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WHAT'S THE DEAL WITH HOMO ECONOMICUS?
A bibliographic map of the scientific discourse on the assumptions of human behavior in economics

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Abstract German

Wenn es darum geht, das Verhalten von Menschen im wirtschaftlichen Kontext zu verstehen, verwendet die moderne Wirtschaftswissenschaft ein Modell, das auf der Annahme beruht, dass Menschen stets rational und mit allen relevanten Informationen ausgestattet Entscheidungen treffen, die ihren persönlichen Nutzen um jeden Preis maximieren. Dieses Modell wird von Kritiker*innen spöttisch als Homo oeconomicus bezeichnet, dessen Entstehung ein jahrzehntelanger Diskurs vorausgegangen ist, der zu einem großen Teil aus kritischen Arbeiten und Widerlegungen besteht. Die vorliegende Arbeit gibt einen Überblick über den wissenschaftlich-literarischen Diskurs und zeigt auf, wer die wichtigsten Autor*innen sind, welche zentralen Artikel es im Diskurs gibt und mit welchen Themen sie sich hauptsächlich auseinandersetzen. Ziel war es auch, mögliche Anknüpfungspunkte für weitere Forschungen zu liefern, insbesondere für solche, die sich mit humanökologisch relevanten Themen beschäftigen, da viele Umweltprobleme auch in direktem Zusammenhang mit Konsum und Handel stehen. In Form von bibliographischen Netzwerken mit Hilfe der Software VOSviewer wurden diese identifiziert und Zusammenhänge aufgezeigt. Neben den bekanntesten Vertretern Ernst Fehr und Joseph Henrich wurden weitere Autor*innen mit ihren wichtigsten Arbeiten identifiziert. Die behandelten Themen reichen von Kooperation, Altruismus und Entscheidungsfindung bis hin zu Fragen der Moral, Ethik und der Infragestellung des vorherrschenden Wirtschaftssystems. Auch Ansatzpunkte für weitere Forschung konnten identifiziert werden. Insbesondere für humanökologische Fragestellungen bietet diese Arbeit eine hilfreiche Grundlage, um sowohl neue Forschungsfelder zu erschließen als auch Kollaborationen zu forcieren, da auch die Themen Nachhaltigkeit und Klimawandel präsent waren.

Keywords: Homo oeconomicus, Menschliches Verhalten, Ökonomie, Neoklassische Ökonomie, Wissenschaftlicher Diskurs, VOSviewer, Bibliographische Netzwerke, Szientometrie, Humanökologie, Nachhaltigkeit

Abstract English

When it comes to understanding human behavior in an economic context, modern economics uses a model based on the assumption that people always make rational decisions, are equipped with all relevant information, and strive to maximize their personal utility at all costs. This model is mockingly referred to by critics as Homo economicus, and its development is the result of decades of discourse, much of it consisting of critical works and refutations. This thesis provides an overview of the scientific literature and shows who the most important authors and central articles of the discourse are and what topics they mainly deal with. The aim was also to provide possible starting points for further research, especially for those dealing with issues relevant to human ecology, since many environmental problems are directly related to consumption and trade. These have been identified in the form of bibliographic networks using the VOSviewer software, and the connections between them have been shown. In addition to the well-known researchers Ernst Fehr and Joseph Henrich, other authors and their most important papers were identified. The topics covered range from cooperation, altruism, and decision making to questions of morality, ethics, and questioning the dominant economic system. Starting points for further research were also identified. For human ecology issues in particular, this work provides a helpful basis for opening up new areas of research and encouraging collaborations, as the issues of sustainability and climate change were also present.

Keywords: Homo economicus, human behavior, economics, neoclassical economics, scientific discourse, VOSviewer, bibliographic networks, scientometrics, human ecology, sustainability

1 INTRODUCTION

The currently accepted school of economics, neoclassical economics, is based on concrete assumptions about human behavior. In their view, all actions of human beings are driven by selfishness (Urbina & Ruiz-Villaverde, 2019). Accordingly, individuals in economic contexts are self-interested and always strive to maximize their profits. To achieve this goal, they also have perfect rationality. These behavioral premises are summarized under the term "Homo economicus," which represents an image and a theoretical model of human beings (Kluver et al., 2014; Urbina & Ruiz-Villaverde, 2019).

Despite its general acceptance in economics, this model has some well-known flaws. Several experiments have shown how often behavior deviates from the theoretical predictions of Homo economicus. The concept of complete selfishness is strongly challenged when fair and reciprocal behavior, often at great cost, are observed (Henrich et al., 2001). Many economists are aware of this, and among them are indeed the biggest critics. Nevertheless, it is safe to assume that the majority of economists are proponents of the model. In the end, these basic assumptions are part of the dominant paradigm in economics. The fact that the model is ultimately very practical cannot be denied. After all, the strong methodological reduction significantly increases the computability of the economic models. Of course, economists know that actual human behavior is much more complex, but according to proponents of the model, behavior that goes beyond the simplified assumptions has no relevance in economic settings. Even some studies that examine real-world conditions demonstrate that, depending on the specific question, there is no significant difference from the model's predictions (Drechsler, 2021). However, the subject remains unclear, and there are still doubts about its validity.

But what would be the implications if our entire economic system relies on flawed assumptions? A multitude of sectors could be affected. If one thoroughly considers this, the way institutions or even treaties are set up might be misguided or might have a problematic impact on governance strategies (Henrich et al., 2001). For example, incentives designed to promote sustainable consumption might not work if the predictions are wrong. From a human ecological perspective, this has a tremendous impact. All the efforts that have been made so far to provide incentives to encourage sustainable behavior may have been in vain.

In order to thoroughly investigate this matter, it is necessary to examine the entire development and the current status. The most effective approach to doing so is to examine the scientific discourse. After all, the concept of homo economicus has been the subject of heated debates since its creation. Through centuries of scientific discussion, Homo economicus has undergone a long evolution. From the beginning, the postulated human preferences and social moral concepts, to a technical tool for modeling economic theories (Braun, 2021; Thaler, 2000).

However, this discourse is by no means closed, as the many papers by leading scientists show. This leads to the question of what the current state of the scientific discourse on homo economicus looks like, and what recent trends have emerged. Is there a vital critical debate, or did it come to nothing? This master's thesis aims to give answers to these questions by providing an overview of the state of the scientific discourse on human behavior in an economic context.

To achieve this goal, a bibliographic map will be created showing the relationships between scientists, their studies, and possible collaborations. The method of analyzing scholarly literature through networks of researchers and their work allows for the examination of the most important topics and trends, as well as how they have evolved over time. This well-established method is commonly used in scientometrics (Capari et al., 2022). The tool of choice is the program VOSviewer (van Eck & Waltman, 2010), developed to display bibliographic networks.

In addition, the results of this thesis should help identify potential directions and starting points for future research on human behavior in the economy, from consumers to stakeholders in large corporations. A better understanding of this can help solve challenges related to economic issues. For example, corporate social responsibility is becoming increasingly important (Daub & Ergenzinger, 2005; Gruber & MacMillan, 2017), and if companies act according to moral guidelines rather than the idea of the selfish economic actor, many problems could be better addressed. The idea can be taken even further. Many of the world's current challenges are closely linked to global trade, including resource exploitation and inhumane working conditions, unequal distribution of wealth, environmental degradation caused by the exploitation of new natural resources, a standard of living that exceeds the carrying capacity of the planet and the resulting greenhouse gas emissions, and the resulting social and international conflicts. Existing economic theories are insufficient to explain and solve current complex challenges. Even wars are supposed to be explained by neoclassical theories, but they also fail (Cramer, 2002).

There is certainly no question that this work will not be able to provide an answer to any of these challenges. Nor does it claim to do so. But every contribution, no matter how small, can help get closer to the goal. Especially for human ecology and behavioral research, the findings can lead to further studies and, thus to new insights. After all, every piece of knowledge gained can help put our own behavior on a more sustainable path.

1.1 Background

At its core, Homo economicus is not a model but a summary of simple, basic assumptions about human behavior in the economy. For example, how consumers, households, and corporations would behave if they had to make an economic decision. This ranges from simple purchasing decisions to market reactions to certain changes.

Originally, the basic assumptions were relatively complex and had a more philosophical moral foundation (Morgan, 2006). However, these assumptions have changed in line with the transition from classical economics to the neoclassical economics that currently prevails (Elahi, 2014; Ng & Tseng, 2008).

In classical economics, moral motives were always included in the considerations (Alger & Weibull, 2013). Accordingly, this has been applied to assumptions about behavior. Adam Smith, the founder of modern economics, already considered a tendency to selfish behavior in humans (Kluver et al., 2014), but the overall portrait consisted of more than that, namely preferences, instincts, motives, and talents, which he did not consider as a real model (Morgan, 2006; Persky, 1995). It was not the economic man as it is understood today, nor did Smith invent the term. The economist John Stuart Mill is considered to be the inventor of the term, but in fact he only postulated simplified basic motives of human behavior, from which at best one can derive egoism and the pursuit of profit. The term itself was actually created by his opponents. It was only the scientific discussion of his work on a theoretical economic subject that caused critical voices to refer negatively to the idea of "economic man" (Persky, 1995). According to Bee and Desmarais-Tremblay (2023), the term Homo economicus was not invented until 1878 by Claudio Jannet. Homo economicus was therefore a critical term from the very beginning.

The characteristics attributed to economic man were also not immediately intended as an analytical tool, but developed over time in parallel with economics (Ng & Tseng, 2008). Economics evolved from a social science to a

discipline with a much more mathematical approach. Once the assumptions of selfish human behavior were applied to economic models, the original concept turned into a well-defined, rather technical, image of human beings with perfect rationality and unrestricted pursuit of profit maximization (Thaler, 2000). It was early economists such as William Stanley Jevons who pushed this development by comparing human thinking to a calculating machine (Maas, 1999).

In addition, economists strived to emphasize the scientific nature of economics. As a result, the demands on the models increased, and the predictability of behavioral assumptions became more important, while it was also pointed out that it was not meant to be a realistic picture. Over time, models became more rigid, and values disappeared entirely from the discussion. According to Tsakalotos (2005), economists today are unwilling to deal with values and morality for fear of losing their scientific credit.

However, a moral debate would certainly be beneficial. The truth is that economics is not value-free. After all, many authors are already addressing politically and socially relevant issues such as income inequality (Corneo & Grüner, 2002) and tax morality (Frey & Torgler, 2007). Many economists simply do not want to start a value-based debate. The fact that actual economic ideals even interact with people is particularly worrying (Benería, 1999; Hamann, 2009; Mintzberg et al., 2002; Stanghellini, 2023), especially when a moral debate does not want to take place. An economy that promotes impulsive consumption also endangers vulnerable people (Verplanken & Sato, 2011).

A debate is also necessary because the basic assumptions about behavior in an economic context have been proven wrong countless times, and alternative models and theories can explain behavior much better (Bowles & Gintis, 2000; Camerer & Fehr, 2006; Caporael et al., 1989; Dopfer, 2004; Gintis, 2000; Tomer, 2001; Urbina & Ruiz-Villaverde, 2019). Some dogmas, such as that of perfect rationality, are meanwhile outdated (Zafirovski, 2014), but nevertheless the general assumptions remain, and there is no sign of a change. „There is probably no other hypothesis about human behavior so thoroughly discredited on empirical grounds that still operates as a standard working assumption in any discipline" (Anderson, 2000, p. 173).

A debate on environmental issues would also be particularly important, as an economic ideal such as the notion of Homo economicus contradicts the need for a more sustainable use of resources (Kalimeris, 2018). New approaches in research would also be of enormous importance for environmental policy issues

(Gsottbauer & van den Bergh, 2011; Pedersen et al., 2020). Siebenhuner (2000) even proposes an alternative model characterized by sustainable behavior. Alternative approaches are being researched (Bloemmen et al., 2015; Jager et al., 2000; Nyborg, 2000), but the current state of the art remains unknown.

Just as Homo economicus was created through decades of discourse, further development can also take place in the same way. As previously announced, this thesis is intended to contribute to this process by discussing the current state of the discourse, but more importantly, it is intended to serve as a basis for identifying directions for further research.

1.2 Research Questions

In order to adequately examine and present the scientific discourse on Homo economicus, this thesis will answer the following questions with the help of scientometric analyses:

- **Who are the primary authors, and what is their relationship to one another?**
- **What are the key papers, and what role do they play in the discourse?**
- **What are the predominant topics, and how did they change over time?**
- **From a human ecological point of view - to what extent are sustainability and climate change present in the discourse?**

2 METHODS

Initial research has shown that the discourse on Homo economicus is multifaceted and takes place on different levels. Therefore, the approach chosen here is to examine the discourse on two levels by generating two different data sets. One of these, the so-called explicit discourse, consists of scientific literature that explicitly deals with homo economicus and aims to actively participate in the overall discourse. Accordingly, the authors use the term Homo economicus in prominent positions in their work, such as the title or keywords. The second data set comprises scholarly works that implicitly address the characteristics of Homo economicus and its hypothesized behavior, without explicitly using the term. Although the authors do not mention Homo economicus, their results significantly contribute to the discourse. Therefore, we can refer to this as an implicit discourse.

The next step is to analyze the explicit data set using different bibliographic networks with the VOSviewer software (van Eck & Waltman, 2010). Important aspects will be discussed and described to illustrate the central structure of the scientific literature, and thus, of the discourse. In a second step, the data from the implicit data set will be included, and the resulting networks will be compared with the previous ones.

The bibliometric data for both data sets are obtained from the Scopus database. Web of Science and Scopus are considered the most comprehensive, high-quality literature databases (Harzing & Alakangas, 2015; Mongeon & Paul-Hus, 2015; Zhu & Liu, 2020). However, in terms of journal coverage and output, Scopus is often considered superior (Escher, 2020; Harzing & Alakangas, 2015). To support this, a quick search for Homo economicus in both databases returns approximately 10% fewer papers in Web of Science. In addition, according to Escher (2020) both databases contain a large number of the same works. Nevertheless, when performing a bibliographic analysis, differences in the details can be observed due to the papers they do not share. However, an analysis on a more general level still leads to more or less the same conclusion (Escher, 2020). Since it is not possible to use two different types of data sets simultaneously in VOSviewer, using both sources is not an option (Escher, 2020; van Eck & Waltman, 2010; Van Eck & Waltman, 2023).

The subsequently generated results will be displayed as graphics generated by VOSviewer and as tables analyzed in Microsoft Excel.

2.1 Data sets

The goal was to obtain a broad sample, given the complexity of the topic, and to ensure high scientific standards by using exceptionally peer-reviewed literature. Therefore, the data set should be representative and free from any methodological or ideological bias. Consequently, only articles and reviews in English are included, without any further restrictions. Although there are many non-English speaking scientific communities dealing with Homo economicus, scientists who want to participate in the global discourse usually publish in English. Conversely, authors who choose not to publish their scientific work in English may not wish to contribute. In addition, Scopus has a bias towards English-language papers (Lis et al., 2020; Vera-Baceta et al., 2019), which can be addressed by restricting the data in advance.

The construction of the optimal search string is an iterative process of generating queries and testing the outcomes by examining the resulting bibliographic networks for relevance and completeness, which is very time consuming (Capari et al., 2022). After several runs, the final search string could be defined. Although the search query should be open to all possible outcomes, a few more selections were necessary. Entries with missing titles, author names, or obviously incorrect assignments have been deleted. Additional changes to the data set were also needed due to the functional properties of VOSviewer.

As a result, the two data sets differ in quality. Due to the significant difference in size, only the smaller, explicit data set could be thoroughly checked and corrected. The data set was manually reviewed, and author names, keywords, and some values were adjusted or corrected. Performing the same task on the implicit dataset would have exceeded the intended scope. Details of the changes are provided in the Modifications & Corrections section.

To maintain explanatory power, only the explicit data set is analyzed in detail. The implicit data serves as an underpinning tool, so only the most striking and obvious results are considered. Findings and trends from the explicit data should be verified by extending the data with those from the implicit data set. The assumption here is that authors and their work, as well as certain topics, are of most central importance if they stand out in both explicit and implicit discourse. In addition, the comparison of the two will provide further insights into different facets of the discourse.

2.1.1 Explicit Discourse

The data set consists of articles and review papers that include the terms Homo economicus, Homo oeconomicus, Homo economics, or Economic man in the title, abstract, or keywords.

