Social Network Analysis of the Covenant Code and Its Comparison with the Holiness Code

F. D. Nazarov
Higher School of Economics, Moscow
nazarovfeliks222@gmail.com

Abstract: This study applies social network analysis (SNA) to the Covenant Code (Exod 20:22–23:33) to examine its depiction of social structure and compare it with the Holiness Code (Lev 17–26). Building on the methodology developed by Christian Canu Højgaard for Leviticus, a manually constructed dataset of semantic triplets was analyzed using standard SNA metrics like cohesion, centrality, clustering, and multidimensional scaling. The Covenant Code network reveals a steep, two-tier hierarchy dominated by YHWH and the singular addressee (2MSg), while all other participants remain peripheral. Compared with the Holiness Code, the Covenant Code is less dense and less integrated, though it exhibits greater diversity of participants' roles. Clustering analysis also highlights specific patterns, such as the proximity of "fellow" (רֵעַ) to "an Israelite," suggesting its function solely as a referent to the second participant in an interaction.

Keywords: Covenant Code, Holiness Code, social network analysis, comparative analysis

1. Introduction

Social network analysis (hereafter SNA) is an umbrella term for a range of mathematical techniques based on graph theory that have gained momentum over the past decade in biblical studies, reflecting a broader trend toward the digital examination of traditional material. In conventional readings of the text, we may overlook certain details or interpret them through a few established lenses, remaining unaware that entirely different readings might exist. SNA may offer a solution to this problem by providing an objective (as far as possible) representation of the world depicted in the text and perhaps shed light on certain features that will help us reconsider or, otherwise, amplify prevailing stances on some of the ideas. For example, the sojourner (גֵּר), both in the eyes of a typical reader and some scholars, is often perceived as a marginalized figure within Israelite society. However, an SNA of the so-called Holiness Code (Leviticus 17–26, hereafter HC) conducted by Højgaard (2024) demonstrated that the sojourner occupies one of the central positions in the network, which calls into question the traditional view of his marginality.

This study will focus on the so-called Covenant Code (Exod 20:22–23:33, hereafter CC)—a collection of various laws and ordinances embedded within the Book of Exodus. The compositional history of this collection is extremely complex and multifaceted, unlike the Holiness Code, which is

considered a more homogeneous work.[1] This study nevertheless does not address historical-critical issues;[2] rather the text will be examined as it has come down to us in the Biblia Hebraica Stuttgartensia. In other words, I will interpret the data from a text unified by a single editor, whose worldview is potentially reflected in how they portrayed Israelite society and the covenant between humans and God. The CC encodes various social actors, intended to reflect a certain vision of society as seen by the author: a slave-owning master, a widow, a pregnant woman, God, a burglar, an Israelite, and many others. Their interactions can be identified, cataloged, and subsequently constructed into a social network, which in turn can be subjected to numerous and diverse forms of analysis.

SNA, as mentioned earlier, has already been applied to the text of the Bible, and multiple introductory papers on the confluence of network sciences, digital humanities, and biblical studies have been published (Czachesz 2022; Dörpinghaus 2021; 2023). Numerous studies have examined relationships within the Four Gospels (see, e.g., McClure 2020; Grandjean 2013). Napoleon Chebineh Che (2017) constructed a social network based on Genesis 27–28 by weighting the participants' speech acts and drawing conclusions about the role of a father, using both the resulting network and external evidence such as archaeological data, African tribal social practices, and linguistic features of expressions. Around that time, Anthony and John Dekkers (2018) published an article on the social network of the Book of Ruth. More recently, Højgaard (2025) analyzed the role of the earth (אֶרֶץ), remodeling his HC network to include spatial realms alongside characters. The objects of SNA need not be limited to human networks, nor must its aims be confined to studying interpersonal interactions. For instance, a recent study applied SNA to Coptic manuscripts of unknown provenance, in an attempt to determine their date (Cook 2025).

Jens Dörpinghaus can be named as one of the most prolific popularizers of network-based approaches to the Bible and historical data—a vocal advocate for supplementing narrative exegesis with SNA. According to him "the information provided by SNA must always be interpreted in the context of its construction, for example, in a narrative context. Consequently, the evaluation does not position itself historically since it interprets the narrative within its immanent framework. It does, however, contribute to the understanding of narratives and opens up new perspectives for interpretation and interdisciplinary models" (Dörpinghaus 2023).

Naturally, the primary work that inspired the idea to analyze the Covenant Code is the book—originally a doctoral dissertation (2021)—by Christian Canu Højgaard (2024), *Roles and Relations in Biblical Law: A Study of Participant Tracking, Semantic Roles, and Social Networks in Leviticus 17–26*. This work is, in my opinion, by far the most intricate example of using SNA and the first attempt to apply this method to legal corpora. In his study, Højgaard emphasizes the importance of conducting similar research on other laws, including the CC:

[1] Westbrook, for example, argues that the laws found in the books of Leviticus and Deuteronomy "share something of the intellectual ferment of contemporary Greek sources," while the Covenant Code "looks back to the cuneiform codes of the second and third millennia" (2009, 110).

[2] No one has yet attempted to delineate compositional layers of a document like the CC using SNA. Whether this method is suitable for such a purpose is an open question that calls for investigation.

"…the methodology developed in this project can be applied to other legal collections, most importantly the Covenant Code (Exod 20:22–23:33) and the Deuteronomic Code (Deut 12–26), in order to characterize the participants of those texts. As a matter of fact, SNA is more efficient when similar social networks are compared and contrasted" (Højgaard 2024, 373).

With the present study, I aim to fill this gap by constructing a social network for the CC and comparing the structural aspects of both networks side by side. This project may be viewed as a form of continuation of Højgaard's research, and for this reason, I have deliberately preserved most of the methodology.

All biblical verses are cited according to NRSV unless otherwise indicated. Verse numbering follows the Hebrew tradition (this is relevant primarily for chapter 22). The dataset (including brief annotations), visualizations, and code notebook are available online.[3]

2. Tracking the Participants, Creating a Dataset

2.1. Manual and automated approaches to data modelling

The methodology in this article is based on Højgaard's work. The main deviation, however, is the fully manual creation of a dataset.

The first step in constructing the social network is the extraction of semantic triplets. Each semantic triplet consists of an "actor," an "undergoer," and an "event."

(1) וְכִֽי־יִמְכֹּ֞ר אִ֣ישׁ אֶת־בִּתּ֗וֹ לְאָמָה֙ לֹ֣א תֵצֵ֔א כְּצֵ֖את הָעֲבָדִֽים׃

When a man sells his daughter as a slave, she shall not go out as the male slaves do. (Exod 21:7)

In example (1), the actor is an Israelite (אִישׁ), who performs the action; the undergoer is the daughter (בִּתּוֹ), who undergoes the action performed by the actor; the event is selling (יִמְכֹּר), which directly connects the two participants in the situation. For those who are interested in nuances of data modeling, I refer to Appendix 1.

Højgaard developed a specialized algorithm for identifying participants,[4] which was later manually cross-validated. This system is more objective compared with my entirely manual approach; however, it has its own technical peculiarities. For example, in Lev 25:14, the law concerning the sale of property literally states: "You (Pl) may not oppress, a man his brother (אַל־תּוֹנוּ אִישׁ אֶת־אָחִיו)." Since the commandment is formally divided into two clauses[5]—אַל־תּוֹנוּ and אִישׁ אֶת־אָחִיו—it cannot be counted

[3] https://github.com/FelixBBL/SNA-Covenant-Code.

[4] The algorithm can be examined via the following links to Højgaard's repository on the online platform GitHub: https://github.com/ch-jensen/SNA/blob/master/1a_Generating%20Hierarchies%20of%20Participants.ipynb; https://github.com/ch-jensen/SNA/blob/master/1b_Disambiguating%20and%20Collocating%20Participants.ipynb.

[5] The BHSA recognizes אִישׁ in this clause as the subject, rather than as a complex object, as we would typically understand it.

as a semantic triplet, because Højgaard operated under the assumption that only participants within a single clause can be included in the study "for the sake of consistency" (Højgaard 2024, 287).

The Holiness Code dataset cannot be considered perfect. Some inconsistencies are visible in several stages of the dataset's development.

Højgaard treated the priest (כֹּהֵן) as a synonym for the group "Aaron and his sons," so the algorithm matched the priest either with Aaron or with his sons, and the author manually confirmed the choice. However, the final result came out mixed. For instance, in Leviticus 22:2, a speech is addressed to Aaron and his sons (2 triplets ID 440148), but in 22:11 the priest (כֹּהֵן) is associated only with Aaron (ID 440194). The opposite occurs in 23:11, where, despite the fact that the audience is the sons of Israel, the priest is associated only with the sons of Aaron (ID 440298). Overall, the decision to replace each priest with Aaron and/or his sons is quite questionable given that, ultimately, in many evaluations they were merged into a single category of "priests."

In nearly identical situations where participants should have the same semantic roles (see the terminology in section 2.2. below), exceptions occur. For example, concerning the sojourner's residence among the Israelites: in 18:26, the sojourner is identified as "patient" (ID 439799), but in 19:33 as volitional undergoer (ID 439929). In personal correspondence, the author confirmed the presence of these inconsistencies in the assignment of semantic roles.[6]

As can be seen, automatic and semi-automatic extraction of triplets does not yield perfect results. In any case, I made every effort to be consistent and cross-checked with Højgaard's dataset when creating triplets, from selecting participants to assigning semantic roles.

2.2. Semantic roles

To better understand the essence of these semantic roles, it is necessary to become familiar with the term "agency." Since this part of the methodology is heavily influenced by Højgaard's, the reader is directed to his book for full details (Højgaard 2024, 134–144; 242–272); what follows is a brief overview.

Agency is a concept asserting that in speech situations involving two or more participants, one of them is supposedly more active than the other. Agency is related to a large set of semantic parameters: animacy, control, change of state, mobility/staticity, instigation, volition, affectedness, and others.

Næss (2007, 41–43) believes that only the last three are necessary for determining a semantic role, since one characteristic can include several others. According to this model, for example, an agent may be described as [+VOL, +INST, –AFF]. It is important to understand—and the author herself notes—that each of these parameters lies on a continuum, so a "plus" means that the participant exhibits such a characteristic to the greatest extent, and a "minus" indicates to the least or none (Næss 2007, 44).

[6] It is to be mentioned that in his second dataset for the article on the social network of places (2025) some improvements were made, including changing the status of Aaron in 22:11, and appeared to be cleaner overall and easier to navigate.

As a result, eight semantic roles emerged from various combinations: agent, affected agent, patient, volitional undergoer, force, instrument, frustrative, and neutral (Næss 2007, 37; 51; 89–107).

To assess the contribution of each participant in the network, Højgaard constructed a hierarchy of agency and aligned the semantic roles derived by Næss to it (see Figure 1); each of them has a so-called "agency score" with a step of one. Agent and patient are antagonistic, according to the Maximally Distinct Arguments Hypothesis (Næss 2007, 30)—they differ in all respects and therefore are placed at opposite ends of the continuum, while the neutral participant has none of the parameters and thus serves as the reference point for all other roles (Højgaard 2024, 267). By identifying the semantic roles in a triplet, we can assign each participant an agency score corresponding to their role, which allows us to evaluate the activity of a given participant in the social network.

