinction made by Bednarek (2018) gives rise to a finer classification, where we can also investigate the different ways in which characters interact by dialogues. For example, in a dialogue involving three characters, we could have one speaker talking to the other two, who remain silent, or we could have speaker A talking to speaker B, who talks to speaker C. The

identification of such dialogue configurations may shed light on the kind of narration that the series adopts.

In this chapter, we aim to investigate the structure of dialogues in TV series. In particular, we wish to classify dialogues in TV series according to their structure and detect if recurrent patterns emerge, building a taxonomy of dialogue structures. For that purpose, we resort to the tools of graph theory, employing graphs to represent the dialogue and extract that taxonomy. It is important to note that we do not examine the content of dialogues, which have been subject to linguistic analyses and could shed a different perspective on the relationship between characters. We consider just the general structure of dialogues, i.e. how many speakers are involved and how they interact with one another.

The research questions we formulate are the following:

- RQ1 Is there a preferred size of dialogues?
- RQ2 Are all speakers equally involved in the dialogue?

We focus on a specific medical drama, i.e. *House, M.D.* (Fox, 2004-2012), given the importance of medical dramas and the particular relevance of dialogues in that series. In fact, dialogues, often conflicting ones, are the main tool through which the main character (Dr. House) achieves the correct diagnosis. In addition, *House, M.D.* is a major example of the instrument of stabilizing selection, where the selection of characters is narrowed to focus on the main character, i.e. Dr. Gregory House, as shown by Pescatore and others (2014).

The organization of the chapter is as follows. In the second section, we review the genre of medical dramas and focus on *House, M.D.*, explaining the peculiarities of that series and the reasons for its choice. Next, we describe the use of graph theory to represent dialogues and the potential richness of dialogue structures in the third section. The dataset we employ for our analysis is described in the fourth section. Finally, we show some early results in the fifth section.

Medical Dramas and *House, M.D.*

Medical dramas are a genre of television shows that revolve around the medical field, providing viewers with an opportunity to experience the intense and emotionally charged environment of healthcare settings. These dramas combine elements of realism, medical accuracy, and human drama to captivate audiences while contributing to public awareness of medical practices and healthcare challenges.

The history of medical dramas dates back to the early days of television, with landmark shows like *Dr. Kildare* (NBC, 1961-1966) and *Marcus Welby, M.D.* (ABC, 1969-1976) popularizing the genre. However, it was in the 1990s that medical dramas experienced a surge in popularity with the success of *ER* (NBC, 1994-2009) and *Grey's Anatomy* (ABC, 2005-present), among others.

Typically, medical dramas follow a serial format with individual episodes featuring standalone medical cases intertwined with the personal lives of the main characters. The characters, often medical professionals like doctors, nurses, and sometimes administrative staff, are developed to have complex personalities and emotional arcs that create compelling storylines.

The importance of medical dramas in the landscape of TV series can be related to several factors. Here, we mention just the three most relevant.

First, medical dramas can be seen as the starting point of quality TV. For some scholars, the release of *ER* in 1994 marks the beginning of the second golden age of American TV (see Thompson 1997), later to be dubbed complex TV by Mittell (2015). Plots get more and more complex in *ER*, adopting a multistrand narration, as highlighted by Innocenti and Pescatore (2018) and a more realistic setting. In contrast to previous productions, we start seeing doctors who may err, get scared, and show low empathy. Doctors show their human nature, their frailties, and their private life that influences their performance on the job.

Second, their continued success warrants their being a subject of study. They have a long history, see the accounts by McAnea (2001) and Rocchi (2019), accompanied by significant audience results. Their success derives from widespread interest in health issues as highlighted by Branea and Guguianu (2013) and their capability to heighten the emotional strain of dramas with life, disease, and death issues (see Rocchi 2019). Their excellent ratings are the reason for their long duration over the years, creating a perfect example of a complex narrative ecosystem (Innocenti and Pescatore 2014).

Third and final, medical dramas exhibit a social and cultural roles that other genres cannot boast. Their topics (diseases, diagnoses, death) are very sensitive and urge to be treated with exactness and responsibility. That's a major reason for the recruitment of medical staff as consultants to guarantee correctness and realism, as described by McGann (2015).