Assumption: If an author places a keyword like Homo economicus in a prominent position, the intention is to participate actively and directly in the discourse, and to ensure the paper is easily discovered by interested parties. It is important to note the role of the title and keywords. In addition to its main purpose, the title serves as an attention-grabber. Therefore, including the term Homo economicus in the title is probably the most obvious attempt to be part of the discourse. Using the term in the keywords section is a very direct way to draw attention to my paper when someone searches for a specific topic.

Search string:
TITLE-ABS-KEY („homo economicus“ OR „homo economics“ OR „homo oeconomicus“ OR „economic man“) AND (LIMIT-TO (DOCTYPE , „ar“) OR LIMIT-TO (DOCTYPE , „re“)) AND (LIMIT-TO (LANGUAGE , „English“)) AND (EXCLUDE (LANGUAGE , „Spanish“) OR EXCLUDE (LANGUAGE , „German“) OR EXCLUDE (LANGUAGE , „Portuguese“) OR EXCLUDE (LANGUAGE , „Chinese“) OR EXCLUDE (LANGUAGE , „Russian“) OR EXCLUDE (LANGUAGE , „Ukrainian“) OR EXCLUDE (LANGUAGE , „Italian“) OR EXCLUDE (LANGUAGE , „Polish“))

2.1.2 Implicit Discourse

The data set consists of papers with references containing Homo economicus, Homo oeconomicus, Homo economics, or Economic man. One restriction is the absence of these terms in the title, abstract, or keywords, since these papers are already included in the explicit dataset.

Assumption: During the process of creating the optimal search query, it was already possible to get a first impression of the scientific literature and the problem that many authors examine the characteristics of Homo economicus without mentioning it. At least not in the title, abstract, or keywords, but in some of them several times in the text. However, if authors reference papers with Homo economicus in the title, they are likely dealing with a topic closely related to, or directly aiming at the overall discourse. Therefore, these authors participate, sometimes intentionally and sometimes unintentionally, but they do.

Search string:
(REF („homo economicus“ OR „homo economics“ OR „homo oeconomicus“ OR „economic man“) AND NOT TITLE-ABS-KEY („homo economicus“ OR „homo economics“ OR „homo oeconomicus“ OR „economic man“)) AND (LIMIT-TO (DOCTYPE , „ar“) OR LIMIT-TO (DOCTYPE , „re“)) AND (LIMIT-TO (LANGUAGE , „English“)) AND (EXCLUDE (LANGUAGE , „Spanish“) OR EXCLUDE (LANGUAGE , „Portuguese“) OR EXCLUDE (LANGUAGE , „German“) OR EXCLUDE (LANGUAGE , „French“) OR EXCLUDE (LANGUAGE , „Italian“) OR EXCLUDE (LANGUAGE , „Croatian“) OR EXCLUDE (LANGUAGE , „Russian“) OR EXCLUDE (LANGUAGE , „Polish“) OR EXCLUDE (LANGUAGE , „Slovenian“))

2.1.3 Modifications & Corrections

When analyzing bibliometric data from Scopus, VOSviewer requires a certain structure in order to read the data correctly and create accurate networks. In particular, assigning the correct author names is a major challenge, because, at the time of data collection, Scopus only provided surnames and first initials. This leads to the problem that some authors with the same surname and a first name starting with the same letter have been merged, although they are certainly different people. As a result, papers, collaborations, and citations were incorrectly assigned. This made it necessary to check each noteworthy author's first name if there was more than one paper and if there was a likelihood of mis-merging due to a common last name. In addition, key authors were double-checked to ensure that no one was overlooked. To address this issue, the first names of affected authors have been added to the database.

Another problem was caused by the way VOSviewer reads the bibliographic data. To identify matching pairs, VOSviewer first refers to a „combination of the name of the first author, the publication year, the volume number, and the begin page number”(Van Eck & Waltman, 2023, p. 32). This is a problem because the formatting of references in Scopus can vary a lot. In particular, the volume number is not consistent, which led to some serious errors. Therefore, it was necessary to identify the correct volume number, which happened to be in the „Issue“ column, and change it. Research was done to ensure that the number was correct. It turned out, for example, that the journal Foucault Studies does not use volume numbers at all, at least not for the articles in this sample.

Furthermore, one paper was found that happened to be in the sample because of the term „economic men“. In this case, Scopus apparently does not distinguish between „man“ and „men“. This paper was excluded from the sample because it was not relevant to the overall topic.

Nevertheless, it is part of this kind of bibliometric analysis to deal with data with a certain amount of noise. This is particularly true for the implicit data set. Some papers are missing certain information, like keywords or even the entire abstract. However, because this approach focuses primarily on peaks and trends, only cumulative data are taken into account. Therefore, small errors in the data should not matter. For example, an article that contains no keywords has probably no effect on the overall relationship between the thousands of other keywords.

In order to keep the rest of the data set as unchanged as possible, many other inconsistencies or redundant information have been resolved by a thesaurus, which will be discussed in another section.

2.2 Bibliographic Network Maps & VOSviewer

The mapping of bibliometric data is a widely used method to gain insights into the structure, current trends, and collaborations in a scientific field, as demonstrated by numerous articles (Börner et al., 2005; Donthu et al., 2020; Escher, 2020; Figg et al., 2006; Herrera-Franco et al., 2020; Kabil et al., 2021; Kamdem et al., 2019; Lis et al., 2020; Nan et al., 2023; Putera et al., 2022; Turatto et al., 2021) to name only a few.

Also, the use of VOSviewer is rapidly growing and common for analyzing scientific literature (Capari et al., 2022; Kozakiewicz & Lis, 2021; Lis et al., 2020). Compared to other bibliographic analysis tools, VOSviewer focuses on displaying the data for a more visual overview (van Eck & Waltman, 2010). Nevertheless, the generated networks yield both quantitative and qualitative results (Capari et al., 2022).

There are several types of networks that provide different aspects of the literature. VOSviewer calculates similarities in the bibliometric data and generates clusters that contain the items with the highest similarity (Van Eck & Waltman, 2023). The same technique is used for all network types. For instance, it is possible to calculate and visualize how often and with whom a scientist collaborates through co-authorship. Each author gets a certain position in the

network based on their connections to other authors and their similarities. VOSviewer displays the weight of a particular feature, depending on the network settings, as colored circle or knot together with the author's name. These knots are called „items“ in VOSviewer. The size of an item depends on its weight, the higher the weight the bigger the item. Therefore, when examining how many co-authorships an author has, the author with the highest number has the most links and therefore the largest item.

Additionally, the position of an item in the network provides information, as the distance between them indicates their relationship (Escher, 2020; McAllister et al., 2021; Van Eck & Waltman, 2023). Thus, it is possible to identify not only the most common elements, such as authors and keywords, but also how they relate to each other. However, it is important to note that due to the extensive amount of data, the diverse discourse, and the limited scope of a master’s thesis, the analysis can only be conducted from a broad perspective and cannot go into much detail.

The software versions of VOSviewer used throughout the entire period were 1.6.19 to 1.6.20.

2.2.1 Network Types

In order to answer the questions about central authors, central papers, and central topics, it is necessary to clarify what is required to fulfill this role. Scientometrics provides various networks to answer these questions. Three types of networks are particularly useful. A list of the specific questions and the appropriate networks for answering them can be found in Table 1.

Co-Authorship:

Co-authorship networks show the links between authors who have written papers together. In addition, it can also be used to examine the number of documents and general citations an author has. Co-authorship networks can also be considered a kind of social network where each scientist benefits from this relationship. In particular, junior and senior researchers gain from each other. The younger researcher benefits from the senior’s reputation and experience, while the latter receives a lot of assistance (Li et al., 2009).

This makes the co-authorship network a good candidate for identifying newcomers in a particular research field, often referred to as rising stars. Being

part of a high-impact collaborative group is a better indicator of a rising star than citation numbers, since younger scientists won't have a high citation count (Li et al., 2009).

Examining co-authored papers contributes additionally to the understanding of the scientific discourse since these articles usually get more attention. According to Figg et al. (2006), collaboration requires openness and the ability to work together productively, which appears to lead to higher cited articles.

As previously mentioned, co-authorship networks also provide the ability to view general citations and the number of documents by an author. Although this is also achievable when using other types of networks only with co-authorship, it is possible to see both the documents' count and citation rate of the authors, as well as their position in the social network of the field. These aspects are important because productivity and expert status play a crucial role in identifying key authors (Kamdem et al., 2019). Therefore, while the number of documents certainly determines productivity, high citations can be considered a measure of an individual's expert status (Kabil et al., 2021).

However, it is worth noting that using citation rate as the only measure of expert status can be problematic due to potential biases, such as the „Matthew effect" (Kozakiewicz & Lis, 2021), which is the phenomenon that highly cited authors tend to receive more citations based solely on their reputation.

For older papers, that have apparently more citations due to the longer time period to receive them (Kozakiewicz & Lis, 2021), VOSviewer provides a feature to address this problem by normalizing the citation numbers „The normalized number of citations of a document equals the number of citations of the document divided by the average number of citations of all documents published in the same year and included in the data that is provided to VOSviewer. The normalization corrects for the fact that older documents have had more time to receive citations than more recent documents" (Van Eck & Waltman, 2023, p. 38).

In summary, three requirements are taken into account to identify the central authors: collaboration, productivity, and citations, both in general and in the discourse. For the latter, it is necessary to employ a citation network, which will be discussed in the next section.

Citation:

Depending on the unit of analysis, citation networks connect papers or authors that cite each other. It is therefore perfect for examining three different aspects at the same time. It is possible to illustrate the most cited papers and authors within the discourse as well as on a general basis. In addition, citation networks can be used to identify the central topics by examining the research focus of the generated clusters.

For this thesis, the only requirement for a central paper is the number of citations. As in Kozakiewicz and Lis (2021), it is assumed that highly cited papers are more important and receive more attention from peers. While for general citations there is more than one network to represent the quantity, for citations within the discourse only citation networks are able to map them. One concern might be that a citation network within a discourse, and thus often within a scholarly community, might create a distorted image through self-citation and mutual peer citation. However, Zaggl (2017) found that the vast majority of authors of high-quality papers legitimately cite each other. Similarly, improper self-citation is rare in highly cited papers (Zaggl, 2017). Consequently, these assumptions also apply to the authors of these works and can therefore be used as an additional criterion for identifying the central authors. According to Kabil et al. (2021) citations are a legitimate measure to define the expert status of authors.

Identifying central topics by examining the subject of a cluster of citation networks is a common method. However, it is not always clear which type of citation network is best suited for this approach. In fact, in addition to the type described above, often referred to „direct citation", there are also „bibliographic coupling" and „co-citation" networks (Shibata et al., 2008). In VOSviewer, bibliographic coupling links units such as papers or authors that share one or more references. Co-citation, on the other hand, connects papers or authors that are cited together in a third article (McAllister et al., 2021; Shibata et al., 2008; van Eck & Waltman, 2010; Van Eck & Waltman, 2023).

To answer the question of which network is most capable of investigating cluster topics, the scientific literature provides different suggestions (Donthu et al., 2020; Shibata et al., 2008). According to Boyack and Klavans (2010), direct citation is the weakest in terms of accuracy when presenting the research fronts. Bibliographic coupling is the strongest, and co-citation is only slightly weaker. However, when it comes to identifying similarities between clusters, citation networks are apparently the most effective (Klavans & Boyack, 2006;

Kozakiewicz & Lis, 2021; Shibata et al., 2008). Additionally, bibliographic coupling and co-citation sometimes overlook „core papers“ (Shibata et al., 2008).

In conclusion, not only does co-citation seem to have some weaknesses, it is actually not worth considering, since VOSviewer warns against using co-citation networks when using Scopus for data acquisition due to its inconsistencies in the format of references (Van Eck & Waltman, 2023). Bibliographic coupling would have been a good candidate as well, but for the purpose of this master's thesis, the application of direct citation is perfectly sufficient.

The use of citation networks, and in particular direct citations, is a perfect approach to examining research fronts and is highly qualified to illustrate the „intellectual structure" of the discourse (Kozakiewicz & Lis, 2021; Shibata et al., 2008) and thus contributing profoundly to the identification of central topics.

Kozakiewicz and Lis (2021) also suggest using citation networks as preliminary research before applying co-occurrence networks, which are used for keyword analysis, which will be discussed in the following.

Co-Occurrence:

In contrast to the other network types, co-occurrence networks are applied to keywords and terms. VOSviewer connects keywords that occur together in the papers in the sample. For instance, it can be expected that Homo economicus, which is probably the most important keyword in the discourse, appears most often and several times together with other keywords in the papers. Both the frequency of occurrence and the co-occurrence are shown in the network. The indicator for the co-occurrence of a keyword is the „total link strength". Keywords with a high total link strength also tend to appear frequently in most articles (Escher, 2020; Park et al., 2020) and are therefore important for the overall discourse.

Compared to the citation network analysis of clusters, co-occurrence networks provide a different picture of the thematic field. While citation networks can be considered a map of the actual topics the authors are researching, co-occurrence is more like a „cognitive structure"(Börner et al., 2005), since the authors choose these keywords, which reflect what they think they are researching. To focus on this aspect, only author keywords are used in this thesis.

In addition, VOSviewer offers the feature of displaying the time span of all items in the networks, which allows for examining the thematic emphasis over the years (Lis et al., 2020). Another map type that is available for all network types is the „Density Visualization", which uses different background colors to show keyword hot spots and the distances between keywords to reveal the most important thematic areas and their relationships (McAllister et al., 2021).

As mentioned before, in addition to keywords, terms can also be mapped with co-occurrence networks. The linking association is the same, except that instead of keywords, terms from the abstract, title, or both are analyzed. Some authors only perform a co-occurrence network with terms to analyze the main topics of their sample (Kamdem et al., 2019; Turatto et al., 2021). The advantage of using both is that it allows comparing the words chosen by the authors (keywords) with the words actually used in the text (title, abstract). Therefore, using co-occurrence networks with both, keywords and terms is probably the most comprehensive approach to answering questions about the central topics in the discourse.

Subject	Requirements	Network Type	Unit	Weights
Central Authors	Collaboration	**Co-Authorship**	Author	T. Link Strength
	Paper Quantity	**Co-Authorship**	Author	Documents
	Expert Status	**Citation**	Author	T. Link Strength
Central Papers	Citations	**Citation**	Documents	T. Link Strength
Central Topics	Research Subject	**Citation**	Documents	T. Link Strength
	Keywords	**Co-Occurrence**	Keywords	Occurrences T. Link Strength
	Used Terms	**Co-Occurrence**	Terms	Occurrences T. Link Strength

Table 1: Overview of the research subjects and the appropriate networks to examine them.

2.3 Thesaurus

As mentioned in the „Modifications and Corrections" section, the data set should remain as unmodified as possible. This is to preserve the original data to avoid any bias and to have the possibility to create networks with all possible variations, e.g., a network with certain keywords or without. In order to be able to modify the network output, VOSviewer offers two features. One of them is a checklist during the network creation process, where unwanted items can be deselected. While this is helpful when a spontaneous change is desired, for permanent changes, it is quite inconvenient to uncheck items for each network generating process.

Therefore, the second feature provided is a Thesaurus, which can be created as an „Editor Text File (txt)", containing a list of synonyms to harmonize the data. Especially for the different spellings and terms for Homo economicus, it was necessary to reduce them to just one word, otherwise, the entire keyword analysis would be pointless. A list of the different terms for Homo economicus can be found in Table 2.

Another challenge is numerus, which means changing the plural form of a term to the singular or vice versa, depending on the individual goal or purpose. It is also useful to standardize author names, as some are written with the middle initial and some are written without. This is particularly relevant because VOSviewer will recognize any different spelling as a different term, and this will lead to a completely different and, most importantly, a completely wrong network output (McAllister et al., 2021). The Thesaurus can also be used to ignore certain terms by skipping the field where alternative terms usually belong. This was conducted for general terms such as „human", „article", „female", etc.

In order to create a Thesaurus, it is necessary to check the entire list of authors and keywords in the data set. Similar to the experience reported by McAllister et al. (2021), this process is very extensive and time consuming. Again, due to the large difference in scope between the explicit and implicit data sets, the Thesaurus was created only according to the spelling differences of the explicit data set.

Two different Thesaurus documents were created, one for authors and one for keywords. The rules that apply to them had to be established. In general, the more common spelling in the sample was preferred. In the event of a tie, the

following procedure was used depending on the type, unless otherwise specified:

Rules that apply in the case of a tie:

- Numerus: If the term was available in both singular and plural, singular was chosen.
- Terms that are spelled partly with and partly without a hyphen are preferably used with a hyphen.
- For the authors' names, the longest names were chosen (names with initials of all middle names) in order to give their names a unique identity.