Role	Parameters	Score	Examples
Agent	+VOL +INST –AFF	5	I am YHWH your God who brought you out of the land of Egypt (Lev. 19.36)
Force	–VOL +INST –AFF	4	The land vomited out its inhabitants (Lev. 18.25)
Affected Agent	+VOL +INST +AFF	3	Anyone of the house of Israel or of the sojourners sojourning among them who eats any blood (Lev. 17.12) You shall love your neighbour as yourself (Lev. 19.18)
Instrument	–VOL +INST +AFF	2	I will bring terror upon you, disease and fever, which destroy the eyes… (Lev. 26.16)
Frustrative	+VOL –INST –AFF	1	You may not let some of it remain until morning (Lev. 22.30)
Neutral	–VOL –INST –AFF	0	You shall love your neighbour as yourself (Lev. 19.18)
Volitional Undergoer	+VOL –INST +AFF	-1	I am YHWH your God who brought you out of the land of Egypt (Lev. 19.36) A man who takes his sister as wife and sees her nakedness… (Lev. 20.17)
Patient	–VOL –INST +AFF	-2	The people of the land shall stone him with stones (Lev. 20.2)

Figure 1. Hierarchy of semantic roles and their agency scores (Højgaard 2024, 268).

2.3. Concluding remarks on methodology

In the present study, the nodes of the network include both ordinary human beings and divine entities. Parts of the human body were also included (e.g., Exod 21:6), as it is logical to assume they belong to one of the participants in the communicative situation. All other entities not falling into these categories were excluded. The edges represent interactions between participants. These may be *active*

(e.g., payment or killing), *affective* (love or hatred), or related to *perception* (hearing), among others. The weight of each edge is calculated as the squared difference between the agency scores of the participants: **(Source_agency – Target_agency)²**. Table 1 below illustrates the first row of the dataset from which all networks in this study were constructed.

Table 1. First row of the CC dataset.

Source	Source_agency	Target	Target_agency	Label	Weight	Reference	Notes
YHWH	5	Moses	-1	speak	36	20:22	

Visualizations were created using the NetworkX library for the Python programming language; for the majority of the tests and measurements, I used code written by Højgaard,[7] with slight modifications.

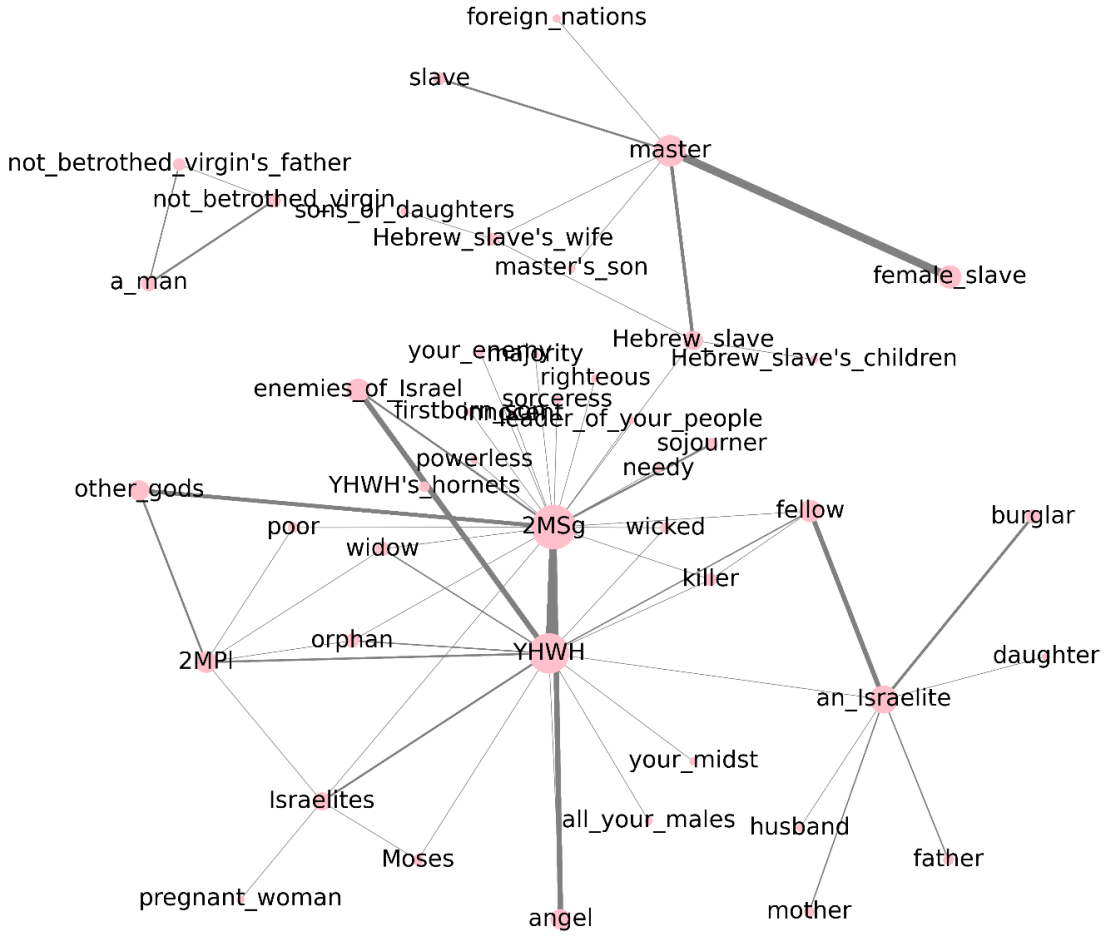

Figure 2. Visualization of the social network of the Covenant Code (Exod 20:22–23:33).

[7] The repository with all the materials used in the book *Roles and Relations in Biblical Law*: https://github.com/ch-jensen/SNA.

3. The Social Network of the Covenant Code

3.1. Cohesion

The term "cohesion" usually refers to how tightly connected the nodes in a social network are. There are several metrics to determine cohesion. The most basic one is density. For binary network data (i.e., when edges in the graph are undirected and unweighted—as is the case here), it is calculated as the ratio of the number of existing connections to the maximum possible number of connections. Thus, the social network of Exodus has 46 nodes and 63 edges, resulting in a density of 0.061. In Leviticus, there are 59 nodes, 128 edges, and the network density is 0.075.

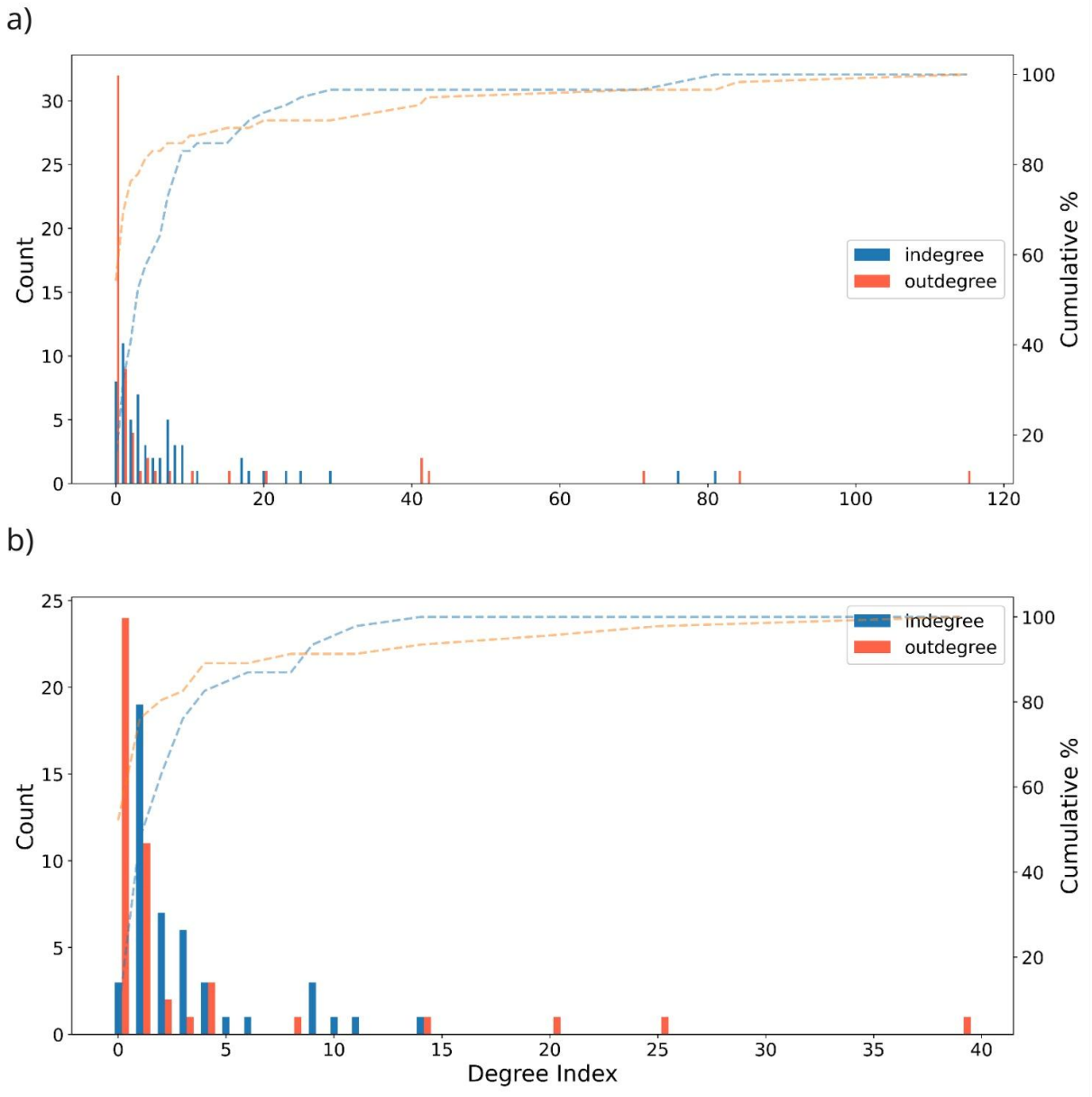

Figure 3. Degree distribution (multiple, directed graph). Dashed lines are cumulated degree. a) Leviticus HC; b) Exodus CC.

At first glance, this is an atypical situation. Usually, smaller social networks tend to have a higher density than larger ones, since it is more likely in a small group that each person is connected to another, unlike in larger groups (Borgatti et al. 2018, 175). Accordingly, it was expected that the CC would have a higher density compared with the HC, but the opposite is true: the density of the Exodus social network is almost 19% lower than that of Leviticus. This is a sign of loose connections among participants of the CC. The presumed author of the CC does not leave enough textual space for participants to build more ties. It seems the diversity of the participants was of more importance to him than their embeddedness in the social network: there are 27.5 distinct participants per 1,000 words against 9.9 in the HC. It does not seem possible to ascertain whether the CC author, given the opportunity, so to speak, to write as many words as the HC has (1,672 vs. 5,958), would follow his strategy of including more nodes but not connecting them proportionally, or would reach the desired number of participants constituting Israelite society and expand on their interconnections, thus more or less equalizing the resulting cohesion with that of the HC.

Another straightforward metric is average degree, which is calculated by dividing the total number of incoming and outgoing ties by the number of nodes. In Exodus, the average degree is 5.9, while in Leviticus it is 2.5 times higher: 16.23.