Among medical dramas, we decided to focus on *House*. The series was created by David Shore and was aired on the Fox network from November 2004 to May 2022, for a total of eight seasons and 177 episodes. It ob-

tained great success, both among critics and the general public. It ranked among the ten most viewed TV shows in the U.S.A. and the most viewed TV show in the world in its second and fourth season, as well as in 2008. It also won several awards, including two Golden Globes and three Emmy awards. *House, M.D.* centers on the life and medical cases handled by Dr. Gregory House, an exceptional but contentious diagnostician at Princeton-Plainsboro Teaching Hospital.

Dr. House heads a group of young doctors, who assist him in the task of discovering the diseases affecting their patients, using an unconventional detective-like approach. In most cases, the symptoms exhibited by patients appear mysterious and House turns out being the only one who succeeds in delivering the right diagnosis and the right cure.

As in all medical dramas, each episode is based on a different case, following the vertical plot of multi-strand narration (see the studies by Halvatzis 2011, and Braga 2016, on the multi-strand structure). At the same time, all episodes within a season are linked by a horizontal plot that marks the development of the narrative arc for each character. House is not the only fixed character in the series, whose evolution we follow through the episodes; we have, e.g. his friend Dr. James Wilson, and his boss Dr. Lisa Cuddy.

The series distinguishes itself by presenting medical mysteries that challenge traditional diagnostic methods. Dr. House employs an unconventional approach, emphasizing the importance of thorough patient histories, scrutiny of minute details, and relentless questioning of colleagues. This distinctive diagnostic style often involves various differential diagnoses and encourages viewers to engage in medical problem-solving processes.

The series has been studied from several viewpoints.

A major viewpoint is that of ethical dilemmas and medical decision-making. Dr. House often faces tough decisions, balancing the pursuit of accurate diagnoses with potential risks to patients. The portrayal of informed consent, experimental treatments, and confidentiality issues offers a lens into the ethical complexities faced by medical professionals. And the behavior of both Dr. House and his group may be prone to criticism from an ethical viewpoint, raising the question of whether they can be considered as a reference from would-be doctors, as investigated by Wicclair (2008).

The psychological exploration of Dr. House is also of interest, since his character is depicted as an irascible and emotionally complex individual with a leg injury causing chronic pain, leading to addiction issues. His misanthropic tendencies and strained interpersonal relationships are also

moulded by his personal challenges and affect his diagnostic acumen and decision-making.

His approach to diagnosis is probably the most striking among the panorama of medical dramas. The series distinguishes itself by presenting medical mysteries that challenge traditional diagnostic methods. What Dr. House thinking approach in the quest for the right diagnosis? Certainly, the importance of thorough patient histories, and the scrutiny of minute details are stressed, but, most importantly, Dr. House proceeds by relentless questioning of his colleagues. Bernardelli and others (2007) places Dr. House in Popper's philosophical footsteps, since his approach exploits conflicts. House is continuously looking for an opinion conflict with his team, trying to arrive at the right diagnosis through trial and error. The reasoning behind the search for the right diagnosis is the core of each episode. Once the right diagnosis is found, the actual cure application receives scanty attention.

Dialogues and Network Representation

In this chapter, we use graphs to represent dialogues and classify them. In this section, we describe how we carry out that representation.

Graphs are mathematical structures made of nodes and edges. In this context, we use nodes to represent characters, while edges represent the presence of a dialogue between characters. We use directed graphs, where edges have a direction indicated by an arrow, so an edge directed from node (character) A to node (character) B means A has talked to B. An example is shown in Figure 1, which has been extracted from Fronzetti Colladon and Naldi (2020). Here, the numbers above the edges represent the number of lines that a character has spoken. In the following, since we are interested in the structure of dialogues rather than frequency, we will not include that information.

Graphs have been employed in the literature to represent the relationship between characters. For example, Beveridge and Shan (2016) have used graphs to describe interactions between characters in *Game of Thrones* (HBO, 2011-2019), while Bonato and others (2016) use graphs to represent character networks in novels, with an edge being drawn between two nodes when the corresponding character names occur a certain number of words apart from each other. Those representations are different from ours, where an edge is drawn just if a character talks to another.

