Digital Discourse Analysis of Posthumanism in Open Access Academia

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Table of Contents

Introduction

Much of the eminent works done by French philosopher Michel Foucault centers on the ways in which people are turned into subjects. According to him, power operates in exercising its control over subjects through constituting or forming the different available subjectivities available to a person. He describes this process to occur through objectification. That is, through the transformation of individuals, persons or agents, into objects of knowledge that are then disciplined through various institutions like the schools, prisons and hospitals. He lists out three main aspects of this entire process. These aspects include: (1) the formation of authoritative discourses that speak about the subject, (2) the categorization of different types of subjects and, (3) the process of learning as exhibited by people (Foucault, 1998; Foucault, 1982). To provide an example of this, the authoritative discourse of biology speaks about living beings and creates categories of different types of living beings such as mammals, reptiles, etc. Then, a multi-faceted and complex participant (or a recipient) of this discourse learns to see herself as a mammal who is alive. Other examples of subjects formed out of their respective authoritative discourses include ‘the hysterical women’, ‘the good boys’, ‘the deviants’, ‘criminals’, ‘workers’, etc. Through studying the different techniques with the use of which individuals are converted into subjects, Foucault, in his work attempts to challenge dominant notions and holds open the door for critical engagement with the mechanisms that shape our identities. And, he also encourages his readers to resist oppressive forces attempting to define and limit personal liberation and transformation.

Then, Dutch discourse scholar, Teun A. van Dijk, has produced considerable amount of work analyzing discourse through a socio-cognitive perspective. In his

work, he too like Foucault, highlights the important role of authoritative, trustworthy or credible discourses in shaping the beliefs, knowledge and opinions of recipients (Dijk, 2008). His framework further contains insights into the mechanisms of this influence of discourse through theories of mental models and text processing (Garnham, 1987; Johnson-Laird, 1983). These theories throw light on the influence that structures of text and talk have towards the formation of mental models or mental representations in the episodic memory of individuals, guiding their decisions, actions, behaviors. Explainable by the understanding of text comprehension as the process of constructing mental models from texts (Bock & Brewer, 1985), these theories make van Dijk's socio-cognitive perspective a valuable framework for understanding the power of language and communication. For example, using this framework, it can be seen that a person immersed in right wing political discourse that she considers as authoritative could be repeatedly exposed to texts in which the concepts relating to threats and fears are often incited or mentioned along with immigrants from a different country. So, during her readings of these texts, the person will actualise a mental model or a frame in which the immigrants are related to threatening or fearful situations. This model solidified through repeated exposure will then be present in her episodic memory for retrieval in the future whenever either the fearful concepts or immigrants are actualised in her future experiences. She then is prone to acting fearfully towards immigrants and immigration. The framework used by van Dijk looks upon the authoritative texts produced by various authoritative discourses within a group of people as socio-culturally shared knowledge. These, formed under the socially accepted truth criteria for the group, forms the basis of social cognitions or socially accepted beliefs guiding group behaviors through the

just mentioned mechanism of mental model formation of the group individuals (Dijk, 2008).

Further, one important concept that many participant agents of contemporary global society would be familiar with is the notion of (or the subjectivity of, or the model or representation of) the ‘Human’. The term often denotes a self-schemata that is generally accepted and used by members of contemporary society to make sense of their selves. This idea of the self would have different aspects depending on the locality of the different groups that shape its meaning through their authoritative discourses. And literature suggests that this construct plays a crucial role in determining actions. For example, the theory of planned behavior (Madden et al., 1992) as well as the social cognitive theory of Bandura (1997) both highlight the fundamental role of self-efficacy for action. Then, several studies have also directly shown the influence of self-schemata on decision making and subsequent action (Kendzierski, 1990; Stein, 1996; Kendzierski & Whitaker, 1997). Thus, in light of Human actions leading to an earth wide ecological breakdown through the overshoot of several planetary boundaries (Hickel et al., 2022), there is growing importance and relevance in reflecting upon the construction of the notion of ‘Human’ and what is understood as its essence or ‘Human nature’. Perhaps answering this growing importance there has been recent emergence of the term ‘Posthuman’ in academic literature. In one sense the term offers a challenge to the traditional notion of the human and seeks to redesign it (Gane, 2006). However, the origin of the term itself is contested and it is also used by different discourses in varying contexts with different meanings that are difficult to easily disambiguate. Intrinsically however, in a raw form or a globally understandable form for most speakers of English language, the term connotes ‘after’-‘human’. But what does it mean for something to be after

the human? Does it refer to an amalgamation of silicon and carbon as imagined by several authors of science fiction? Or does it refer to beings that are biologically enhanced by gene engineering as envisioned by some others? How would this kind of a being differ from a human in her relationship with the environment? This paper is inspired by these questions.

Further, both Foucault's and van Dijk's works focus extensively on the relations of power and discourse. They both recognize that some knowledge and meanings are more likely to be accepted and reproduced than others. For one simply based on the authoritativeness of the discourse assigning such meanings. And, as scientific or academic discourse being produced by experts are often perceived to contain a high degree of authority and credibility, the ideas of Posthuman within this discourse is considered to be influential in this paper. Then, within the academic discourse itself, there would be different topologies or organizations of credibility and trust. These structures of the discourse would then influence which ideas are more likely to receive a broader acceptance and which are reproduced more often leading to their higher rate of dispersion. This paper also ponders upon these questions.

In all, this paper is majorly influenced by the questions of power and influence as well as the subtle mechanism of mental model formations. Additionally, it is also intrigued by the emerging notion of the 'Posthuman' which it deems a significant movement in light of the ecological crisis. Furthermore, the development and societal integration of new emerging technologies such as artificial intelligence also accentuate the importance of the emergence of this new notion of 'after' human. And thus, declares its primary objective to be to contribute towards more understanding of the discourse surrounding the 'Posthuman' within the discursive sphere of open

access academia. To achieve this aim, the paper will tread on a line of investigation to describe the major senses of the ‘Posthuman’ present in this discursive sphere. Then, it will also identify the other important concepts that are being constructed in this same sphere. And finally, the paper will also attempt to identify the power configuration that is present within this sphere of discourse to then reflect upon the influential or powerful ideas that flow within the realm of this discourse as captured.

Thus, in light of the aforementioned objectives, three main research questions are posed by this paper. They are as follows:

RQ1. What are the different constructions of the notion of ‘Post Human’ in the discursive sphere of open access academia?

RQ2. What are the other important objects formed inside this discursive sphere?

RQ3. What is the power configuration in this discursive sphere?

So, to now adequately answer these questions, this paper must first define its core concepts.

Statement, Discourse and Discursive Spheres

A particularly significant concept that this paper must first define or clarify for its questions and their subsequent answers to make sense to the reader is the notion of discourse. However, this is easier said than done. The term is frequently used by a wide range of scholars. And these scholars in turn originate from a host of different disciplines and traditions within the social sciences and humanities including but not limited to linguistics, semiotics, psychology, sociology, philosophy, history, social anthropology, and political science (Boholm, 2016). In the dictionary, particularly the

Oxford Advanced American Dictionary, the term is defined as ‘the use of language in speech and writing in order to produce meaning’ (Oxford Learner's Dictionaries, n.d.). Then academically, the term is defined in several different ways across the social sciences. Even in the single discipline of sociology it is often defined differently depending on which researcher the reader might ask. For example, one definition might focus on where discourse can be found. Like in talk, documents, media along with the meanings held in them. Another definition could take a different approach and form a definition focused on the function of discourse. For example, Bischoping and Gazso (2015), in their book ‘Analyzing Talk in the Social Sciences’ state “Discourse is a web of meanings, ideas, interactions and practices that are expressed or represented in texts (spoken and written language, gesture, and visual imagery) within institutional and everyday settings”. Then, another definition that can be found reads “Discourses are ways of enacting and recognizing different sorts of socially situated and significant identities through the use of language integrated with characteristic ways of acting, interacting, believing, valuing, and using various sorts of objects (including our bodies), tools, and technologies in concert with other people” (James Paul Macgee, 2011).

Thus, amidst this variation, to situate into one easily understood, practical and acceptable picture of discourse the paper delves into the work of French philosopher, Michel Foucault. As a historian of ideas and political activist, Foucault worked to describe the workings of institutions and how they exert control over society through power and discourse. He is an important figure in critical theory and an authoritative scholar of discourse analysis. Of particular interest to this paper is his work called ‘Archeology of Knowledge’ (Foucault et al., 1972). The book is a rare methodological treatise by the author. And, is an appropriate collection of text to

pursue for a comprehensive and detailed exploration of his ideas on the topics such as discourse. In it, Foucault presents his elaborations on the topic and makes a thorough attempt to define it precisely.

In this book Foucault first makes sure to create a boundary around his constructions by stating them as to be relevant only within the field of history of knowledge or ideas. Then he takes up some traditionally important objects considered natural and inevitable in the field and proceeds with their deconstruction. The notions of the Book and the Oeuvre (a construction delimited or created through the attribution of a group of texts to one author) that have been prominent objects in the study of history through documents meets this fate. Foucault argues that since the “book” exists in a web of references to other such objects that contain and imbue meaning into the words and sentences that are contained in them, it is actually not such a ‘natural’ unit that one might assume at first glance. The Oeuvre or the grouping of books by an author is argued to be another problematic unit as it is difficult to claim that a published book written by an author and some scribbled few lines on a journal by the same author are at the same level or can be clubbed together to form a coherent whole.

Foucault uses the deconstruction of these two unities to introduce the reader to the form of the object of his study without any groupings. He states,

“The object of study without any groupings, or field is made up of the totality of all effective statements (whether spoken or written) in their dispersion as events and in the occurrence that is proper to them. Before approaching with any degree of certainty. A science or novels. Or political speeches or the oeuvre of an author, or

even a single book, the material with which one is dealing is, in its raw, neutral state, a population of events in the space of discourse in general."

These statements are noted by this paper to hold a vision of the author that describes an entirety. In particular the entirety of discourse or the form of the entire discourse that occur at any given moment. This whole is then described further by Foucault to be purely made up of the unit he calls the 'statement'. These statements Foucault claims have been selected to be articulated or expressed by the rules of their place of occurrence or the context of their expressions.

Further, in the same book, another important concept is highlighted. This is termed 'enunciative modalities' by the author. And, are said to be present within or inside discourse. This concept or idea itself is further constitutive of three things. That is, the trifold construct of 'enunciative modalities' as described by Foucault is formation of:

(a) Information in regards to the speaker or the author of a statement.

(b) The institutional site where the statement is occurring and provides it with legitimacy.

c) The subjective positions that may be occupied in relation with the objects of the discourse.

Then finally, the book delves into the definition of the basic unit of a discourse that Foucault has so far called the statement. This he finds a difficult task. To adequately define anything is not easy. Let alone the most puzzling of things that is the basic unit of discourse. However, in his attempt, Foucault makes sure to set it apart from constructs such as, the 'proposition' used by logicians. The proposition is generally thought of in the context of logics as a complete thought or idea that may

be true or false. It is made clear that this notion is not what Foucault is referring to as a statement. Then, he also separates the statement from the notion of a ‘sentence’ used by grammarians. Which, like the proposition, can also be thought of as a complete thought or idea. But instead of a value for truth and false, this notion is constitutive of a subject and a predicate.

Finally, the ‘speech act’ as used by people he calls the ‘analysts’ is also disentangled from the statement which has been described as the basic unit of discourse by Foucault in his seminal methodological book. He claims that the criteria for the identification of a proposition is not the same as that of the statement. Then he notes the existence of statements that are not sentences. For example a growth curve or a graph or any diagram for that matter. And lastly, he proclaims that a he sees a speech act as something that could be formed out of a series of statements (e.g. a prayer) and thus is not exactly what he refers to as the statement. But away from these disentanglements, what does Foucault then refer to exactly when he uses the term, a statement? In his words:

“We will call statement the modality of existence proper to that group of signs: a modality that allows it to be something more than a series of traces, something more than a succession of marks on a substance, something more than a mere object made by a human being; a modality that allows it to be in relation with a domain of objects, to prescribe a definite position to any possible subject, to be situated among other verbal performances, and to be endowed with a repeatable materiality.”

From these words, this paper interprets the statement to be used by Foucault to denote a group of signs or marks, which are infused with meaning and significance through the context of its place of occurrence. In this regard, Foucault’s

description of discourse is finally considered to be meaningful: “a constitution by a group of sequences of signs, in so far as they are statements”. For further clarity and details of the idea of discourse constituted by statements in Foucault’s ideas, the paper also looks towards the writings of another contemporary French philosopher to Foucault, Gilles Deleuze. An influential figure in postmodernist thought, Deleuze has produced significant works in the history of philosophy and his contributions in metaphysics are held in good esteem. In his book titled “Foucault” (Gilles Deleuze & Seán Hand, 2014) he works along-side Foucault’s ideas to bring further clarity and detail. Particularly, he extends and clarifies upon the notion of the statement and describes them to be intricately linked with the entire group of their related statements as well as with the rules of the field in which they exist and are reproduced.

He further goes on to crucially describe three spaces that he sees around a statement. First of these, he calls the ‘collateral space’. This is the area that contains all the other related statements. The second he calls, the ‘correlative space’. This space contains the subjects, objects and concepts that are linked with the statement. And then he terms the third space as the ‘complementary space’ and explains it to be a place where the non-discursive formations linked with the statements are to be seen (i.e. political events, economic factors, etc). Finally, for a comprehensive and encompassing definition of a statement for the task in this paper that is to answer the research questions posed, it also turns to Teun van Dijk. As another prominent author in discourse studies, he too is an authoritative figure in the field. In his work he describes discourse very generally, as communicative actions and primarily emphasizes its role in the formation of social cognitions (Dijk, 2008).

Finally, the paper likes the idea of statements as the basic units of a discourse. The task then is to appropriately make a definition of statements that would be readily acceptable for its use in this paper, is constitutive of the main aspects of discourse and also agreeable with the intuitive understanding of a unit of discourse. For this, it is noted that a major aspect of the notion of discourse as found in various different places is its function of sense making. Thus, it is important that the products of discourse would have meaning infused in them. Based on this, the paper then goes on to make three important assertions. That are: (1) The products of discourse are meaningful unities or entities. (2) It can be commonly agreed that meaningful objects can be referred to as signs. (3) Signs are an integral part of the basic unit of discourse. And thus, from these assertions it follows that the product of discourse is the positive aspect or the visible aspect of discourse itself. Which is herein referred to as positive statements. From this the picture of discourse emerges to be visible as a collection of statements. And from this, discourse is defined as the selection of these statements that are made positive while rejecting the statements that are denoted to be negative. Now towards more clarity on the concept of statements, the idea of ‘ennunciative modalities’ is combined together with the description of a statement by Foucault to establish a multifaceted entity or object. One that is primarily filled with meaning and signification. But not just by the system of signs that is the semantic structure of the text produced. But also by the social position of the speaker or the author as well as the place of their occurrence.

To illustrate these definitions, the paper urges the reader to imagine a discourse within a classroom. Or in a general sense, the communicative actions that occur within the event of a class. Through the event, participants author or select various different statements that are infused with signification. Two distinct

statements show up that use the same system of signs ordered as, “Class Dismissed!” This is one aspect of the statement. These systems of signs form the underlying structure of their meaning. However, another aspect of the statement includes the authors of the signs and the place of their occurrence. In our example the first statement with the signs of “Class Dismissed” was authored by a student known for being the class clown from the last bench of the classroom. The other was authored by the Professor herself at the end of the class hour. Thus, these two statements containing the same terms or signs produce very different effects in listeners or readers and can be said to hold very different meanings. Thus, while a system of signs as an aspect of statement does imbue meaning into them, it is also moderated by the second aspect of a statement that consists of the author and the place of occurrence. Furthermore, it is also to be noted that for our definition of discourse, the negative statements or the statements that are refused the right of occurrence within a given area of discourse are also provided importance. These negative statements contrasted with the positive ones illuminate the inherent and often hidden rules of a discourse and also infuse it with meaning and signification. In our classroom example, negative statements may include the students from low income families that are often rejected seats in highly competitive university classes. Their confusions and questions. And also rude gestures or signs that are forbidden by punishment and thus rejected for occurrence by the students inside the classroom. All these also infuse the discourse or the communicative action at play with meaning and signification. However, for the purposes of this paper, the positive statements are taken as the crucial visible form of discourse that are readily available for analysis.

In summary, this paper is interested in discourse in such that discourse is communicative events that are a selection of statements. These statements as used in this paper refers to an entity infused with meaning and made up of two aspects. That is:

- A statement is an entity with meaning constitutive of two things.
    - The first thing is a system of signs and their meanings.
    - The second thing again consists of two other things:
        - The author of the signs.
        - The field where she speaks.

The overall meaning of a statement being a product of the meanings of the signs and the outside context in which they occur or the meanings endowed by both the aspects of a statement. The paper also uses the term discursive sphere often to denote the overall space where the selection of statements or discourse occurs. This can be simply thought of as the ‘arena’ of discourse.

Thus, to answer the research questions posed in this paper and in context of the discourse over ‘Posthuman’ in open access academia, the paper will investigate the positive statements found in this discursive sphere in terms of the semantic structure of the language used, the composition of the places or journals of occurrence and the authors. Further the authors as they are related to each other play a special role in our analysis as described in the next section.

Power and its Configurations

Similar to the notion of discourse the concept of power as well, is found in a large variety of discourses constructed with a variety of senses. It is widely

discussed within several fields of the social sciences like economics, political science, sociology, psychology, etc. Otherwise, the concept is also formed within the discourses of physics and mathematics. In the dictionary (in this case the Oxford Advanced American Dictionary) the term is defined simply as ‘control’ or the ‘the ability to control people or things’ (Oxford Learner's Dictionaries, n.d.). In the physical sciences the notion is intrinsically linked with work and is defined as the rate of change of work with respect to time (Halliday et al., 2018). The notion captures a quantity that measures the change or transformation caused upon an object by force over time. Then, in the social sciences, its different fields have different definitions and attached meanings to the concept of power. For example, within sociology, Dennis Wrong, an American Sociologist, in his book called Power, notes down a definition of power as, “the capacity of some persons to produce intended and foreseen effects on others”. Then there is the Weberian definition, as interpreted by Talcott Parsons, which defines Power as, “The probability within a social relationship of being able to secure one’s own ends even against opposition” (Wallimann et al., 1977). It is sometimes thought of in traditional social philosophy that power is a repressive phenomenon. Violent in nature and achieves its ends through forced subjugation and oppression.

However, Michel Foucault, specifically in his book The History of Sexuality (Vol 1) (Foucault, 1979) delving extensively into the notion of power, criticizes this traditional idea. In the book he highlights the inadequacy of conceiving of power through its mechanism of subjugation, or the incompleteness of the notion of a ‘repressive power’. He dubs this notion of power to be “anti-energy” and goes on to claim that the presence of this model might even actually be a tactic of power itself, in an attempt to hide its true form which would enable its hidden mechanisms to

function more effectively. He argues that while some of the mechanics of power may indeed be repressive or oppressive and achieved through juridical means within a state. There has been a steady emergence of new mechanisms that may not be reducible to simply the formation and enforcement of laws. Particularly, Foucault claims, since the French Revolution the exercise of power through law appears to be on the downturn. And a creative and productive mode of operation on the emergence. For example, he highlights the creation of the term ‘population’ and it being linked to economic and political problems. That is, he claims that in the eighteenth century, the population was conceived of and linked to problems such as ‘labor capacity’ and ‘manpower’. This caused a change in perspective of Governments towards its Governed. The Governed were no longer ‘subjects’, nor were they even ‘people’. They were now, a ‘population’ with attributes such as birth and death rates, life expectancy, fertility, health, etc. Then, Foucault sets apart his idea of power from the ‘Power’ that is a group of institutions and mechanisms that ensure the subjugation of persons inside a given territory. He also notes that his idea of power is not simply a form of domination of a group over another. And finally towards a description, he states that his power also does not have a ‘sovereign’ like the state as its basis, but it exists as multiplicities within a network of force relations. In his words:

“It seems to me that power must be understood in the first instance as the multiplicity of force relations immanent in the sphere in which they operate and which constitute their own organization; as the process which, through ceaseless struggles and confrontations, transforms, strengthens, or reverses them; as the support which these force relations find in one another, thus forming a chain or a system, or on the contrary, the disjunctions and contradictions which isolate them from one another;

and lastly, as the strategies in which they take effect, whose general design or institutional crystallization is embodied in the state apparatus, in the formulation of the law, in the various social hegemonies."

This paper interprets multiplicities in this context to refer to a function that takes an edge or a relation between two forces within a network or nexus of these relations to a real number or a quantity. The force relations themselves are conceived of as to signify two individuals engaged in discursive or communicative action towards each other. Together these conceptualizations make way to think of power as a structural or topological property within a sphere of relations that collectively seen forms a network or a graph.

Further, Deleuze in his book "Foucault" also expands on Foucault's ideas on on power. He also conceives of power to exist within relations of forces and reiterates Foucault's idea of the state or sovereign bodies to be a result of power rather than power itself. These forms then, traditionally thought of to be the base of power, are dynamic and arise out of the specific configuration or structure of the network of force relations in a given society at a time. Then, the notion of power as a structural or topological property of a network can also be found in the works of the Spanish sociologist Manuel Castells. Castells' works extensively conceive of society as a network of individuals and he has also devoted scholarly attention towards unravelling the intricacies of the concept of power in the information age. In this work titled 'A Network Theory of Power' (Castells, 2011), he declares "Power in the network society is exercised through networks". He points out various forms of power within a network such as Networking Power, Network Power, Networked Power and Network-making Power. Out of these Network-making power is termed as the most important and it is said to be majorly held by actors termed 'Programmers'. These

are people with the ability to significantly influence the cultural materials within a network and is said to hold this influence based on their position in the social structure or the social network structure of which they are participants.