In Leviticus, 32 out of 59 nodes have no outgoing connections, and 8 out of 59 have no incoming connections; in Exodus, these numbers are 24 out of 46 and 3 out of 46, respectively. Overall, there are no sharp contrasts in this comparison.

The most connected participants in the Covenant Code are: 2MSg (48 connections), YHWH (39 connections), master (23 connections), an Israelite (18 connections), female slave (12 connections), and enemies of Israel (12 connections).

These top six nodes account for 55.88% of all connections in the network, which is less than in Leviticus, where the top six make up almost 10 percentage points more: 65.34%.[8] If we go a bit further and take the 15 most connected participants, they occupy 80.51% of the connections in Exodus and 85.22% in Leviticus. For 30 nodes, it is 94.12% in Exodus and 94.86% in Leviticus. In other words, the gap narrows as we move further down the ranking. This indicates some dispersion of interactions among participants in the CC, meaning they are less tightly connected with each other compared with the HC.

76.09% of nodes have three or fewer incoming connections (82.61% for outgoing connections), while in Leviticus these numbers are 52.54% and 77.97%, respectively. Although the gap in incoming connections between Exodus and Leviticus is quite significant—about 23.5 percentage points—it is noteworthy that the gap in the last metric is smaller: just under 5 percentage points. This suggests that in

[8] Leviticus: "YHWH, for instance, has 115 outgoing ties and 76 ingoing ties and has the highest overall degree within the network (191) … Other frequent participants include the collective group of Israelites (degree=165), the singular 'you' labelled 2MSg (78), the sojourner (66), the singular an Israelite (65), and Moses (61)" (Højgaard 2024, 290–91).

Leviticus there is more interaction with passive participants, but these participants themselves do not initiate interaction, which finds a parallel in Exodus.

The graphs in Figure 3 look visually similar: we see a sharp rise in the cumulative degree curve and a long "tail." From this, one might conclude that the networks are quite alike. However, such a conclusion might be premature without paying close attention to a quantitative analysis of these curves.

I measured the shape of the cumulative degree curve using four metrics: standard deviation of increments (Std diff), their range (Range diff), mean absolute residual from the smoothed curve (Mean abs resid), and root mean square residual (RMS resid).

A brief explanation of what they indicate:

- **Std diff:** Measures the standard deviation of increments between adjacent points on the curve; higher values indicate more chaotic and uneven growth.
- **Range diff:** Reflects the difference between the maximum and minimum increment between adjacent points; the higher it is, the sharper the fluctuations in the curve.
- **Mean abs resid:** Measures the average absolute deviation of the curve from a smoothed trend line; a higher value indicates a rougher and noisier curve relative to its trend.
- **RMS resid:** Similar to **Mean abs resid**, but squares the deviations before averaging, making it more sensitive to strong outliers and fluctuations; it enables evaluating the overall "waviness" of the curve.

Table 2. Statistical analysis of the cumulative degree distribution curve

		Std diff	**Range diff**	**Mean abs resid**	**RMS resid**
Leviticus HC	Indegree	4.458	20.339	0.869	1.702
	Outdegree	3.141	15.254	0.739	1.283
Exodus CC	Indegree	10.665	41.304	2.126	4.324
	Outdegree	5.966	23.913	1.449	2.775

As can be seen from Table 2, almost all metrics of the CC network are at least twice as large as those of the HC. I associate this pattern with the steeper degree hierarchy of the CC network: these figures reflect the "gaps" between the most powerful and the smaller participants. There are simply not enough "middle-tier" participants to balance these two groups.

3.2. Reciprocity

Reciprocity of ties indicates whether relationships between participants are mutual or not. A simple way to measure reciprocity is to count the number of mutual ties and then divide by the total number of ties. See the reciprocity scores of the HC and the CC, respectively, in Figure 4.

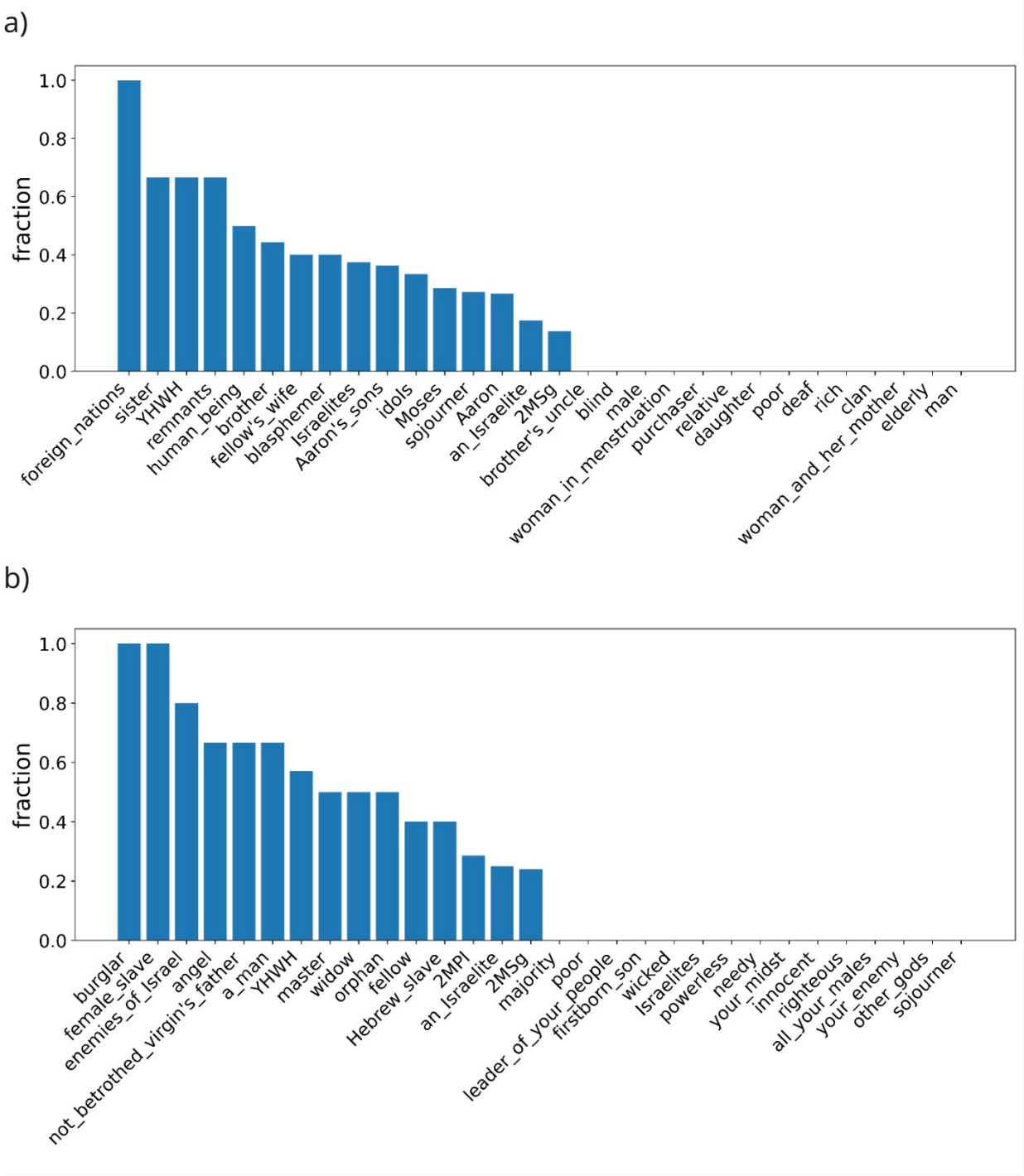

Figure 4. Reciprocity (singular, directed graph). a) Leviticus HC; b) Exodus CC.

In my opinion, the reciprocity metric is actually of limited applicability to the resulting networks of Leviticus and Exodus, since social network edges usually represent one type of connection: either active actions like trade or expressions of attitude like hatred. Due to the uniformity of ties, it is easy to determine who, figuratively speaking, "gives more" and who "receives more," allowing us to draw concrete conclusions about network hierarchy, social status of participants, and so on. However, in our case, edges represent all types of interactions, including killing, listening, trading, and even

childbirth. Though these ties were weighted based on semantic roles, this characteristic is irrelevant in this test. Nevertheless, for the sake of continuity with Højgaard's research, I will attempt to interpret the obtained results.

In Leviticus, only 24.66% of interactions are reciprocal, whereas in Exodus it is 32%, indicating a more bilateral character of the laws in the latter.

As in Leviticus, in Exodus reciprocal relationships occur both among the most frequent participants (YHWH, 2MSg, Israelite, 2MPl) and among lesser-known ones (burglar, not betrothed virgin's father, and a man). Participants appearing in specific episodes can also be noted: master, female slave, Hebrew slave.

Notably, other gods do not have reciprocal ties, unlike in Leviticus (where they are called "idols"). YHWH's reciprocity score is nearly identical in both the Holiness Code and the Covenant Code (slightly higher in the former).

In summary, the Covenant Code has a slightly higher reciprocity measure than the Holiness Code, indicating greater cooperation among certain participants, although structurally both networks are similar with respect to reciprocity, considering that the highest scores are shown by the least significant participants within the entire network.

3.3. Centrality

Centrality is an umbrella term that encompasses various measures used to quantitatively assess the importance, influence, or strategic position of a node in a network. In the literature, the terms "centrality" and "centralization" are often used interchangeably. Scott (2017, 102) suggests using centrality when referring to individual nodes or groups of nodes (so-called "point centrality"), whereas centralization describes properties of the overall graph structure. Thus, centrality reflects the relative importance of specific points, while centralization characterizes the degree of integration or cohesion of the entire network around certain key nodes. Centrality is one of the most important and popular measures among biblical scholars (see, e.g., Dekkers 2018; Dörpinghaus 2025). Dörpinghaus (2025, 229), however, warns researchers about potential pitfalls: "Nevertheless, these (centrality) measures, though derived from social science theory, do not entail the direct application of theories within SNA, which means that theories from the social sciences are not directly applicable." For measuring centrality, the same four metrics used by Højgaard were employed: outdegree, indegree, betweenness, and PageRank.[9] Centrality scores are indicated in Figure 5.

The first two metrics—indegree and outdegree—were introduced earlier; however, this time they are calculated as centrality degrees, meaning their values are normalized.[10]

[9] There are many other metrics for measuring centrality, such as closeness centrality (Borgatti et al. 2018, 199), k-step reach centrality (Borgatti et al. 2018, 200), and others. Højgaard nowhere explains his choice of metrics.

[10] The number of connections for each node is divided by the maximum possible number of connections (n – 1), where n is the total number of nodes in the graph. As a result, the centrality degree values range from 0 to 1, allowing comparison of the activity and importance of nodes even across networks of different sizes.