In addition, American English spelling was always preferred, and errors and typos were corrected in the thesaurus, not in the original data.

Table 2: Standardizing the Homo economicus terms in the Thesaurus.

Keyword in the original data set	**Replaced by**
homo oeconomicus	homo economicus
economic man	homo economicus
'economic man'	homo economicus
„economic man"	homo economicus
homo œconomicus	homo economicus
homo economics	homo economicus
homo economicu	homo economicus
homo-economicus	homo economicus
'homo economicus'	homo economicus
model of economic man (homo economicus)	homo economicus
model of self interest (homo economicus)	homo economicus
economic man (homo economicus)	homo economicus

A complete list of the Thesaurus can be found in the appendix.

3 RESULTS

This chapter presents the results, starting with the data acquisition, followed by the results of the individual network analyses. It is organized according to the research questions, starting with the central authors, the central papers, and ending with the central topics for each, the explicit and the implicit data set. The tables with the highest scores are presented first, providing insight into most of the answers to these questions, followed by the illustrations of the networks. The tables usually represent the top 10 lists. Since, in many cases, results are ranked equally, the lists often contain more than 10 entries. A more in-depth analysis of the results follows in the discussion section.

3.1 Results Explicit Discourse

Output of the query with the date 06.06.2023 after modification and correction: The data set contains 801 documents and 1223 authors. The oldest paper was written in 1902 and the others were written between 1943 and 2023. The mean publication year was 2010 and the median was 2014. The most recent year that was completed was 2022 with 47 papers.

3.1.1 Central Authors

Co-Authorhip Network

All 1223 authors are included. The settings were set to default since no other configuration produced a better result. VOSviewer associated 707 clusters, but only 18 of them reached a certain threshold to be displayed in color.

Collaboration

The total link strength is an indication of the strength of the collaboration, as the score increases with each co-authorship, even if the same author is involved more than once. Thus, authors who have collaborated with the same person several times are no less collaborative than others who have co-authored with many different authors. Table 3 shows the authors with the highest total link strength with at least two papers, since a high value can also be achieved by being part of only one particular paper with numerous co-authors. For the link values, only the linked authors count, regardless of how often they have collaborated.

Table 3: Authors with the highest value for co-authorship by total link strength.

Label	T. Link Strength	Cluster	Links	Docs
chen s.	**8**	3	7	2
wang yingming	**8**	3	7	2
gintis h.	**8**	5	6	4
fehr e.	**8**	5	6	3
bowles s.	**7**	5	6	2
camerer c.	**7**	5	6	2
nekhay v.n.	**7**	6	6	2
shaov a.a.	**7**	6	6	2
gowdy j.m.	**6**	7	6	5
boyd r.	**6**	5	6	2
ruiz-villaverde a.	**5**	13	5	3
frey b.s.	**5**	26	4	3
becchetti l.	**4**	11	4	3
corrado l.	**4**	11	4	2
pelloni a.	**4**	11	4	2
cullis j.	**4**	97	2	3
jones p.	**4**	97	2	3

Total link strength (T. Link Strength.) indicates the strength of co-authorship because every collaboration is counted. „Links" instead are counted only for each connection to another author, regardless of frequency. Threshold: min. total link strength: 4. Min. documents 2.

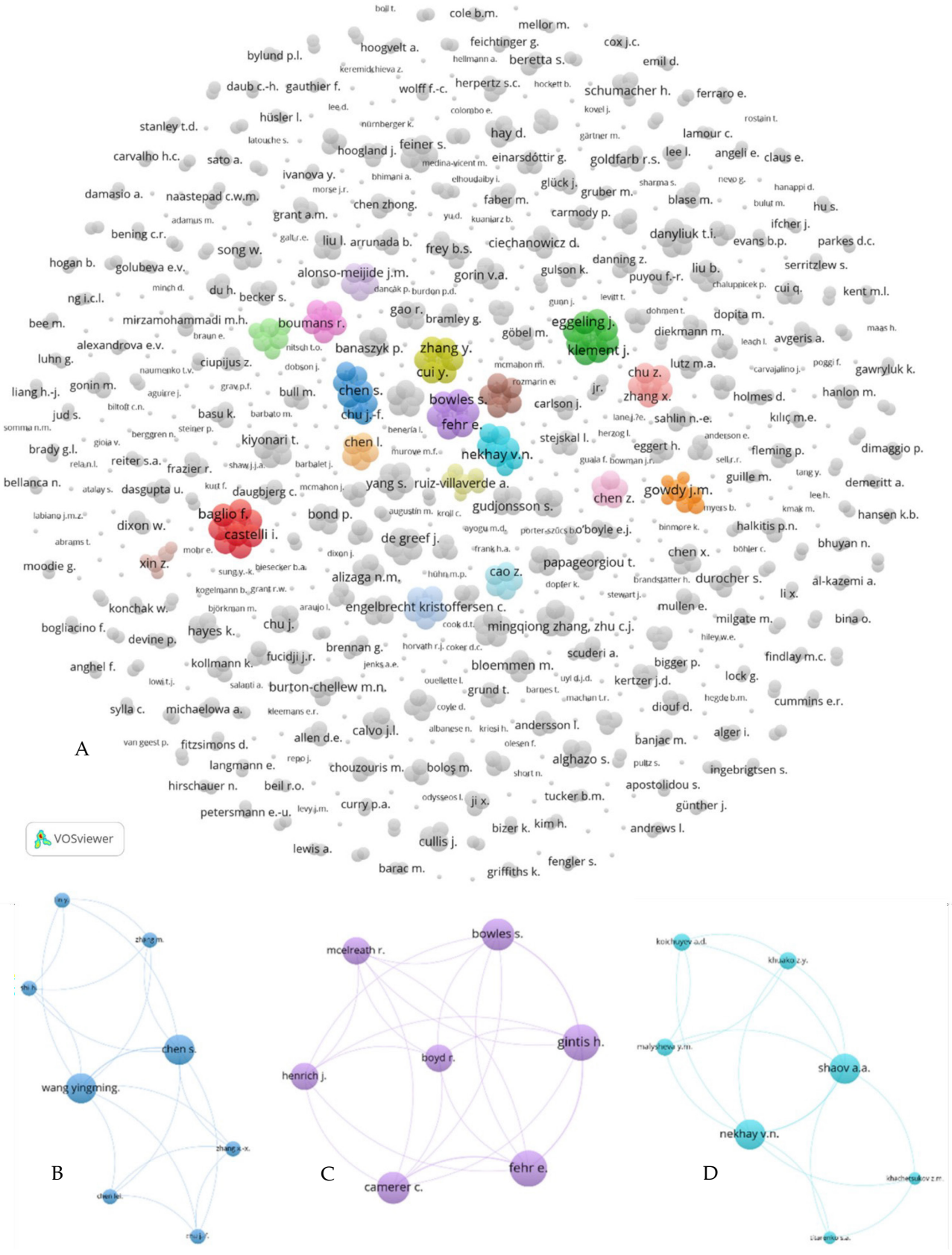

*Figure 1: Co-authorship network. Weights: Total link strength. **A**: all authors except of the cardiovascular group. **B**: Cluster 3 with wang, y.; chen, s.; **C**: Cluster 5 with bowles, s.; fehr, e.; gintis, h. **D**: Cluster 6 with nekhay, v.n.; shaov, a.a. as the main authors.*

Most prominent Clusters:

Cluster 1 disproportionately dominates the entire network. It consists of a group of researchers who work together on cardiovascular diseases caused by nutrition, or rather, malnutrition. This is a quite atypical field of research that deals with Homo economicus. In their work, Homo economicus stands for modern humans and their lifestyle-based diets. This is a kind of misapplication of the term Homo economicus, considering the origin of the concept and its definition. Nevertheless, the rules for the data set apply to them as well; using the term prominently is equivalent to a willingness to participate in the discourse. Therefore, although the authors remained in the data set, they were largely excluded from the analysis. In most cases, it was not even necessary to omit them, as they rarely played a role, apart from the co-author network (Figure 2).

Cluster 3 (8 items). Two authors, Chen, S. and Wang, Y., play a central role as they act as a connecting link within their cluster. However, only two documents are included (Figure 1 B).

Cluster 5 (7 items). The authors, Fehr, E. and Gintis, H. stand out a little more than the others. Followed by Camerer, C. and Bowles, S. with only one point less. In this cluster, everyone is connected to everyone, and thus it can be considered a cluster with high collaboration strength (Figure 1 C).

Cluster 6 (7 items). Similar to cluster 3, two central authors, Nekhay, V.N. and Shaov, A.A., connect the other authors, although here again only two documents make up the whole cluster (Figure 1 D).

Cluster 7 (7 items). Gowdy, J. M. is the most prominent author in this cluster. Out of 5 documents in the sample, he is the sole author of only one. In each of these papers, he is the first author (Figure 3).

Cluster 11 (6 items). A cluster with three even authors by co-authorship. Becchetti, L. with three papers, two of them collaborations. First author in all of them. Corrado, L. with two papers in collaboration. One as the first author. Pelloni, A. with two papers in collaboration. Second co-author in both.

Cluster 13 (6 items) Ruiz-Villaverde, A. plays an important role in this cluster. He is the only link for all other authors. There are a total of three documents in this cluster (Figure 4).

Cluster 17 (3 items). The only link in this cluster is Xin, Z. with three papers, all in collaboration, two of them as first author.

Cluster 26 (5 items). In this cluster Frey, B. S. is sole connection to the other authors with three papers of which he is the first author. No color could be assigned to this cluster in the VOSviewer association process.

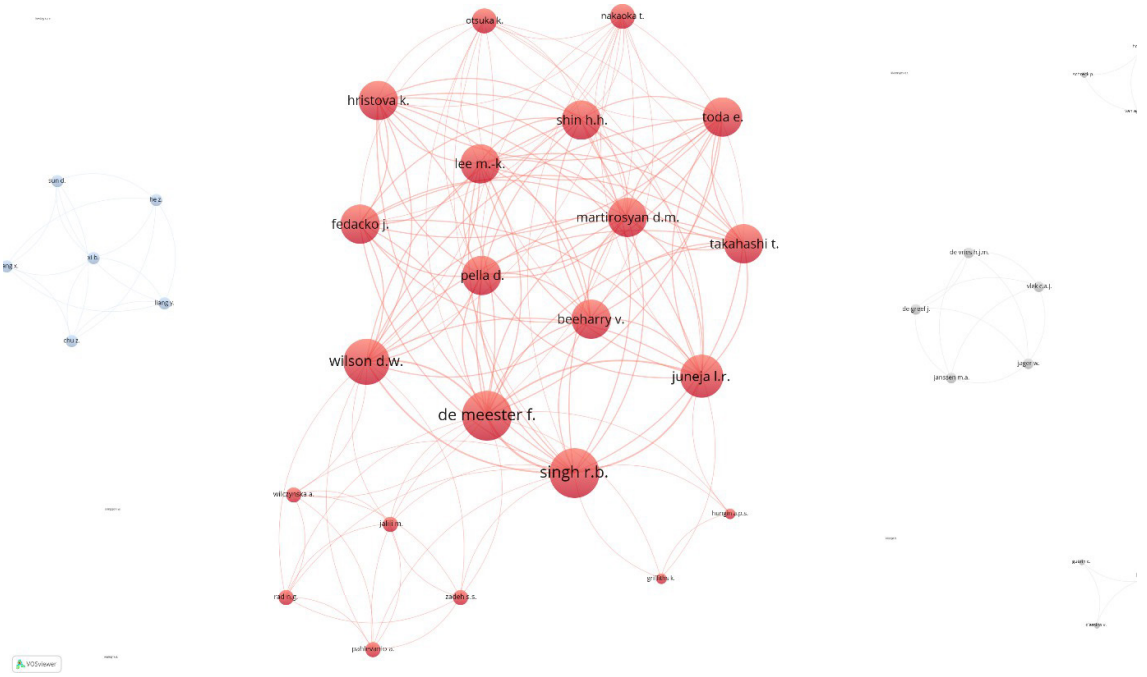

Figure 2: Cluster 1 is a group of scientists researching diet-related cardiovascular diseases. They use Homo economicus as a synonym for modern humans and western diets. Excluded from the overall co-authorship network.

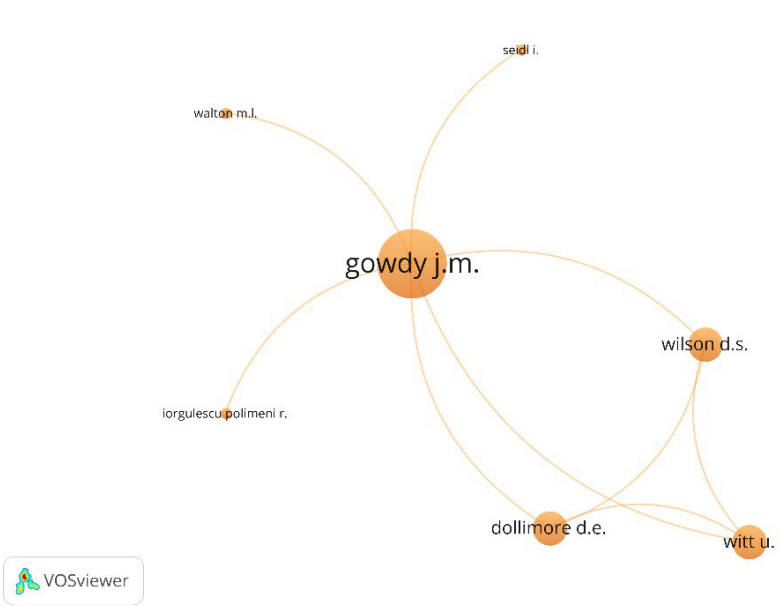

Figure 3: Cluster 7. Weights: Total link strength. Gowdy, J. M. is the most prominent author with a score of 6. The smaller items (authors) have 3 and the smallest 1.

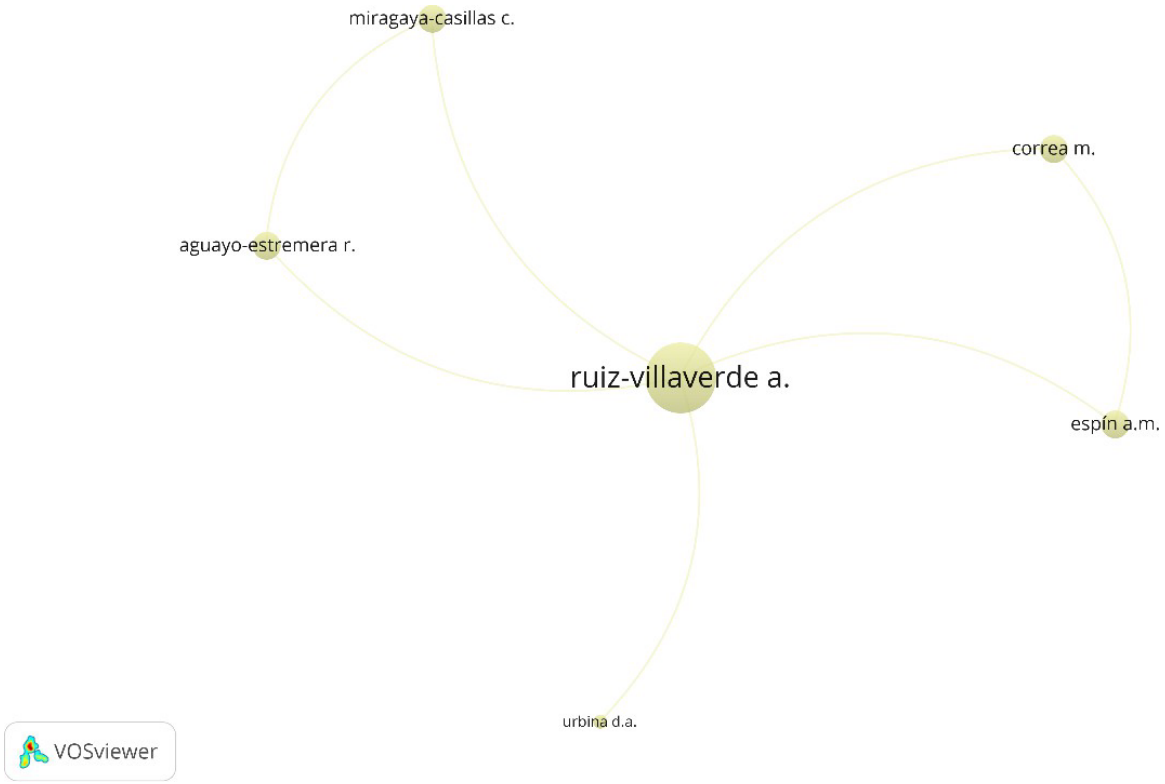

Figure 4: Cluster 13. Weights: Total link strength. Ruiz-Villaverde, A. as the connecting link.