Then the communication sciences and applied social research has a long history of searching for these agents of influence or locations of high power from which ideas flow to rest of society. A popular theory backing this search is the two-step flow of communications which postulates that ideas tend to flow from a small group of individuals to the rest of people with whom these influential people (or opinion leaders) are engaged in a communicative relation. Research to understand these influential agents has repeatedly found that the location of these individuals within the overall web (or network) of the group of people under study, (or simply ‘social location’ of these individuals) is majorly related to the influence or power they appear to hold. On the topic, American-Israeli sociologist and communication scientist Elihu Katz, in one of his important papers (Katz, 1957), summarizes the results of several papers regarding influentials as:

“The Decatur study finds gregariousness—"whom one knows"—related to every kind of leadership. The Rovere study reports that the leadership of the "local" influentials is based on their central location in the web of interpersonal contacts. Similarly, studies of rumor transmission have singled out those who are ‘socially active’ as agents of rumor”

In line with these ideas and conceptions of power and influence, this paper views the authors of the statements found in our discursive sphere to be engaged in communicative or discursive action with each other. And since the statements are academic this engagement or relation can be concretely observed through the act of

citations. Then, within this network of citations, there would be present nodes or locations of high power or influence. These authors and the ideas present in the statement of these authors can be considered as the influential ideas that are in the process of programing the network. To illustrate this idea, this paper asks the reader to imagine two cities and a road connecting them. This is a network of two nodes. Now from city A to city B, there is a one way 6 lane highway. However the other way round, in the path from city B to city A, there is only one lane. This is because there are a lot of cars travelling from city A to B but not from city B to city A. The cars in this image can be thought of as ideas and other cultural artifacts and it can be seen that the network structure (the lanes in the highways in this case) reflects the cars or ideas from city A entering and flooding city B at a higher rate than the other way round. Similarly, imagine three cities, A, B and C with the only paths, A to B and A to C between them. This three mode network clearly shows that a lot of cars or ideas move from city A to city B and city C (in these examples the number of lanes are linked with the number of cars moving in the highway in the specific direction). And thus, city A could be identified as an influential or powerful city through observation of the network structure within which the city exists.

Thus, this paper asserts that to identify the configuration of power in our discursive sphere is to describe the topology of the network formed out of the actors within the statements of our discursive sphere. This task can be achieved through the use of metrics such as the commonly used centrality measures. Several types of these measures exist. For example, between-ness centrality, eigenvector centrality, closeness centrality, degree centrality, etc. Perhaps for a very thorough analysis and high fidelity results, a composite of these measures would need be used. This would need to be custom designed to fit with every nuances of the theoretical frameworks

for influence and power as outlined above. However, for the purposes of this paper, the eigenvector centrality and degree centrality are considered appropriate and reflect the major aspects of influence and power discussed in this section.

Thus, considering the core concepts in this work to be outlined and clarified, the paper moves towards its analysis.

Data

To collect the data for our analysis, three different databases of academic publications were identified. Elsevier, Springer and Jstor. Elsevier is a Dutch academic publishing company and one of the five most prolific publishers in the academic publishing industry ranked by amount of scientific documents published (Larivière et al., 2015). Similarly, Springer is another member of the top 5 publishing companies that together accounted for 50% of all papers published in 2013 (Larivière et al., 2015). Jstor short for “Journal Storage” is an electronic archive of research publications. It is a not for-profit organization based in New York and houses a wide range of journals in its database (Taylor, 2001). The publications are accessible through its Constellate project which accommodates research by providing requested datasets.

For retrieval of the necessary data from these sources, queries were made through the Springer and Elsevier APIs. The term “Posthuman” was searched for and the metadata for all articles containing it in the 2 databases were collected. Then the metadata was used to identify the open access records and subsequently, the

open access article texts were retrieved and merged with their metadata. From Jstor, a text dataset was requested through their Constellate interface. And, text and article information from their open academic content containing the term “Posthuman” was retrieved. Then, the article information was used to obtain the metadata of these articles using the Crossref API. Crossref is an organisation which allows its members to register the DOIs of their publications. And, the registered DOIs are associated with a URL to the publication’s webpage as well as the metadata of the publication (Hendricks et al., 2020). Next, the metadata and the texts were merged. And finally, the three different datasets obtained from the three different sources were merged into one data frame containing the title, author, digital object identifier (doi), text and date. This data frame was then filtered for English articles and any duplicate was removed. Ultimately, dropping any missing values, there remained 491 observations of open access academic publications on the term “Posthuman” which were used for the analysis in this paper. All this data were retrieved on the 1st, 2nd and 3rd of April, 2023.

At a later point, on the 24th of April, 2023. Each article’s digital object identifier were used to retrieve their web of sciences identification number. The Web of Science is a citation database that indexes scholarly literature which up till recently was the only credible database with a comprehensive coverage of the research landscape (Norris & Oppenheim, 2007). Upon collection, the identification numbers were used to obtain the list of referenced authors in those articles. Upon collection of the list, each article author was attached with the authors they referenced, and removing any missing values, 51,236 acts of citation was observed between 13,240 authors.

Methodology

Textual Analysis

To analyse the statements found in the open access academic discourse of the Posthuman, this paper first looks into the textual component of the statements, i.e. the signs produced and the relations between these signs. For this, the text of the articles are processed using standard natural language processing techniques such as sentence segmentation, tokenization, parts of speech tagging, lemmatization and dependency tree parsing. All these were done with the help of UDPipe, an easy to use and freely available pipeline which accomplishes these tasks for multiple languages in accordance with the Universal Dependencies framework. The UD framework provides a standardized set of guidelines for language agnostic annotation of the syntactic and semantic structures in natural languages and has so far been applied to over 100 different languages. For details of this framework and its underlying theory see De Marneffe et al. (2021), Nivre et al. (2020) and de Marneffe et al. (2020). The UDPipe tool consists of one executable file (a binary) and one model for each of its supported language. It was built with the intention of providing a state of the art automated natural language processing tool that can be used by users with no special linguistic knowledge as well as little interest in programming (Straka & Straková, 2017; Straka et al., 2016). Since its launch, it has been widely used to help in multiple lines of academic investigations over text like Slater et al. (2022), Glaurdić et al. (2022) and Mochtak et al. (2020). For this paper specifically, the Udpipe Model ud-2.5-191206 for English language was used.

After the raw text was annotated, towards building an understanding of the corpus, this paper provides descriptions of the distribution of the parts of speeches, lists the most common nouns, adjectives and verbs (for a quick reference on how these parts of speeches are defined the reader can look at Universal Dependencies (n.d.), while a more linguistically oriented reader can find the details of these categories amidst the literature on the Universal Dependencies framework referenced earlier). Then, as nouns are defined as a part of speech typically denoting an entity in the theoretical background for the Universal Dependency framework (De Marneffe et al., 2021), the list of most frequent nouns are used to identify the most significant objects that are formed within this discursive sphere. Thus, providing some answers for RQ2.

Then, for further clarity on the significant objects in this discursive sphere as well as working towards answering RQ1, this paper falls back on a 53 year old tradition, which holds that it is word associations that represent the inherent meanings in texts, i.e. “meaning is contextual; meaning is networks” (Doerfel, 1998; Segev, 2021). And, implements a semantic network analysis (SemNet Analysis) to identify important objects in this discursive sphere and discover the different meanings of the Posthuman being constructed in it. The extraction of the semantic network is done using the R package for UDpipe which makes this task simple to carry out. For details on how to use UDpipe for analytical tasks like semantic network extraction see, UDPipe—Basic Analytics. (n.d.).

For the extraction of the structure of word associations or the semantic network of our data this paper uses the k-neighbourhood or k-window approach to assign word relations. That is, it is assumed that frequently co-occurring terms within a k window usually have an intellectual relationship and thus words falling inside a k

radius of each other are coded to be related. Specifically in this paper, k is kept a variable referring to the window of a sentence (as defined by the Universal Dependencies Framework). For the exact R code extracting the semantic network from the text in our dataset, see Appendix G. Furthermore, for an easily approachable overview of the technical aspects of this method as well an example of its exemplary use this paper highly recommends the work of Drieger (2013). The same paper (Drieger's, 2013) also highlights the advantages of SemNet Analysis as a robust method for both quantitative and qualitative analysis of text. Moreover, given the drastic increases in computer storage and processing power in recent decades in sync with the dramatic increase of freely accessible textual data over the digital realm, this method has been gaining in popularity. Through its use, not only does a practitioner join a distinguished stream of enquirers recorded to make the use of semantic networks for analysis since as far back as third century AD (Sowa, 1992), but also takes advantage of 21st century developments that allow for easy building of graph models (semantic network) of voluminous text. Furthermore, advancements in the mathematics of graphs also bestows upon practitioners multiple rigorous tools to make rich analysis of their networks of inquiry. For some recent examples of use of this method see, Fu et al. (2022), Xi et al. (2022), Featherstone et al. (2020), Ban (2019) and Kang et al. (2017).

After extraction of the semantic network, in a general sense the paper has a graph G = (V,E, F) where V is the set of nodes E is a set of two point subsets of V and F is a function that takes the members of the edge sets to a real number greater than or equal to 0. V is called the nodes or vertices, E is the edges and F is the weight of the edges. In this particular sense, V or the nodes is basically a collection of all the noun, adjective and verb words in the text of our dataset. E or the edges is

a relation which is coded into two words if they co-occur with each other inside the window of a sentence. And the value of F is simply the number of times a given co-occurrence has happened within the text. This value is always greater than or equal to 0 since it makes no sense for two words to occur together a negative number of times. Now, to examine the structure of this graph, the paper will draws its major hubs and presents its descriptive statistics. Particularly, its diameter, clustering co-efficient, average distance between two nodes (which are words in this case) and its degree distribution. The diameter of a graph is a metric that is equal to the length of the longest shortest path between 2 nodes of a graph (West, 2000). Clustering co-efficient is a measure of the extent to which nodes in a graph tend to cluster together. A cluster being simply a group of nodes (in this case words) that are densely connected (or related) to each other but not with nodes (in this case words) outside the cluster. For details on the calculation of this measure see, Barrat et al. (2004). A degree of a graph is the number of neighbours it has, neighbours being the nodes that a node is immediately or directly connected with (Jiří Matoušek & Jaroslav Nešetřil, 2009). Or in this case, the degree of a word is the total number of other words that it is related to.

Subsequently, the paper derives a sub-graph consisting of the noun words and calculates their degree centralities and eigenvector centralities. These are centrality measures commonly used in analysis of graphs to identify important nodes (Metcalf & Casey, 2016). The degree centrality of the node is just the degree of the node (Golbeck, 2013). While the eigenvector centrality of a node is calculated by taking into account the centrality scores of each of its neighbours as well. The basic idea being that a node whose neighbours are important is more important than a node with less important neighbours even if the actual number of neighbours are the

same. For a detailed description of its calculation see, Newman (2008) or Bonacich (1987). These two metrics are regularly used to find important concepts in a semantic network and it has also been found that they perform well to guide the identification of keywords in a given text (Beliga et al., 2015). Performing at par with the commonly used metric for keyword extraction called the TF-IDF (Term Frequency Inverse Document Frequency) but with the added benefit that these can be used to identify keywords given just one document of text (Lahiri et al., 2014). Thus, the paper uses these two metrics to list out the top words with the highest scores. To be precise, the top ten words with the highest scores in each of these two measures was first used to plot an induced sub-graph of these nodes (an induced sub-graph is a graph that contains a selected few nodes and all the edges between them, from the original graph). And second, their lists tabled. Subsequently, the paper uses these diagrams and lists along with the list of most frequent words to identify the most significant objects that are formed within this discursive sphere. Thereby providing a substantial and rigorous answer to RQ2.

Then, towards providing a comprehensive answer to RQ1, this paper looks into the measures of degree centrality, eigenvector centrality and local clustering co-efficient of the node in our network representing the term ‘Posthuman’. The local clustering co-efficient is similar to the global clustering co-efficient but only indicating the probability that the neighbours of the particular node is connected. See Barrat et al. (2004) for its calculation and detailed explanation. Then, crucially the paper attempts to disambiguate the term ‘Posthuman’ as used in our corpus. Since, this paper understands that ambiguity is a very common feature of any word in a language, (that is to say, almost all words can and usually do have more than one meaning), it stands to reason that a rigorous answer to RQ1 can only be provided

through disambiguating the different meanings of the term present in the corpus. For a comprehensive pondering on word ambiguity and the naivety of the belief that words have only one meaning, this paper highly recommends the engaging piece by Robinson (1941). For this, the paper immediately, charts the distribution of the parts of speech for the term ‘Posthuman’. Furthermore, the task of word disambiguation has been at the centre of a lot of attention from the natural language processing community and a very effective technique for it is through the examination of semantic networks (Dorow, 2006). That is, in our case, through examining the connections or edges in the neighbourhood of the node representing the word posthuman in our semantic network we are able to identify the different meanings of the term in the corpus. And then by also examining the neighbourhoods of some of the most important neighbours, we are able to gain a relatively comprehensive understanding of how the posthuman is being constructed in this discourse (through seeing the different meanings that are being assigned to the term in addition with how the term is being modified and described). For similar work see Medriano and Torio (2022) and Nulty (2017).

To examine the neighbourhood of the node representing ‘Posthuman’, the paper constructs a degree 1 noun ego-graph of the node in focus. An ego graph is a sub-graph containing the ego (in our case the node representing the term ‘Posthuman’) and all other nodes that are at a given distance (the degree) from that node along with all the edges in between. Distance here being defined by the number of edges in the shortest path from node A to node B. So an ego-graph of degree 1 of ‘Posthuman’ would give us a subgraph that contains the node representing ‘Posthuman’ and all its neighbours. The paper trims this extracted ego network to only preserve the important connections by deleting any node and its

connecting edge with a very low weight. Then, this paper uses a community detection algorithm to find the different communities in this ego-graph[1]. And subsequently, plot the graph for a visual analysis. Communities in a graph are groups of clustered together nodes that have a lot of edges within themselves as compared to the nodes outside the group (Fortunato & Castellano, 2007). In our network these communities would represent the different meanings or senses of the term 'Posthuman'. The algorithm used to detect these communities is known as the Cluster Walktrap Algorithm. This algorithm in simple terms iteratively simulates random walks on the network and identifies communities as sets of nodes with high connectivity between themselves. For a detailed overview of this algorithm see, Pons and Latapy (2005). And then, the algorithm used to plot the networks is called the force-directed layout algorithm by Fruchterman and Reingold (1991). This algorithm creates visually pleasing layouts through following the basic principle that connected vertices should be attract each other in general but repulse each other if they are too close. This whole procedure (from extracting the ego networks to plotting them with detected communities highlighted) is then also applied to extract, plot and analyse some important neighbours of the term 'Posthuman' or some important concepts related to the concept of 'Posthuman' in our corpus. Thereby providing a rigorous and comprehensive answer to RQ1.

Citation Analysis

Then, towards analysing the second dimension of our collected statements. That is, the speakers of the sentences and the place of their occurrence. For this, the paper tabled the list of the 10 most frequent journals. Moreover, the list of the ten

[1] *For detailed information on this algorithm see, Blondel et al. (2008).*

most frequent authors are also tabled. Then towards observing parts of the configurations of power in this discursive sphere the paper conducts a citation network analysis of the papers collected. Citation Network Analysis has a rich history in the field of Bibliometrics. Bategelj (2003) attributes the origin of the method to Garfield et al. (1964). In which the notion of citations as networks has been credited to Dr. Gordon Allen. Since then, the method has been steadily used to draw academic landscapes (Kajikawa et al., 2007; Calma and Davies, 2017), understand the influence and role of the network actors (Pieters et al., 1999; Calma and Davies, 2017), identify communities of authors or papers (Jo et al., 2009) and detect emerging research trends (Shibata et al., 2011). This kind of analysis allows a researcher to use tools from network science to effectively identify important or influential actors. It also allows through visualisations of the network model and its communities a substantial picture of the landscape of the research fields or topics in regards to the papers in it or their authors. For some recent examples of its use, see Jeong et al. (2022), Leng and Leng (2021) and Martinez-Perez et al. (2020).

To apply citation network analysis, the paper takes the previously formed citation data and extracts a citation network. This directed weighted network has its nodes as the authors that have been cited or have made citations. While the edges of the network or the graph, represent the act of citation from an author to another. The weights of the edges equals the number of citations between the corresponding to two authors (of the same direction). The paper then recodes some author names to standardize them. For example, Avery Jones and Avery J. (hypothetical names) referred to the same author. Thus, Avery J. was recoded to Avery Jones. Then, for a description of the citation network, similar to the description of our earlier semantic network, the degree distribution was plotted. And then, its diameter, clustering co-

efficient and mean distance between two nodes (authors in this case) was calculated and tabled. Towards visualising the network's 'backbone'. 5% of the nodes with the highest degrees were identified and an induced sub-graph of these nodes was extracted from our original graph. It is argued that since the distribution of the degrees follows the power law distribution (i.e. there are few nodes with high degrees and the rest have very low degrees) the induced sub-graph maintains much of the basic structure of the entire network. Then, from this sub-graph, different communities were extracted through the use of the cluster walk-trap algorithm (Pons and Latapy, 2005). Further, the nodes were colour coded according to their membership to a community. And finally, the sub-graph was plotted.

To also visualise the "Active Authors" and the "Inactive Authors", the authors were coded according to their presence amongst the papers extracted. That is, if an author had authored a paper that was amongst those collected for analysis by this paper, she is an "Active Author". Otherwise, "Inactive". Following this coding, the entire network was plotted through the use of the igraph's layout_with_lgl function (for details on this function see, Csardi, n.d.). This function uses a version of the Large Graph Layout algorithm. The algorithm is an effective one to visualize large networks that contains hundreds of thousands of vertices and millions of edges (Adai et al., 2004). It is for connected graphs so in our case the algorithm plots the largest component.

Then, moving towards answering RQ3, the paper extracts the largest component of our citation network and calculates the eigenvector centrality scores (with directions considered). The scores are then used to identify 10 nodes (or authors in our case) with the highest eigenvector centrality. In the context of a citation network, this measure has been used to identify important papers (Diallo et

al., 2016) and also to measure a journals' scientific prestige (González-Pereira et al., 2010). Overall, the measure is a popular tool in Social Network Analysis and has been used to identify prominent or key authors in research professionals' relationship network (Bihari & Pandia, 2015), detecting opinion leaders in online communities (Litterio et al., 2017), influential physicians on Twitter (Riddell et al., 2017) and political opinion leaders on Twitter (Dubois & Gaffney, 2014). The paper thus uses this metric to identify the powerful or influential actors in the network of citations. These 10 nodes, actors or authors identified through the eigenvector centrality score are used to first extract an induced sub-graph of these nodes from our citation graph. This sub-graph is then plotted. The 10 authors are then also tabled. Finally, the distribution of all the eigenvector centrality scores was plotted to gauge the configuration of power in our discursive sphere. To provide an answer to RQ3.

Ultimately towards enriching the answer for RQ1 and RQ2, the thesis uses the list of most influential authors, filters for the active authors, proceeds to find their most cited article in the list of our collected articles. These articles are then used to perform a close reading to describe the ideas found in them.

Results and Conclusion

Now to present the results of the analysis in this paper, we begin by examining the distribution of the parts of speech as illustrated in figure 1.1. Here, it is immediately noticeable that our text contains a high proportion of nouns, which is the most frequent part of speech. Nouns are then followed punctuations, followed by adpositions, verbs and finally adjectives. The paper notes that this distribution deviates from standard non-fiction text as found by Mendhakar (2022) with a higher share of punctuations and adpositions. While, the high value or share of nouns is in

line with the regular high frequency of nouns in standard non-fiction texts. The paper attributes the higher share of punctuations in our text to be possibly explainable by the style of writing found in academic non-fiction text which are riddled with frequent usage of within text citations requiring an increased usage of punctuations. As per the adpositions, the paper understands this part of speech to be a cover term or an umbrella term for pre-positions and post-positions. These are typically found before or after noun phrases and are primarily used to describe relationships between the noun phrases and the verbs within a given clause (Dryer, 2013). Given this usage, it sounds reasonable to attribute their high frequency again to the style of academic texts which are often detail oriented, descriptive and aims to be specific.

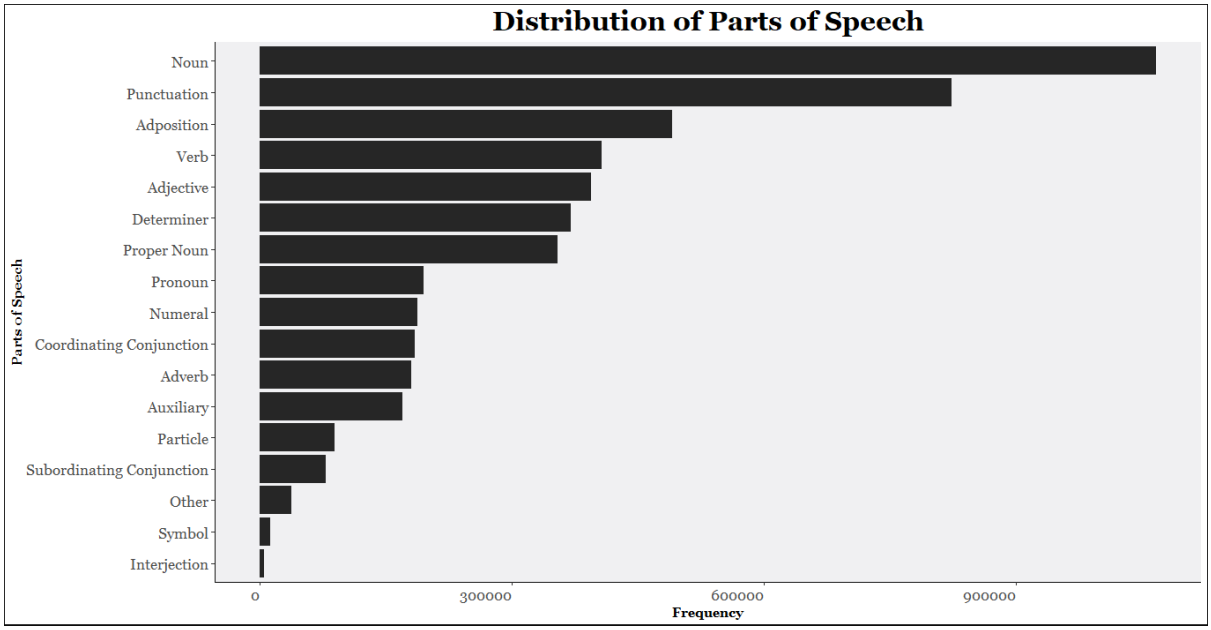

Fig 1.1 *Distribution of Parts of Speech*

Then, the paper presents the distribution of degrees from analysis of our semantic network. This can be seen in figure 1.2. From this plot, we can see that there are few nodes with high quantities of connections or degrees while majority of the nodes have a low count of degree. This is suggestive of a power law distribution. Which in turn implies that our semantic network is scale free (i.e. the degree

distribution follows the power law curve). This scale free property of a graph has been frequently and characteristically found to be present by previous research in networks build from natural language through co-occurrences like our semantic network. For example, this has been previously observed in the study by Cancho & Sole (2001). Then, in the realm of words and co-occurrences, this property of our semantic network means that in our text, there exists a few words which co-occur with a lot of other words. But commonly, most other words in our text only tend to co-occur with a few other words.