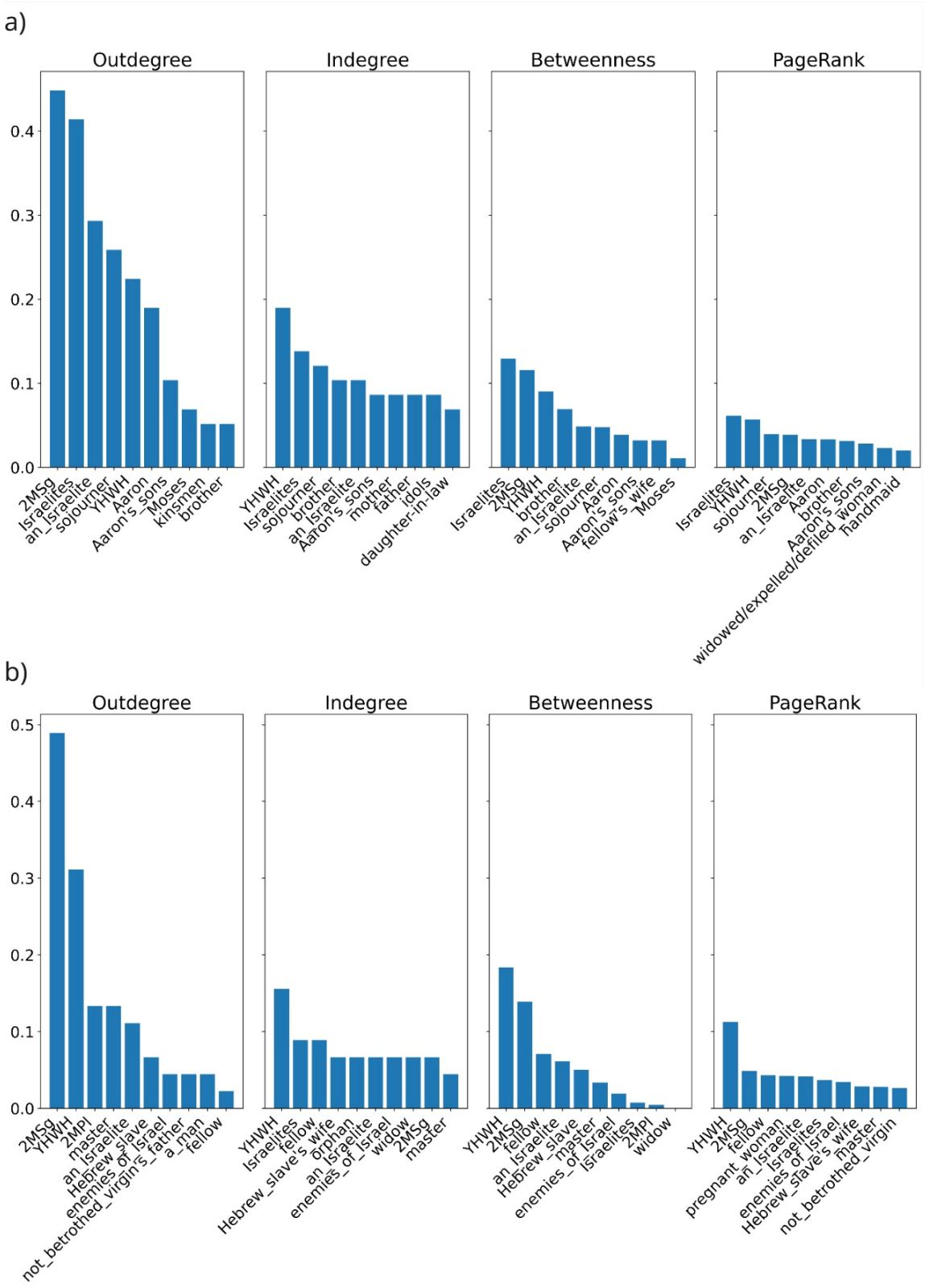

Figure 5. Top ten distributions of centrality measures. a) Leviticus HC; b) Exodus CC.

2MSg clearly stands out ahead of the other participants in terms of outdegree. It exceeds YHWH's outdegree by almost 40% and is four times greater than that of 2MPl, who follows YHWH. Starting

from 2MPl, the histogram evens out. The difference with Leviticus is striking. There, 2MSg and YHWH are also in the lead, but the gap between them is much smaller. The difference between second and third place is not as significant. Middle-tier participants stand out—from an Israelite to Aaron—with degrees around 0.2. In Exodus, we do not observe this: there are two super-central participants, and the rest are peripheral (and quite deeply peripheral, from the Hebrew slave to the end).

The situation with indegree is less critical. YHWH surpasses the second place by approximately the same margin in both Leviticus and Exodus. The overall level of indegree in the former is higher than in the latter.

Betweenness measures how often a node lies on the shortest path between two other nodes in the network. Even with low connectivity, such a node can play a critically important intermediary role and exert significant influence on the structure of the entire network. This metric is calculated as the sum of the proportions of shortest paths between all pairs of nodes that pass through the given node.

Betweenness is often interpreted as a control index, since nodes with high centrality lie at critical junctions of the network and act as "gatekeepers" (Scott 2017, 99). The loss of such nodes can lead to fragmentation of the network, causing some participants to lose connection with others.

As with outdegree, YHWH and 2MSg occupy the top ranks. Interestingly, fellow ranks third, even though it is typically understood as referring to a person who is to be "treated as the law demands" (Kellerman 2004, 527), a reading that would not ordinarily place him so high in the test. The distribution of betweenness centrality in Exodus is steeper than in Leviticus.

The PageRank metric, originally developed by Lawrence Page and colleagues to rank web pages in the Google search engine, can also be applied to our network. PageRank takes into account not only the number of incoming links (outgoing links are considered only indirectly in this metric) but also the weight of the nodes. In other words, if a node is referenced by other important nodes, its own rank increases—because influence is transmitted through the connections. This allows for identifying participants who may not have many direct interactions but become significant due to their position in the structure and the "trust" of other central nodes.

YHWH has an astonishingly high score of 0.11, which is more than twice of that of the next node, 2MSg. After that, the values decline more gradually. In Leviticus, the situation is somewhat different: "Israelites" hold the top position, followed closely by YHWH. The gap between these two and the rest is not as large; the values of other nodes decrease smoothly. Though PageRank centrality presents some of the most intriguing results (note the pregnant woman's higher position relative to an Israelite's), it must be interpreted with caution. PageRank depends on social relationships with similar circularity (e.g., a fashionable person is someone whom other fashionable people regard as such). In texts—both the CC and the HC—such relationships are rather lacking (see Dekkers 2018).

Summing up, the Exodus network is YHWH-centric: YHWH ranks first in all tests except indegree. 2MSg also significantly contributes to the network's centralization. However, there is no other participant comparable to these two. The Leviticus network, on the other hand, demonstrates three "pillars" of the social network: YHWH, 2MSg, and the Israelites.

3.4. Elimination test

Che proposed using an elimination test to determine the importance of each participant in the social network. The algorithm works by removing one participant at a time from the original network and calculating the density of the resulting network. This process is repeated for each participant (Che 2017, 239). Figure 6 demonstrates the densities resulting from deletion of top N participants. The initial network density is marked with a dashed line.

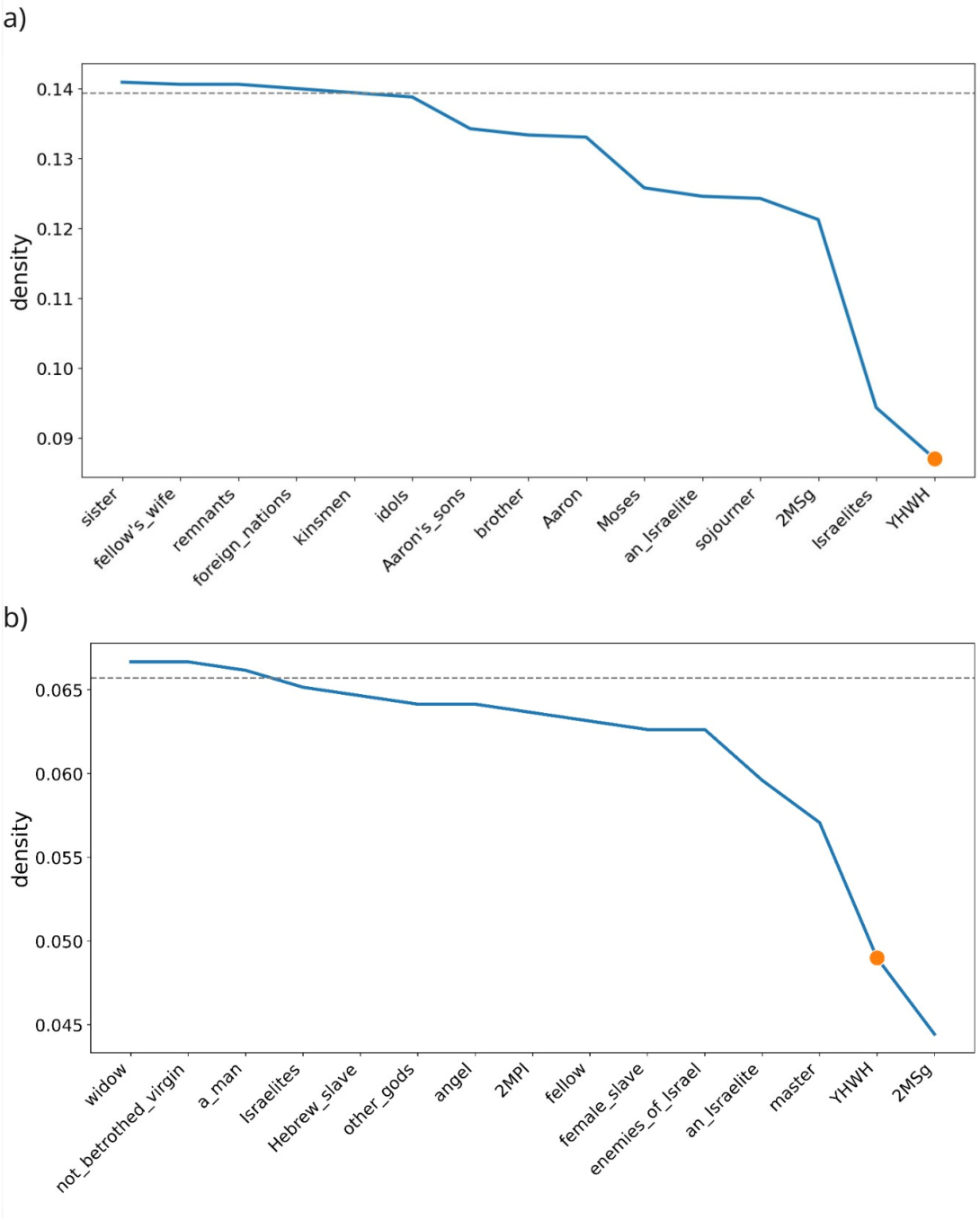

Figure 6. Elimination test of the network. Multiple, directed graph. Only the 15 most important participants with respect to density are shown. The dashed line represents the original density of the network. a) Leviticus HC; b) Exodus CC.

We see that the most important participant is 2MSg, followed by YHWH, the master, an Israelite, the enemies of Israel, and others.

It is noteworthy that in Exodus only three out of fifteen participants cause the network density to increase when removed, whereas in Leviticus, there are five such participants. This can be interpreted in different ways. On the one hand, this suggests that Exodus has more "middle-tier" participants, making the network less hierarchical. On the other hand, it could mean that the Exodus network is so hierarchical that removing any participant almost uniformly decreases its density, implying many of them occupy the bottom of the hierarchy. Considering the results of previous tests, I support the latter interpretation.

Also notable are the remaining participants whose removal decreases the network's density. Besides the expected participants such as 2MSg and YHWH, the list includes a female slave and a Hebrew slave (along with the master). While Leviticus did not feature any women among the most important participants, according to the elimination test, the presence of a woman, especially an enslaved one, in Exodus is quite interesting.