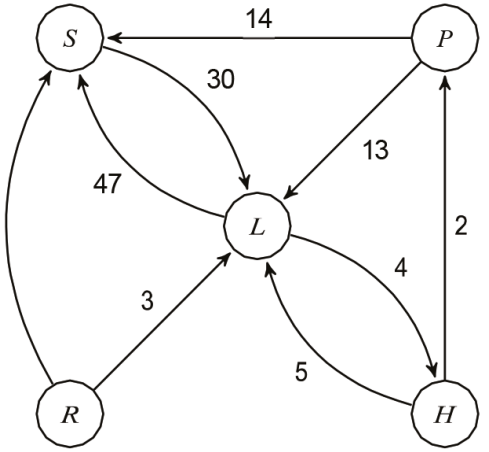

FIGURE 1
Example of dialogue graph (Episode 1 of Season 1 of *The Big Bang Theory*, CBS 2008-2019).

L =Leonard
P=Penny
H=Howard
S=Sheldon
R=Receptionist

In describing dialogues through graphs, we have to define the time horizon over which the presence of dialogues is observed. For example, Fronzetti Colladon and Naldi (2020) considered a whole episode as the observation interval, so the presence of an edge between A and B meant that A had talked to B at least once during the episode. In this chapter, we have opted to consider scenes as the observation interval. The size of the graph will be accordingly given by the number of characters present in a single scene. We expect then to obtain graphs of small size.

As hinted in the Introduction, we are not interested here in examining who talks to whom, but rather in the general structure of dialogues, so the two graphs shown in Figure 2, though representing two different dialogues, exhibit the same structure.

In the language of graph theory, two graphs exhibiting the same structure are said to be isomorph. Two graphs are isomorph when we can find a

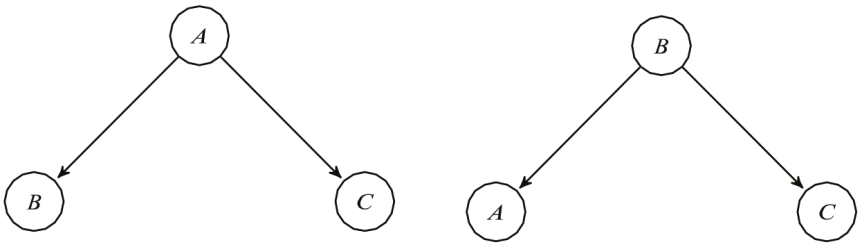

FIGURE 2
Graphs of identical structure.

mapping between the nodes of the two graphs so that their adjacencies are the same. Detecting if two graphs are isomorph to each other is called the graph isomorphism problem and is a classical algorithmic problem that is solvable in quasi-polynomial time, as shown in the survey by Grohe and Schweitzer (2020).

Since we focus on the structure of the graph, neglecting the actual label representing the character, we are interested in directed unlabelled graphs. In directed graphs (as opposed to undirected ones), the edges between nodes are associated with a direction from a node to the node at the other end of the edge. Focusing on directed graphs means that we are taking into account who is talking to whom, not just that the characters are involved in a dialogue (which is what we would represent with an undirected graph). In unlabelled graphs, we do not associate a node with a specific character. If we go back to Figure 2, we see that putting labels on nodes makes us see the two graphs as different from each other, while we wish to take into account their connectivity pattern only and consider them identical. Their structural identity comes from the possibility of mapping one into the other simply by swapping labels, i.e. recognizing that the two graphs are isomorph to each other.

An important issue is understanding how many different structures we can have for a scene involving n speaking characters, or, to say it in graph theory language, how many non-isomorph connected directed unlabelled graphs we can have for a graph of n nodes. It turns out that the problem can be decomposed into finding all oriented graphs (where an oriented graph is a directed graph having no symmetric pair of directed edges), all connected graphs with bidirectional edges,[1] which is equal to the number of undirected connected graphs, and the mixed configurations (where some edges are unidirectional and some are bidirectional). A pictorial representation of the undirected configurations (i.e., those where dialogues are not reciprocated) for $n \leq 3$ is shown in Figure 3. In Figure 4, we can instead see the simplest configurations ($n = 2, 3$) when dialogues are not reciprocated (i.e., for any two characters, either they don't talk to each other or one talks, and the other listens).