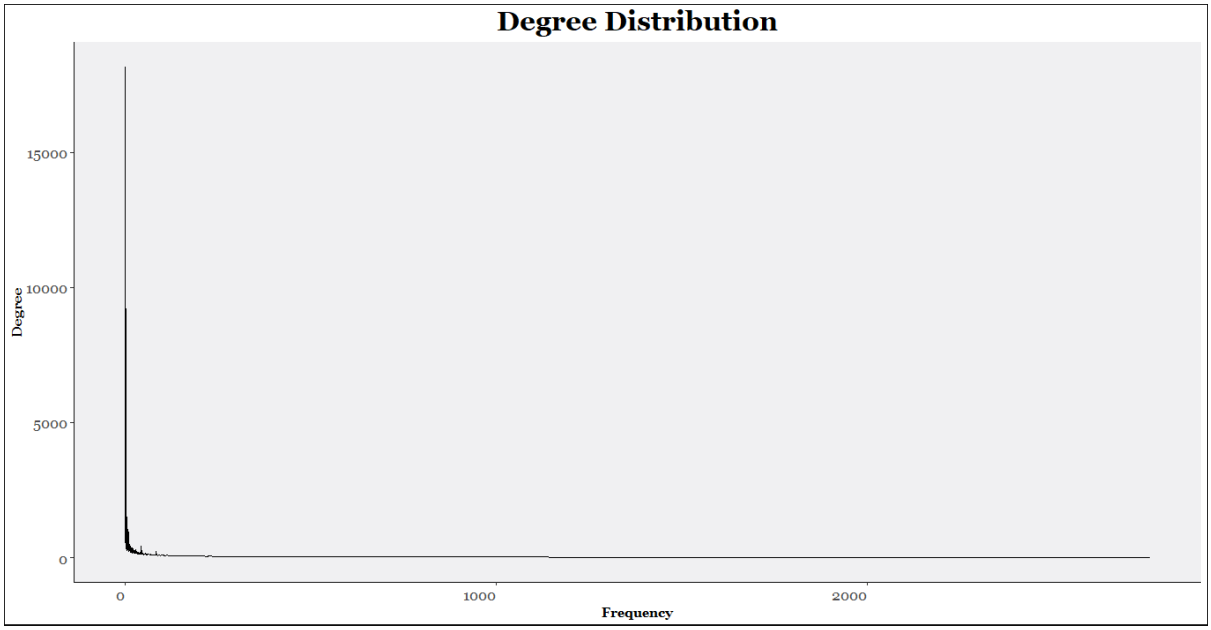

Fig 1.2 *Degree Distribution*

Next, the descriptive statistics for our semantic network is tabled over table 1.1. Here it can be seen that our semantic network has a wide diameter of 14, a clustering co-efficient of 0.177 and an average distance of 2.83 between two separate nodes. To analyse these statistics, first the short average distance of 2 nodes which is between 2 and 3 is noted. This fact endows our network with the

small-world effect (Cancho & Solé, 2001). That is, most nodes in our networks are not directly connected. Yet, the connections are configured in such a way that most nodes can be reached from every other node by a short path of intermediate nodes. Then, both the clustering co-efficient and the diameter suggests that our words or nodes are not very clustered together in our semantic network. In the context of the text which our network models, it can be said that there are a large number of words that do not typically co-occur together or different concepts in our complete set of statements are diverse and are typically not densely related to each other. This is suggests that the text in our dataset is from a wide variety of academic disciplines that typically do not focus on the same things. And nor do they describe their objects of study in similar ways. Thus, we suspect that the open access academic discourse of Posthumanism as captured in our study has participation from a diverse variety of academic disciplines.

Descriptive Statistics

Name	Statistic
Diameter	14.0000000
Clustering Coefficient	0.1769503
Average Distance	2.8308298

Table 1.1 *Descriptive Statistics of Semantic Network*

Moving towards the results of the frequency analysis. The paper lists the most frequent nouns as found in our text in 1.2. Here we can notice that the word ‘way’

has the highest frequency. Followed by ‘technology’, ‘research’, ‘life’ and ‘practice’. In a general sense of the term, this paper perceives the word ‘way’ to indicate a path to something. In the academic context, which is the context of the text data under analysis, the paper asserts that the term might refer to processes, perspectives, methodologies, etc. Then the term “technology” is often used in academia by various disciplines to refer to processes and systems. These processes and systems typically portray a frame consisting of human and hardware. Or can also signify methodologies, when used in academic literature (Kline, 1985). The paper underscores the high frequency of these two terms (way and technology). And also notes the high frequencies of terms such as “system”, “process”, “work” and “body” as found within our text. And together suggests that these words appear to all indicate the salience of a theme that is maybe best termed ‘processes and methodologies in regards to bodies’. Meanwhile, it is also to be noted that the presence of the term “life” suggests the presence of a biological topics in our text data.

Most Frequent Nouns

Nouns	Frequency
Way	7,236
Technology	7,118
Research	5,595
Life	5,332
Practice	5,287
World	5,104
Time	4,947
Body	4,711

Nouns	Frequency
People	4,566
System	4,499
Process	4,349
Study	4,257
Work	4,199
Nature	4,068
Space	4,057

Table 1.2 *Most Frequent Nouns*[2]

Next, towards more understanding of the nature of our text, this paper presents the list of the most common adjectives in our text data tabled in table 1.3. This shows that things in the discursive sphere of Posthumanism in open access academia as captured in our dataset or archive are most often described as “Human”. This adjective is then followed by “Other”, “Social”, “Such” and “New”. These words suggest that topics dealt with in this discursive sphere are objects of social nature. They are also often new or novel and not in line with regular or normal conventions and expectations. These words, together with the presence of adjectives such as “Different” and “Digital”, and the frequent nouns found previously, strongly suggests that this discursive sphere very frequently speaks of novel systems and processes that involve humans and information. Then, the presence of the adjective “Ethical” also implies that ethicality is an important topic in major parts of our text data. This would be in line with the focus on novel emerging systems and processes involving humans.

[2]*All counts are shown for lemmas.*

Most Frequent Adjectives

Adjectives	Frequency
Human	12,888
Other	7,571
Social	7,348
Such	6,964
New	5,736
Different	4,248
More	3,737
Digital	3,689
Many	2,809
Ethical	2,546
Own	2,539
Political	2,442
Critical	2,427
Cultural	2,373
Important	2,244

Table 1.3 *Most Frequent Adjectives*

Then finally in our set of results from the frequency analysis, we have the list of the most common verbs tabled in table 1.3. From the table it can be seen that the top most frequent verb as found in our text is ‘Be’. This is suggestive of a dense presence of existential discussions in our text. The suggestion of this kind of density is then also backed by the presence of the verb ‘Become’. Furthermore, it is also seen from this from the table that there is a high concentration of verbs that are related to cognition. Such as ‘Learn’, ‘Consider’ and ‘Think’. These put together are indicative of the intellectual nature of the text under inspection. And finally, the paper

also notes verbs such as “Make”, “Use” and “Do”. And comments that these are further suggestive of talk about ‘processes’.

Most Frequent Verbs

Verb	Frequency
Be	9,783
Have	8,817
Make	6,689
Use	5,943
See	5,668
Become	4,557
Take	4,064
Do	3,598
Include	3,521
Think	3,351
Base	2,968
Give	2,929
Consider	2,896
Provide	2,856
Learn	2,713

Table 1.3 *Most Frequent Verbs*

Then, to begin the analysis of important concepts in our discursive sphere through our semantic network, the paper plots the diagram of the major hubs in figure 2.1. The major hubs here are defined as the top 5% nodes with the highest

number of degrees. And the diagram of their induced sub graph is shown in the figure. An induced sub graph being the graph that only contains a selection of nodes from the original graph (in this case, the nodes that are designated as major hubs) and the edges between them. This diagram can be described as a hairball and reflect the fact that the major hubs are densely connected with each other. This fact was also indicated through the small world effect found to exist within our semantic network earlier. Primarily this diagram is to present the reader with a visualisation that makes our semantic network tangible. The reader can imagine all these hubs to be the base of, or at the centre of, several different clichés or communities of nodes that would exist within our loosely clustered graph.

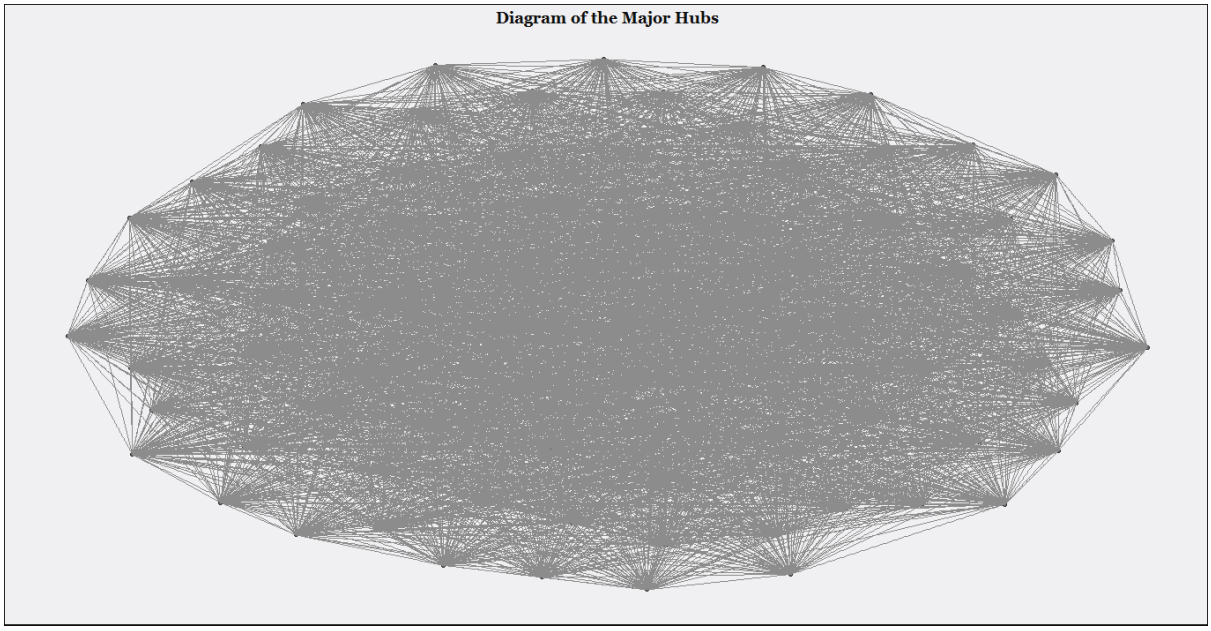

Fig 2.1 *Diagram of Major Hubs in Semantic Network*

Next, we see the induced sub-graph of the noun network consisting of the nodes with the highest degree centrality scores (or simply the highest degrees) in figure 2.2. And, we also see their list with degree values in table 2.1. The graph drawn in a circle layout not only shows the top concepts according to their degree

centralities but crucially also makes the relationship they have with each other apparent. This is done through the edges whose darkness or lightness reflect the frequency of their co-occurrence in our text data. From the diagram and the list, we can see that the words ‘way’ and ‘technology’ along with ‘life’, ‘practice’, ‘world’, ‘time’ and ‘body’ are present here as well. These were also found amidst the list of the top 10 high frequency nouns. But now, from the diagram, we also see how these words relate with each other. And we find the words ‘way’ and ‘world’ to be closely related. That is, these words co-occur a lot in our text. This is suggests an interpretation of ‘way’ as a perspective (i.e. a ‘way’ to see things) may explain a major part of its use in this discourse. Then, from the diagram, we can also observe the close link between ‘way’ and the ‘technology’ suggesting a process interpretation of way, one that is being modified by technology. Further, the dark tie between ‘body’ and ‘way’ as well as ‘body’ and ‘technology’ hint at an image of a body aided by technology engaged in a process. Not to ignore the presence of ‘form’ who’s dark tie with ‘life’ and ‘technology’ which first pops out the noun phrase life-form and draws a ‘biologically’ inclined image of life-forms together with technology or systems. Then, the word ‘example’ and its weak ties with the other words with the highest degrees suggests a discourse that articulates its ideas through the uses of several examples. This, together with ‘p.’ (which appears to be an artefact of the usage of inline citations with page numbers) is indicative of the academic writing style employed in this discursive sphere.

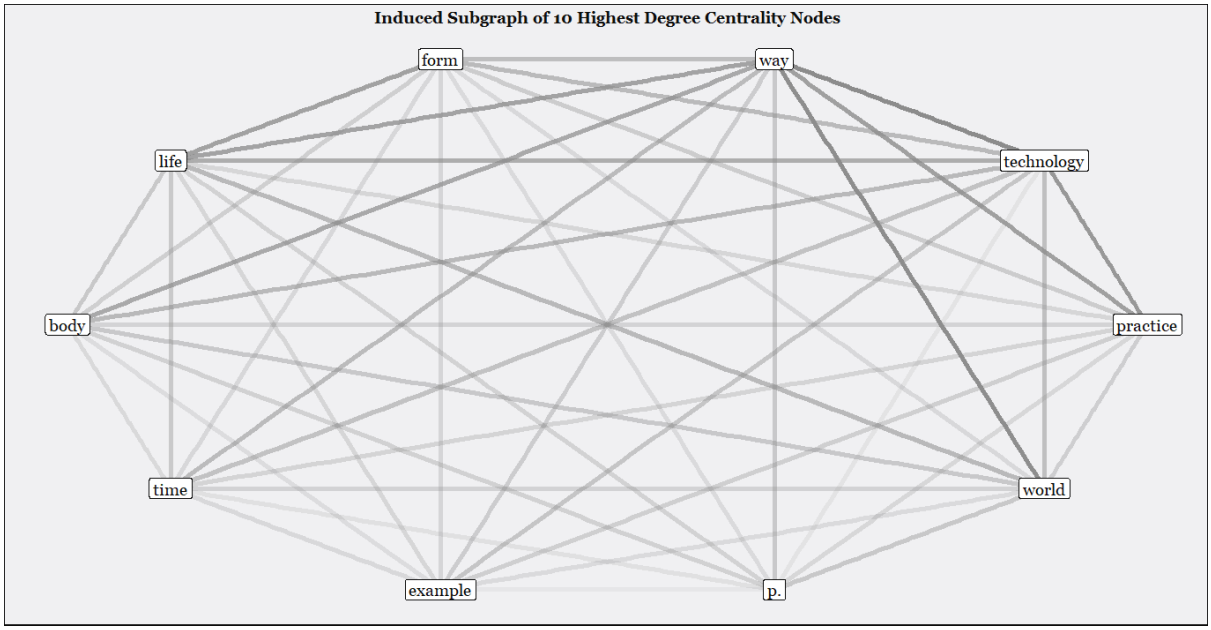

Fig 2.2 *Induced Sub-graph of the 10 Nodes with the Highest Degree Centrality Score*[3]

Top 10 Degree Centrality Words

Lemma	Degree
Way	7,988
Technology	6,891
Time	6,858
Body	6,626
Example	6,587
Life	6,502
World	6,495
Form	6,348
p.	6,052
Practice	6,030

Table 2.1 *List of the Top Ten Words with the Highest Degree Centrality Score and Their Degrees*

[3] *The transparency of the edges (or the line between two words) is directly correlated with the weight of the edges (or the frequency of collocation of the two words).*

Then, figure 2.3 shows us the induced sub graph of the terms with the highest eigenvector centrality scores within the noun sub-graph of our semantic network. While, table 2.2 lists them and shows their values. Here again we see similar words repeat with the only change being that ‘p.’ is not present on this list and instead the term ‘process’ is found. Which however, was previously noted in the list of most frequent nouns. Again, strong relations are observed between the terms: ‘way’ and ‘world’, ‘way’ and ‘technology’, ‘way’ and ‘body’ and ‘way’ and life’. These associations suggest the presence of the themes of ‘perspectives to the world’ and ‘technological processes’. And together with the strong tie between ‘body’ and ‘technology’ and also ‘body’ and ‘way’ draws an additional theme of ‘configurations of body and technology’.

All these put together are highly indicative of the most important objects formed in our discursive sphere to be ‘structures of being’ (evident from the words ‘life’, ‘form’ and ‘body’), ‘technologies/practises/processes’ and ‘perspectives’ (evident from the strong ties between ‘way’ and ‘world’).

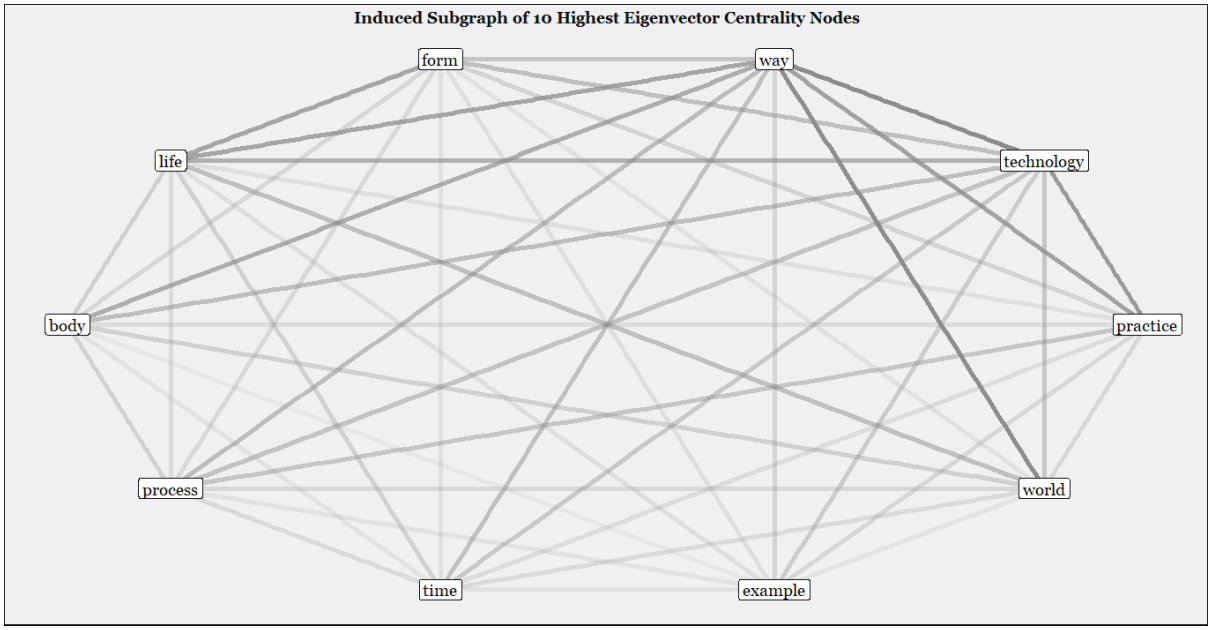

Fig 2.3 *Induced Sub-graph of the 10 Nodes with the Highest Eigenvector Centrality Score*

10 Highest Eigenvector Centrality Words

Lemma	Eigenvector Centrality
Way	1.0000000
Technology	0.9449022
Time	0.9441601
Example	0.9339652
Life	0.9280621
Form	0.9254906
World	0.9145225
Process	0.9074993
Practice	0.9059091
Body	0.9032575

Table 2.2 *List of Top 10 Words with the Highest Eigenvector Centrality Score*

Now, moving towards results regarding the construction of the term ‘Posthuman’ in our captured discursive sphere, this paper first plots figure 3.1 which contains the distribution of the parts of speech of ‘Porthuman’. That is, it shows us the frequency with which the term is used as the respective parts of speeches. From the diagram, it can be clearly seen that the term is used as an adjective a lot more than as a noun. Thus, this paper asserts that various things in our discursive sphere are being described as ‘Posthuman’. And this is being done with more frequency than the object ‘Posthuman’ is being described. Thus, this fact put together with the important objects found earlier suggests the presence of three types of ‘Posthuman’

things: (1) ‘Posthuman beings’ (2) ‘Posthuman processes’ and, (3) ‘Posthuman perspectives’.