Attention should also be paid to the shape of the graphs. In Leviticus, the curve has distinct "thresholds"; for example, removing Aaron's sons, Aaron himself, or brother reduces the density by roughly the same amount, indirectly indicating their structural equivalence (see section 3.5 below). However, the jump from the least important to the most important participant is sudden, for instance, from idols to Aaron's sons. In Exodus, there are no such thresholds; the curve decreases smoothly down to the enemies of Israel, after which it drops sharply.

These graphs show that the social organization is more developed in Leviticus. If we can talk about several levels of hierarchy there, then in Exodus there are only peripheral, quasi-middle (an Israelite and the master), and super-important participants.

3.5. Structural equivalence. Clustering

In a social network, some participants may share identical connections with the other participants; for example, if two participants regularly interact with the same set of actors. This situation is called "structural equivalence." The term was first introduced by F. Lorrain and H. White (1971) and refers to nodes which occupy identical structural positions within the network. Structurally equivalent nodes are not necessarily directly connected to each other, but their patterns of connections with surrounding nodes coincide. Such similarity may indicate comparable social roles, functional positions, or status within the observed interaction.

Structural equivalence is more of a strict mathematical concept than a phenomenon commonly observed in real data, since it is very rare to find participants with identical structural positions in the real world. As a result, researchers' attention shifted from the idea of full equivalence to a more flexible concept of structural similarity. This approach allows for partial matches and enables the identification of common functional behavior of nodes even when specific connections differ. Thanks to this, it became possible to apply various hierarchical clustering methods, that is, grouping nodes based on the degree of their structural similarity within a hierarchical framework.

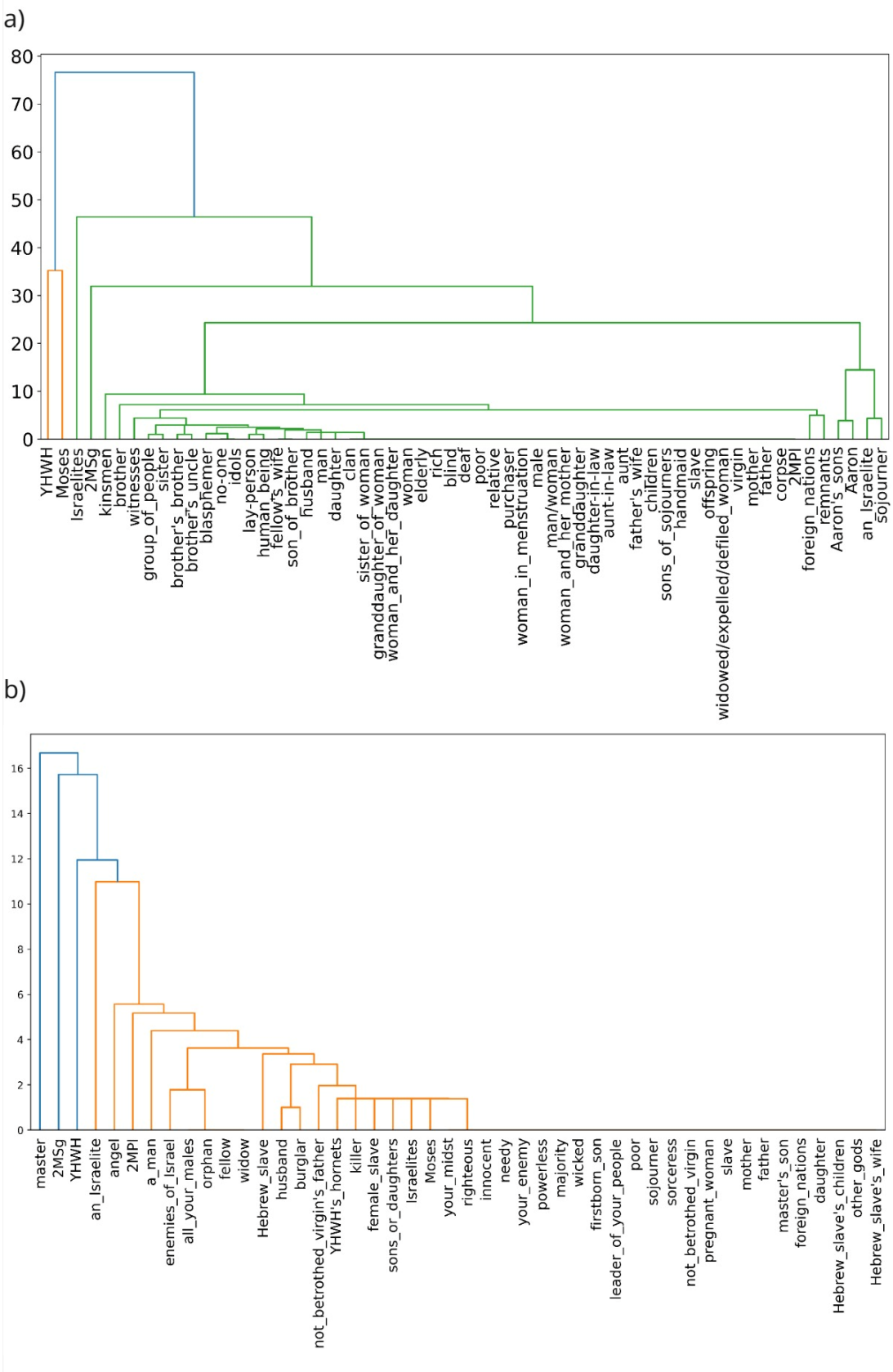

Figure 7. A dendrogram of the participants. Multiple, directed graph. The clustering is computed with the Ward algorithm. a) Leviticus HC; b) Exodus CC.

Figure 7 shows dendrograms computed using Ward's algorithm.[11] The main difference between the Exodus dendrogram and that of Leviticus is its "stepped" structure, where clusters form according to a "one participant versus all others" pattern. In Leviticus, clusters of closely interacting participants are noticeable, such as YHWH and Moses or the Israelite and the sojourner.

The most unique participant turned out to be the master. Such an outcome could have been predicted, since the master is a core of a group consisting of himself and various slaves, who do not have many connections to other nodes. It is also noteworthy that the "fellow" is clustered together with all your men, the orphan, and the widow. Other gods ended up in a cluster with many less frequently occurring participants, who most often act as the patient.

The structure of the Exodus dendrogram may indicate that participants interact independently from one another or occupy unique roles, making them less interchangeable. In contrast, the Leviticus dendrogram demonstrates a more balanced branching: key participants such as YHWH and Moses are grouped into a separate branch, from which other clusters then diverge. This may point to distinct centers of interaction or a hierarchy of roles, where participants group around certain "core" figures.

3.6. Multidimensional scaling and feature-based role discovery

The edges in the graph underlying this dendrogram were unweighted, meaning the agency of triplets was not taken into account. However, another approach is possible, which considers mean agency.

Figure 8 visualizes connections between participants based on the mean agency using multidimensional scaling (MDS). It is important to understand that the numerical values on the axes in an MDS plot are not directly interpretable, as they result from a projection onto an abstract space. Neither are the orientation and scale of the projection interpretable. The only meaningful aspect is the relative distance between points, which reflects the degree of structural similarity between participants.

Immediately noticeable are the main participants positioned at four opposite corners of the graph: the master, an Israelite, 2MSg, and YHWH. Overall, the remaining participants do not stand out much and cluster near the center. However, on the periphery of the center stand the angel, man, Hebrew slave, burglar, not betrothed virgin's father, enemies of Israel, and 2MPl.

Besides these two mechanisms for analyzing structural similarity, there is a third clustering method that applies the k-means method. This approach is a part of so-called "feature-based role discovery," which differs from traditional equivalence methods by not relying solely on the graph structure. Instead, the graph is transformed into a set of features (vectors), where each node is represented as a numeric vector reflecting its properties. This method includes two steps:

1. Transforming graph nodes into numeric vectors based on selected characteristics (e.g., number and direction of connections, agency values, attributes of neighbors, etc.).
2. Grouping nodes into clusters based on the similarity of these vectors.

[11] The numbers on the Y-axis represent the level of dissimilarity between clusters: the lower the value, the higher the similarity between the merged participants.

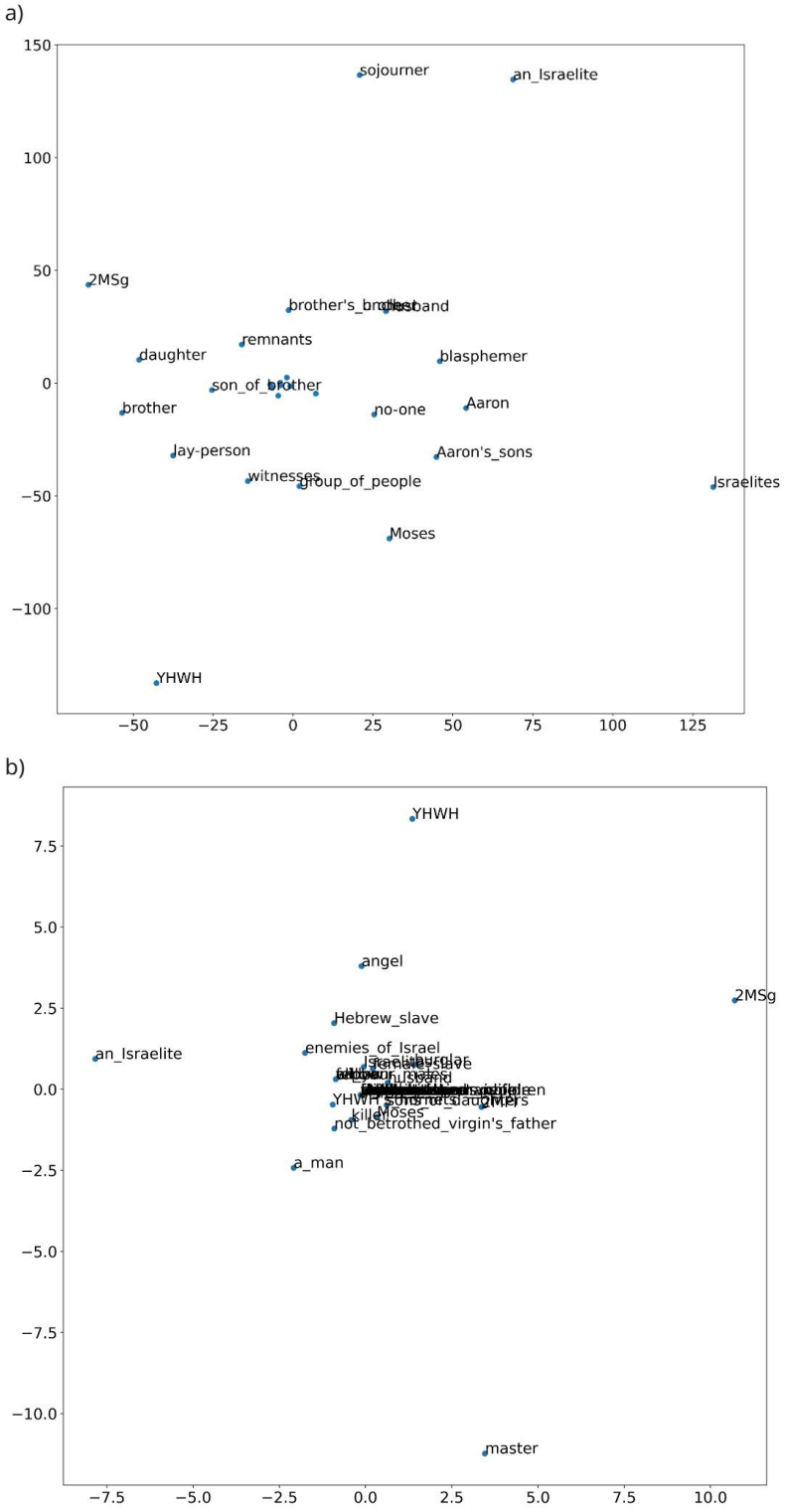

Figure 8. MDS of the network (edges conceptualized as agency scores). a) Leviticus HC; b) Exodus CC.