The number of graphs for unreciprocated dialogues can be found in Demirci and others (2021) and is labelled as sequence A086345 in the On-

[1] See the webpage https://mathworld.wolfram.com/OrientedGraph.html (last accessed 22-08-2023).

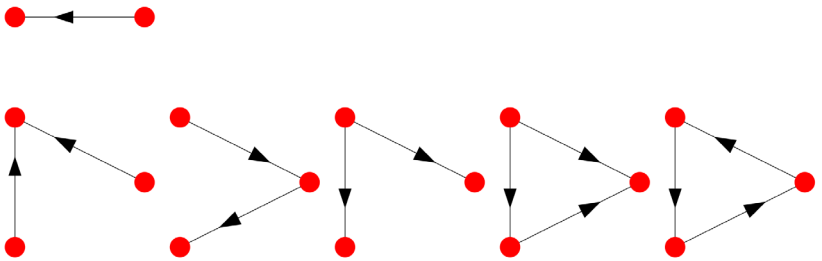

FIGURE 3
Dialogue graph configurations for unreciprocated dialogues n = 2, 3.

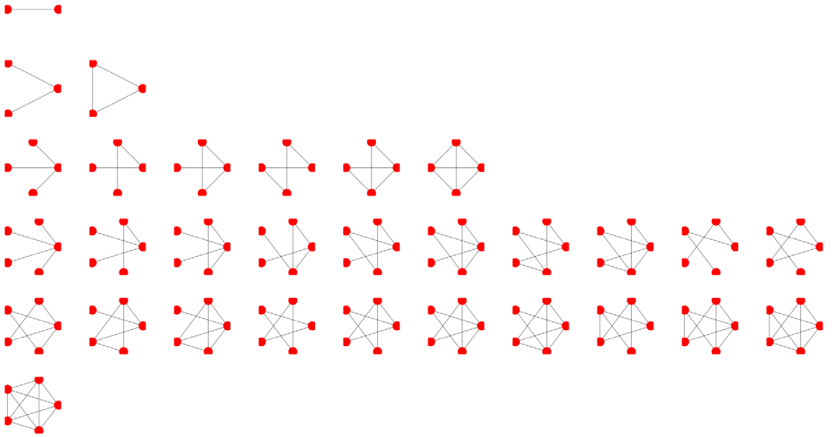

FIGURE 4
Dialogue graph configurations for reciprocated dialogues (n ≤ 5).

Line Encyclopedia of Integer Sequences.[2] Instead, the number of graphs for reciprocated dialogues is reported by Harary (1957) and can be found as sequence A001349 in the On-Line Encyclopedia of Integer Sequences.[3]

Even if we neglect the mixed cases (where some dialogues are reciprocated and some are not), we can see in Figure 5 that the number of possible configurations grows very quickly, faster than exponentially, exceeding 2 million when we have 7 characters.

[2] https://oeis.org/A086345 (last accessed 22-08-2023).
[3] https://oeis.org/A001349 (last accessed 22-08-2023).

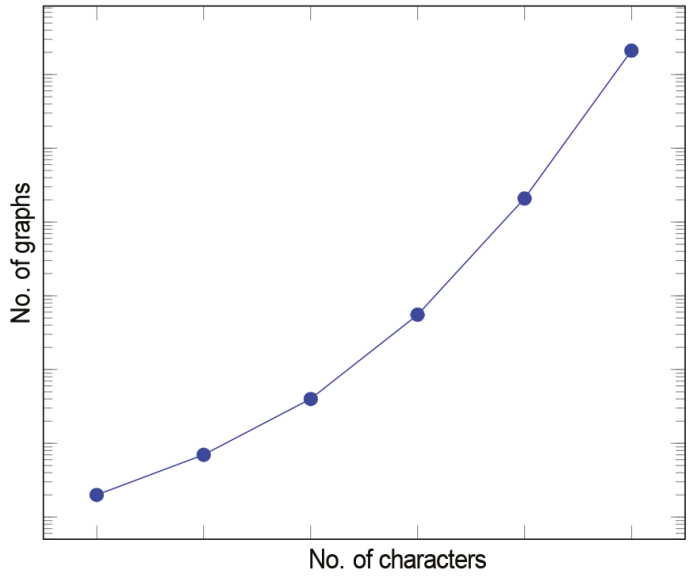

FIGURE 5
Characters and potential dialogue graphs (excluding the mixed configurations).