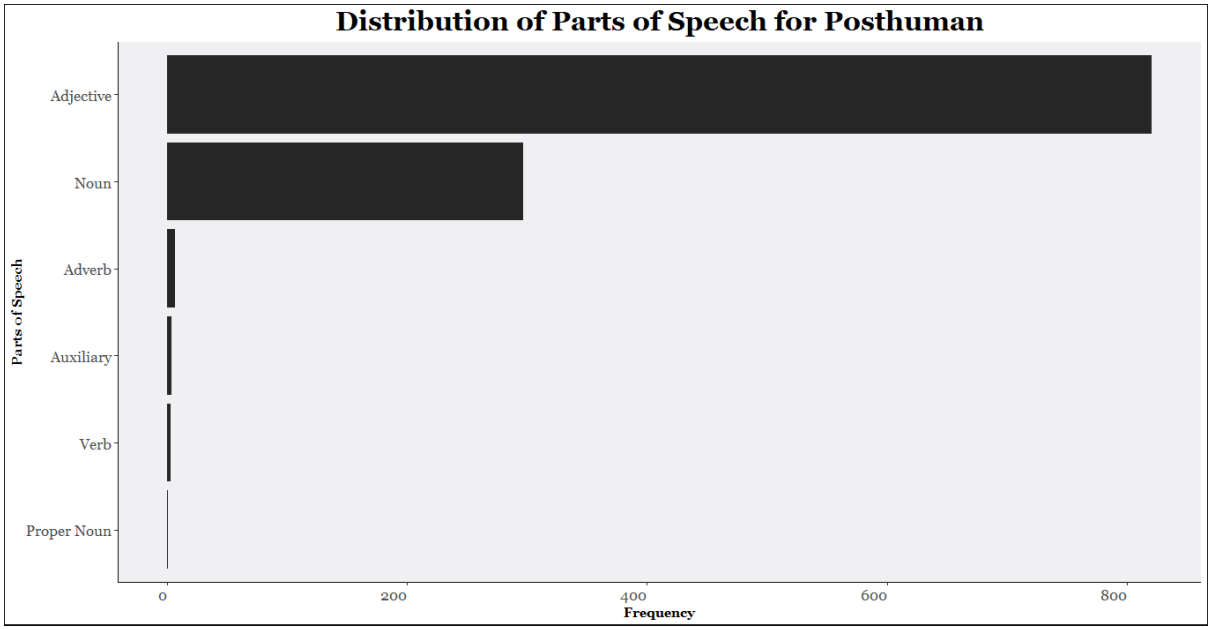

Fig 3.1 *Distribution of Parts of Speech for the term ‘Posthuman’*

Subsequently, this paper plots the the degree 1 ego network of the node representing the term ‘Posthuman’ in our semantic network. This diagram can be seen in drawn in full colour in figure 3.2. Here it is shown that 5 communities were detected in this ego-graph by the cluster walk-trap algorithm. These communities are marked in the diagram by the colour of the edges. While the transparency or the darkness or lightness of the edges in the diagram are indicative of the frequency of co-locations of the two terms, connected by that edge, in our text. The structure of communities detected indicates a polysemy of the term ‘Posthuman’ in our text. With the surrounding communities denoting the different meanings or senses of the term. One sense of the term is then found within the group of words in the red region of the diagram. Here, the presence of words such as ‘body’, ‘subject’ and ‘human’ indicates the construction of a ‘Posthuman being’. Then, in the same community we see

concepts and adjectives such as ‘work’, ‘way’, ‘new’ and ‘other’ which incites the image of a working being that is new and other which can be labelled as a ‘Posthuman process’. That is, work being done by ‘Posthuman beings’. Then, two separate communities formed by the lone terms ‘voice’ (in blue) and ‘subjectivity’ (in green) hints at two types of ‘Posthuman perspectives’. One with a ‘Posthuman’ voice and another with a ‘Posthuman’ subjectivity.

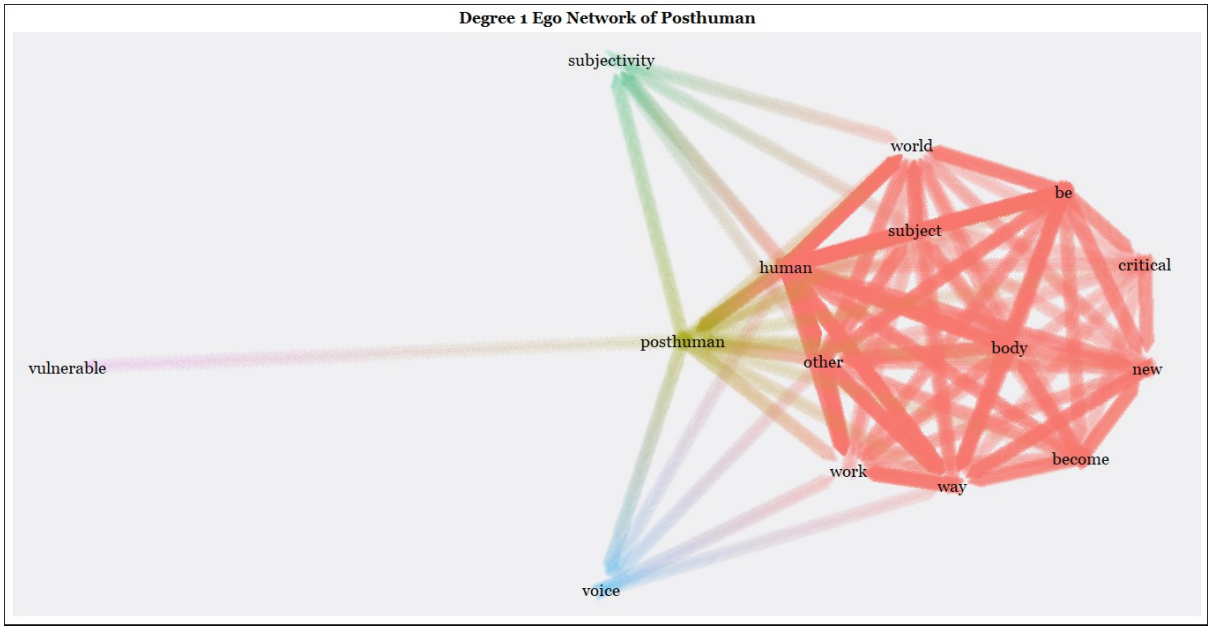

Fig 3.2 *Degree 1 Ego Network of ‘Posthuman’ with Minor Connections Trimmed*[4]

Next, this paper delves into the degree 1 ego-network of the term ‘way’ which has so far been well recognised as a prominent term in our discursive sphere. This diagram is drawn in figure 3.3. So far, the paper has suspected the usage of ‘way’ as a ‘perspective’ as well as ‘way’ as a ‘process‘ within our discursive sphere. Now, from the figure we can see three distinct communities recognised by the cluster walk trap algorithm. The community marked in red in our diagram contains words such as ‘see’ and ‘think’, these two words together with the adjective different implies a

[4] The colours of the edges of the graph denote the community of its starting and ending nodes as found by the cluster walk-trap algorithm. While the transparency of any edge denote the weight of the edge or the frequency of collocations.

'perspective' meaning of 'way' is dominantly present in our text. The fact that the term itself is included in the red community also suggests this meaning is dominant. However, another large community is formed out of terms such as 'social', 'technology', 'human', 'life', 'world', 'work' and 'practise'. Together with the verbs such as 'be', 'use' and 'have' and 'make', along with the adjectives 'such' and 'new' suggests a sense of 'way' as a 'socio-technical process' that is 'new'. Then, the connection with 'know' also suggests a usage of 'way' as a methodology for knowledge.

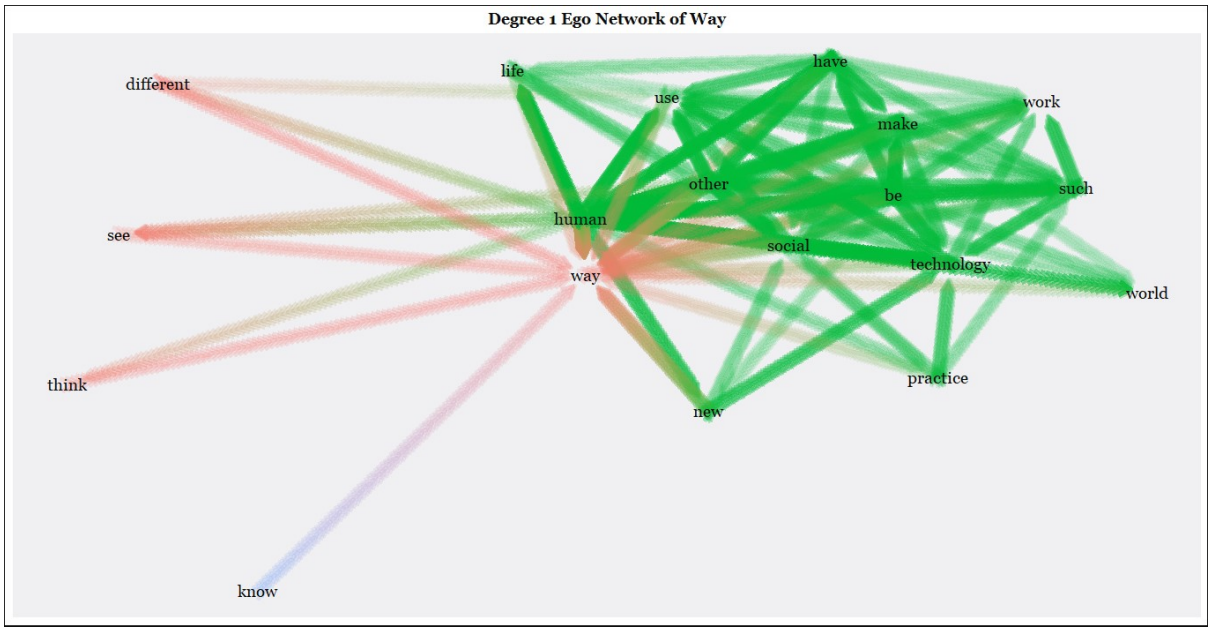

Fig 3.3 *Degree 1 Ego Network of 'Way' with Minor Connections Trimmed*[5]

Next the paper zooms in on another important term around the 'Posthuman', 'Work'. In figure 3.4 the degree one ego network is drawn. Similar to the previous diagrams, the communities in this network as found by the cluster walk-trap algorithm is indicated by the colours of the edges. While the darkness or lightness of the colours (or the transparency) is reflective of the strength of the edge that is

[5] The colours of the edges of the graph denote the community of its starting and ending nodes as found by the cluster walk-trap algorithm. While the transparency of any edge denote the weight of the edge or the frequency of collocations.

directly proportional to the frequency of co-locations of the two terms connected by that edge in the text under analysis. In this diagram we can see ‘work’ being used in the sense of ‘meaningful work’ demarcated by the blue community containing only the word ‘meaningful’. Meanwhile, the presence of the community marked in red containing terms such as ‘social’, ‘technology’, ‘human’ and ‘practise’ suggests a meaning of ‘work’ in terms of socio-technological processes. While in the same community terms such as ‘see’ and ‘research’ also suggests the presence of a meaning of ‘work’ in terms of ‘research work’. The term ‘work’ itself being its own community in purple suggests the polysemy of the term in our text.

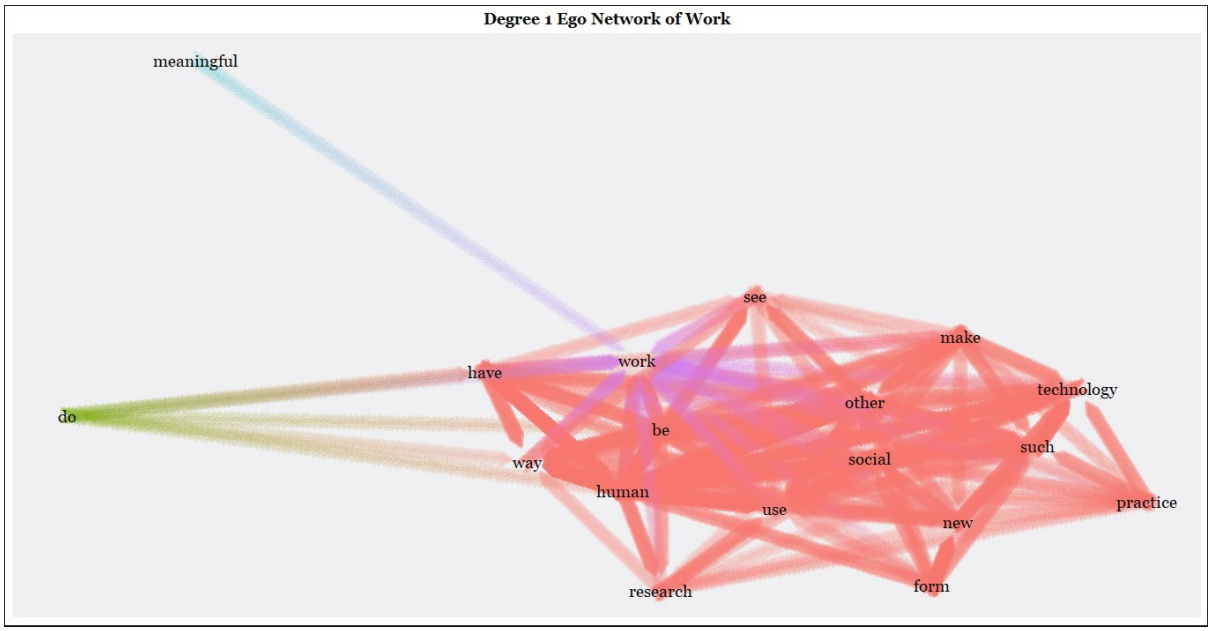

Fig 3.4 *Degree 1 Ego Network of ‘Work’ with Minor Connections Trimmed*[6]

Further, in figure 3.5, the paper looks at the 1 degree ego network of the term ‘world’. Here, in its large red community, we can see the existence of words such as

[6] The colours of the edges of the graph denote the community of its starting and ending nodes as found by the cluster walk-trap algorithm. While the transparency of any edge denote the weight of the edge or the frequency of collocations.

'social', 'human' and 'technology' suggests a world of 'socio-technological' processes is dominantly conceived of in our discursive sphere. There is also the term 'life' present in this community. This suggests that the world as constructed in our discursive sphere is one with biological life beings in it. Thus, in all the diagram is indicative of the usage of the term 'world' to refer to a landscape consisting of a social and technological systems along with biological processes and beings. Further, another sense is also seen in the community with the sole term of 'real'. This suggests a sense of the term referring to a landscape or environment that is 'real' in nature.

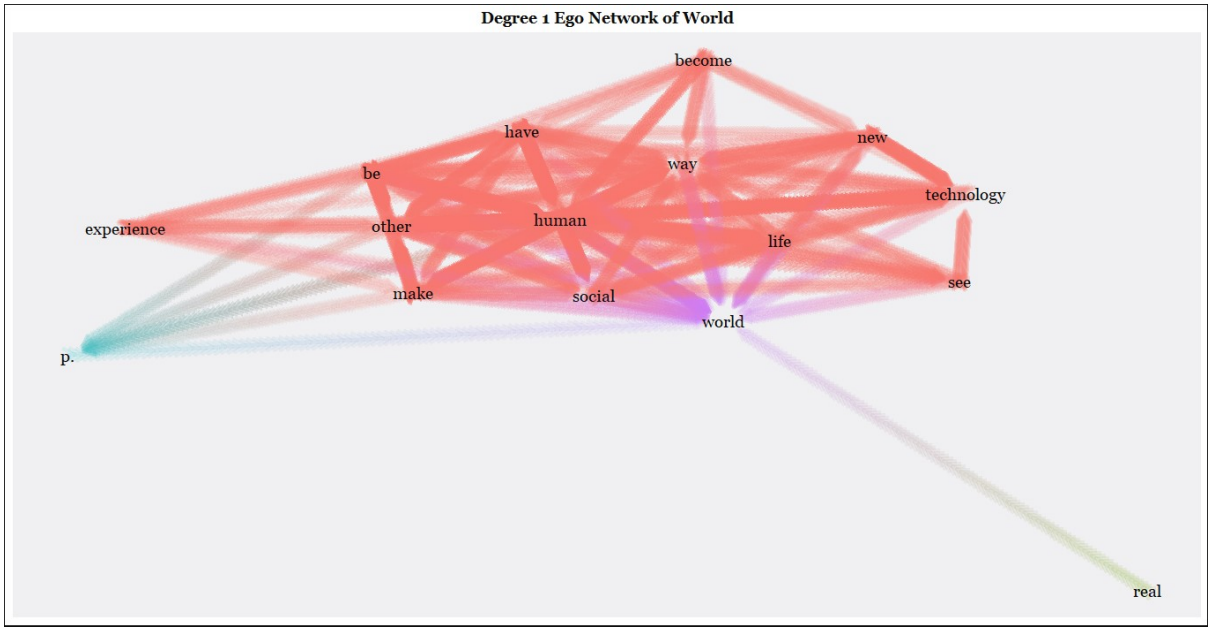

***Fig 3.5** Degree 1 Ego Network of 'World' with Minor Connections Trimmed*[7]

Next, in figure 3.6, the paper looks at the degree 1 ego-graph of the term 'Body'. Here, a dominant meaning emerges out of the red community in the graph containing the terms 'human', 'body' and 'part'. This community indicates a dominant

[7] The colours of the edges of the graph denote the community of its starting and ending nodes as found by the cluster walk-trap algorithm. While the transparency of any edge denote the weight of the edge or the frequency of collocations.

presence of the term ‘body’ to refer to the human body and its parts. Another community in blue with the individual term ‘physical’ suggests a sense of body referring to something physical. Then, the community in purple suggests a meaning of ‘body’ as one part of being, in a mind-body dualist paradigm. Furthermore, the large green community contains words such as ‘work’, ‘technology’ and ‘social’. This community might encompass a meaning of the term as an object within a socio-technological system.

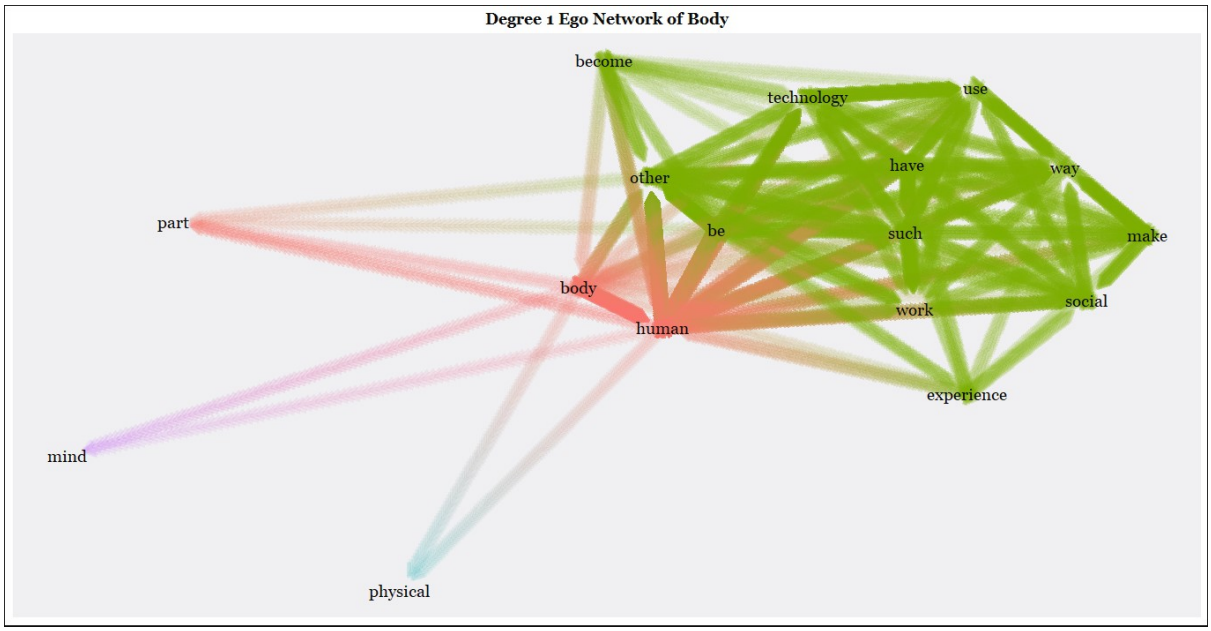

Fig 3.6 *Degree 1 Ego Network of ‘Body’ with Minor Connections Trimmed*[8]

In figure 3.7, the paper sees the degree 1 ego network of the term ‘Technology’. In this graph or network, we see 5 distinct communities marked by the cluster walk trap algorithm. Aided by this demarcation, we can see the green community with words such as ‘human’, ‘social’, ‘practice’, ‘new’ and ‘technology’. This suggests a dominant usage of the term ‘technology’ to refer to new technical processes with a social and human dimension. Then, the group marked in green

[8] The colours of the edges of the graph denote the community of its starting and ending nodes as found by the cluster walk-trap algorithm. While the transparency of any edge denote the weight of the edge or the frequency of collocations.

contains a single word that is ‘digital’. This is indicative of the use of ‘technology’ to refer to ‘digital technologies’ in our discursive sphere. Further, ‘technology’ clubbed with ‘science’ as in the purple community suggests a use of the term to denote the applications of scientific enquiry. And, the community in blue with the term ‘development’ is suggestive of a sense of ‘technology’ as advancements bettering human lives. The large red community here, contains terms such as ‘work’, ‘other’, ‘way’, ‘use’, ‘make’. This indicates a sense of the term that is a ‘different than normal’ or ‘otherly’ process that ‘makes’ and ‘uses’.