One widely used tool to generate such vectors is the node2vec algorithm, developed by Grover and Leskovec (2016). It allows for simultaneous consideration of two types of similarity:

- Homophily (nodes are similar if they belong to the same community or group);

- Structural equivalence (nodes are similar if they perform analogous functions in different parts of the network, e.g., teachers at different schools).

After converting nodes into vectors using node2vec, they can be analyzed with standard statistical methods, including k-means clustering. This algorithm divides nodes into a specified number of clusters, minimizing within-cluster differences and maximizing between-cluster differences. Thus, k-means helps identify groups of nodes performing similar roles regardless of their position in the network, providing a clear and quantitative representation of role distribution. Figure 9 shows the cluster graphs obtained using this algorithm.

Three clusters stand out, each represented by nodes of corresponding colors.[12] Light blue nodes mark peripheral participants, who generally act as undergoers and appear rarely. In contrast, the cluster with yellow nodes groups the most frequent participants, many of whom ranked highest in importance in previous measurements. Between these two groups lie intermediate participants, who are difficult to characterize clearly since this group includes a diverse range from Israelites to YHWH's hornets, from 2MPl to a pregnant woman—participants with very different frequencies and agency scores.

Unexpectedly, among the important participants appears a fellow, who, although playing a notable role in the network's centrality and cohesion, did not stand out significantly overall. Does this finding point to the possible equivalence of a fellow and an Israelite? I expand on it a bit more in the Appendix 1, but it is too early to draw definite conclusions—more research is needed—though the expectations are promising. The presence of the enemies of Israel in this cluster is also notable.

When discussing similarities between two networks, it is difficult to draw definitive conclusions about participants' positions based solely on MDS and node2vec findings. We can only list participants who belong to different clusters. Three participants fall into the same group in both networks: YHWH, 2MSg, and the Israelite. The Israelites belong to this same group in Leviticus but to the intermediate group in Exodus; the opposite is true for the fellow.[13] The sojourner, one of the central nodes in HC, is peripheral in CC. Unique nodes in the "yellow" cluster for Exodus are the master and the enemies of Israel; in Leviticus, the priests (Aaron and Aaron's sons) appear in this cluster.

[12] In the graph of the Leviticus network, as one might expect, the colors are different: light blue represents the most important participants, yellow stands for intermediate participants, and purple indicates peripheral ones. The difference in colors is arbitrary and does not carry any significant interpretative meaning.

[13] In Leviticus, the "brother" group includes the fellow and several other participants grouped under this common label (Højgaard 2024, 344).

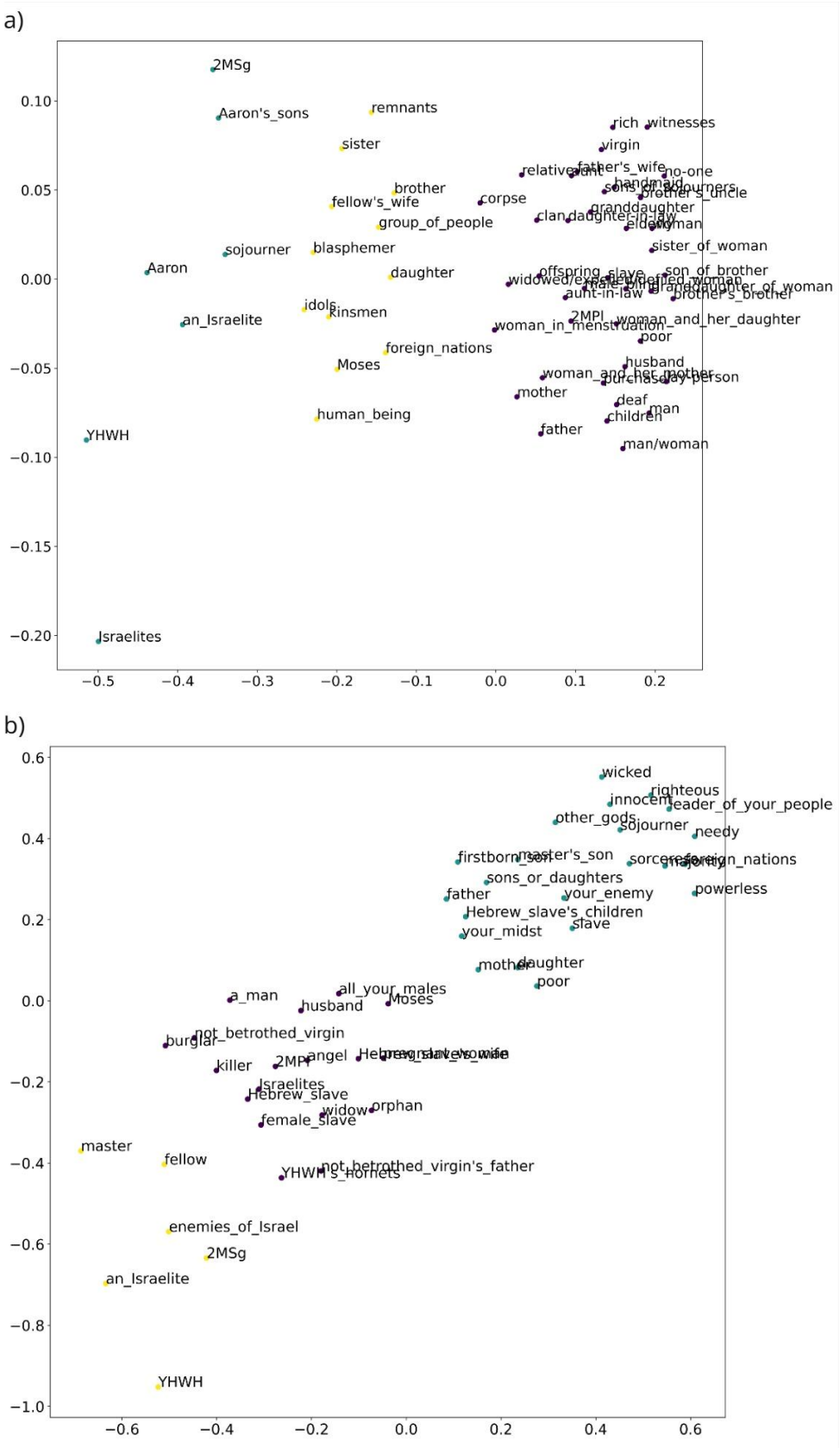

Figure 9. Structural role similarity based on feature vectors learned by node2vec. a) Leviticus HC; b) Exodus CC.

Conclusion

Cohesion and elimination tests revealed a rigid, hierarchical, binary structure of society depicted in the Covenant Code, albeit loosely knit. In the Holiness Code, several clearly distinguishable levels of hierarchy are evident, whereas in the CC only one emerges: the singular addressee of the laws (2MSg) and YHWH, with all other participants relegated to the periphery.

Centrality measurements show YHWH as a dominant participant, which is particularly noteworthy given that the CC is often perceived as a more "socially oriented" legal corpus with less emphasis on divine presence compared with the HC. At the same time, 2MSg also clearly claims leadership: its removal leads to the greatest reduction in network density; it has the highest number of connections among all nodes and the highest outdegree centrality, meaning it is the most agentive of all participants. Even if we set aside social network analysis and simply read the text, we notice how often exhortations and commands are formulated as second-person singular masculine imperatives (this is precisely what 2MSg represents). Che wrote about Genesis 27–28: "The main character is the one about whom a narrative is written and a central character is the one around whom a narrative revolves … Isaac is the main character because it is his Toledoth and Jacob is the central character because the narrative revolves around him" (2017, 341). In a similar vein, one might apply this distinction to the CC: the main character is the addressee Israelite (2MSg), since the overwhelming majority of prescriptions are addressed to "you," meaning an individual Israelite is of primary importance to the author, while YHWH remains the central figure because the narrative unfolds around Him, directly or indirectly, accumulating the connections of other participants. Compared with the CC, the HC network is generally denser and better structured.

Structural equivalence/similarity tests revealed greater role diversity in Exodus compared with Leviticus. Consequently, Ward's clustering algorithm produced a "stepwise" rather than a "tree-like" (as in HC) structure. Multidimensional scaling analysis identified the most unique (and uniqueness tends to correlate with importance) participants: YHWH, 2MSg, an Israelite, and the master. After transforming nodes into feature vectors, two additional members joined this cluster: the enemies of Israel and the fellow. Both cases are noteworthy. The enemies of Israel, as antagonists of Israelite society, appear unexpectedly alongside YHWH and other Israelites, raising interpretive questions. Similarly, the fellow, previously unremarkable in other tests, emerged within this group. This likely reflects its semantic proximity to an Israelite, suggesting that a fellow (רֵעַ) functions primarily as a referent to the second participant in an interaction—a hypothesis that warrants further investigation.

This study fills a gap in the comparative analysis of social networks of three different legal texts. Despite the application of multiple metrics, the research is exploratory and should be regarded as a first step toward a more comprehensive SNA of the Covenant Code.

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Bibliography

Borgatti, Stephen P., Martin G. Everett, and Jeffrey C. Johnson. 2018. *Analyzing Social Networks*. 2nd ed. SAGE.

Che, N. Chebineh. 2017. "Participants, Characters and Roles: A Text-Syntactic, Literary and Socioscientific Reading of Genesis 27–28". Ph.D. dissertation, Vrije Universiteit Amsterdam.

Cook, Samuel Peter. 2025. "Social Network Analysis and the Dating of Coptic Manuscripts from the Monastery of Saint Macarius". *Vigiliae Christianae* 79 (3): 271–310. https://doi.org/10.1163/15700720-bja10105.

Czachesz, István. 2022. "Network Science in Biblical Studies: Introduction". *Annali di Storia dell'Esegesi* 39 (1): 9–26. https://doi.org/10.69071/112196.

Dekker, John T., and Anthony H. Dekker. 2018. "Centrality in the Book of Ruth". *Vetus Testamentum* 68 (1): 41–50. https://doi.org/10.1163/15685330-12341310.

Dörpinghaus, Jens. 2021. "Die soziale Netzwerkanalyse: Neue Perspektiven für die Auslegung biblischer Texte?" *Biblisch erneuerte Theologie* 5: 75–96.

———. 2023. "Digital and Network-Based Methods for Narrative Criticism". *Svensk Exegetisk Årsbok* 88 (1): 106–34. https://doi.org/10.58546/se.v88i1.12091.