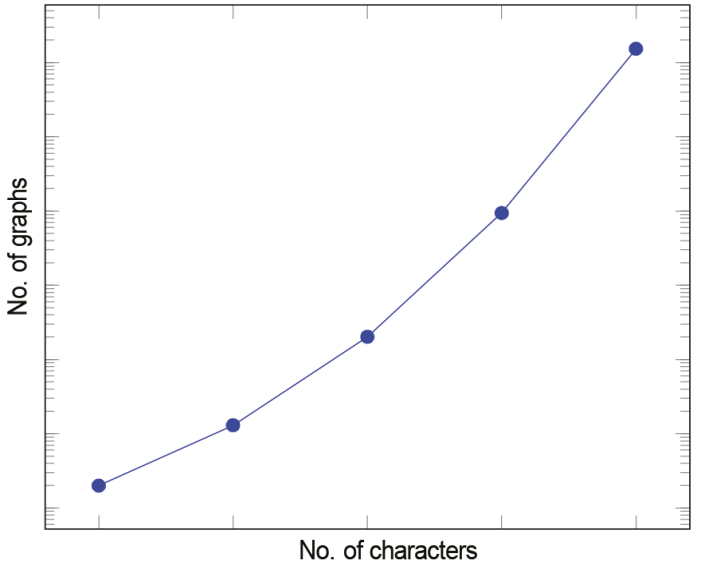

FIGURE 6
Characters and potential dialogue graphs.

Alternatively, we can obtain the overall number of graphs from the website https://users.cecs.anu.edu.au/~bdm/data/digraphs.html, where they have been generated, after removing those that are not connected. The resulting number is shown in Figure 6. As can be seen, the growth is even more staggering, reaching over 1.5 million graphs when we have six characters, instead of 20960 when we neglect mixed configurations. As can be seen, the number of mixed configurations, where there is a mixture of monologues and two-way interactions, is largely dominant.

The Dataset

As justified in the second section, we have chosen *House, M.D.* as the medical drama to focus on. Since we are interested in dialogues, we relied on the dialogues as extracted from subtitles. We retrieved the subtitles (which included the speaker for each line) and have them annotated. Each episode was annotated by at least two annotators, who separately viewed the episode, checked the correspondence between speaker and line as reported in the subtitles, and took note of the direction of each dialogue. We retrieved and annotated dialogues for all seasons and all episodes, for a total of eight seasons and 177 episodes.

Results

In this section, we report the results of our classification work on all episodes of *House*.

For the time being, we have limited ourselves to carrying out a preliminary classification of dialogue structures by the number of speaking characters involved. As highlighted in the third section, there are many different structures possible for each choice of the number of speaking characters. For

No. of speaking characters	Frequency [%]
0/1	21.7
2	32.5
3	18.2
4	14.2
5+	13.5

Table 1
Frequency of graph sizes.

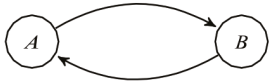

Figure 7
The dyad.

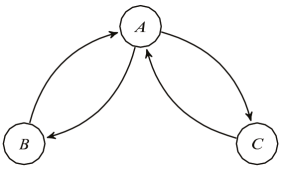

Figure 8
The bidirectional star tryad.

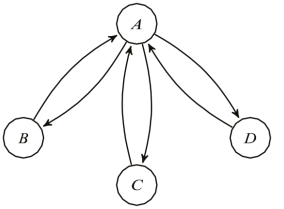

Figure 9
The bidirectional star tetrad.

example, even for three characters, we have no less than seven possibilities. In Table 1, we report the relative presence of each structure size. The raw where the number of speaking characters is 0/1 refers to those cases where either no character is speaking or we observe a monologue. Though they cannot be considered as dialogues (which are conversations between two or more people), we report the figure for completeness.

We see that the most recurring pattern is the dyadic structure shown in Figure 7. In that picture, labels are shown on the nodes but they have to be considered as generic, not representing any specific character, following the choice of considering unlabeled graphs to deal with archetypal structures. It is to be noted that that dyad is the only dialogic structure possible when we have two characters. It represent nearly one third of all structures employed in *House, M.D.*, with its weight growing to 41% when we remove silent scenes and monologues from the count.