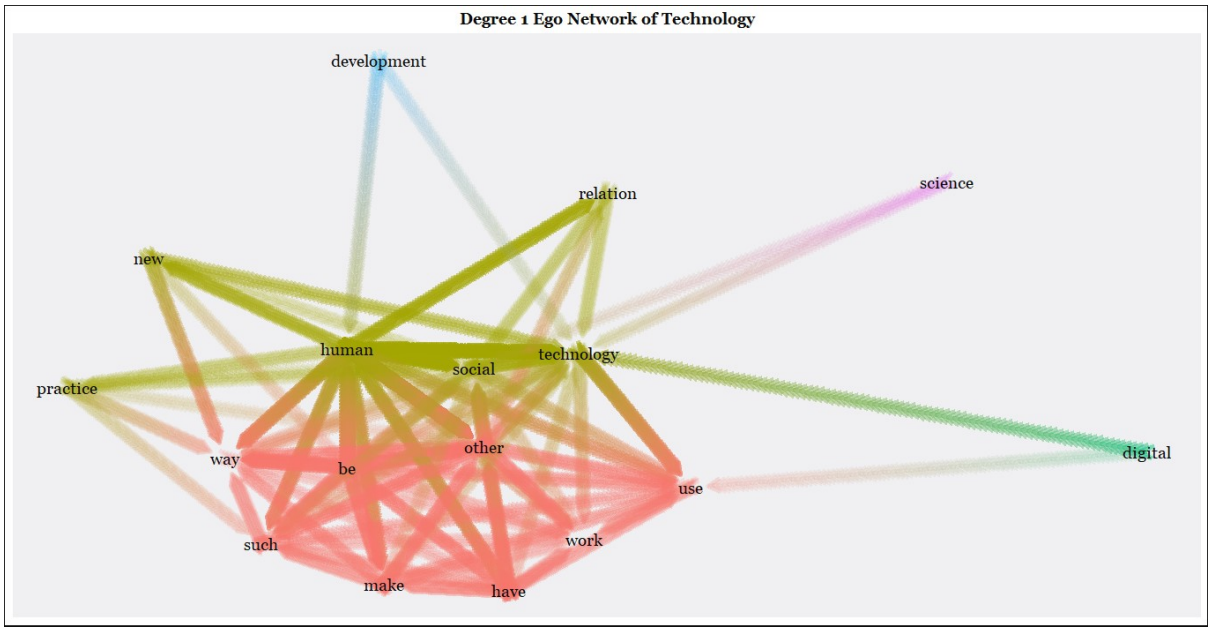

Fig 3.7 *Degree 1 Ego Network of ‘Technology’ with Minor Connections Trimmed*[9]

Additionally, we have figure 3.8 which plots the degree 1 ego-network of the term ‘voice’. Here, we see ‘voice’ and ‘Posthuman’ club together into the green community. This indicates the presence of a ‘Posthuman voice’ in our text. Further, the community in blue with ‘qualitative’ incites a frame of ‘Posthuman voices’ in

[9] The colours of the edges of the graph denote the community of its starting and ending nodes as found by the cluster walk-trap algorithm. While the transparency of any edge denote the weight of the edge or the frequency of collocations.

qualitative research papers. The large community in red contains nouns such as ‘way’, ‘human’, ‘other’, ‘body’, ’process’ and ‘work’. These words together along with the presence of the verb ‘think’ is suggestive of a sense of voice that is a different perspective in regards to the human body along with its role in various processes. Then there is also a community demarcated with the term ‘analytic’. Which is suggestive of a meaning of voice that is a critical perspective.

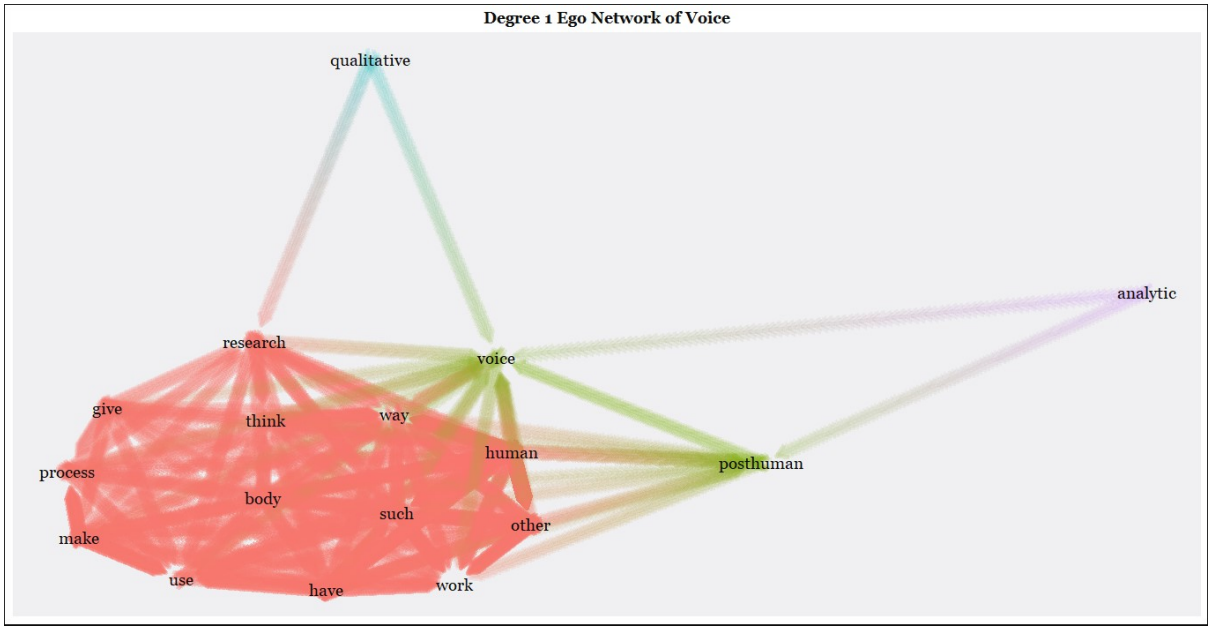

Fig 3.8 *Degree 1 Ego Network of ‘Voice’ with Minor Connections Trimmed*[10]

And finally, the paper observes figure 3.9 showing the degree 1 ego graph diagram of the term ‘Other’. In this diagram, we find a red community consisting of nouns such as ‘human’, ‘other’, ‘life’, ‘body’, ‘form’ and ‘work’ along with the verb ‘see’. Thus, this community is suggestive of the use of ‘other’ to denote a different perspective towards ‘body’, ‘human’ and ‘life’. Then, the green community characterised by the presence of nouns such as ‘social’ and ‘technology’ together with the verbs such as ‘use’, ‘make’ and ‘be’ is indicative of the use of the term

[10] The colours of the edges of the graph denote the community of its starting and ending nodes as found by the cluster walk-trap algorithm. While the transparency of any edge denote the weight of the edge or the frequency of collocations.

'other' to describe non regular social and technological processes and configurations. Moreover, the diagram shows a few other small communities like the one with the term 'hand'. This community is indicative of the usage of 'other' as part of 'on the other hand' which is a common phrase which introduces an opposing view point.

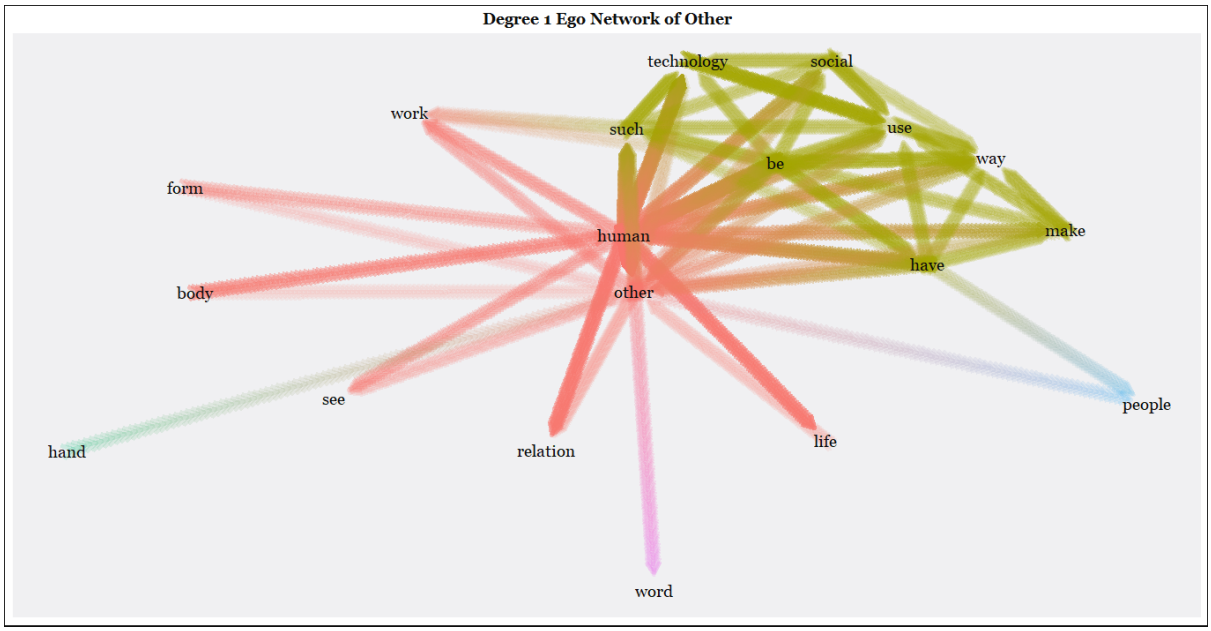

Fig 3.9 *Degree 1 Ego Network of 'Other' with Minor Connections Trimmed*[11]

Having completed the analysis of the system of signs as found in our discursive sphere, this paper now moves towards the second aspect of statements. That is, the speakers of the sentences and their location of occurrence. For this, first, the list of the top ten most frequent journals in table 4.1 is noted. Here, the most frequent journal is discovered to be AI and Society. This journal publishes work on the intersection of Artificial Intelligent Systems and Society. Its presence is again

[11] The colours of the edges of the graph denote the community of its starting and ending nodes as found by the cluster walk-trap algorithm. While the transparency of any edge denote the weight of the edge or the frequency of collocations.

suggestive of the salience of processes constitutive of people, hardware and information in our discursive sphere. Or, it may be said that the relationship between people and technology is an important object in this discursive sphere. Then, we find ‘Film-Philosophy’. This journal publishes work on film studies and philosophy. It is easy to image this space being fertile ground for the occurrence of imaginations of several different types of Posthuman beings. Next, the third most frequent journal is found to be ‘Palgrave Communications’. This is an interdisciplinary journal that publishes works from all across the social sciences including the interaction between society and technology which is a common theme in our discursive sphere. These together with the mix of the other journals reveal the themes, ‘literature and film’, ‘interaction between technology and society’, ‘interaction of society and medicine’ and ‘ethical considerations’ of these interactions.

Top Ten Most Frequent Journals

Journal	N
AI & SOCIETY	13
FILM-PHILOSOPHY	11
PALGRAVE COMMUNICATIONS	11
CHILDRENS LITERATURE IN EDUCATION	7
HUMANITIES & SOCIAL SCIENCES COMMUNICATIONS	7
SCIENCE AND ENGINEERING ETHICS	7
JOURNAL OF BUSINESS ETHICS	6
NANOETHICS	6
NEUROETHICS	6

Journal	N
SOCIAL SCIENCE & MEDICINE	6

Table 4.1 *Ten Most Frequent Journals*

Further, table 4.2 reveals the ten most frequent speakers in our discursive sphere. Here we see Francesca Ferrando who speaks of Posthumanism from a gender studies perspective. Her dominant meaning of the term Posthuman is a perspective, i.e. ‘Posthumanism’. For example, see Ferrando et al. (2021) in which she describes Posthumanism as a ‘philosophy of existence’. For more on her comprehensive work on Posthumanist Philosophy see, Ferrando (2016) and Ferrando (2012). Then, we have Melike Şahinol who works on the intersection of society and medicine and has produced work on body – technology relationship (Şahinol, 2018) and human body ‘enhancement technologies’ (Compagna & Şahinol, 2022). This is suggestive of her use of ‘Posthuman’ being towards a biotechnologically enhanced way of being or medically enhanced bodies. Third on the list is Julian Savulescu who is a bioethicist and has produced works on the effects of technology on society (Rueda et al., 2023) and the ethics of brain-to-brain interfacing technology (Lyreskog et al., 2023). And finally, fourth on the list with 3 papers in our discursive sphere (which is equal to the first three) is Hub Zwart who writes on bioethics and is also a philosopher.

Table of Most Frequent Authors

Author	No. of Papers
Ferrando, Francesca	3
Sahinol, Melike	3

Author	No. of Papers
Savulescu, Julian	3
Zwart, Hub	3
Ardashkin, I	2
Becker, Kira	2
Bogdan, A	2
Brown, William	2
Chandler, David	2
Coeckelbergh, Mark	2

Table 4.2 Table of Most Frequent Authors

Subsequently, this paper moves on towards the results of our citation network analysis. On this similar to the analysis of our semantic network, the paper first observes the degree distribution of the nodes of our citation network and plots this distribution in figure 4.1. Furthermore, the descriptive statistics of our citation network is also tabled and presented in table 4.3. From these we can see that the distribution of degrees again (like our semantic network) appear to follow the power law distribution. That is, some nodes in our graph (or authors in this case) have a lot of degrees (citations in this context) while a majority of nodes have only very few degrees. Moreover, the diameter is also similar to the diameter of our semantic network while the clustering co-efficient is 0.120. These two quantities put together again suggests that the statements collected are of an interdisciplinary nature. However, the average distance between two nodes of 2.256 here too, as was the case with our semantic network of our text, grants our citation network with the small world effect (Cancho & Solé, 2001).

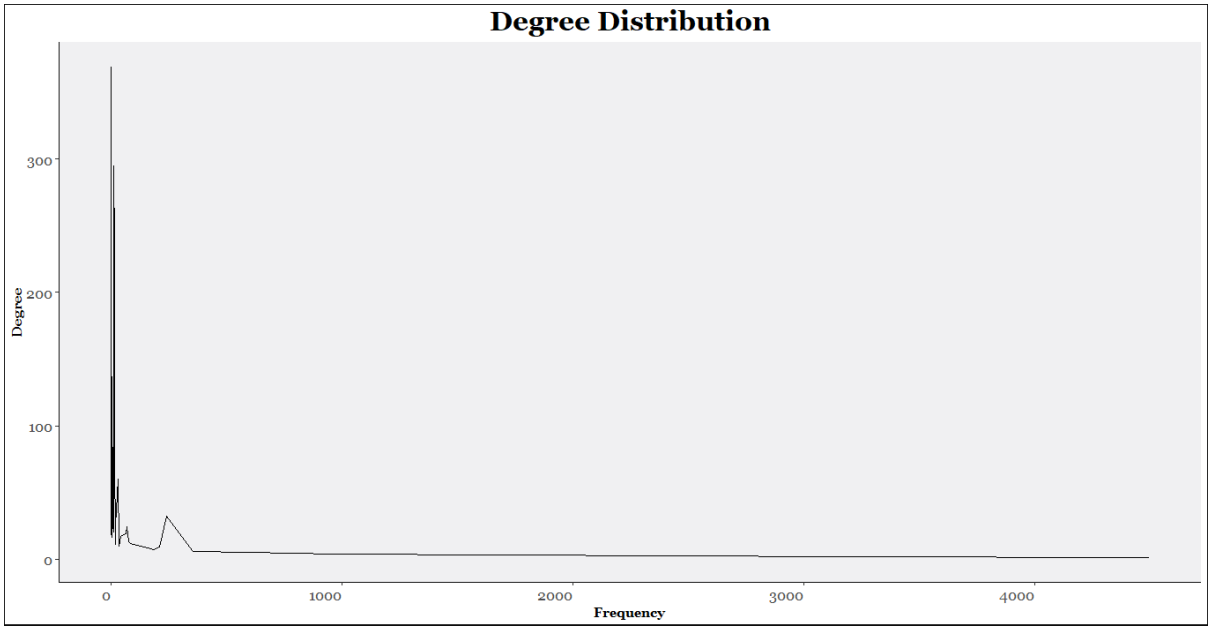

Fig 4.1 *Degree Distribution of Citation Network*

Descriptive Statistics of Citation Network

Name	Statistic
Diameter	10.000000
Clustering Coefficient	0.120952
Average Distance	2.256490

Table 4.3 *Descriptive Statistics of Citation Network*

The paper next looks at figure 4.2 which shows the 'structural backbone' of the citation network through visualising an induced sub-graph of the top 5% nodes with the highest degrees. The diagram also marks the different communities, found in the graph with the aid of the cluster walk-trap algorithm, through the colour of their nodes. From the diagram, one large connected component can be observed with several other disconnected components. Then, in the connected component two major communities can be observed to exist. The tightly packed yellow community and the comparatively dispersed red community. This indicates there exists 2 major

factions in our discursive sphere and one of these factions is very tightly connected to each other through the act of citation.

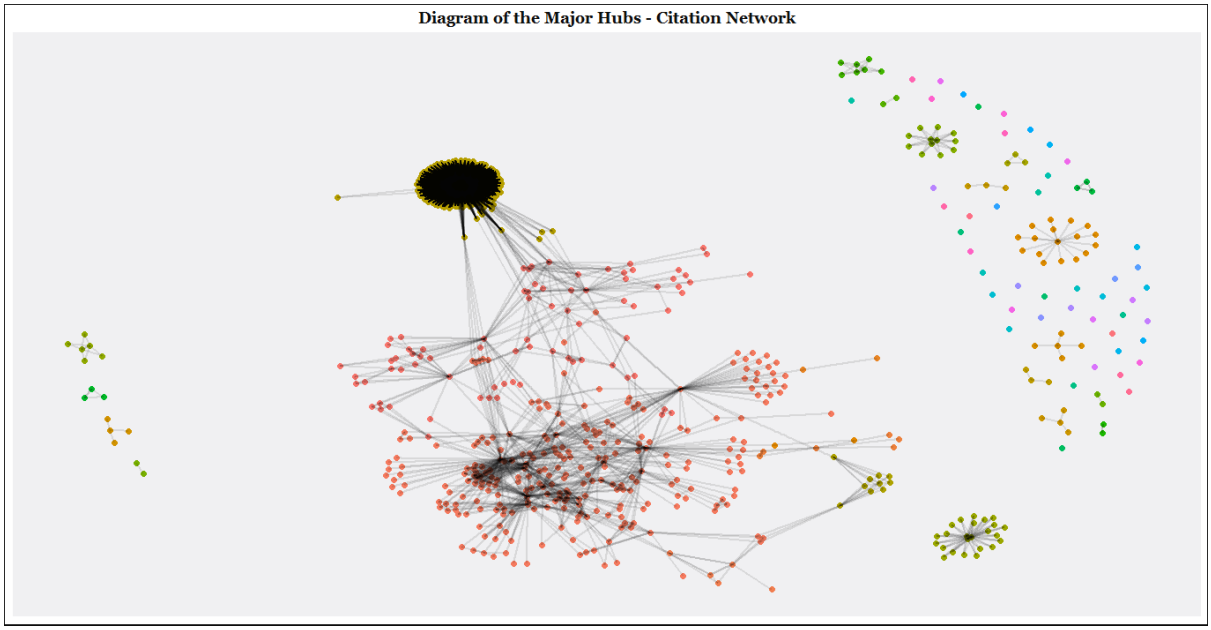

Fig 4.2 *Diagram of Major Hubs of Citation Network*[12]

Then, figure 4.3 shows the Active authors in comparison with the inactive ones within the citation network. From this diagram this paper notes that the authors that are active within this discursive sphere (i.e. the authors whose publications are found within the collected text) as compared to the entirety of the authors that are cited within this discourse are a very limited few. In the diagram, the active authors are marked with the red colour of the nodes representing them. While the blue colour is marking the authors that have been cited by some active author but themselves are not participant to the discourse as captured for analysis in this paper. This paper remarks that this ratio of active vs. inactive authors suggests that Posthuman talk is

[12]The color of the nodes indicate their group or community membership as assigned by the cluster walk-trap algorithm.

currently limited within the various academic fields from which our active authors draw from.

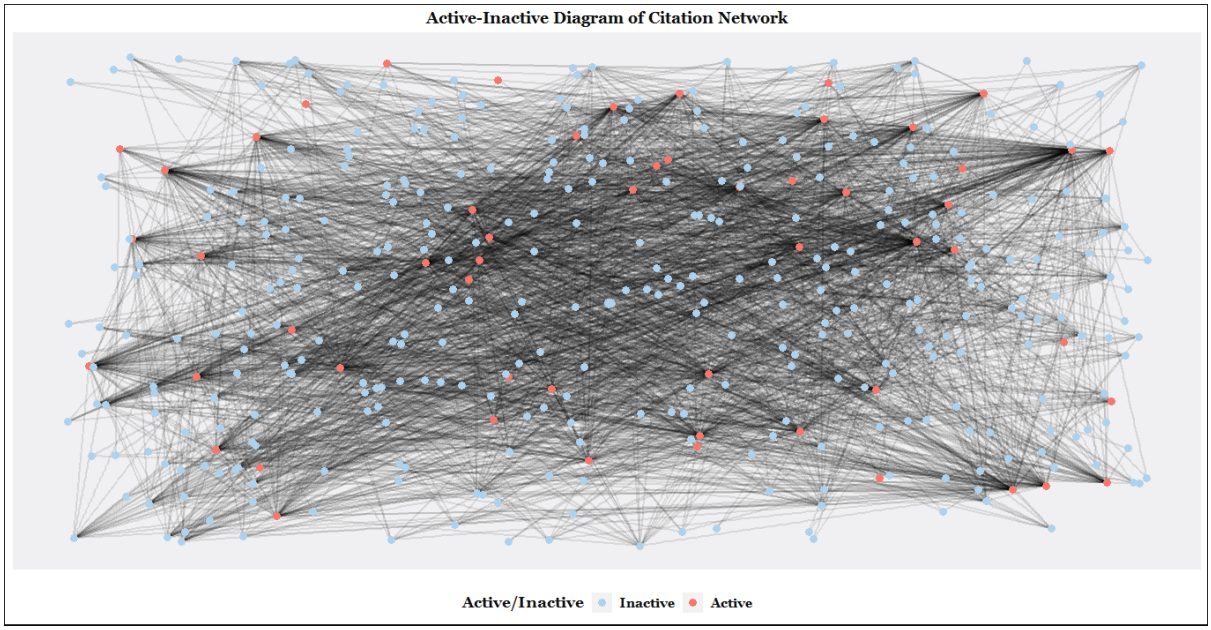

Fig 4.3 *Active/Inactive Diagram of Citation Network*

Then, towards identifying the powerful actors within this discursive sphere, the paper charts the induced sub-graph of the ten nodes (or in the context of our citation network, authors) with the highest eigenvector centrality scores in figure 4.4 and tables the list of the top ten authors along with their scores and their active/inactive status in table 4.4. From the diagram we can clearly see three authors that are active. Their scores indicate that they are highly influential or powerful. And moreover, it is clearly evident that two of these authors are connected while the third is not. This suggests two influential distinct streams of ideas of the 'Posthuman' present in our discursive sphere. The paper then identifies one of these authors as Simone Rossi, who has produced work on neuroscience and biotechnological enhancements of the human body (Hussain et al., 2015) and electro-magnetic brain stimulation (Lefaucheur et al., 2014). Then, another influential active author

according to the eigenvector centrality score is V. Dubljevic. His work lies in the intersection of neuroscience and social science and engages with the ethicalities of brain stimulation technologies (Day et al., 2022), cognitive enhancement (Edgren & Dubljević, 2022) and the interaction of society with artificial intelligence (Dempsey et al., 2023). The author with the highest eigenvector centrality score is found to be Jonathan Pugh. His works focuses on social and environmental sciences and he has written extensively on the anthropocene (Chandler & Pugh, 2018) and alternative ways of knowing and being (Chandler & Pugh, 2022).