Number of Documents

Other elements that can be examined in the network are the number of documents and, additionally, the time dimension. Another type of visualization offered by VOSviewer is the so-called „overlay visualization". This allows examining more and different aspects of the network. In Figure 5, the weights are set to documents, and the score is set to the average year of publication. Thus, the size of the items depends on the number of documents the author has, and the color represents the average publication year of these documents.

The authors with the most papers are shown in Table 4. Gowdy, J. M. and Wagner-Tsukamoto, S. A. with five papers, are the authors with the most papers. In addition, it can be observed that most authors with a larger number of documents have published them either longer ago, or perhaps steadily, since the greenish color for 2010 can also indicate an even distribution, as it is the average publication year. The only exceptions are the author Ruiz-Villaverde, A. who participated in three published papers from 2019 to 2023 and Xin, Z. who even published as the first author two papers in 2022 and 2023 and one more in 2013.

Table 4: Authors with the most documents in the explicit discourse.

Label	Docs	Citations	Norm. cit.	Avg. pub. year
gowdy j.m.	**5**	54	2,61	2006,00
wagner-tsukamoto s.a.	**5**	88	2,04	2010,60
gintis h.	**4**	2241	21,25	2002,00
beretta s.	**4**	2	0,16	2017,50
söderbaum p.	**4**	125	2,88	2006,00
watson m.	**4**	25	1,79	2014,75
fehr e.	**3**	2317	22,89	2004,67
ruiz-villaverde a.	**3**	33	7,58	**2021,33**
frey b.s.	**3**	384	7,87	2009,00
cullis j.	**3**	23	0,43	2004,00
jones p.	**3**	23	0,43	2004,00
becchetti l.	**3**	232	8,31	2014,67
dixon w.	**3**	14	0,57	2010,00
wilson d.	**3**	14	0,57	2010,00
maggioni m.a.	**3**	2	0,16	2017,33
xin z.	**3**	18	1,54	**2019,33**
brennan g.	**3**	48	1,96	1996,67
dierksmeier c.	**3**	112	7,14	2014,00
mahyudi m.	**3**	17	1,12	2015,33

Number of documents is at least 3. Citation shows the total number of citations the authors received. Normalized citations (Norm. cit.) put the citations in relation to the average year of publication. Gowdy, J. M. and Wagner-Tsukamoto, S. A are the authors with the most documents. Ruiz-Villaverde, A. and Xin, Z. published most recently.

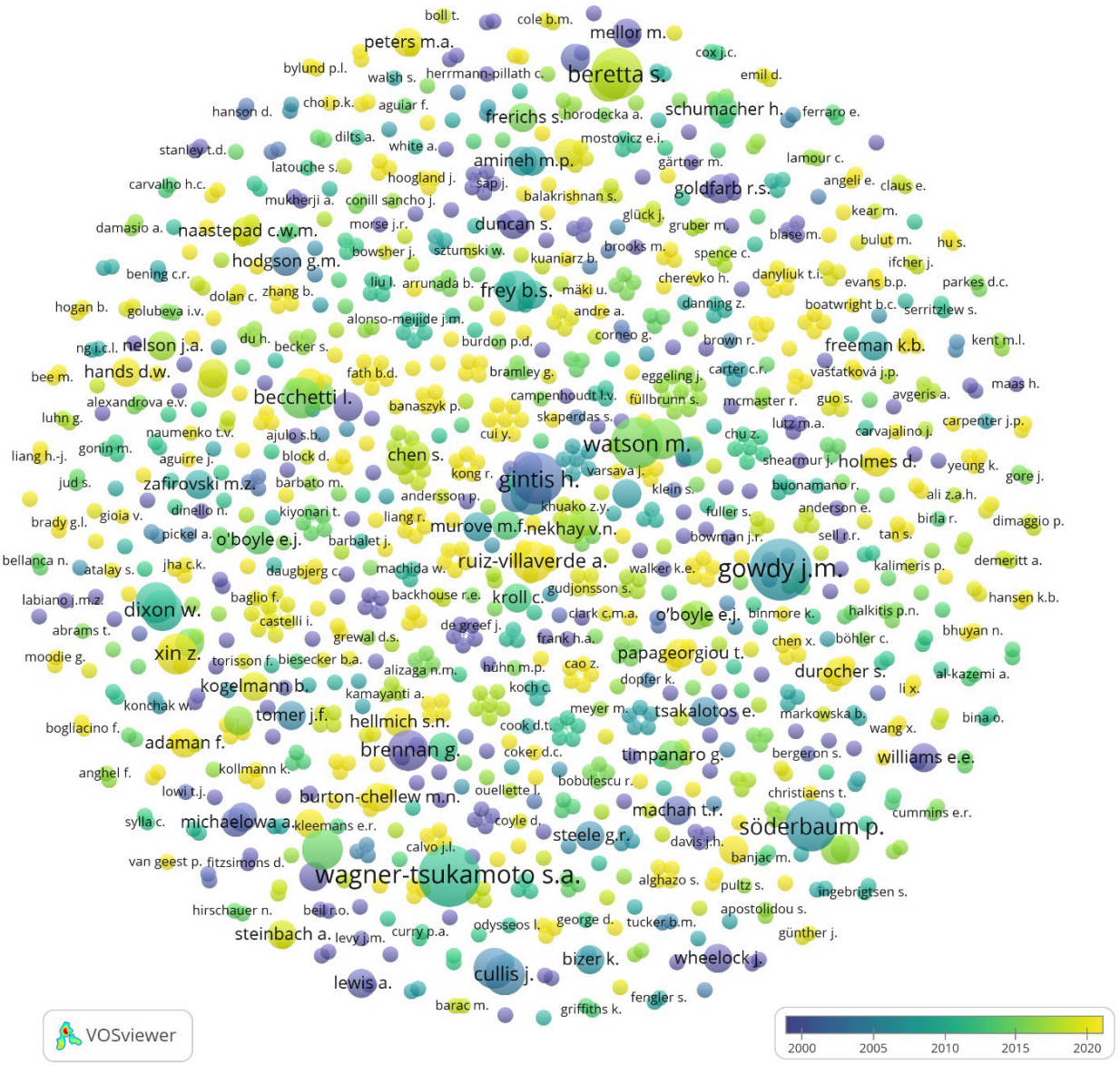

Figure 5: Co-authorship Network. Overlay Visualization with weights set to documents and a score set to average publication year. Cluster 1 (cardiovascular group) is not included. The size of the items indicates the number of documents, and the colors indicate the average publication year. The yellow items are the most recent and the dark purple items are the oldest.

Citations

To be considered an expert, both the overall frequency of citations (Table 5) and the number of citations (Table 6) within the discourse are crucial.

It should be noted that the total number of citations given here is the sum of all citations that the authors received only from the articles in this sample. These numbers are taken from Scopus. This means that not all citations the author has ever received are listed here. On the other hand, the Total Link Strength values in Table 6 correspond exclusively to the citations that the authors have received from the other authors through their work in this sample.

Table 5: Top 10 of the most cited authors.

	Label	Citations	Norm. citations	Avg. pub. year	Avg. citations
1	**davis j.h.**	**2638**	8,38	1997,00	2638,00
1	**donaldson l.**	**2638**	8,38	1997,00	2638,00
1	**schoorman f.d.**	**2638**	8,38	1997,00	2638,00
2	**fehr e.**	**2317**	22,89	2004,67	772,33
3	**gintis h.**	**2241**	21,25	2002,00	560,25
4	**camerer c.**	**1961**	18,49	2003,50	980,50
5	**bowles s.**	**1642**	14,12	2000,50	821,00
6	**boyd r.**	**1501**	12,71	2010,50	750,50
7	**henrich j.**	**1500**	12,52	2001,00	1500,00
7	**mcelreath r.**	**1500**	12,52	2001,00	1500,00
8	**hamari j.**	**482**	14,61	2013,00	482,00
9	**thaler r.h.**	**456**	5,13	2000,00	456,00
10	**read j.**	**421**	6,64	2009,00	421,00

The citations are the sum of the citations of all authors' documents in the sample. The three authors in first place co-authored a highly cited paper, so they share the same position with exactly the same citation frequency. The same is true for Henrich, J. and Mcelreath, R.

Table 6: Top 10 of the most cited authors within the sample.

	Label	T. Link Strength	Link	Docs	Citations	Norm.cit.
1	**fehr e.**	**103**	78	3	2317	22,89
2	**gintis h.**	**90**	69	4	2241	21,25
3	**camerer c.**	**84**	72	2	1961	18,49
4	**bowles s.**	**50**	41	2	1642	14,12
5	**boyd r.**	**41**	37	2	1501	12,71
5	**henrich j.**	**41**	37	1	1500	12,52
5	**mcelreath r.**	**41**	37	1	1500	12,52
6	**ruiz-villaverde a.**	**40**	30	3	33	7,58
7	**gowdy j.m.**	**38**	12	5	54	2,61
8	**thaler r.h.**	**26**	26	1	456	5,13
8	**urbina d.a.**	**26**	21	1	31	5,54
8	**xin z.**	**26**	21	3	18	1,54
9	**read j.**	**22**	21	1	421	6,64
10	**bull m.**	**17**	17	1	8	1,52
10	**childs a.**	**17**	17	1	8	1,52
10	**coomber r.**	**17**	17	1	8	1,52
10	**kalimeris p.**	**17**	16	1	1	0,12
10	**lee j.**	**17**	11	2	3	1,33

The Total Link Strength counts for each citation the author received in the sample. The Links instead shows the number of authors that cited the particular author in the list.

Most authors do not cite any other author in the sample. However, there is a considerable proportion of authors who do cite each other quite frequently. Figure 6 shows the full sample as well as a zoom on the connected group.

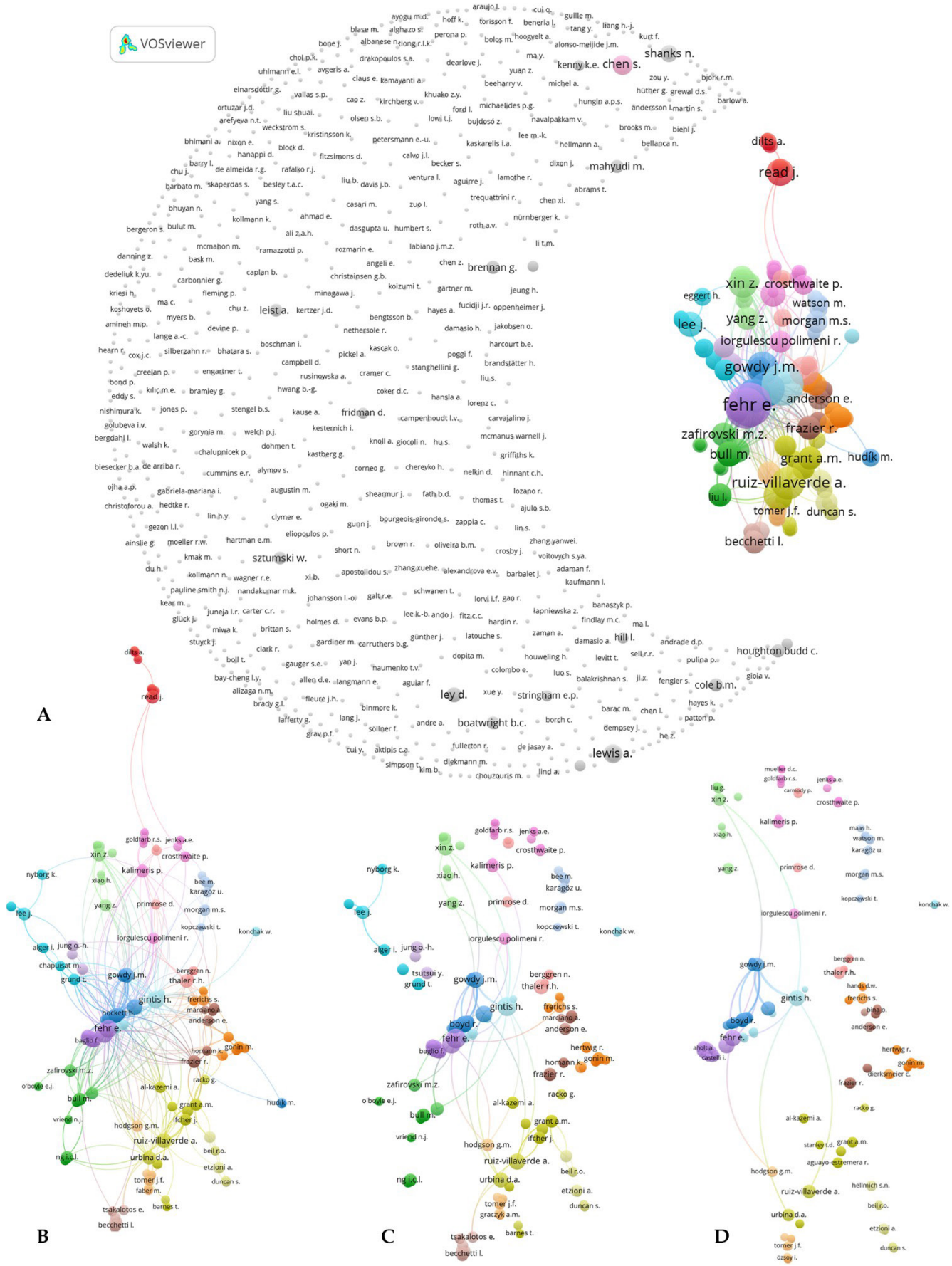

Figure 6: Citation network. Weights on links corresponding to reciprocal citations. The minimum cluster size is set to 10. Figures B to D show a zoom on the main and only connected accumulation of the network with different strengths of links between authors. There is a gradual decrease from A to D (A, B:0, C:2, D:3). Thus, A and B show all links, regardless of their strength, and D shows only the strongest links.

3.1.2 Central Papers

Table 7: Top 10 of the most cited papers within the discourse.

	Label	Links	Citations	Norm. cit.
1	**henrich j. (2001)**	**22**	1500	12,52
2	**thaler r.h. (2000)**	**17**	456	5,13
3	**camerer c.f. (2006)**	**16**	461	5,97
3	**read j. (2009)**	**16**	421	6,64
4	**urbina d.a. (2019)**	**12**	31	5,54
5	**gintis h. (2000)**	**11**	243	2,73
6	**fehr e. (2007)**	**10**	356	4,40
6	**kalimeris p. (2018)**	**10**	**1**	0,12
7	**morgan m.s. (2006)**	**8**	55	0,71
8	**bowles s. (2000)**	**7**	142	1,60
8	**crosthwaite p. (2013)**	**7**	**6**	0,18
8	**braun e. (2021)**	**7**	**1**	0,44
9	**anderson e. (2000)**	**6**	118	1,33
9	**molinsky a.l. (2012)**	**6**	89	4,12
9	**childs a. (2020)**	**6**	**8**	1,52
10	**etzioni a. (2015)**	**5**	26	1,23
10	**karagöz u. (2014)**	**5**	**3**	0,24
10	**tomer j.f. (2001)**	**5**	23	0,19
10	**alger i. (2013)**	**5**	156	4,73
10	**zafirovski m. (2014)**	**5**	12	0,95
10	**miragaya-casillas c. (2023)**	**5**	**0**	0,00

The links correspond to the number of citations a paper has received from other authors in the sample or vice versa. Papers with a very low citation frequency but a high link value indicate papers that mainly cite others and are rarely cited themselves (highlighted by numbers in bold). At least up to the time of data collection.