When we come to tryads, i.e. the structures where three characters talk, the number of structures shows some variety, though not all possible structures are present. Here we highlight the most frequent one, which is the bidirectional star network shown in Figure 8, where a leading character establishes reciprocated talks with the other two, who do not talk to each other. In the language of graphs, the leading character acts as the hub here.

The bidirectional star structure is also the most frequent one when we consider tetrads, i.e. the structure made of four talking characters, as shown in Figure 9, where, again, we find a leading character (the hub), who talks (reciprocated) to all the other characters, which, on the other hand, do not talk to each other.

Conclusions

We have extracted the network structure of dialogues for all episodes of the well-known medical series *House*. We can now answer the two research questions we posed at the beginning of this chapter.

As to RQ1, we have observed that there are some preferred sizes of dialogue. Nearly one-third are dyadic, while the dialogues with two, three, or four characters represent 65% of the total. The dyadic form has ancient origins. Greek tragic theatre, in fact, is built according to a dialogic structure and the special case of a dialogue between two characters is called stichomythia. It is a long and tight procedure, constructed with symmetrical interventions (Ercolani 2016). As with every form of dramatic expression in Greek tragedy, sticomythia determines the character of the characters who utter them (Baldry 1971). Sticomythia prevails when action and interaction between human beings prevail, human relationships are the focus of attention. Sticomythic dialogues are informative, but they also allow conflicts and contrasts between two characters to emerge (Guidorizzi 2004). In addition to being informative, stichomythia is also expressive, thus stabilizing the understanding and appreciation of the narrative universe. Perhaps this is why it is also the most frequently used structure in *House* scripts, which, as highlighted by other studies, has a stabilizing ecosystem structure (Pescatore et al. 2014). The references to Greek theatre and, more generally, to the drama and narrative structures of antiquity are not peregrine but are justified by the fact that precisely most American screenwriting manuals rely on those forms and texts to build a screenplay and always start from the Aristotelian model, as highlighted, e.g. by Truby (2008), McKee (1997), Bang (2022), and Snyder (2005).

On the other hand, triadic and tetradic structures, which are runners-up to the prevailing stichomythic dialogue, have a key feature: only the character who is at the top of the structure speaks and listens to the others who interact with him and him alone (not with each other). This leads us to answer our RQ2. Whereas in the stichomythic structure, a balance prevails between the two characters involved who both speak and listen, in triads and tetrads speakers are not all equally involved in the dialogues, and a hub prevails who coordinates and manages all the talk. There is thus a multiplication of discourses, stabilized by having a single point of reference that listens and responds. Here, too, a structure is created that, while more complex than the simple dual structure, nevertheless has its own balance, its

own stabilizing function. It would seem, then, that even from the analysis of the dialogic structure of the narrative universe of *House, M.D.* we arrive at that idea of the contemporary TV series as a narrative ecosystem that nevertheless tends to- ward balance, whatever the system for achieving it. Balance means consistency, and that makes it possible for the ecosystem to survive over time (Pescatore et al. 2014).

We must add that our analysis is based, for now, on a medical drama with a particular structure. *House, M.D.*, in fact, is a character-driven medical drama and almost always involves its protagonist, either speaking or listening. A protagonist who uses the dialogic method with his team of helpers to solve cases. So, logically, in most cases, Dr. House works as the hub of the tetrads and triads structures. Another final consideration relates back to Rocchi and Pescatore (2022) who focused on medical series. For the two authors, medical dramas can be modelled along three narrative lines that characterize them: sentimental plot, professional plot, and medical case plot. And these isotopies then define four different profiles of medical drama: the soap opera formula, the anthology formula, the doctor and patient formula, and the social formula. Our analysis (which would certainly have to be broadened to include the datasets of other medical series to really get a definitive picture) might suggest that medical series can also be characterized by some dialogic forms, which serve to stabilize their narrative universe. One could therefore speak of dialogic isotopies that shape the narrative ecosystem. This appears to be the case for *House, M.D.* where dialogic isotopies exhibit discursive flows that tend toward balance, comprehensibility, and expressiveness.

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