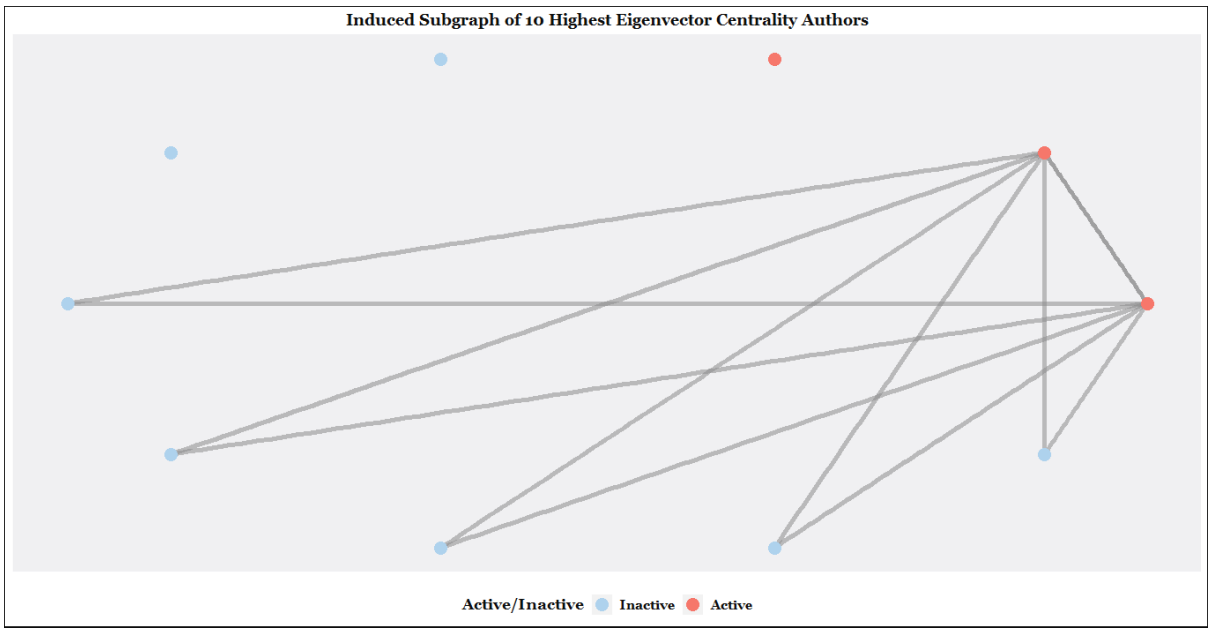

Fig 4.4 *Induced Sub-graph of 10 Highest Eigenvector Centrality Scored Nodes of Citation Network*

Top Eigenvector Centrality Authors

Author	Eigenvector Centrality	Status
Pugh, Jonathan	1.0000000	Active
Repantis, Dimitris	1.0000000	Inactive
Dubljevic, Veljko	1.0000000	Active

Author	Eigenvector Centrality	Status
Dubljevic, V.	1.0000000	Inactive
Sakai, K	0.9336477	Inactive
Assecondi, Sara	0.9336477	Inactive
Paus, T	0.9336477	Inactive
Sehm, Bernhard	0.9336477	Inactive
Strenze, Tanno	0.9336477	Inactive
Rossi, Simone	0.9336477	Active

Table 4.4 *10 Authors with the Highest Eigenvector Centrality Scores*

Next, the paper observes the distribution of the eigenvector centrality scores as plotted in figure 4.5. From the plot it can be seen that most nodes in our citation graph has an eigenvector centrality score that is around 0. And, there exists very few nodes with their eigenvector centrality scores in the range of 0.85 to 1. This is indicative that there are a few highly influential authors in our discursive spheres while most others have negligible influence values.

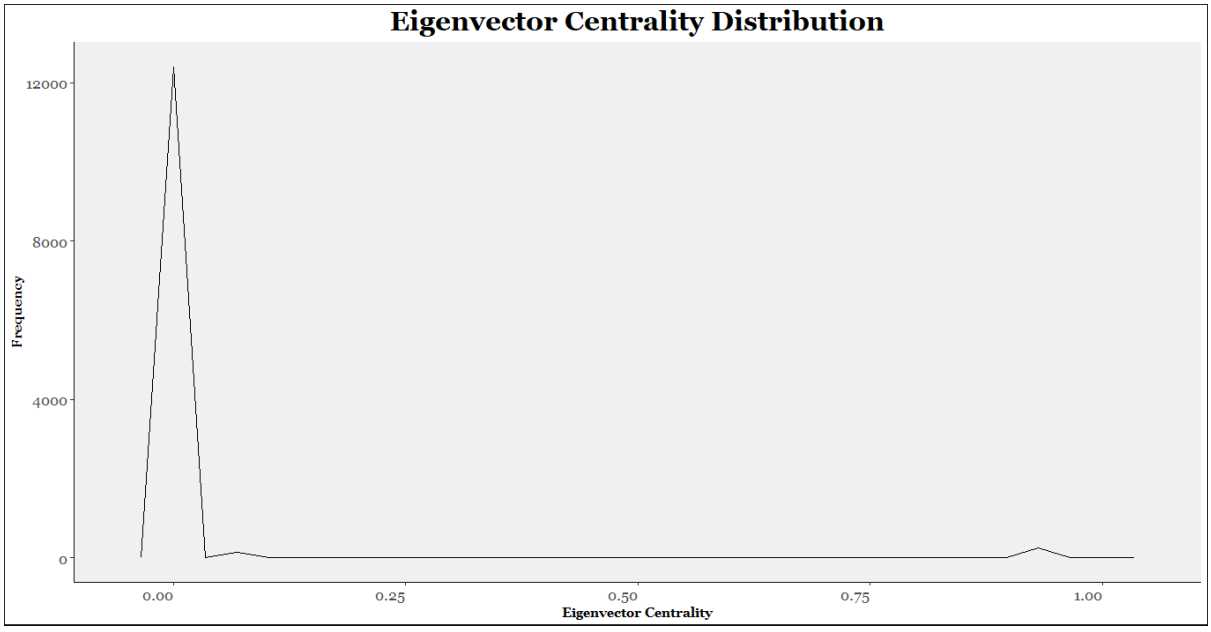

Fig 4.5 *Distribution of Eigenvector Centrality Scores in Citation Network*

Ultimately, the paper identifies two papers which are present in our dataset by these authors. They are Chandler & Pugh (2022) and Antal et al. (2022). Here, in Chandler & Pugh (2022), modern reasoning is challenged through two different ways called ‘interstitial’ and ‘abyssal’ analytics. These approaches, in the context of the ecological crisis, are highlighted and explained to operate through the use of island metaphors to focus on a relational understanding of the nature of being as well as challenge ‘modernist ontology of the human as a subject and the world as an object’. The Posthuman in this paper is used in the sense of a different perspective (than the modernist one) of being. Meanwhile, in Antal et al. (2022) non-invasive brain stimulation and neuro-enhancement is discussed. The paper presents technological enhancement of humans as a key concept and highlights the ambivalent public perception of the idea. It discusses the safety and possible uses of recent stimulation techniques of the brain and speaks of the ‘Posthuman’ as a ‘Posthuman being’ that has been technologically enhanced away from the ‘Human being’.

Discussion

From the findings, this paper ascertains the presence of the small world effect in both, our semantic as well as the citation network. Then, some markers have been singled out which might reflect the discursive strategies of academic writing, i.e. the frequent use of citations and high use of adpositions. The paper also finds that the distribution of degrees in both our citation as well as semantic networks are such that a few nodes have a very high degree while most others have very few. And it was also found that our discursive sphere is constitutive of statements from across

several different disciplines. Further, it was also seen (from the active/inactive diagram in figure 4.3) that the statements usually arise with a few members in their respective fields and the topic of ‘Posthumanism’ is yet niche within the different individual fields.

Then, the paper finds that the main objects formed within our discursive sphere can be categorized under 3 main categories:

(1) Novel socio-technical processes.

(2) Technologically enhanced being.

(3) New perspectives to being.

Further, the ‘Posthuman’ is seen to be used in three main senses:

(1) New processes consisting of people and technology.

(2) New perspectives in regards to being.

(3) New forms of being enhanced by technology.

Furthermore, our discursive sphere was identified to be majorly constitutive of the intersecting areas of academic disciplines such as the journals of AI and Society, Film-Philosophy and Palgrave Communications. The intersections between social sciences, technology, biotechnology and ethics appear major along with philosophy and film.

Next, the most influential or powerful actors were identified and the two ideas present in their statements involved:

(1) ‘Interstitial’ and ‘Abyssal’ Geographies – Which are new or rather non-modernist perspectives to being that focuses on the relational nature of the self. Here the ‘Posthuman perspective’ is encouraged and argued for as a way to move on from the modernist way of being.

(2) Ethics of Brain enhancement technologies – In particular brain enhancement through electro-magnetic stimulation is considered. The ‘Posthuman being’ and a society of ‘Posthuman beings’ was treated with caution amongst the statements consisting this idea.

Ultimately, this paper provides an up-to date and thorough snapshot of the discursive sphere over ‘Posthumanism’, identifies the major objects formed within this sphere, identifies the major senses of ‘Posthuman’ in the sphere as well as provide a description of the power configuration in it. Then it demarcates two influential themes. How will the construction of the ‘Posthuman’ change in the future? Will the different senses converge somehow? How? Will the influential ideas identified continue to gain ground or will new ideas arise as challengers? With the current pace of advancement, this snapshot might be interesting reference point for future research on the dynamics of ‘Posthumanism’.

Limitations

This paper has several limitations. One of the most major ones that needs to be highlighted is the fact that the analysis only focuses on the positive statements in the discourse over ‘Posthumanism’. I.e. the papers discards any analysis on the negative statements, or the statements that are not allowed to occur within our discursive sphere (or the statements that are not selected to form). This form of

analysis is important for a holistic description of the discursive sphere. Not analyzing the absent statements hides the rules of selection of statements which is a mechanism of power, its repressive function. However, this is deemed acceptable for this paper as the main focus was on the constructive form of power functioning through the network of discourse. Future research can look into the repressive power at play in this discursive sphere.

Furthermore, the analysis in this paper is static in nature. That is to say it does not make any distinctions between statements made recently and statements made a long time ago. But instead it takes all the text as found containing the term ‘Posthuman’ in the databases searched as a homogeneous body of information without any temporal aspect. This is neglects the dynamics of this discourse and thus could possibly result in conclusions to not be in sync with the latest or just emerging trends in the discursive sphere. Future research could incorporate the temporal aspect in its analysis to study.

Also, it is important to note that in its analysis this paper also makes no distinctions in the ideas present in the sphere that are by the authors and the ideas present that are being referred to by the authors for critical evaluation. This, could possibly influence the results of the construction of the ‘Posthuman’ within this discursive sphere. Although this distinction was possible to make in the reading of the identified influential papers. In the automated extraction of the semantic network and its subsequent use to graph the ego-networks, this separation was not made.

Finally, in the calculations of the eigenvector centrality scores in the citation network, it was impossible to differentiate between two authors with the exact same name. Thus, it is possible that two authors with the same names could produce

some noise in the calculations for the eigenvector centrality scores. Future research might look into disambiguating authors with same names and run the same analysis.

Declaration of Conflict of Interests: The author declares no conflict of interest.

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Appendices

Appendix A

```python
#Importing Required Libraries
import requests
from dotenv import load_dotenv
import os
import pandas as pd
import json
import collections
import matplotlib.pyplot as plt
import nltk
from nltk.corpus import stopwords
import string
import re
import collections
import matplotlib.pyplot as plt
import nltk
from nltk.corpus import stopwords
import string
import re
import math
import time
import random
from lxml import etree
```

```python
#Loading Environment Variables
load_dotenv()
```

```python
#Loading Required API Keys
springer_key = os.getenv('springer_api_key')
elsevier_key = os.getenv('elsevier_api_key')
```

```python
#Retrieving First Metadata Result from Springer API
n = 1
payload = {'q':'posthuman sort:date openaccess:true', 'p':'100' ,'api_key': springer_key, 's': n}
r = requests.get('http://api.springernature.com/meta/v2/json', params=payload)
```

```python
#Processing Response into Data Frame
data_dict = r.json()
df = pd.DataFrame(data_dict["records"])
```

```python
#Retrieving All Metadata Results from Springer API
total_num = int(data_dict["result"][0]["total"])
for i in range(math.ceil((total_num-100)/100)):
    n+=100
    payload = {'q':'posthuman sort:date openaccess:true', 'p':'100' ,'api_key': springer_key, 's':
n}
    r = requests.get('http://api.springernature.com/meta/v2/json', params=payload)
    data_dict = r.json()
    df = pd.concat([df, pd.DataFrame(data_dict["records"])], axis=0, ignore_index=True)
```

```

```python
#Retrieving Text Results from Springer API
text_list = []
for i in range(len(df)):
    doi = df.loc[i, 'doi']
    doi_q = "doi:" + doi
    querry = {'q': doi_q,'api_key': springer_key}
    r = requests.get('http://api.springernature.com/openaccess/jats', params=querry)
    jats_root = etree.fromstring(r.content)
    body = jats_root.xpath("//body//text()")
    text_content = ' '.join(body)
    text_list.append([doi,text_content])
    time.sleep(8 + random.randint(3, 5))
```

```python
#Saving Data Frames as CSV
df.to_csv("data/springer_data_meta.csv", index=False)
pd.DataFrame(text_list).to_csv("data/springer_data_text.csv", index=False)
```

```python
#Retrieving First Search Result from Elsevier API
n=0
payload = {'query': 'posthuman', 'start': n, 'count': '100' ,'apiKey': elsevier_key}
r = requests.get('https://api.elsevier.com/content/search/sciencedirect', params=payload)
```
```

```python
#Processing Search Results into Data Frame
data_el = r.json()
data_el_df = pd.DataFrame(data_el['search-results']['entry'])
```

```python
#Retrieving All Search Results from Elsevier API
total_n = int(data_el['search-results']['opensearch:totalResults'])
for i in range(math.ceil((total_n-100)/100)):
    n+=100
    payload = {'query': 'posthuman', 'start': n, 'count': '100' ,'apiKey': elsevier_key}
    r = requests.get('https://api.elsevier.com/content/search/sciencedirect', params=payload)
    data_el = r.json()
    data_el_df = pd.concat([data_el_df, pd.DataFrame(data_el["search-results"]['entry'])],
axis=0, ignore_index=True)
```

```python
#Counting Open Access Articles
data_el_df.value_counts("openaccess")
```

```python
#Filtering for Open Access Articles
df_elsevier = data_el_df.loc[data_el_df['openaccess'] == True]
df_elsevier = df_elsevier.reset_index()
```

```python
```

```
#Retrieving Texts of Open Access Articles from Elsevier API
doi = []
text = []
for i in range(len(df_elsevier)):
    call = "https://api.elsevier.com/content/article/pii/" + df_elsevier["pii"][i]
    header = {'Accept': 'application/json'}
    payload = {'apiKey': elsevier_key}
    r = requests.get(call, params=payload, headers=header)
    data_dict = r.json()
    doi.append(data_dict['full-text-retrieval-response']['coredata']['prism:doi'])
    text.append(data_dict['full-text-retrieval-response']['originalText'])
    time.sleep(8 + random.randint(3, 5))
```

```python
#Converting Results into Data Frame
text_elsevier = pd.DataFrame({'doi':doi, 'full-text':text})
```

```python
#Retriving First Metadata Results from Elsevier API
call = "https://api.elsevier.com/content/article/pii/" + df_elsevier["pii"][0]
header = {'Accept': 'application/json'}
payload = {'apiKey': elsevier_key}
r = requests.get(call, params=payload, headers=header)
```

```python
#Processing Result into Data Frame
data_el = json.loads(r.content)
```

```
meta_elsevier = pd.DataFrame.from_dict(data_el['full-text-retrieval-response']['coredata'], orient="index").transpose()
```

```python
#Retrieving Metadata for Remaining Elsevier Batch
for i in range(1, len(df_elsevier)):
    call = "https://api.elsevier.com/content/article/pii/" + df_elsevier["pii"][i]
    header = {'Accept': 'application/json'}
    payload = {'apiKey': elsevier_key}
    r = requests.get(call, params=payload, headers=header)
    data_el = json.loads(r.content)
    temp_df = pd.DataFrame.from_dict(data_el['full-text-retrieval-response']['coredata'], orient="index").transpose()
    meta_elsevier = pd.concat([meta_elsevier, temp_df], axis=0, ignore_index=True)
    time.sleep(5 + random.randint(3, 5))
```

```python
#Saving Elsevier Data into CSV Files
text_elsevier.to_csv("data/elsevier_data_text.csv", index=False)
meta_elsevier.to_csv("data/elsevier_data_meta.csv", index=False)
```

```python
```

Appendix B

```python
#Importing Required Libraries
import pandas as pd
import json
import requests
import time
import random
```

```

```python
#Uploading Jstor Data as a Data Frame
file_path = "data/jstor_data.jsonl"
jstor_df = pd.read_json(file_path, lines=True)
```

```python
#Inspecting Jstor Data Frame
jstor_df.value_counts("docType")
```

```python
#Inspecting Jstor Data Frame
jstor_df.columns
```

```python
#Droping NA values for DOI
jstor_df = jstor_df.dropna(subset=['doi'])
```

```python
#Retrieving DOIs for Crossref API Call
dois_jstor = jstor_df["doi"].reset_index()
```
```

```python
#Setting Header for Crossref API call
header = {'User-Agent': 'Shivam Sen(Collecting Data for Masters Thesis;
mailto:shivamsen910@gmail.com; Institution: Charles University, Prague)'}
```

```python
#Setting URL for Crossref API call
url = "https://api.crossref.org/works/"+dois_jstor.loc[0,'doi']
```

```python
#Making First Crossref API Call
r = requests.get(url, headers=header)
```

```python
#Processing Response to Data Frame
message = json.loads(r.content)['message']
temp_keys = list(message.keys())
temp_values = list(message.values())
meta_jstor = pd.DataFrame([temp_values], columns=temp_keys)
```

```python
#Making Remaining API Calls for Jstor batch Metadata
for i in range(1,len(dois_jstor)):
    url = "https://api.crossref.org/works/"+dois_jstor.loc[i,'doi']
    r = requests.get(url, headers=header)
    message = json.loads(r.content)['message']
```

```
    temp_keys = list(message.keys())
    temp_values = list(message.values())
    temp_df = pd.DataFrame([temp_values], columns=temp_keys)
    meta_jstor = pd.concat([meta_jstor, temp_df], axis=0, join='outer')
    time.sleep(3 + random.randint(3, 5))
```

```python
#Saving Jstor Metadata into CSV Files
meta_jstor.to_csv("data/jstor_metadata.csv", index=False)
```

```python

```

Appendix C

```python
#Importing Required Libraries
import pandas as pd
import math
from langdetect import detect
from docx import Document
from docx.shared import Pt
from docx.enum.text import WD_ALIGN_PARAGRAPH
```

```python
#Importing Springer Data
springer_meta = pd.read_csv("data/springer_data_meta.csv")
springer_text = pd.read_csv("data/springer_data_text.csv")
```

```python
#Inspecting the Imported Data Frames
len(springer_meta)
len(springer_text)
```

```python
springer_meta.head()
```

```python
springer_text.head()
```

```python
#Renaming Columns for Springer Text Data Frame
springer_text.rename(columns={'0': 'doi', '1': 'text'}, inplace=True)
```

```python
```

springer_text.head()
```

```python
#Joining Springer Text and Meta Data
springer_df = pd.merge(springer_meta, springer_text, on='doi')
```

```python
#Inspecting Joined Data Frame
springer_df.head()
```

```python
#Listing the Columns of the New Data Frame
springer_df.columns
```

```python
#Importing Elsevier Data as Data Frames
elsevier_meta = pd.read_csv("data/elsevier_data_meta.csv")
elsevier_text = pd.read_csv("data/elsevier_data_text.csv")
```

```python
#Insepcting Elsevier Data
elsevier_meta.head()
```
```

```

```python
elsevier_meta.columns
```

```python
elsevier_text.head()
```

```python
#Joining Elsevier Text and Metadata
elsevier_df = pd.merge(elsevier_meta, elsevier_text, left_on='prism:doi', right_on='doi', how='left')
```