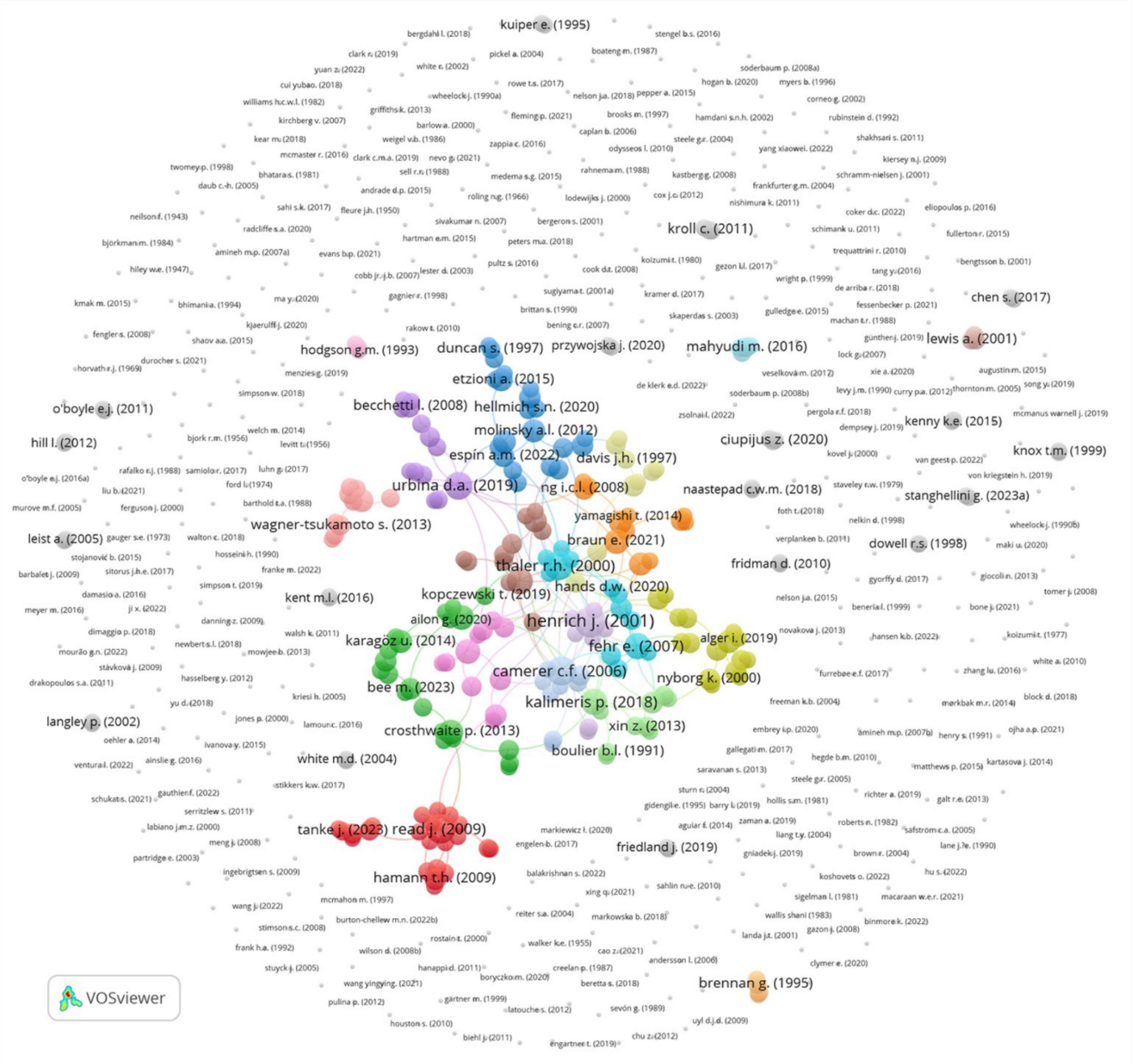

Figure 7: Citation Network. Reciprocally cited papers. Weights on links. Minimum cluster size 8.

Similar to the citation network with authors as the unit of analysis, the citation network with documents shows an image of a „non-citing" majority and a center with a highly connected agglomeration (Figure 7). The most reciprocal citations within the sample are shown in Table 7. Additionally, the total citations of these papers are also shown, since both total and reciprocal citations are important to answer the question about the central papers.

3.1.3 Central Topics

As previously stated, three different approaches are used to analyze the central topics: cluster analysis, co-occurrence of keywords, and terms. In this chapter, for the cluster analysis, only an overview of will be given. A more detailed analysis will be done in the discussion section.

Table 8: Central topics obtained by cluster analysis.

Cluster	Central Paper	Cluster Topic
Cluster 1	read j. (2009)	Foucault
Cluster 2	molinsky a.l. (2012)	Interaction of doctrine on different people
Cluster 3	alger i. (2013)	Homo moralis. Moral & Evolution
Cluster 4	morgan m.s. (2006)	Genealogy of the concept of Homo economicus
Cluster 5	urbina d.a. (2019)	Criticism of ideological legitimization of economic system by Homo economicus.
Cluster 6	thaler r.h. (2000)	Forecast on the development of economics
Cluster 7	ng i.c.l. (2008)	Rationality
Cluster 8	gintis h. (2000)	Alternative economic models. Reciprocity
Cluster 9	bowles s. (2000)	Critique of Walrasian economic theory, economic institutions and policies.
Cluster 10	tomer j.f. (2001)	Heterodox business schools, for integrated economics, criticism of materialistic focus.
Cluster 11	kalimeris p. (2018)	Ecological economics. Resource depletion and environmental impact. Degrowth
Cluster 12	camerer c.f. (2006)	Cooperation and defection. Behavioral economics.
Cluster 13	davis j.h. (1997)	Criticism and theories of business management.
Cluster 14	henrich j. (2001)	Behavioral experiments
Cluster 15	crosthwaite p. (2013)	Classification of Homo economicus.
Cluster 16	mahyudi m. (2016)	Homo islamicus
Cluster 17	brennan g. (1995)	Constitutional Political Economy
Cluster 18	lewis a. (2000)	Morals and ethics in economy.

Central Paper is the most prominent paper in each of its clusters.

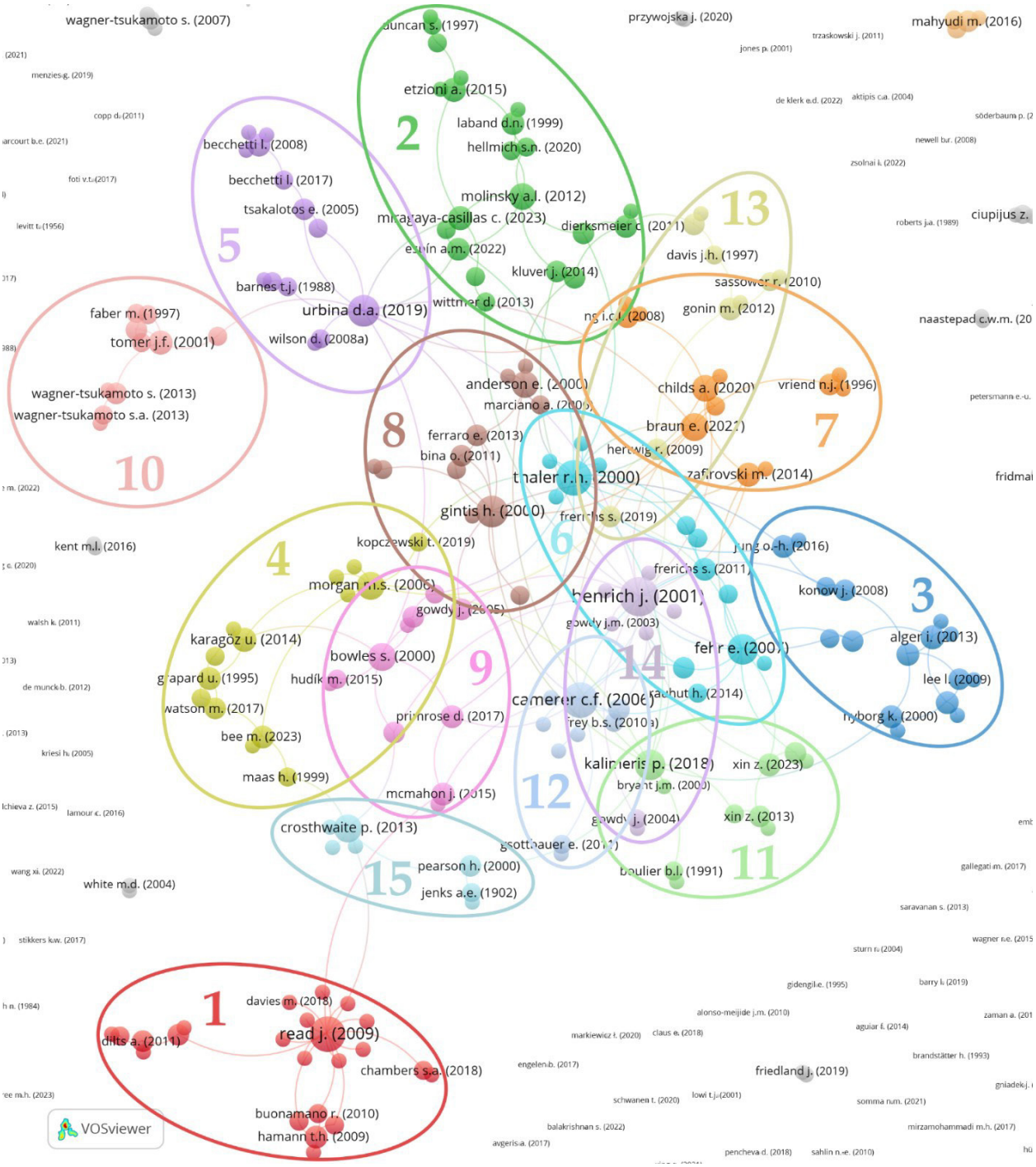

Figure 8: Citation network with a zoom on the most prominent Clusters from Cluster 1 to 15. Unit of analysis is documents. Weights on links. Minimum cluster size is set to 7.

As shown in Figure 8, the papers are clustered based on their similarities. The distance between clusters also indicates similarity. By comparing the research focus of the papers, a cluster topic can be obtained, which is shown in Table 8. An image of the entire citation network can be seen in Figure 7. (Note: the minimum cluster size varies between these figures).

Co-Occurrence – Keywords

Table 9: Top 15 of the most frequent keywords. Listed by occurrence.

	Label	Occ.	T. L. S.		Label	Occ.	T. L. S.
1.	homo economicus	177	968	14.	performativity	7	68
2.	neoliberalism	53	249	14.	market	7	46
3.	behavioral economics	30	138	14.	game theory	7	45
4.	economics	25	129	14.	social preferences	7	31
4.	rationality	25	124	14.	consumer behavior	7	28
5.	altruism	23	123	14.	value	7	26
6.	foucault	19	139	15.	liberalism	6	55
7.	governmentality	16	115	15.	james m. buchanan	6	50
7.	self-interest	16	83	15.	neuroscience	6	38
8.	capitalism	14	88	15.	institutions	6	38
8.	rational choice	14	67	15.	business ethics	6	37
9.	adam smith	13	77	15.	corporate social responsibility	6	36
10.	decision-making	12	55	15.	subjectivity	6	34
11.	neoclassical economics	10	47	15.	higher education	6	33
11.	economic theory	10	34	15.	reciprocity	6	30
12.	globalization	9	72	15.	political economy	6	30
12.	ethics	9	60	15.	cooperation	6	30
13.	biopolitics	8	43	15.	neuroeconomics	6	27
13.	bounded rationality	8	38	15.	economic sociology	6	26
13.	gender	8	37	15.	culture	6	26

Occ: Occurrence, T. L. S.: Total Link Strength

The Co-Occurrence network links keywords that are used together in the papers of the sample. Therefore, the Total Link Strength indicates the number of times a keyword occurs together with another keyword. For instance, as shown in Table 9, the keyword „globalization" occurred nine times, but a total of 72 other keywords were found together with these nine. Both Total Occurrence and Co-Occurrence serve as metrics to evaluate the central topics. The links in the visualization of the Co-Occurrence network, shown in Figure 9, illustrate how the keywords are connected. The keywords „basic income", „diet", „willingness to pay", and „behavioral model" are in a distant position, which indicates a low similarity.

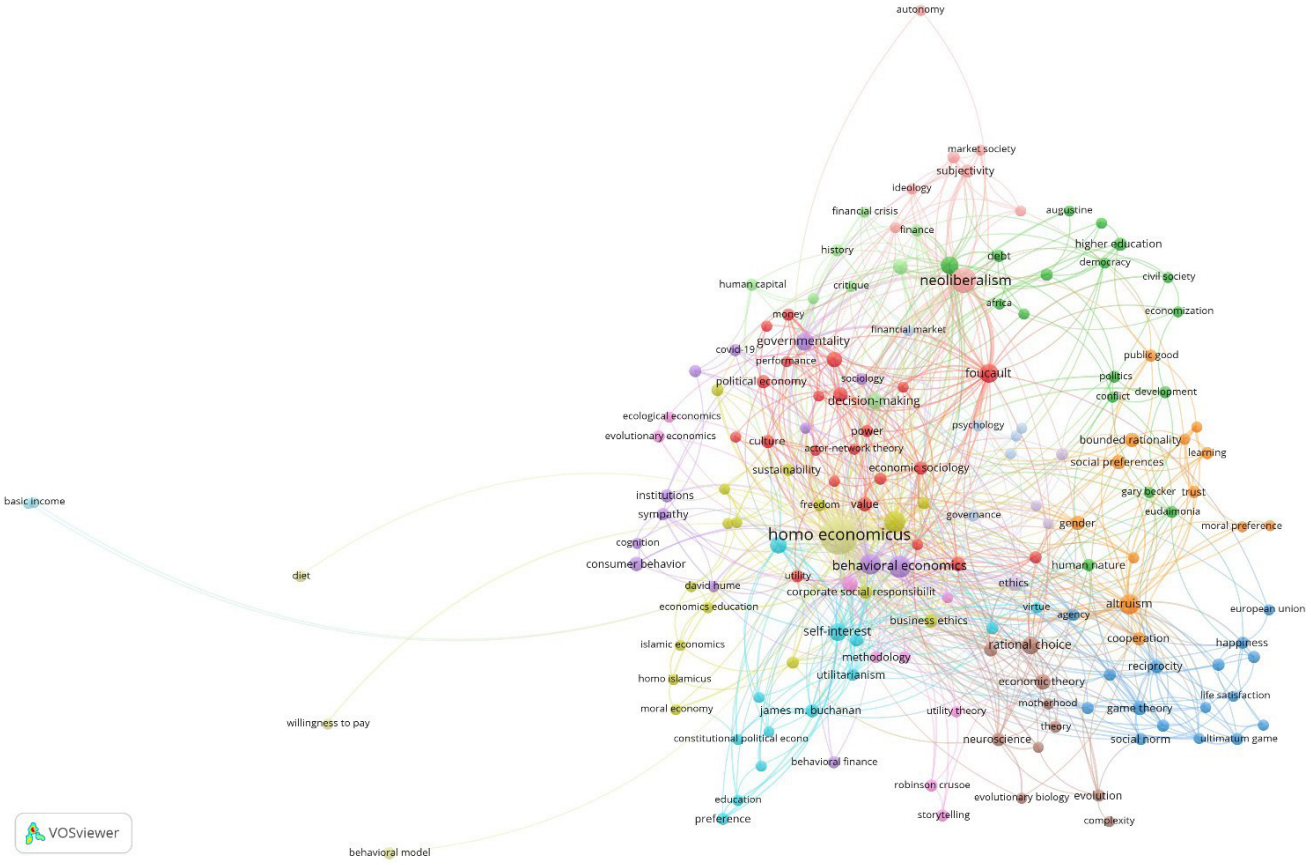

Figure 9: Co-Occurrence network of keywords. Minimum 3 occurrences are required, and weights is set to occurrences.

A deeper insight into the core keywords around Homo economicus is shown in Figure 10. The minimum strength of the links is increased to 2 to illustrate the keywords with stronger connections. Which means that only the lines with a link strength value of at least 2 are visible. A closer perspective on keywords that occur at least six times is shown in Figure 11. VOSviewer was able to identify six different thematic clusters.