———. 2025. "The Portrayal of a Mediator: The Social Network of Peter in Luke–Acts". *European Journal of Theology* 34 (2): 225–48. https://doi.org/10.5117/EJT2025.2.003.DORP.

Grandjean, Martin. 2013. "Comparing the Relational Structure of the Gospels: Network Analysis as a Tool for Biblical Sciences". Paper presented at the Annual Meeting of the Society of Biblical Literature, St. Andrews, UK, July 7–11.

Højgaard, Christian Canu. 2021. "Roles and Relations in Biblical Law: A Study of Participant Tracking, Semantic Roles, and Social Networks in Leviticus 17–26". PhD dissertation, Vrije Universiteit Amsterdam.

———. 2024. *Roles and Relations in Biblical Law: A Study of Participant Tracking, Semantic Roles, and Social Networks in Leviticus 17–26*. Open Book Publishers. https://doi.org/10.11647/obp.0376.

———. 2025. "The Social Network of the Holy Land." *Religions* 16 (7): 843. https://doi.org/10.3390/rel16070843.

Hopper, Paul J. 1985. "Causes and Affects". In *Causatives and Agentivity: Papers from the Parasession on Causatives and Agentivity of the 21st Annual Meeting of the Chicago Linguistic Society*, edited by William H. Eilfort, Paul D. Kroeber, and Karen L. Peterson, 67–88. Chicago Linguistic Society.

Kellermann, Diether. 2004. "רֵעַ rēaʿ". In *Theological Dictionary of the Old Testament*, vol. 13, edited by G. Johannes Botterweck, Helmer Ringgren, and Heinz-Josef Fabry, translated by David E. Green, 522–32. Eerdmans.

Levinson, Bernard M. 2006. "The 'Effected Object' in Contractual Legal Language: The Semantics of 'If You Purchase a Hebrew Slave' (Exod. XXI 2)". *VT* 56 (4): 485–504. https://doi.org/10.1163/156853306778941737.

Lorrain, François, and Harrison C. White. 1971. "Structural Equivalence of Individuals in Social Networks". *Journal of Mathematical Sociology* 1 (1): 49–80. https://doi.org/10.1080/0022250X.1971.9989788.

Massey, Steven E. 2019. "Form and Relationship of the Social Networks of the New Testament". *Social Network Analysis and Mining* 9 (32). https://doi.org/10.1007/s13278-019-0577-7.

McClure, Jennifer M. 2020. "Jesus's Social Network and the Four Gospels: Exploring the Relational Dynamics of the Gospels Using Social Network Analysis". *Biblical Theology Bulletin: Journal of Bible and Culture* 50 (1): 35–53. https://doi.org/10.1177/0146107919892841.

Næss, Åshild. 2007. *Prototypical Transitivity*. Typological Studies in Language 72. John Benjamins. https://doi.org/10.1075/tsl.72.

Otto, Eckart. 1988. “Interdependenzen zwischen Geschichte und Rechtsgeschichte des antiken Israel”. *Rechtshistorisches Journal* 7: 347–68. Repr. pages 75–93 in *Kontinuum und Proprium: Studien zur Sozial- und Rechtsgeschichte des Alten Orients und des Alten Testaments*. Orientalia Biblica et Christiana 8. Harrassowitz, 1996.

Propp, William H. C. 2006. *Exodus 19–40: A New Translation with Introduction and Commentary*. Anchor Yale Bible 2B. Yale University Press.

Scott, John. 2017. *Social Network Analysis*. 4th ed. SAGE. https://doi.org/10.4135/9781529716597.

Westbrook, Raymond. 2009. *Law from the Tigris to the Tiber: The Writings of Raymond Westbrook*. Vol. 1, edited by Bruce Wells and F. Rachel Magdalene. Eisenbrauns.

Appendix 1

This appendix contains some principles upon which my dataset was created.

Constructions with passive meaning and implicit participants

(1) כָּל־שֹׁכֵב עִם־בְּהֵמָה מוֹת יוּמָת

Every bestial offender shall be put to death. (Exod 22:18)

In example (1), the undergoer (the bestial offender) and the event (killing) are easily identified, but the actor remains unknown.

I considered three possible interpretations for the missing explicit third component of the triplet:

First, considering that the target audience of the CC is all Israelites, one could assume that in passive constructions they are also the addressees. However, the opposite can also be supposed. Apodictic laws, to which the example above belongs, reflect the jurisdiction of the *pater familias* according to Eckart Otto (1988), meaning justice was administered by the head of the family within the household or clan. Even if Otto is correct, we cannot be certain whether the author of the CC intended the same, since the CC as a unified document appeared later than the formulation of such laws. Attempts to determine who had the authority to execute bestial offenders would lead us into historical discussions about *Sitz im Leben* and remarks on the *Formgeschichte* of the CC, which would diverge from the study's main goal: to consider society as depicted by the author.

Second, if we refrained from immediately identifying the missing actor but still created semantic triplets by replacing the absent element with a placeholder question mark, this approach would not only make the resulting social network analysis less informative and more distorted but would ultimately force us to interpret this enigmatic question mark. That would lead us back to what we initially avoided—the attempt to identify the actor.

Third, to avoid all these problems, such cases can simply be excluded from the study. Of course, some participants would be left out of the analysis and thus affect the final network, but this drawback seems less serious compared with those introduced by the first two approaches. In personal correspondence, Højgaard stated that he included only explicitly expressed participants in his research. Maintaining continuity with his work and weighing the pros and cons of each approach to passive constructions, I decided to follow this strategy of triplet extraction.

Cases where we truly cannot know who is connected to whom were excluded from the analysis; however, this rule does not apply to elliptical omissions of participants.

(2) וְאִם־אָמֹר יֹאמַר הָעֶבֶד אָהַבְתִּי אֶת־אֲדֹנִי אֶת־אִשְׁתִּי וְאֶת־בָּנָי לֹא אֵצֵא חָפְשִׁי׃

If a slave says, "I love my master, my wife, and my children; I will not go free." (Exod 21:5)

In example (2), there is no direct indication of the recipient of the slave's message, although the context allows us to understand that he is addressing his master, since, firstly, the slave is the master's

property,[14] and secondly, nothing is known about inspections regarding slaves' rights. Thus, we justifiably extract the triplet (slave — say — master).

Identification of participants

When constructing a triplet, we cannot record, for example, אִישׁ simply as "man," since this designation provides almost no information about the subject's social status. Some disambiguation is required, involving interpretation of the participant. Højgaard classified words such as כֹּהֵן, נֶפֶשׁ, אִישׁ, and others as synonyms and consequently associated these synonyms with the acting persons according to the context.[15] I followed a similar approach.

(3) וְכִי־יַכֶּה֩ אִ֨ישׁ אֶת־עַבְדּ֜וֹ אֽוֹ אֶת־אֲמָתוֹ֗ בַּשֵּׁ֙בֶט֙ וּמֵ֣ת תַּחַ֣ת יָדֹ֔ו נָקֹ֖ם יִנָּקֵֽם

If someone [a master] strikes his male or female slave with a rod, and the slave dies under his hand, he shall surely be punished. (Exod 21:20)

(4) וְכִי־יִמְכֹּ֞ר אִ֣ישׁ אֶת־בִּתּ֗וֹ לְאָמָה֙ לֹ֣א תֵצֵ֔א כְּצֵ֖את הָעֲבָדִֽים׃

If someone [an Israelite] sells his daughter as a female slave, she shall not go out as the male slaves do. (Exod 21:7)

In example (3), אִישׁ should be understood specifically as master, since the slave bears a possessive suffix, indicating his belonging to the אִישׁ. In cases where there are no grounds to assume that the participant has any special status, I used "an Israelite," as in example (4).[16]

Participants must be distinctly designated. Otherwise the triplet is spurious—formally, actor and undergoer denote the same person, meaning no interaction between two individuals has occurred.[17] Thus, examples like (5) were not included in the study.

(5) מַכֵּ֥ה אִ֖ישׁ וָמֵ֣ת מ֑וֹת יוּמָֽת׃

If someone [an Israelite] strikes someone [an Israelite], he must be put to death. (21:12)

In the text, the participant רֵעַ frequently appears. In situations where the participants have the same status (often without being explicitly stated), רֵעַ refers to the second participant (being mentioned after the actor) and is always the undergoer.[18] It would be logical to translate רֵעַ with the definite

[14] In 21:21 it is stated that "a slave is the master's property (כִּי כַסְפּוֹ הוּא)."

[15] https://github.com/ch-jensen/SNA/blob/master/1b_Disambiguating%20and%20Collocating%20Participants.ipynb.

[16] Surely, one could say that here the actor has the status of a parent, but the emphasis in this law is not on parental rights, but on the rights of an ordinary person, that is, an Israelite. Moreover, if all participants were named on such a basis, the social network would become much more difficult to interpret and study.

[17] In SNA terminology, this is called a "loop." The presence of loops in social networks of our type can cause various errors, but in networks reflecting, for example, individual psychology, their presence is quite logical: an edge expressing reflection loops back to the same node. Højgaard's dataset did not include triplets with identical participants.

[18] Introductory article on רֵעַ: Kellermann 2004, 522–32. See especially p. 527.

pronoun "the other," which the vast majority of translators do, except, for example, the Septuagint, which consistently translates this word as πλησίος "neighbor":

(6) וְכִֽי־יְרִיבֻ֣ן אֲנָשִׁ֗ים וְהִכָּה־אִישׁ֙ אֶת־רֵעֵ֔הוּ בְּאֶ֖בֶן אוֹ֣ בְאֶגְרֹ֑ף וְלֹ֥א יָמ֛וּת וְנָפַ֖ל לְמִשְׁכָּֽב׃

When people quarrel and one [an Israelite] strikes another [fellow] with a stone or fist, so that he does not die but is confined to bed (21:18)

ἐὰν δὲ λοιδορῶνται δύο ἄνδρες καὶ πατάξῃ τις τὸν πλησίον λίθῳ ἢ πυγμῇ καὶ μὴ ἀποθάνῃ κατακλιθῇ δὲ ἐπὶ τὴν κοίτην

This observation allows us to classify רֵעַ as a synonym for אִישׁ, and considering that, as demonstrated above, it refers to an Israelite, a large number of triplets would have to be excluded. However, I consistently translated רֵעַ as "fellow" in all cases for three reasons. First, in ancient Hebrew, in many contexts this word can mean "companion," "neighbor," or "fellow"; second, רֵעַ appears in Højgaard's network; and third, there is a case in the Covenant Code where it is not a direct referent to the second Israelite in the event, as in example (7):

(7) אִם־חָבֹ֤ל תַּחְבֹּל֙ שַׂלְמַ֣ת רֵעֶ֔ךָ עַד־בֹּ֥א הַשֶּׁ֖מֶשׁ תְּשִׁיבֶ֥נּוּ לֽוֹ׃

If you take a cloak as a pledge from your fellow, return it to him before sunset. (22:25)

Grouping Participants

For greater informativeness of the social network and ease of analysis, I grouped together some nominally different but essentially similar participants into a single participant. Similarly, Højgaard grouped, for example, several participants under the common name "idols."[19] Of course, grouping also reduces the objectivity of the work, as the choice of participants to be grouped is unlikely ever to be fully objective.