```python
#Inspecting Merged Elsevier Data Frame
elsevier_df.head()
```

```python
elsevier_df.columns
```

```python
#Dropping the Repeated DOI Column
```
```

```
elsevier_df.drop('prism:doi', axis=1, inplace=True)
```

```python
#Inspecting Resulting Data Frame
elsevier_df.head()
```

```python
elsevier_df.columns
```

```python
#Uploading Jstor Text Data
jstor_text = pd.read_json('data/jstor_data_text.jsonl', lines=True)
```

```python
#Inspecting Jstor Text Data Frame
jstor_text.head()
```

```python
jstor_text.columns
```

```python
#Uploading Jstor Metadata
jstor_meta = pd.read_csv("data/jstor_metadata.csv")
```

```python
#Inspecting Jstor Metadata
jstor_meta.head()
```

```python
jstor_meta.columns
```

```python
#Joining Jstor Text and Meta Data
jstor_df = pd.merge(jstor_meta, jstor_text, left_on='DOI', right_on='doi', how='left')
```

```python
#Inspecting Jstor Merged Data Frame
jstor_df.head()
```

```python
jstor_df.columns
```

```python
#Dropping Duplicate DOI Column
jstor_df.drop('DOI', axis=1, inplace=True)
```

```python
#Inspecting New Jstor Data Frame
jstor_df.columns
```

```python
#Filtering Springer Data Frame for English Language
springer_df = springer_df[springer_df['language'] == 'en']
```

```python
#Assigning a Language to Each Observation Through Language Detection on Titles
language = []
for t in elsevier_df['dc:title']:
    lang = detect(t)
    language.append(lang)

elsevier_df['language'] = language
```

```python
```

```
#Filtering Elsevier Data Frame for English Language
elsevier_df = elsevier_df[elsevier_df['language'] == 'en']
```

```python
#Filtering Jstor Data Frame for English Language
jstor_df = jstor_df[jstor_df['language_x'] == 'en']
```

```python
#Extracting Doi, Author, Title, Text and Date from Springer Data Frame
springer_to_merge = springer_df[['doi','creators','title','text','publicationDate']]
```

```python
#Renaming the Column Names for Consistency
springer_to_merge = springer_to_merge.rename(columns={'doi': 'doi', 'creators': 'authors',
'title': 'title', 'text':'text', "publicationDate":'date'})
```

```python
#Extracting Required Columns from Elsevier Data Frame
elsevier_to_merge = elsevier_df[['doi','dc:creator','dc:title','full-text','prism:coverDate']]
```

```python
#Renaming Columns for Consistency
```

```
elsevier_to_merge = elsevier_to_merge.rename(columns={'doi': 'doi', 'dc:creator': 'authors', 'dc:title': 'title', 'full-text':'text', "prism:coverDate":'date'})
```

```python
#Extracting Relevant Columns from Jstor Data Frame
jstor_to_merge = jstor_df[['doi','author','title_x','fullText','datePublished']]
```

```python
#Renaming Columns for Consistency
jstor_to_merge = jstor_to_merge.rename(columns={'doi': 'doi', 'author': 'authors', 'title_x': 'title', 'fullText':'text', "datePublished":'date'})
```

```python
#Merging All the Data Frames
merged_df = pd.concat([springer_to_merge, elsevier_to_merge, jstor_to_merge], axis=0)
```

```python
#Inspecting Merged Data Frame
len(merged_df)
```

```python
#Checking for Duplicates
duplicates = merged_df.duplicated(subset=['doi'])
```

duplicates.value_counts()
```

```python
#Dropping Duplicates
merged_df = merged_df.drop_duplicates(subset=['doi'])
```

```python
#Dropping Any Missing Values
merged_df.dropna(inplace=True)
```

```python
#Saving the Merged Data Frame to a CSV File
merged_df.to_csv("data/merged_df.csv", index=False)
```

```python
########################################
#Making a Word Document for the Data##
########################################

#Create a new Word document
document = Document()

#Set font size and alignment for all paragraphs
```
```

```
style = document.styles['Normal']
font = style.font
font.size = Pt(12)
document.add_paragraph().add_run().add_break()

#Iterate over each row in the DataFrame and add the values to the document
for _, row in merged_df.iterrows():
    document.add_page_break()
    document.add_paragraph(str(row['date']))
    document.add_paragraph(str(row['doi']))
    document.add_paragraph(str(row['authors']))
    document.add_paragraph(str(row['title']))
    document.add_paragraph(str(row['text']))
    document.add_paragraph('\n\n')

#Save the document
document.save('data/posthuman_data.docx')
```

```python

```

Appendix D

```python
#Importing Libraries
import requests
from dotenv import load_dotenv
import os
import pandas as pd
import json
import random
import math
import time
```

```python
#Loading Environment Variables
load_dotenv()
```

```python
#Loading Required API Keys
```

```
wos_key = os.getenv('wos_api_key')
```

```python
#Upload DOIs
dois_df = pd.read_csv('data/merged_df.csv')
```

```python
#Assigning Columns for Data Frame of WOS Ids
uid_art = []
doi_art = []
author_art = []
journal_art = []
```

```python
#Retriving UIDs, Author and Journal Names
for n in range(0,len(dois_df)):
    doi = "DO="+dois_df["doi"][n]
    #Setting Parameters to Retrieve UID
    params = {
        "databaseId": "WOK",
        "usrQuery": doi,
        "count": 1,
        "firstRecord": 1
    }
    header = {
        "X-ApiKey": wos_key
```

```
    }
    #Making API Call
    r = requests.get("https://wos-api.clarivate.com/api/wos",
                     params=params,
                     headers=header)
    doi_response = r.json()
    #Logging Response
    if(doi_response["QueryResult"]["RecordsFound"]==0):
        doi_art.append(doi)
        uid_art.append(0)
        author_art.append(0)
        journal_art.append(0)
    else:
        num_authors =
doi_response["Data"]["Records"]["records"]["REC"][0]["static_data"]["summary"]["names"]["co
unt"]
        if(num_authors>1):
            for i in range(0,num_authors):
                doi_art.append(doi)
                uid_art.append(doi_response["Data"]["Records"]["records"]["REC"][0]["UID"])

author_art.append(doi_response["Data"]["Records"]["records"]["REC"][0]["static_data"]["sum
mary"]["names"]["name"][i]["full_name"])

journal_art.append(doi_response["Data"]["Records"]["records"]["REC"][0]["static_data"]["sum
mary"]["titles"]["title"][0]["content"])
        else:
            doi_art.append(doi)
            uid_art.append(doi_response["Data"]["Records"]["records"]["REC"][0]["UID"])

author_art.append(doi_response["Data"]["Records"]["records"]["REC"][0]["static_data"]["sum
mary"]["names"]["name"]["full_name"])

journal_art.append(doi_response["Data"]["Records"]["records"]["REC"][0]["static_data"]["sum
mary"]["titles"]["title"][0]["content"])
    time.sleep(3 + random.randint(3, 5))
```

```

```python
#Converting Collected Data to Data Frame
df_part_A = pd.DataFrame({
    'doi': doi_art,
    'wos-uid': uid_art,
    'author': author_art,
    'journal': journal_art
})
```

```python
#Inspecting Data Frame
df_part_A
```

```python
#Saving Data
df_part_A.to_csv("data/wos_id_data.csv", index=False)
```

```python
#Dropping Missing Values
filtered_df = df_part_A[df_part_A['wos-uid'] != 0]
filtered_df.reset_index()
```
```

```python
#Extracting WOS UIDs
uids = filtered_df['wos-uid']
```

```python
#Extracting Unique Uids
uids = uids.drop_duplicates()
uids = uids.reset_index()
```

```python
#Making Collecting Lists
total_refs = []
references = []
```

```python
#Retrieving References
#Creating Outer Loop
for n in range(0,len(uids)):
    #Setting Querry Parameters and Header for References Retrieval
    params = {
        "databaseId": "WOK",
        "uniqueId": uids['wos-uid'][n],
        "count": 100,
        "firstRecord": 1
    }
```

```
header = {
   "X-ApiKey": wos_key
}
#Sending Query
r = requests.get("https://wos-api.clarivate.com/api/wos/references",
                 params=params,
                 headers=header)
ref_response = r.json()
#Collecting Total References
num_ref = ref_response["QueryResult"]["RecordsFound"]
total_refs.append(num_ref)
#Retrieving All References
if(num_ref == 0):
   references.append(("NA", uids['wos-uid'][n]))
if(num_ref>100):
   for k in range(0,math.ceil(num_ref/100)):
      params = {
         "databaseId": "WOK",
         "uniqueId": uids['wos-uid'][n],
         "count": 100,
         "firstRecord": (100*k) + 1
      }
      header = {
         "X-ApiKey": wos_key
      }
      #Sending Query
      r = requests.get("https://wos-api.clarivate.com/api/wos/references",
                       params=params,
                       headers=header)
      ref_response = r.json()
      for m in range(0,99):
         try:
```

```
                references.append((ref_response['Data'][m]['CitedAuthor'], uids['wos-uid'][n]))
            except IndexError:
                print("Index out of bounds error!")
                print("At n:", n)
                break
            except Exception as e:
                print("An error occurred:", e)
                print("At this n:", n)
            time.sleep(1 + random.randint(1, 2))

    else:
        for i in range(0,num_ref):
            print(i)
            try:
                references.append((ref_response['Data'][i]['CitedAuthor'], uids['wos-uid'][n]))
            except Exception as e:
                print("An error occurred:", e)
    time.sleep(1 + random.randint(1, 2))
```

```python
#Converting to Data Frame
df_part_B = pd.DataFrame(references, columns=['cited_author', 'wos-uid'])
```

```python
#Merging From and To Author Data
merged_df = pd.merge(df_part_B, df_part_A, on='wos-uid', how='left')
```

```python
#Saving Data
merged_df.to_csv("data/citation_data.csv", index=False)
```

Appendix E

```
#Importing Libraries
library(tidyverse)
library(udpipe)
library(magrittr)

#Setting Root Directory
setwd("E:/Charles University/Thesis/masters-thesis-code")
rm(list=ls())

#Uploading Data as Tibble
root_df <- read_csv("data/merged_df.csv")

#Inspecting Uploaded Data
names(root_df)

#Loading Udpipe Model
ud_model <- udpipe_load_model('english-ewt-ud-2.5-191206.udpipe')



#Extracting Corpus from Data
text_corpus <- root_df %>%
  mutate(doc_id = row_number())%>%
  select(doc_id,text)



#Annotating with Udpipe
x <- udpipe_annotate(ud_model, x = text_corpus$text, doc_id = text_corpus$doc_id)
x <- as.data.frame(x)
x <- as_tibble(x)
```

```
#Saving Annotated Tibble
write_csv(x, "data/annotated_df.csv", col_names = TRUE, na = "NA")
```

Appendix F

```
#Importing Libraries
library(tidyverse)
library(ggtext)
library(magrittr)
library(flextable)

#Setting Root Directory and Adding Font
setwd("E:/Charles University/Thesis/masters-thesis-code")
rm(list=ls())
windowsFonts(georgia = windowsFont("georgia"))

#Uploading Data as Tibble
anno_df <- read_csv("data/annotated_df.csv")

#Inspecting the Uploaded Data
names(anno_df)

#Extracting the Distribution of the Parts of Speeches
pos_dis <- anno_df %>%
  count(upos)

#Assigning Full Forms
abbr <- c("ADJ", "ADP", "ADV", "AUX", "CCONJ", "DET", "INTJ", "NOUN", "NUM", "PART",
"PRON", "PROPN", "PUNCT", "SCONJ", "SYM", "VERB", "X")
full <- c("Adjective", "Adposition", "Adverb", "Auxiliary", "Coordinating Conjunction",
"Determiner", "Interjection", "Noun", "Numeral", "Particle", "Pronoun", "Proper Noun",
"Punctuation", "Subordinating Conjunction", "Symbol", "Verb", "Other")
tib_full <- tibble(abbr, full)

#Joining Full Forms
pos_dis %<>%
  left_join(tib_full, by = c("upos"="abbr")) %>%
  select(upos,full,n)
```

```
#Plotting POS Distribution
pos_dis %>%
  ggplot() +
  geom_col(aes(x = n, y = reorder(full,n)), fill = "#262626") +
  scale_x_continuous(labels = function(x) format(x, scientific = FALSE))+
  labs(x = "Frequency", y = "Parts of Speech") +
  theme_classic() +
  theme(
    axis.text.x = element_text(family = "georgia", angle = 0, hjust = 1),
    axis.text.y = element_text(family = "georgia"),
    panel.grid.major = element_blank(),
    panel.grid.minor = element_blank(),
    axis.line = element_line(colour = "#0D0D0D"),
    legend.position = "none",
    plot.title = element_textbox(face = "bold", family = "georgia", size = 23, hjust = 0.5),
    axis.title = element_textbox(face = "bold", family = "georgia", size = 11),
    axis.text = element_textbox(size = 13),
    panel.border = element_blank(),
    panel.background = element_rect(fill = "#F0F0F2"),
    plot.background = element_rect(colour = "#0D0D0D", size = 1),
  ) +
  ggtitle("Distribution of Parts of Speech")


#Extracting 15 most Frequent Nouns
freq_nouns <- anno_df %>%
  filter(upos=="NOUN")%>%
  count(lemma, sort=TRUE)%>%
  slice(1:15)
```

```
#Making Table of Most Frequent Nouns
my_flextable <- flextable(freq_nouns)
my_flextable <- set_table_properties(my_flextable, width = 1)
save_as_docx(my_flextable, path = "figures_and_tables/table.1.1.docx")


#Extracting 15 most Frequent Adjectives
freq_adj <- anno_df %>%
  filter(upos=="ADJ")%>%
  count(lemma, sort=TRUE)%>%
  slice(1:15)


#Making Table of Most Frequent Adjectives
my_flextable <- flextable(freq_adj)
my_flextable <- set_table_properties(my_flextable, width = 1)
save_as_docx(my_flextable, path = "figures_and_tables/table.1.2.docx")


#Extracting 15 most Frequent Verbs
freq_verb <- anno_df %>%
  filter(upos=="VERB")%>%
  count(lemma, sort=TRUE)%>%
  slice(1:15)


#Making Table of Most Frequent Verbs
my_flextable <- flextable(freq_verb)
my_flextable <- set_table_properties(my_flextable, width = 1)
save_as_docx(my_flextable, path = "figures_and_tables/table.1.3.docx")
```

Appendix G

```
#Importing Libraries
library(tidyverse)
library(udpipe)
library(ggtext)
```

```
library(magrittr)
library(igraph)
library(ggraph)
library(flextable)


#Setting Root Directory, Adding Font
setwd("E:/Charles University/Thesis/masters-thesis-code")
rm(list=ls())
windowsFonts(georgia = windowsFont("georgia"))

#Uploading Data as Tibble
anno_df <- read_csv("data/annotated_df.csv")

#Inspecting the Uploaded Data
names(anno_df)

#Creating Co-occurrences Tibble
cooc <- cooccurrence(x = subset(anno_df, upos %in% c("NOUN", "ADJ", "VERB")),
                     term = "lemma",
                     group = c("doc_id", "paragraph_id", "sentence_id"))

cooc <- as_tibble(cooc)

#Extracting Semantic Network
sem_net <- graph_from_data_frame(cooc)
rm(cooc)
gc()

#Extracting Degree Distribution
degs <- degree(sem_net, mode = "all")
```

```
#Plotting Degree Distribution
degs <- tibble(degree = degs)

degs %>%
  count(degree)%>%
  ggplot()+
  geom_line(aes(x = n, y = degree))+
  labs(x = "Frequency", y = "Degree") +
  theme_classic() +
  theme(
    axis.text.x = element_text(family = "georgia", angle = 0, hjust = 1),
    axis.text.y = element_text(family = "georgia"),
    panel.grid.major = element_blank(),
    panel.grid.minor = element_blank(),
    axis.line = element_line(colour = "#0D0D0D"),
    legend.position = "none",
    plot.title = element_textbox(face = "bold", family = "georgia", size = 23, hjust = 0.5),
    axis.title = element_textbox(face = "bold", family = "georgia", size = 11),
    axis.text = element_textbox(size = 13),
    panel.border = element_blank(),
    panel.background = element_rect(fill = "#F0F0F2"),
    plot.background = element_rect(colour = "#0D0D0D", size = 1),
  ) +
  ggtitle("Degree Distribution")

#Extracting Diameter
diameter <- diameter(sem_net, directed = TRUE, unconnected = TRUE)

#Extracting Clustering Coefficient
clus_coef <- transitivity(sem_net, type = "global")
```

```
#Extracting Average Distance between Two Nodes
mean_dist <- mean_distance(sem_net,  details=FALSE)

#Creating Table of Descriptive Stats
desc_stats <- tibble(names = c("Diameter", "Clustering Coefficient", "Average Distance"),
                     statistic = c(diameter, clus_coef, mean_dist))

#Exporting Table of Descriptive Stats
my_flextable <- flextable(desc_stats)
my_flextable <- set_table_properties(my_flextable, width = 1)
save_as_docx(my_flextable, path = "figures_and_tables/table.2.1.docx")



#Extracting Major Hubs
degs <- degree(sem_net, mode = "all")
cutoff <- quantile(degs, 0.95)
top_nodes <- which(degs >= cutoff)
major_hubs <- induced_subgraph(sem_net, top_nodes)



#Drawing the Major Hubs
set.seed(358)
ggraph(major_hubs, layout="fr") +
  geom_node_point(color = "#262626", alpha = 0.7) +
  geom_edge_link(edge_colour = "#8C8C8C", edge_alpha = 1) +
  ggtitle("Diagram of the Major Hubs") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),
        legend.position = "none",
```

```
      plot.background = element_rect(color = "#0D0D0D", size = 1),
      panel.background = element_rect(fill = "#F0F0F2"))


#Creating Sub-graph of Nouns
sub_noun <- cooccurrence(x = subset(anno_df, upos %in% c("NOUN")),
                  term = "lemma",
                  group = c("doc_id", "paragraph_id", "sentence_id"))
sub_noun <- as_tibble(sub_noun)
sub_noun <- graph_from_data_frame(sub_noun)

#Extracting Top 10 Degree Nodes
degs_noun <- degree(sub_noun, mode = "all")
top_degrees <- order(degs_noun, decreasing = TRUE)[1:10]
top_nouns_degree <- induced_subgraph(sub_noun, top_degrees)


#Drawing Sub-graph of top 10 Nodes With Highest Degree Centrality
set.seed(358)
ggraph(top_nouns_degree, layout="circle") +
  geom_edge_link(aes(alpha = cooc), width = 2, colour = "#8C8C8C") +
  geom_node_label(aes(label = name), color = "#0D0D0D", size = 5, family="georgia")+

  ggtitle("Induced Subgraph of 10 Highest Degree Centrality Nodes") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),
      legend.position = "none",
      plot.background = element_rect(color = "#0D0D0D", size = 1),
      panel.background = element_rect(fill = "#F0F0F2"))


#Checking the Presence of P.
```

```
what_is_p <- anno_df %>%
  filter(lemma=="p.") %>%
  select(sentence) %>%
  slice(1:3)

what_is_p[[1, "sentence"]]
what_is_p[[2, "sentence"]]
what_is_p[[3, "sentence"]]



#Creating Table of Top 10 Degree Centrality Nodes
lemma_top_deg <- names(V(sub_noun))[top_degrees]
value_top_deg <- degree(sub_noun, v = top_degrees, mode="all")
top_degree_table <- tibble(lemma = lemma_top_deg, degree = value_top_deg)

#Exporting Table of Degree Centrality
my_flextable <- flextable(top_degree_table)
my_flextable <- set_table_properties(my_flextable, width = 1)
save_as_docx(my_flextable, path = "figures_and_tables/table.2.2.docx")



#Checking if Sub-graph of Nouns is Connected
is.connected(sub_noun)

#Extracting Largest Component
components <- decompose(sub_noun)
largest_component <- components[[1]]



#Extracting Sub-graph of Top 10 Nodes with Highest Eigenvector Centrality Scores
eigens_noun <- eigen_centrality(largest_component, directed = FALSE)
```

```
eigens_noun <- eigens_noun$vector
top_eigens <- order(eigens_noun, decreasing = TRUE)[1:10]
top_nouns_eigens <- induced_subgraph(sub_noun, top_eigens)



#Drawing Sub-graph of top 10 Nodes With Highest Eigenvector Centrality
set.seed(358)
ggraph(top_nouns_eigens, layout="circle") +
  geom_edge_link(aes(alpha = cooc), width = 2, colour = "#8C8C8C") +
  geom_node_label(aes(label = name), color = "#0D0D0D", size = 5, family="georgia")+

  ggtitle("Induced Subgraph of 10 Highest Eigenvector Centrality Nodes") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),
        legend.position = "none",
        plot.background = element_rect(color = "#0D0D0D", size = 1),
        panel.background = element_rect(fill = "#F0F0F2"))



#Creating Table of Top 10 Eigenvector Centrality Nodes
lemma_top_eigens <- names(eigens_noun)[order(eigens_noun, decreasing = TRUE)[1:10]]
value_top_eigens <- unname(eigens_noun)[order(eigens_noun, decreasing = TRUE)[1:10]]

top_degree_table <- tibble(lemma = lemma_top_eigens, eigenvector_centrality =
value_top_eigens)/

#Exporting Table of Eigenvector Centrality
my_flextable <- flextable(top_degree_table)
my_flextable <- set_table_properties(my_flextable, width = 1)
save_as_docx(my_flextable, path = "figures_and_tables/table.2.3.docx")



#Extracting the Distribution of the Parts of Speeches for Posthuman
```

```
pos_dis_phum <- anno_df %>%
  filter(lemma=="posthuman")%>%
  count(upos)

#Assigning Full Forms
abbr <- c("ADJ", "ADP", "ADV", "AUX", "CCONJ", "DET", "INTJ", "NOUN", "NUM", "PART",
"PRON", "PROPN", "PUNCT", "SCONJ", "SYM", "VERB", "X")
full <- c("Adjective", "Adposition", "Adverb", "Auxiliary", "Coordinating Conjunction",
"Determiner", "Interjection", "Noun", "Numeral", "Particle", "Pronoun", "Proper Noun",
"Punctuation", "Subordinating Conjunction", "Symbol", "Verb", "Other")
tib_full <- tibble(abbr, full)

#Joining Full Forms
pos_dis_phum %<>%
  left_join(tib_full, by = c("upos"="abbr")) %>%
  select(upos,full,n)

#Plotting POS Distribution for Posthuman
pos_dis_phum %>%
  ggplot() +
  geom_col(aes(x = n, y = reorder(full,n)), fill = "#262626")+
  scale_x_continuous(labels = function(x) format(x, scientific = FALSE))+
  labs(x = "Frequency", y = "Parts of Speech")+
  theme_classic()+
  theme(
    axis.text.x = element_text(family = "georgia", angle = 0, hjust = 1),
    axis.text.y = element_text(family = "georgia"),
    panel.grid.major = element_blank(),
    panel.grid.minor = element_blank(),
    axis.line = element_line(colour = "#0D0D0D"),
    legend.position = "none",
    plot.title = element_textbox(face = "bold", family = "georgia", size = 23, hjust = 0.5),
    axis.title = element_textbox(face = "bold", family = "georgia", size = 11),
```

```
    axis.text = element_textbox(size = 13),
    panel.border = element_blank(),
    panel.background = element_rect(fill = "#F0F0F2"),
    plot.background = element_rect(colour = "#0D0D0D", size = 1),
  ) +
  ggtitle("Distribution of Parts of Speech for Posthuman")


#Extracting Node Statistics of Posthuman
phum_deg <- unname(degree(sem_net, v="posthuman", mode="all"))
phum_clus_coef <- transitivity(sem_net, vid="posthuman", type = "barrat")
components <- decompose(sem_net)
largest_component <- components[[1]]
eigens_noun <- eigen_centrality(largest_component, directed = FALSE)
eigens_noun <- eigens_noun$vector
phum_eigen_cent <- unname(eigens_noun["posthuman"])
rm(components)
rm(largest_component)
rm(eigens_noun)

#Creating Table of Descriptive Stats
ph_desc_stats <- tibble(names = c("Degree", "Eigenvector Centrality Score", "Local
Clustering Coefficient"),
                        statistic = c(phum_deg, phum_eigen_cent, phum_clus_coef))

#Exporting Table of Descriptive Stats
my_flextable <- flextable(ph_desc_stats)
my_flextable <- set_table_properties(my_flextable, width = 1)
save_as_docx(my_flextable, path = "figures_and_tables/table.3.1.docx")


#Trimming Semantic Network for Posthuman Ego Network Extraction
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 70])
```

```
#Extracting the Ego-Network of Posthuman
ego_network <- ego(sem_net_trimmed, node = "posthuman", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)


vcount(induced_ego)
ecount(induced_ego)


#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)

#Assigning Communities
V(induced_ego)$community <- members$membership


#Drawing Ego Network with Communities
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
                  end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of Posthuman") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),


        plot.background = element_rect(color = "#0D0D0D", size = 1),
        panel.background = element_rect(fill = "#F0F0F2"))
```

```
#Trimming Semantic Network to Extract Ego Network of Work
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 300])


#Extracting the Ego-Network of Work
ego_network <- ego(sem_net_trimmed, node = "work", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)


vcount(induced_ego)
ecount(induced_ego)


#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)
#Assigning Communities
V(induced_ego)$community <- members$membership


#Drawing Ego Network with Communities
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
                  end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of Work") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),


        plot.background = element_rect(color = "#0D0D0D", size = 1),
```

```
        panel.background = element_rect(fill = "#F0F0F2"))


#Trimming Semantic Network to Extract Ego Network of Body
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 250])



#Extracting the Ego-Network of Body
ego_network <- ego(sem_net_trimmed, node = "body", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)



vcount(induced_ego)
ecount(induced_ego)

#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)

#Assigning Communities
V(induced_ego)$community <- members$membership

#Drawing Ego Network with Communities
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
                  end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of Body") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),
```

```
      plot.background = element_rect(color = "#0D0D0D", size = 1),
      panel.background = element_rect(fill = "#F0F0F2"))


#Trimming Semantic Network to Extract Ego Network of Other
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 500])

#Extracting the Ego-Network of Other
ego_network <- ego(sem_net_trimmed, node = "other", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)



vcount(induced_ego)
ecount(induced_ego)

#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)

#Assigning Communities
V(induced_ego)$community <- members$membership

#Drawing Ego Network with Communities
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
                  end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of Other") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),
```

```
      plot.background = element_rect(color = "#0D0D0D", size = 1),
      panel.background = element_rect(fill = "#F0F0F2"))



#Trimming Semantic Network to Extract Ego Network of Human
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 800])

#Extracting the Ego-Network of Human
ego_network <- ego(sem_net_trimmed, node = "human", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)



vcount(induced_ego)
ecount(induced_ego)

#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)

#Assigning Communities
V(induced_ego)$community <- members$membership

#Drawing Ego Network with Communities
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
                  end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of Human") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),
```

```
      plot.background = element_rect(color = "#0D0D0D", size = 1),
      panel.background = element_rect(fill = "#F0F0F2"))


#Trimming Semantic Network to Extract Ego Network of Subject
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 150])

#Extracting the Ego-Network of Subject
ego_network <- ego(sem_net_trimmed, node = "subject", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)


vcount(induced_ego)
ecount(induced_ego)

#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)

#Assigning Communities
V(induced_ego)$community <- members$membership

#Drawing Ego Network with Communities
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
                  end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of Subject") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),
```

```
      plot.background = element_rect(color = "#0D0D0D", size = 1),
      panel.background = element_rect(fill = "#F0F0F2"))



#Trimming Semantic Network to Extract Ego Network of World
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 250])

#Extracting the Ego-Network of World
ego_network <- ego(sem_net_trimmed, node = "world", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)



vcount(induced_ego)
ecount(induced_ego)

#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)

#Assigning Communities
V(induced_ego)$community <- members$membership

#Drawing Ego Network with Communities
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
                  end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of World") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
```

```
                    family = "georgia", size = , hjust = 0.5),

      plot.background = element_rect(color = "#0D0D0D", size = 1),
      panel.background = element_rect(fill = "#F0F0F2"))


#Trimming Semantic Network to Extract Ego Network of Voice
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 50])

#Extracting the Ego-Network of Voice
ego_network <- ego(sem_net_trimmed, node = "voice", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)


vcount(induced_ego)
ecount(induced_ego)


#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)

#Assigning Communities
V(induced_ego)$community <- members$membership

#Drawing Ego Network with Communities
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
                  end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of Voice") +
```

```
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),

        plot.background = element_rect(color = "#0D0D0D", size = 1),
        panel.background = element_rect(fill = "#F0F0F2"))



#Trimming Semantic Network to Extract Ego Network of Subjectivity
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 50])

#Extracting the Ego-Network of Subjectivity
ego_network <- ego(sem_net_trimmed, node = "subjectivity", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)



vcount(induced_ego)
ecount(induced_ego)



#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)

#Assigning Communities
V(induced_ego)$community <- members$membership

#Drawing Ego Network with Communities
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
```

```
            end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of Subjectivity") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),

        plot.background = element_rect(color = "#0D0D0D", size = 1),
        panel.background = element_rect(fill = "#F0F0F2"))



#Trimming Semantic Network to Extract Ego Network of Way
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 400])

#Extracting the Ego-Network of Way
ego_network <- ego(sem_net_trimmed, node = "way", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)


vcount(induced_ego)
ecount(induced_ego)


#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)

#Assigning Communities
V(induced_ego)$community <- members$membership

#Drawing Ego Network with Communities
```

```
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
                  end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of Way") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),

        plot.background = element_rect(color = "#0D0D0D", size = 1),
        panel.background = element_rect(fill = "#F0F0F2"))



#Trimming Semantic Network to Extract Ego Network of Technology
sem_net_trimmed <- delete_edges(sem_net, E(sem_net)[cooc < 400])

#Extracting the Ego-Network of Technology
ego_network <- ego(sem_net_trimmed, node = "technology", order=1, mode="all")
ego_network <- ego_network[[1]]
induced_ego <- induced_subgraph(sem_net_trimmed, ego_network)



vcount(induced_ego)
ecount(induced_ego)



#Finding Communities in Ego Network
members <- cluster_walktrap(induced_ego)

#Assigning Communities
V(induced_ego)$community <- members$membership
```

```
#Drawing Ego Network with Communities
set.seed(358)
ggraph(induced_ego, layout="fr") +
  geom_edge_link2(aes(alpha = cooc,colour = as_factor(node.community)), arrow =
arrow(length = unit(4, 'mm')),
                  end_cap = circle(5, 'mm'), width = 2, show.legend = FALSE)+
  geom_node_text(aes(label = name), colour = "#0D0D0D", size = 5, family="georgia")+
  ggtitle("Degree 1 Ego Network of Technology") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),

        plot.background = element_rect(color = "#0D0D0D", size = 1),
        panel.background = element_rect(fill = "#F0F0F2"))
```