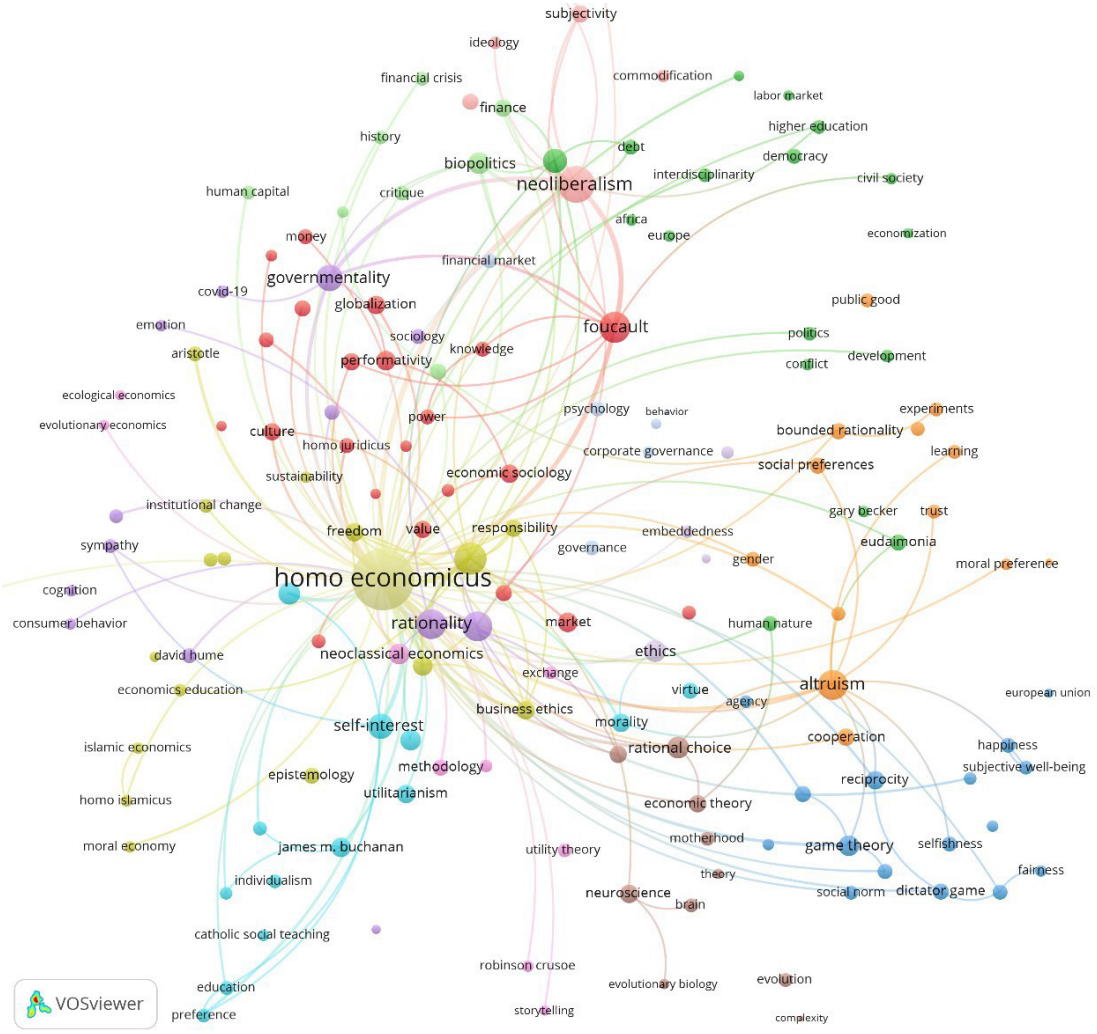

Figure 10: Co-Occurrence network. Minimum 3 occurrences. Weights on occurrences. Minimum link strength set to 2.

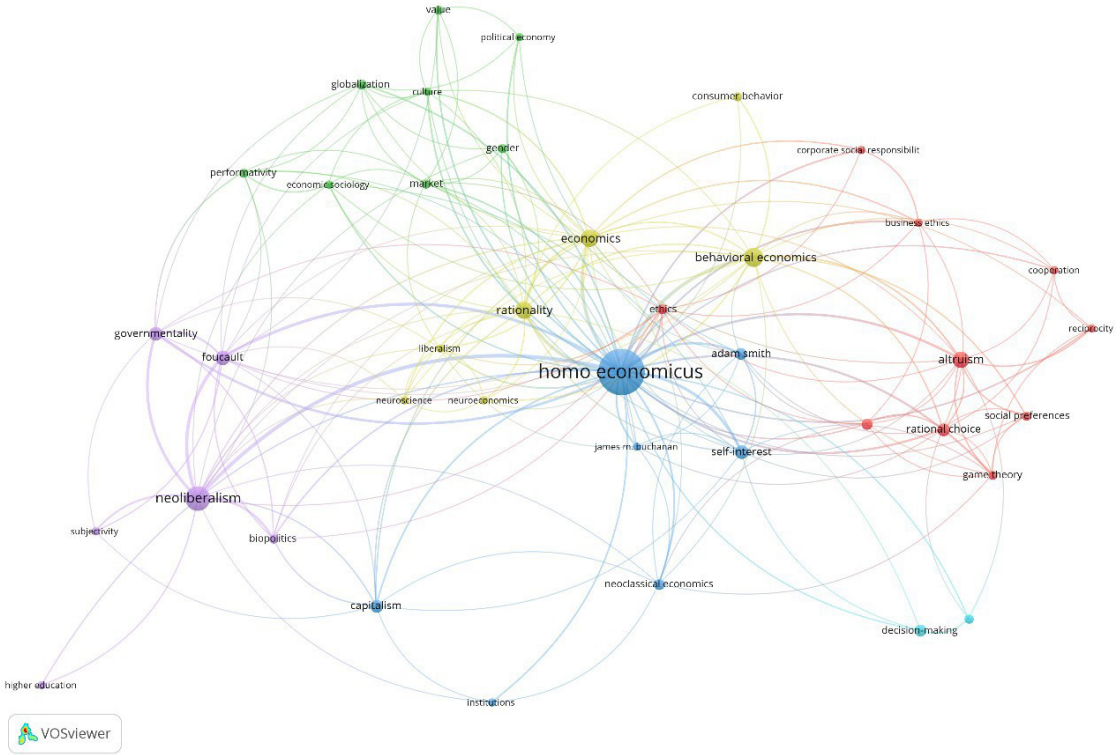

Figure 11: Co-Occurrence network. Top 40 of the most frequent keywords. Minimum 6 occurrences. Weights on occurrences.

Other aspects of the keyword network are the time dimension and citation frequency. A combination of both can provide insight into the most important topics at a certain time. Table 10 shows the keywords of the most cited papers on average. The most frequent keywords are „critique", „prisoner's dilemma", and „exchange". The average publication year of the papers using these words is at least ten years old. „Prisoner's dilemma" is also the keyword with the highest total link strength. The keyword of the most cited papers on average is „collaborative consumption", which is also the most recent keyword compared to the other top 10 keywords.

Table 10: Top 10 keywords whose papers were cited the most on average. Occurrence (Occ.) must be at least 2

	Label	Avg. Citations	Avg. pub. year	Links	T. Link Strength	Occ.
1	**collaborative consumption**	241,50	2016,00	11	11	2
2	**pro-social behavior**	209,00	2009,50	7	7	2
3	**social dilemmas**	208,00	1998,00	13	13	2
4	**sociobiology**	189,50	1999,00	15	16	2
5	**strong reciprocity**	179,50	2005,50	6	6	2
6	**punishment**	178,00	2014,00	12	12	2
7	**critique**	121,33	2014,00	13	15	3
8	**prisoner's dilemma**	119,75	2005,50	26	28	4
9	**exchange**	118,33	2011,00	13	13	3
10	**dynamic**	108,00	2004,00	8	8	2

In addition, Table 11 and Table 12 show the oldest and most recent keywords. The average citations are naturally low for the most recent keywords because there has not been enough time for the papers to receive citations since they were published. The keyword „Prisoner's dilemma" appears in the top 10 keywords of the most cited papers as well as in the top 10 of the oldest keywords. The most frequently occurring keyword among the older keywords is „gender".

Table 11: Top 10 of the oldest keywords.
Occurrence must be at least 3. Average Citations must be larger than 1.

	Label	Avg. pub. year	Avg. Citations	T. Link Strength	Occ.
1	**political economic person**	2005,33	39,00	18	3
1	**ideological orientation**	2005,33	39,00	18	3
2	**prisoner's dilemma**	2005,50	119,75	28	4
3	**motherhood**	2006,33	74,00	17	3
4	**cognition**	2006,67	15,33	18	3
5	**gender**	2006,88	38,00	37	8
9	**economic psychology**	2007,33	47,00	9	3
7	**selfishness**	2007,67	88,33	21	3
7	**social networks**	2007,67	28,00	10	3
8	**politics**	2007,75	9,50	16	4
9	**evolution**	2007,80	45,00	31	5
10	**political economy**	2008,50	41,00	30	6

In Table 12 with the most recent keywords, the score for average normalized citations was set to at least 1 because this guarantees a minimum level of importance of the keywords. That means, since the most recent papers had only a limited amount of time to receive citations, the average citation count is not necessarily a good metric to assess the significance of a keyword. Instead, normalized citations correct for this by relating citations to the year of publication. Therefore, using this threshold provides a top 10 list of recent keywords with a minimum of relevance in the discourse. The most frequently occurring keywords are „value" and „higher education". „Marketization" is both the keyword with the highest average citations and the highest average normalized citations. Second ranked by normalized citations is „knowledge", but only fourth ranked by average citations.

For a visual overview of the top 40 keywords, Figure 12 provides an "Overlay Visualization" that displays a time scale of the keywords. In principle, Figure 12 is the same type of network as Figure 11 with the same parameters, except for the additional score for the average publication year. The different color indicates the average publication year of a period from 2010 to 2018.

Table 12: Top 10 of the most recent keywords. Occurrence must be at least 3. Average citations must be larger than 1. Average normalized citations must be at least 1.

	Label	Avg. pub. year	Avg. Citations	T. Link Strength	Occ.	Avg. norm. Citations
1	**covid-19**	2021,50	2,75	20	4	1,51
2	**catholic social teaching**	2021,33	5,67	13	3	1,08
3	**fairness**	2020,33	4,00	16	3	1,28
4	**knowledge**	2020,00	8,67	15	3	4,01
5	**scale development**	2019,33	16,33	11	3	1,82
6	**economics education**	2019,00	7,00	12	3	1,25
7	**value**	2018,57	7,86	26	7	2,18
8	**marketization**	2018,50	42,00	18	4	5,06
9	**entrepreneurship**	2018,40	29,40	29	5	2,69
10	**higher education**	2018,33	8,50	33	6	1,97

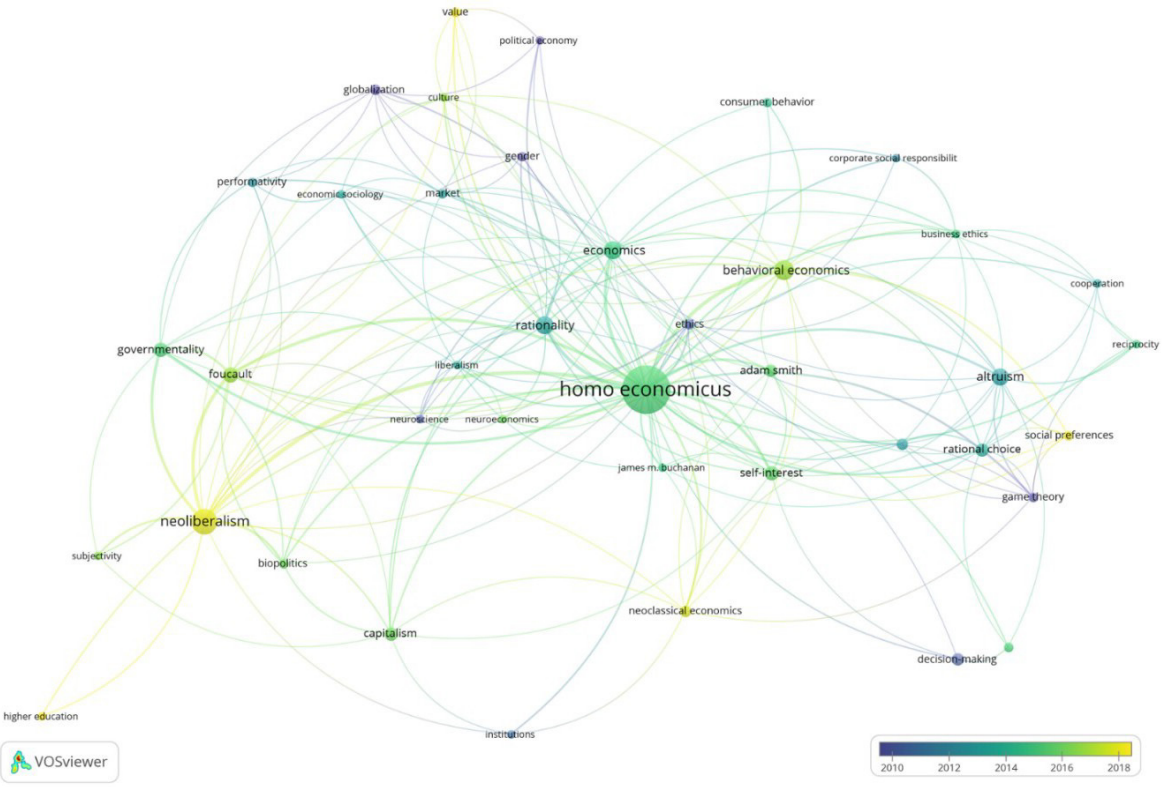

Figure 12: Co-Occurrence network of the 40 most frequent keywords on a time scale (Overlay Visualization). Weights on occurrences. Score is set to average publication year. Compare with Figure 11.

Co-Occurrence – Terms

The analysis of the terms differs from that of the keyword network in that the decisive words of interest are evaluated based on their relevance, which is computed by VOSviewer. The software analyzes the title and abstract and evaluates both the frequency of the terms and, subsequently, their relevance.

For this analysis, titles and abstracts were screened, the chosen counting method was binary (only the presence or absence of a term counts, not every single occurrence), the minimum occurrence was set to 10, and the default of 60% of the most relevant terms was selected. No thesaurus was used, and all other settings were left at default. Four clusters with a total of 235 items were computed.

Table 13: Top 20 of the most relevant of the most frequent terms in the title or abstract of the papers. Listed by Total link strength.

	Label	Occ.	T. L. S.		Label	Occ.	T. L. S.
1	behavior	123	1028	12	agent	59	457
2	decision	79	722	13	factor	46	454
3	subject	73	665	14	psychology	53	453
4	form	76	658	15	data	50	442
5	effect	74	645	16	decision making	47	427
6	evidence	78	624	16	economics	57	427
7	life	71	527	17	government	41	418
8	critique	60	497	18	environment	44	414
9	power	54	478	19	group	45	412
10	preference	57	477	19	impact	47	412
11	discourse	53	470	20	century	44	394

Occ.: Occurrence. The total link strength (T.L.S.) is the metric for relevance as VOSviewer calculates it.

As shown in Figure 13, two main aggregations can be observed around „subject" and „behavior". Among the most relevant terms, „decision", „effect", „evidence", „preference", „agent", and „decision making" are located around „behavior". Additionally, as shown in Figure 14, there is a time shift from older to more recent occurrences between the „behavior" and the „subject" accumulations.