In my case, I grouped the following participants under common headings:

- **Enemies of Israel**: your enemies (23:22); your oppressors (23:22); Amorites, Hittites, Perizzites, Canaanites, Hivites, Jebusites (23:23); all the peoples against whom you shall come (23:27); Hivites, Canaanites, and Hittites (23:28+); inhabitants of the land (23:31+).

  Foreign nations from 21:8 were not included in this group for several reasons. First, they belong to a different narrative (enemies of Israel appear only in the "epilogue" (Exod 23:20–33), whereas foreign nations are mentioned in connection with the rights of the master). Second, נָכְרִי עַם is a somewhat oxymoronic phrase. עַם originally carries the semantic feature of kinship, so combined with נָכְרִי it creates a contradictory notion. In Propp's commentary (2006, 198–99), for example, this participant is understood as "persons unrelated to the maidservant."

[19] "Another case of collocation is the subsumption of all quasi-divine beings and idols under idols, including Moloch (18.21), goat-demons (17.7), and idols (19.4), as well as dead spirits and sooth sayers (19.31)" (Højgaard 2024, 126).

- **Other gods**: other gods of silver (20:23); other gods of gold (20:23); names of other gods (23:13); other gods (23:23+); pillars of other gods (23:24).

Appendix 2

To better understand the nature of interactions in the two sources, it is worth reflecting briefly on the combinations of different semantic roles, taking into consideration their frequency and proportion represented in Table A2.1.

Table A2.1. Frequency and proportion (%) of each combination of semantic roles.

Combination	**Exodus**	**Leviticus**
5 + -1	40 (29.4%)	156 (32.7%)
5 + -2	40 (29.4%)	123 (25.8%)
1 + 0	22 (16.2%)	76 (15.9%)
3 + 0	11 (8.1%)	18 (3.8%)
5 + 0	8 (5.9%)	26 (5.5%)
1 + 1	7 (5.1%)	13 (2.7%)
0 + -1	3 (2.2%)	10 (2.1%)
3 + -2	2 (1.5%)	26 (5.5%)
2 + -2	1 (0.7%)	0 (0.0%)
0 + -2	1 (0.7%)	22 (4.6%)
4 + -2	1 (0.7%)	1 (0.2%)
-1 + -2	0 (0.0%)	6 (1.3%)

5 + -1: The most common combination in both sources. It usually corresponds to cooperative actions, where both participants exhibit volition. This includes cases of speaking (Exod 20:22; 22:22; 23:13, etc.), monetary compensation (Exod 21:19; 22:2, etc.), transfer of property (Exod 21:4; 22:9, etc.), and others. In Leviticus, for example, triplets with the events "speak" and "say" make up more than a third of all instances of this combination: 59. This is not surprising given its discursive structure.[20] In Exodus, verbal communication events make up only 15% of all cases: 6.

5 + -2: The second most frequently occurring combination. It reflects the dynamics of active actions, usually negative, such as violence (Exod 21:14, 15; 22:22, etc.), human trafficking (Exod 21:8; 22:15), and others. Leviticus has fewer such interactions, which may indicate a lesser emphasis on violent actions in both narratives and sanctions.

1 + 0: The most common combination for unrealized situations. Proportionally, it is surprisingly almost equal in both documents: about 16%. It usually reflects prohibitives with אַל or לֹא (Exod 22:20, 27, 23:24, etc.), but there are also cases of casuistic laws (i.e., via third person: Exod 21:8, 21:10, 22:16).

[20] A construction like "YHWH spoke to Moses, saying: Speak to the people of Israel and say to them…" (Lev 18:1–2) is often repeated.

3 + 0: Occurs in Exodus nearly 2.5 times more often than in Leviticus relative to its size. As mentioned above, the participant absorbing information (listening to someone) performs the role of an affected agent (Exod 22:22, 26). Besides that, the affected agent can fear (23:21), love (21:5) among other perceptions. It is difficult to speculate why this imbalance exists. There can be many reasons: from differences in the *Leitmotif* of the texts to the exhaustion of themes (there is no more to write beyond what's already written).

5 + 0: The first participant acts agentively, but the second participant remains either unaffected or is created in the process of the action. The first case is intuitively clear. For example, in Exod 21:13, YHWH appoints cities of refuge for the 2MSg. The 2MSg itself is not affected as a result of this action.[21] The second case is somewhat more interesting. The term "affectedness" denotes transformation of the undergoer during the agent's action; the term "effectedness" denotes creation. I decided to categorize created participants as neutral because, in Hopper's words, objects created as a result of an action "cannot be said to 'undergo' the action of the verb, and therefore cannot be described as Patients" (Hopper 1985, 69). In Næss's system, if such participants are not affected, they become neutral. This conclusion conflicts with Bernard Levinson's view that "An effected object … is thus a prototypical semantic patient … An affected object is much less" (Levinson 2006, 491). An example of this semantic role in Exodus might be the other gods from 20:22.

1 + 1: Akin to "1 + 0," but the second participant was originally a volitional undergoer, meaning they would actually receive some benefit. In Exodus, there are almost twice as many cases of this semantic role combination. This suggests that Exodus places greater emphasis on the undesirability of cooperation between certain participants (for example, between the 2MSg and other gods in Exod 23:32).

Next are the "exotic" semantic role combinations, which make up no more than 2% of all combinations.

0 + -1: This combination appears in about 2% of cases in both texts. In Exodus, there are only 3 such cases (21:8; 23:22 twice). They are related to a change of internal state, specifically dissatisfaction with a female slave (Exod 21:8) and YHWH turning into an enemy and adversary of Israel's enemies (Exod 23:22 twice). In the example from Exod 21:8, the female slave has a higher agency score than the master because without her, he would not have changed his internal state from satisfaction to the opposite. In other words, she acted as a trigger, initiating the master's action.[22]

3 + -2: This combination occurs only twice in Exodus (Exod 22:1; 22:15). In the first case, an Israelite finds a thief, and in the second, a man sleeps with an unbetrothed virgin—a prototypical situation for this semantic role combination, which in Leviticus accounts for about 90% of all occurrences. The significant imbalance in the distribution of this combination (1.5% vs. 5.5%) is explained by the theme of the sacred text: Israel must maintain ritual purity.

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[21] One might think that the 2MSg is actually a volitional undergoer, since it receives some benefit from YHWH's action; however, we cannot be completely sure that the cities of refuge were unambiguously good for every Israelite. Therefore, 2MSg is a neutral participant.

[22] See also Højgaard's explanation (2024, 269–70).

2 + -2: Probably the rarest combination to be found in a social network like ours because instruments are usually inanimate objects. Instruments have been excluded from the modeled data according to the criteria established above.

0 + -2: The only example (Exod 21:4) involves the wife of a Hebrew slave giving birth to children. It might seem paradoxical that the born children have a higher agency score than the mother, since she creates them. However, applying Næss's system to this situation clarifies it. As noted earlier, created participants have a neutral status, so the children by definition have a score of 0. The wife of a Hebrew slave is definitely affected by the action: +AFF. Does she have volition in this situation? No, because the childbirth process does not depend on her will as such: -VOL. Finally, does she perform the action? No, because the action occurs when the fetus matures and triggers labor; in other words, the woman does not start labor, it begins on its own: -INST.

In Leviticus, this combination appears in a notable number of cases: 22 times (4.6%). In most cases, it reflects a change in relationships (Lev 22:5) or their existence as such (Lev 18:26) between two participants, often initiated by a third party (Lev 18:29). Accordingly, the participant who has a relation to the second participant has a neutral role, and the one undergoing the change is the patient.

4 + -2: Similar to the combination "2 + -2," this is one of the rarest because natural elements—prototypical representatives of the semantic role force—do not fit the criteria, and accidental actions are difficult to record.

-1 + -2. Does not occur at all in Exodus. In Leviticus, this combination is usually formed with the involvement of a third party, who is either unknown or duplicated by one of the participants. Earlier in this work, there was an example of a brother selling himself into slavery; notable are examples like Lev 26:17, where YHWH says that He will turn His anger against the sons of Israel, and they will be maimed before their enemies. In this situation, the sons of Israel are the patient, and their enemies are the volitional undergoer because they will witness the maiming of the sons of Israel. Ultimately, it is unclear who will maim the Israelites: YHWH directly because of their sins, or the enemies of Israel. This is the hidden third party.

As shown in Figure A2.1, both sources show similar patterns in the most common combinations ("5 + -2", "5 + -1", "5 + 0", "1 + 0") and the less common ones ("4 + -2", "2 + -2", "0 + -1"). Fluctuations appear in the rare combinations "3 + -2", "0 + -2", "-1 + -2" (with a predominance in Leviticus), and "3 + 0", "1 + 1" (with a predominance in Exodus). Leviticus is characterized by combinations reflecting more complex and abstract relationships between participants, which are also more difficult to convey in the text. Exodus, on the other hand, is more concrete and "practice-oriented." This difference correlates with the literary characteristics of the respective texts: the language of Exodus is more concise, while Leviticus is more elaborate. Overall, Leviticus is more diverse in terms of the combinations of semantic roles and, consequently, types of interactions between participants.

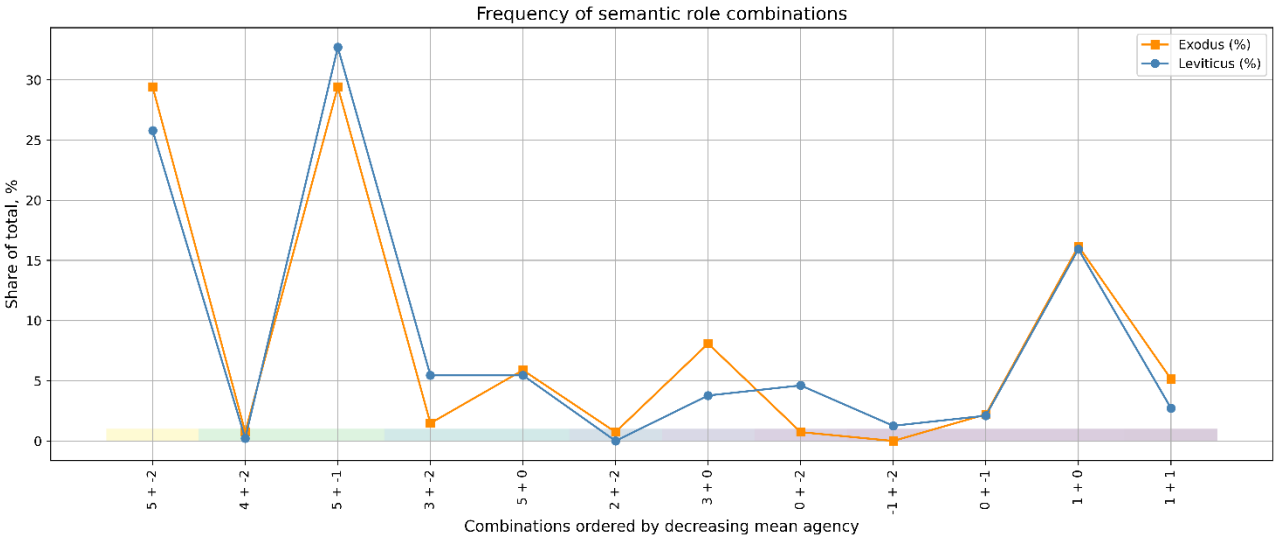

Figure A2.1. Distribution of semantic roles combinations in Exodus and Leviticus. Colors on the horizontal axis indicate agency invested.