Appendix H

```
#Importing Libraries
library(tidyverse)
library(udpipe)
library(ggtext)
library(magrittr)
```

```
library(igraph)
library(ggraph)
library(flextable)

#Setting Root Directory, Adding Font
setwd("E:/Charles University/Thesis/masters-thesis-code")
rm(list=ls())
windowsFonts(georgia = windowsFont("georgia"))

#Upload Data
citation_df <- read_csv("data/citation_data.csv")

#Check for Missing Values
citation_df %<>%
  filter(!is.na(cited_author))

#Count Occurrences of Citation
citation_df$both_side <- paste0(citation_df$author,"_SEP_", citation_df$cited_author)
citation_df <- citation_df %>%
  count(both_side, sort=TRUE)
citation_df %<>%
  separate(col = both_side, into = c("from", "to"), sep = "_SEP_")

#Recoding Laasch, O. to Laasch, Oliver
citation_df$to_recoded <- ifelse(citation_df$to == "Laasch, O.", "Laasch, Oliver",
citation_df$to)
citation_df %<>%
  select(from,to_recoded,n)

#Converting to iGraph Object
cit_net <- graph_from_data_frame(citation_df)

#Checking if Citation Network is Connected
```

```
is.connected(cit_net)

#Extracting Degree Distribution
degs <- degree(cit_net, mode = "all")



#Plotting Degree Distribution
degs <- tibble(degree = degs)

degs %>%
  count(degree)%>%
  ggplot()+
  geom_line(aes(x = n, y = degree))+
  labs(x = "Frequency", y = "Degree") +
  theme_classic() +
  theme(
    axis.text.x = element_text(family = "georgia", angle = 0, hjust = 1),
    axis.text.y = element_text(family = "georgia"),
    panel.grid.major = element_blank(),
    panel.grid.minor = element_blank(),
    axis.line = element_line(colour = "#0D0D0D"),
    legend.position = "none",
    plot.title = element_textbox(face = "bold", family = "georgia", size = 23, hjust = 0.5),
    axis.title = element_textbox(face = "bold", family = "georgia", size = 11),
    axis.text = element_textbox(size = 13),
    panel.border = element_blank(),
    panel.background = element_rect(fill = "#F0F0F2"),
    plot.background = element_rect(colour = "#0D0D0D", size = 1),
  ) +
  ggtitle("Degree Distribution")

#Extracting Diameter
```

```
diameter <- diameter(cit_net, directed = TRUE, unconnected = TRUE)

#Extracting Clustering Coefficient
clus_coef <- transitivity(cit_net, type = "global")


#Extracting Average Distance between Two Nodes
mean_dist <- mean_distance(cit_net,  details=FALSE)


#Creating Table of Descriptive Stats
desc_stats <- tibble(names = c("Diameter", "Clustering Coefficient", "Average Distance"),
                     statistic = c(diameter, clus_coef, mean_dist))

#Exporting Table of Descriptive Stats
my_flextable <- flextable(desc_stats)
my_flextable <- set_table_properties(my_flextable, width = 1)
save_as_docx(my_flextable, path = "figures_and_tables/table.4.1.docx")



#Extracting Major Hubs
degs <- degree(cit_net, mode = "all")
cutoff <- quantile(degs, 0.95)
top_nodes <- which(degs >= cutoff)
major_hubs <- induced_subgraph(cit_net, top_nodes)

vcount(major_hubs)
ecount(major_hubs)


#Finding Communities
```

```
members <- cluster_walktrap(major_hubs)

#Assigning Communities
V(major_hubs)$community <- members$membership



#Drawing the Major Hubs
set.seed(358)
ggraph(major_hubs, layout="fr") +
  geom_node_point(aes(color = as_factor(community)), alpha = 1, size = 2) +
  geom_edge_link(edge_alpha = 0.1, width = 1)+
  ggtitle("Diagram of the Major Hubs - Citation Network") +
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
                                     family = "georgia", size = , hjust = 0.5),
        legend.position = "none",
        plot.background = element_rect(color = "#0D0D0D", size = 1),
        panel.background = element_rect(fill = "#F0F0F2"))



#Coding Active Members of Discourse as 1 and Non-Active as 0
active_authors <- citation_df$from
active_authors <- unique(active_authors)

for (i in 1:vcount(cit_net)) {
  if (V(cit_net)$name[i] %in% active_authors) {
    V(cit_net)$active[i] <- 1
  }
  else {
    V(cit_net)$active[i] <- 0
  }
}
```

```
#Drawing Active Inactive Diagram
set.seed(358)
ggraph(cit_net, layout="lgl") +
  geom_edge_link(edge_alpha = 0.1, width = 1)+
  geom_node_point(aes(color = as_factor(active)), alpha = 1, size = 3) +
  ggtitle("Active-Inactive Diagram of Citation Network") +
  labs(color = "Active/Inactive")+
  scale_color_manual(labels=c("Inactive","Active"), values=c("#AED2ED","#F6776B"))+
  theme(plot.title = element_textbox(face = "bold", color = "#0D0D0D",
```

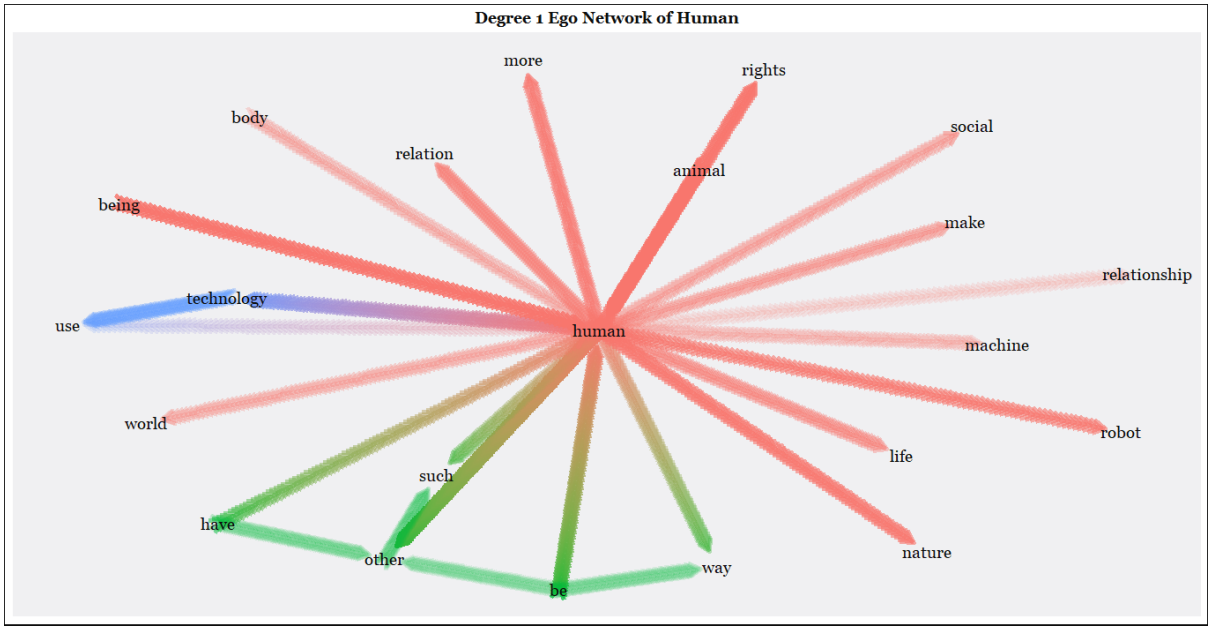
Appendix I

```
#Importing Libraries
library(tidyverse)
library(udpipe)
library(ggtext)
library(magrittr)
library(igraph)
library(ggraph)
library(flextable)

#Setting Root Directory, Adding Font
setwd("E:/Charles University/Thesis/masters-thesis-code")
rm(list=ls())
windowsFonts(georgia = windowsFont("georgia"))

#Upload Papers
papers_data <- read_csv("data/citation_data.csv")

#Making a vector of Top Active Authors
top_authors <- c("Pugh, Jonathan", "Dubljevic, Veljko", "Rossi, Simone")

#Finding Top Papers
top_papers <- papers_data %>%
  filter(author %in% top_authors) %>%
  select(author,doi)

top_papers %>%
  count(doi)

top_papers <- distinct(top_papers)

top_papers
```

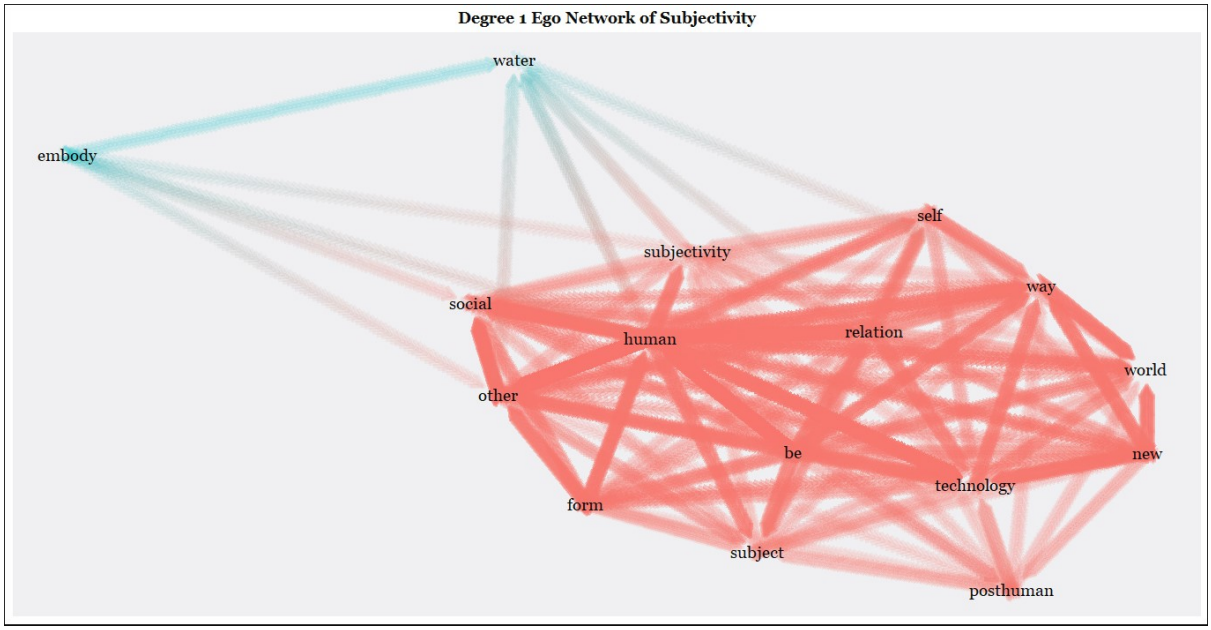
```
#Finding Top Journals
papers_journals <- papers_data %>%
  select(doi, journal)

papers_journals <- distinct(papers_journals)

to_table_journals <- papers_journals %>%
  count(journal, sort = TRUE) %>%
  slice(1:10)


#Exporting Table of Top Journals
my_flextable <- flextable(to_table_journals)
my_flextable <- set_table_properties(my_flextable, width = 1)
save_as_docx(my_flextable, path = "figures_and_tables/table.4.3.docx")



#Finding Most Frequent Authors
all_authors <- papers_data %>%
  select(doi, author)

all_authors <- distinct(all_authors)


freq_auth <- all_authors %>%
  count(author, sort = TRUE) %>%
  slice(1:10)


#Exporting Table of Most Frequent Authors
my_flextable <- flextable(freq_auth)
```

```
my_flextable <- set_table_properties(my_flextable, width = 1)
save_as_docx(my_flextable, path = "figures_and_tables/table.4.4.docx")


#Counting Number of Authors
cited_authors <- papers_data$cited_author
author <- papers_data$author


all_authors <- c(cited_authors, author)


all_authors <- tibble(auth = all_authors)

all_authors <- distinct(all_authors)
```

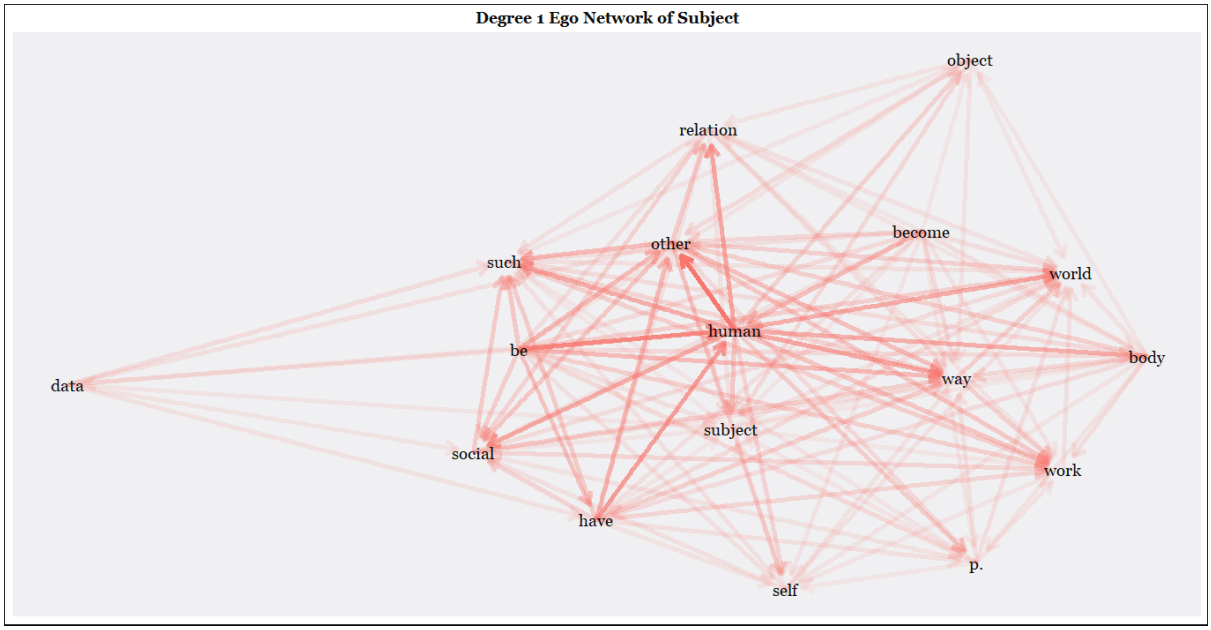
Appendix J


Degree 1 Ego Network of Human
more
rights
body
social
relation
animal
being
make
relationship
technology
use
human
machine
world
robot
life
such
have
nature
other
way
be

Appendix K


Degree 1 Ego Network of Subjectivity
water
embody
self
subjectivity
way
social
relation
human
world
other
be
new
technology
form
subject
posthuman

Appendix L


Degree 1 Ego Network of Subject
object
relation
become
other
such
world
human
be
body
data
way
subject
social
work
have
p.
self