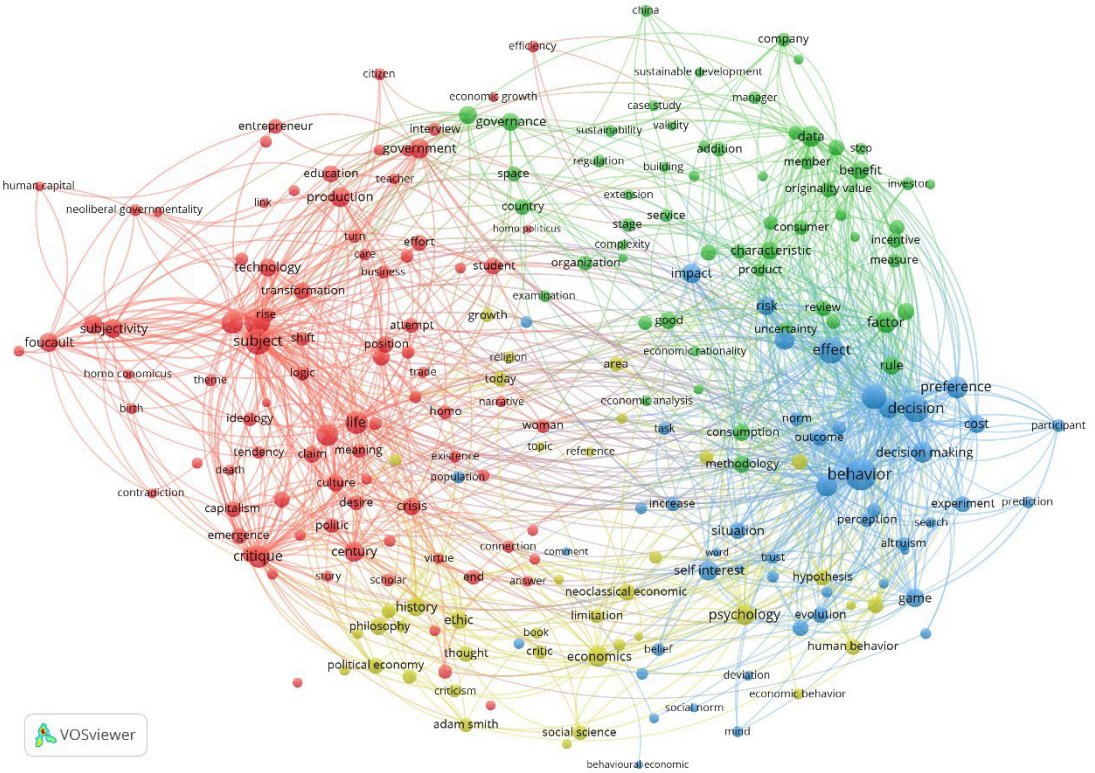

Figure 13: Co-Occurrence network of terms from the title or abstract of the papers. Minimum 10 occurrences, 60% of the most relevant terms.

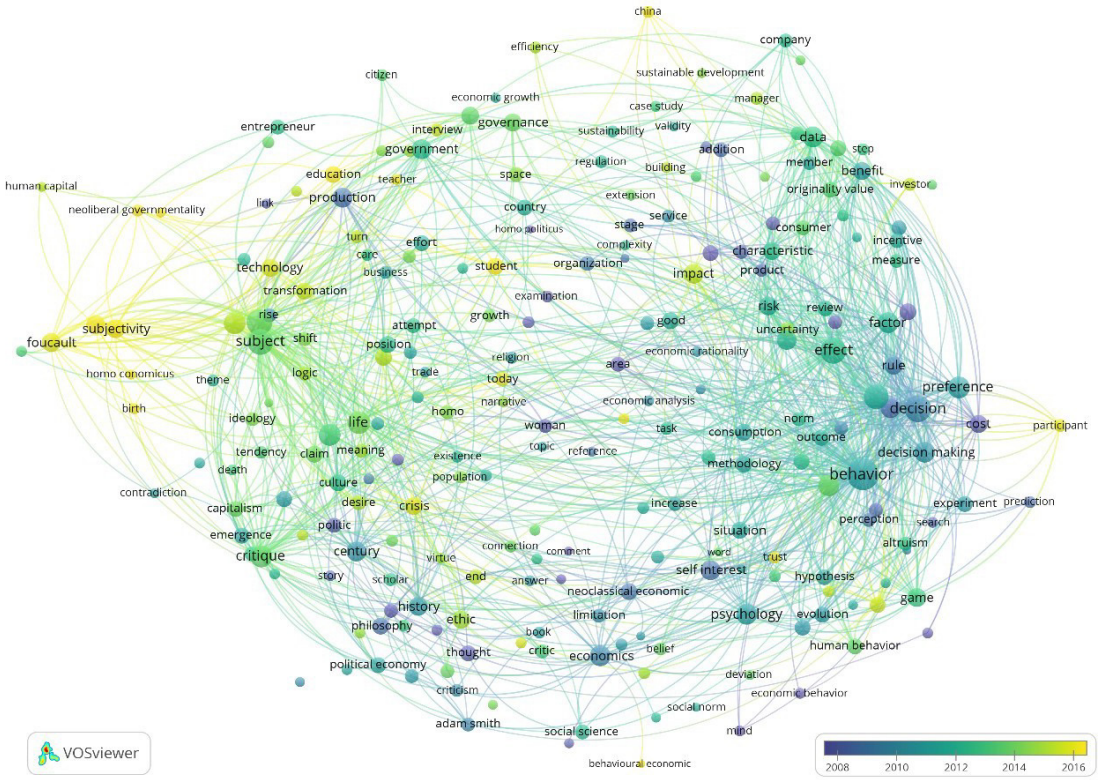

Figure 14: Co-Occurrence network of terms from the title or abstract of the papers. Overlay Visualization. Score on average publication year. Minimum 10 occurrences, 60% of the most relevant terms.

3.2 Results Implicit Discourse

Output of the query with the date 24.06.2023 after modification and correction: The data set contains 9682 documents and 16078 authors. The publication years range from 1970 to 2023. The mean publication year was 2012 (2011,964) and the median was 2014. The most recent year that was completed was 2022 with 667 papers.

In contrast to the explicit, the implicit discourse can only serve as some kind of „double check" or further insight in addition to the explicit results due to some limitations of the implicit data and the analysis. A detailed explanation will be given in the discussion. For the moment, it should be noted that the description of the results of the implicit discourse is therefore different and subsequently represents only a supplement to the explicit discourse.

3.2.1 Central Authors

Co-Authorship Network

After setting the output limit to the top 2000, the network calculation was performed with 1058 items, which was suggested by VOSviewer as the largest connected set. The maximum number of co-authors for each paper was left on default, which is 25. The „cardiovascular cluster" was excluded. For completeness, it should be noted that this group is also represented in large numbers in this dataset. For the illustration, the minimum cluster size was increased to 40 to obtain the optimal level of clustering.

Table 14 shows the top 15 authors by co-authorship of only those included in both the explicit and implicit data set. It also shows the ranking they have in the co-authorship network together with the authors of the implicit data. The first six of the explicit data set also occupy many of the first 10 of the combined data set. Including 2nd, 3rd, and 4th. The last position of the top 15 explicit authors holds 169th place in the combined data set of 1058 authors. In comparison, Table 15 shows the top 15 authors in the implicit data set. However, these rankings should be taken with caution. Due to the preselection of the items to be calculated, here only the 2000 highest values, the results are partially influenced. Different settings will yield slightly different results. However, some other influential factors can cause even stronger differences. This is especially true for single papers with many co-authors. Their authors often dominate over others and

occupy higher ranks, thus displacing those who might be more qualified. A difference due to a different preselection can be observed when comparing Table 15 and Table 16. In Table 16, only papers with a maximum of 15 co-authors were included. For example, Müller, B. ranks first if all papers are considered (default: less than 25 co-authors), but only 11th if the number of co-authors is limited to 15. This effect is due to only two papers, both of which are well above the threshold. As there is an intense debate about how to evaluate papers with a high number of co-authors, all results should be considered in the context of this work. More details about the influencing factors are explained in the discussion section. Furthermore, the rankings are based on the descending order of the values provided by VOSviewer. Since the same values were left unchanged, it can happen that one author receives a different, lower or higher rating than another, even if both have the same values. This can have a significant effect on the lower rankings. For example, Gintis, H. in 169th place. If a large number of authors have the same values between 1st and 168th place, Gintis, H. should be placed significantly higher.

An illustration of the network with max. 25 and max. 15 co-authors is provided in Figure 15 and Figure 16.

Table 14: Top 15 authors by co-authorship, only those included in both the explicit and implicit data sets. Calculated from 1058 authors. Both data sets are considered for the ranking. Max. 25 co-authors. (Total link strength is the metric for co-authorship)

Label	T. L. S.	Place	Label	T. L. S.	Place
henrich j.	64	2	**camerer c.**	27	36
li y.	59	3	**li x.**	23	70
mcelreath r.	56	4	**hamari j.**	21	88
takagishi h.	53	6	**matsumoto y.**	21	102
yamagishi t.	47	7	**zhang x.**	21	118
kiyonari t.	41	10	**kliemt h.**	19	148
zhang t.	35	21	**weber b.**	19	154
fehr e.	34	22	**yang z.**	19	156
janssen m.a.	33	25	**gintis h.**	18	169
zhang y.	32	26			

Table 15: Top 15 authors by co-authorship, only those included in the implicit data set. Calculated from 1058 authors. Both data sets are considered for the ranking. Max. 25 co-authors. (Total link strength is the metric for co-authorship)

Label	T. L. S.	Place	Label	T. L. S.	Place
müller b.	69	1	**uzefovsky f.**	36	19
liu y.	55	5	**marlowe f.**	35	20
ebstein r.p.	45	8	**wang y.**	34	23
groeneveld j.	42	9	**dressler g.**	33	24
israel s.	40	11	**jiang y.**	31	27
bachner-melman r.	39	12	**mcauliffe k.**	30	28
schlüter m.	39	13	**ozimek l.**	30	29
gurven m.	37	14	**zhou x.**	30	30
bornstein g.	36	15	**silk j.b.**	29	31
knafo a.	36	16	**buttar h.s.**	28	33
lerer e.	36	17	**chen j.**	28	34
schwarz n.	36	18	**nishina k.**	28	35

Table 16: Top 15 authors by co-authorship of both data sets. Calculated from 1027 authors. Maximum number of co-authors: 15. (Total link strength is the metric for co-authorship)

Label	T. L. S.	Place	Label	T. L. S.	Place
henrich j.	65	1	**marlowe f.**	35	13
li y.	59	2	**zhang t.**	35	14
mcelreath r.	59	3	**zhang y.**	34	15
takagishi h.	53	4	**janssen m.a.**	33	16
yamagishi t.	49	5	**jiang y.**	31	17
kiyonari t.	42	6	**mcauliffe k.**	31	18
gurven m.	39	7	**ebstein r.p.**	29	19
schlüter m.	39	8	**silk j.b.**	29	20
fehr e.	37	9	**chen j.**	28	21
liu y.	37	10	**nishina k.**	28	22
müller b.	37	11	**groeneveld j.**	27	23
wang y.	36	12	**warneken f.**	27	24

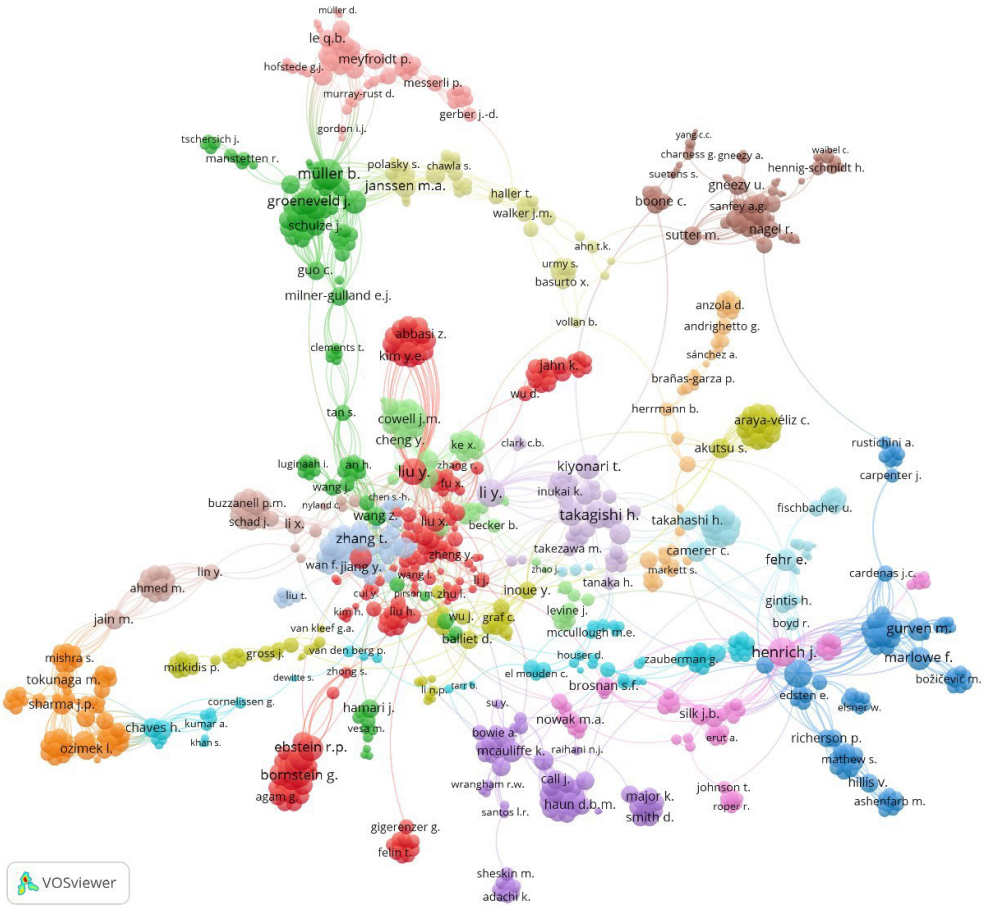

Figure 15: Co-authorship network. Weights on total link strength. Max. 25 co-authors per paper. Cardiovascular group excluded. Min. cluster size 40. 1058 items.

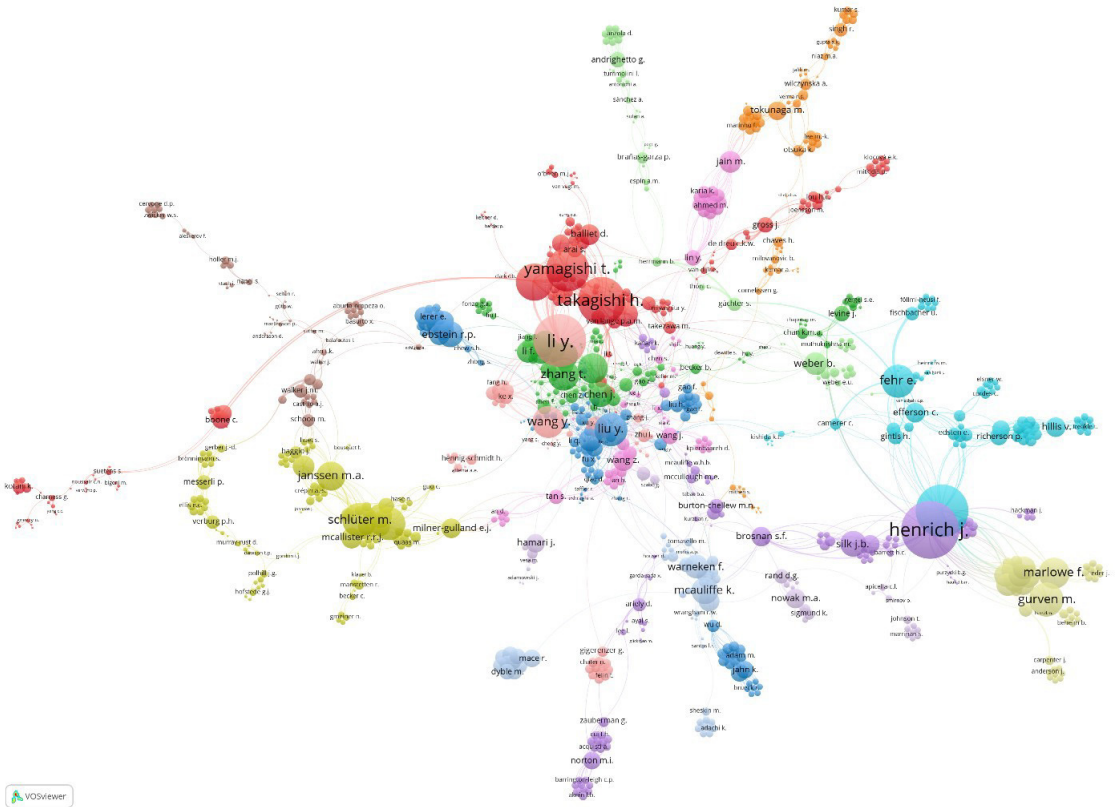

Figure 16: Co-authorship network. Weights on total link strength. Max. 15 co-authors per paper. Cardiovascular group excluded. Min. cluster size 40. 1027 items.

Number of Documents

Table 17: The top 12 authors with the most documents. Minimum of 15 documents.

Label	Docs	Avg. pub. year	Label	Docs	Avg. pub. year
güth w.	29	2007,17	**holler m.j.**	18	2007,06
frey b.s.	28	2000,71	**torgler b.**	18	2011,72
nelson j.a.	28	2007,32	**janssen m.a.**	17	2011,59
fehr e.	26	2006,62	**li y.**	17	2018,53
singh r.b.	23	2013,74	**burton-chellew m.n.**	16	2017,25
hamari j.	22	2017,09	**mcauliffe k.**	16	2017,31
gowdy j.m.	21	2007,05	**zafirovski m.z.**	16	2009,44
henrich j.	20	2012,80	**brosnan s.f.**	15	2011,47
majumdar s.k.	19	2002,00	**camerer c.**	15	2009,40
gintis h.	18	2003,06	**liu y.**	15	2019,33
hodgson g.m.	18	2012,67			

Table 17 shows the authors with the most documents. The corresponding illustration is shown in Figure 17. These authors are considered to be the most productive. Compared to the explicit data, the authors Frey, B.S., Fehr, E., Gowdy, J.M. and Gintis, H. can also be found in this list. All of them in the highest positions.

Figure 18 shows a larger sample of the most productive authors, 59 in total. It illustrates the different clusters of highly productive authors that are well connected to each other, but not very well connected to the other clusters. Due to the large distance between them, VOSviewer detected very little similarity between them.

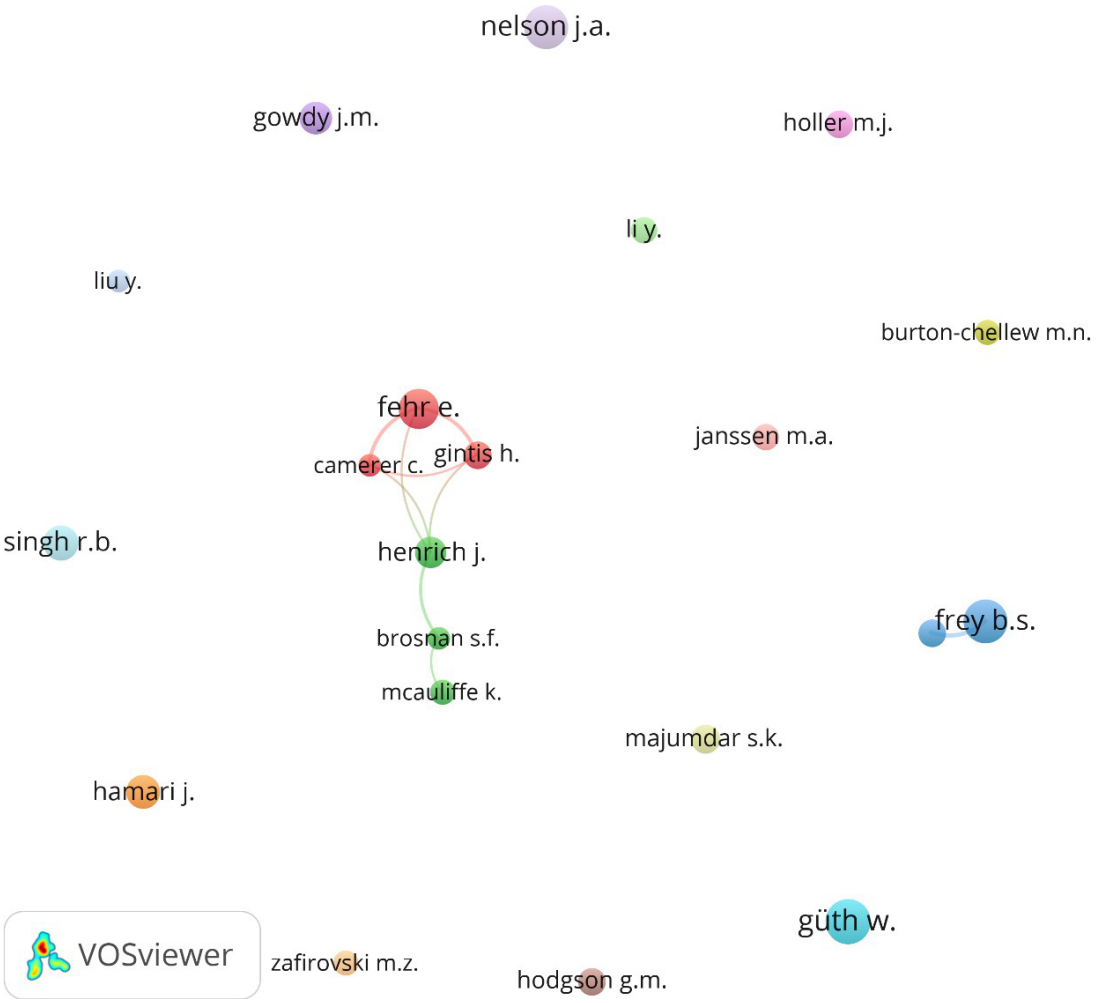

Figure 17: Co-authorship network. Top 21 authors with most papers. Min. 15 documents. Weights on docs. All included.

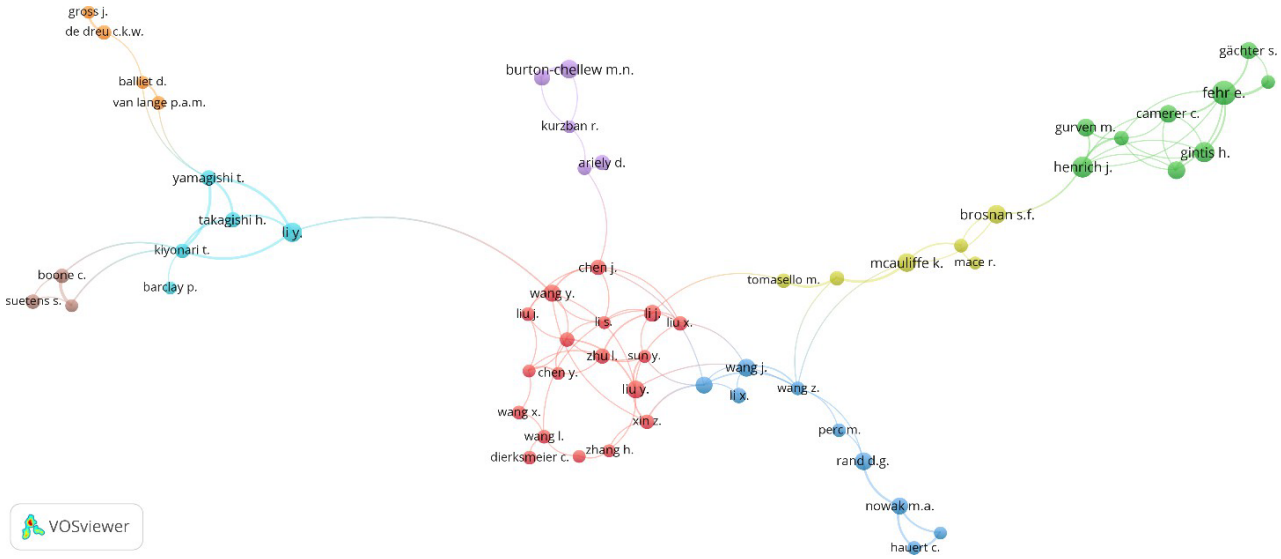

Figure 18: Co-authorship network. Authors with most papers. 59 items. Min. 8 documents. Max. co-authors per paper: 15. Weights on documents. Cardiovascular group excluded.

Citations

Table 18: Top 20 most cited authors. Explicit and implicit data set were taken from the citation network with the highest 2000.

Nr.	Label	Citations	Norm. Cit.	Avg. pub. year	Avg. Cit.
1	**fehr e.**	**11859**	149,61	2006,62	456,12
2	**hamari j.**	**7299**	294,95	2017,09	331,77
3	**nowak m.a.**	**6342**	84,30	2009,31	487,85
4	**henrich j.**	**6260**	168,20	2012,80	313,00
5	**bowles s.**	**6016**	92,42	2003,86	429,71
6	**gintis h.**	**4714**	65,62	2003,06	261,89
7	**fischbacher u.**	**4429**	47,95	2009,44	492,11
8	**list j.a.**	**3663**	50,25	2011,00	457,88
9	**mcelreath r.**	**3635**	58,13	2010,40	363,50
10	**camerer c.**	**3594**	59,17	2009,40	239,60
11	**frey b.s.**	**3447**	47,98	2000,71	123,11
12	**gächter s.**	**3115**	49,21	2008,62	239,62
13	**gneezy u.**	**2953**	53,91	2013,17	492,17
14	**sanfey a.g.**	**2905**	35,49	2012,17	484,17
15	**oswald a.j.**	**2813**	30,01	1999,20	562,60
16	**rilling j.k.**	**2781**	33,25	2007,00	1390,50
17	**croson r.**	**2772**	47,33	2008,00	924,00
18	**cohen j.d.**	**2733**	27,86	2004,67	911,00
19	**ostrom e.**	**2663**	41,92	2007,11	295,89
20	**davis j.h.**	**2638**	43,88	1997,00	2638,00
20	**donaldson l.**	**2638**	43,88	1997,00	2638,00
20	**schoorman f.d.**	**2638**	43,88	1997,00	2638,00

Table 19: Top 20 of the most cited authors within the sample, which means how often they cite each other. Explicit and implicit data sets were taken from the citation network with the highest 2000.

Nr	Label	T. Link Strength	Links	Docs	Citations	Norm.cit.
1	**fehr e.**	**4426**	1336	26	11859	149,61
2	**henrich j.**	**3488**	1232	20	6260	168,20
3	**mcelreath r.**	**2750**	1183	10	3635	58,13
4	**camerer c.**	**2318**	1112	15	3594	59,17
5	**bowles s.**	**2104**	1028	14	6016	92,42
6	**gintis h.**	**2007**	1036	18	4714	65,62
7	**boyd r.**	**1556**	946	5	2375	36,43
8	**gurven m.**	**1486**	691	14	2261	36,31
9	**fischbacher u.**	**1254**	649	9	4429	47,95
10	**marlowe f.**	**1114**	665	3	2328	35,46
11	**barr a.**	**1067**	654	4	1820	25,14
12	**gächter s.**	**1050**	547	13	3115	49,21
13	**barrett c.**	**1037**	646	2	1805	24,71
13	**bolyanatz a.**	**1037**	646	2	1805	24,71
13	**ensminger j.**	**1037**	646	2	1805	24,71
13	**gwako e.**	**1037**	646	2	1805	24,71
13	**henrich n.**	**1037**	646	2	1805	24,71
13	**tracer d.**	**1037**	646	2	1805	24,71
13	**ziker j.**	**1037**	646	2	1805	24,71
14	**hamari j.**	**945**	144	22	7299	294,95
15	**balliet d.**	**907**	438	8	1018	44,89
16	**rand d.g.**	**889**	362	14	2579	80,16
17	**herrmann b.**	**887**	440	7	1960	31,98
18	**nowak m.a.**	**845**	393	13	6342	84,30
19	**sanfey a.g.**	**732**	453	6	2905	35,49
20	**cardenas j.c.**	**721**	490	5	1218	23,63

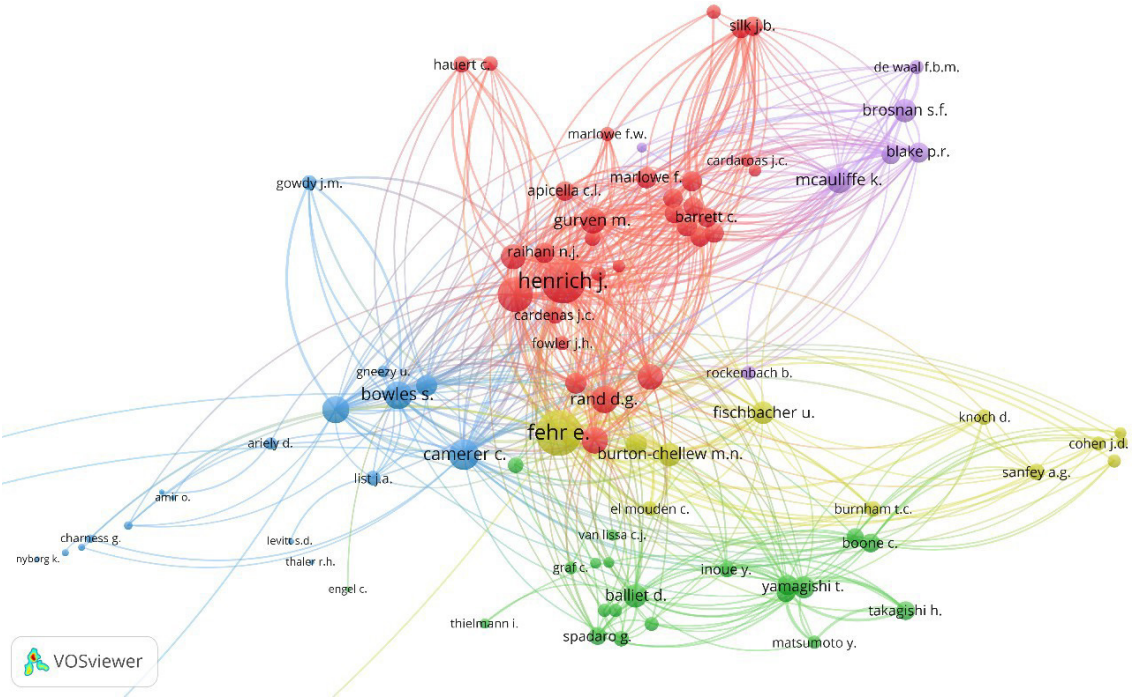

Figure 19: Citation network of the top 100 (97 items; most connected) reciprocal citing and cited authors within the sample. Weights on total link strength. The minimum link strength for the lines is 5. Section of the image: Main accumulation.

Table 18 shows the most cited authors in general. The citation data, taken from Scopus, is the sum of all citations the documents of each author received. Table 19 shows the most reciprocally cited authors. That is, the citations that each author received exclusively from the other authors in the sample. A comparison of the two tables provides insight into the expert status of the authors. The most striking author is Fehr, E., who occupies the first position in both tables and can therefore be identified as the main expert in the discourse. Other authors worth mentioning are Henrich, J., Bowles, S., Gintis, H., Fischbacher, U., and Gächter, S., who all occupy similar positions in both tables. The most striking difference can be found when looking for authors who occupy completely different positions. Hamari, J. and Nowak, M. A. are perhaps the most notable, as they are ranked 2nd and 3rd in the general citation list, but 14th and 18th in the reciprocal citation list. This indicates that these authors play a certain important role in their field, but apparently less in the discourse. McElreath, R. and Camerer, C. on the other hand, move up the reciprocal list, indicating a little more importance in the discourse. Some authors, like List, J.A. and Frey, B.S. disappear from the general list to the reciprocal list, and while others appear, like Gurven, M. and Marlowe, M. Figure 19 shows the main accumulation of reciprocally citing authors. The number in brackets is the number of items suggested by VOSviewer based on the highest level of connection.

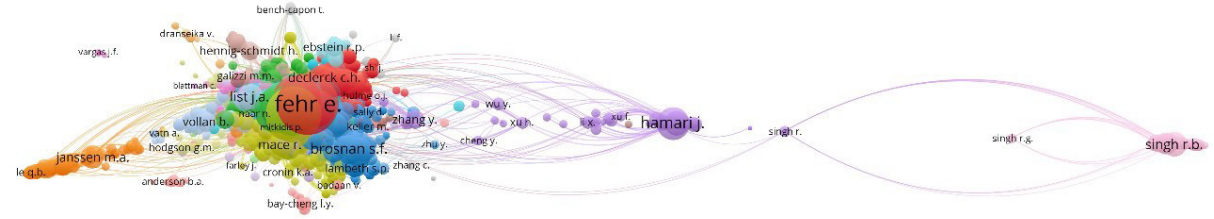

Figure 20: Citation network of the top 2000 (1989 items; most connected). Weights on total link strength. Shows the four most prominent accumulations. From right to left: around Singh, R.G. (Cardiovascular group), Hamari, J., Fehr, E., and Janssen, M.A. Further to the left, not shown in the image, is another small group around Holler, M. J. and Napel, S., which is not connected to any other cluster.

Figure 20 shows the larger picture of the citation landscape with four prominent clusters. On the far right is the „cardiovascular group“ around Singh, R.G. The weak connections and the distant position show the low similarity of these papers. In the middle is a group around Hamari, J., and almost on the far left is the main data cloud (Figure 21). These clusters are highly connected but still very distant from each other. This indicates some thematic overlap, but not enough similarity. Again on the left is a smaller group around Janssen, M. A., which is strongly connected to the large cluster around Fehr, E. and Henrich, J. Further insights into the background of these circumstances can be found in the discussion.

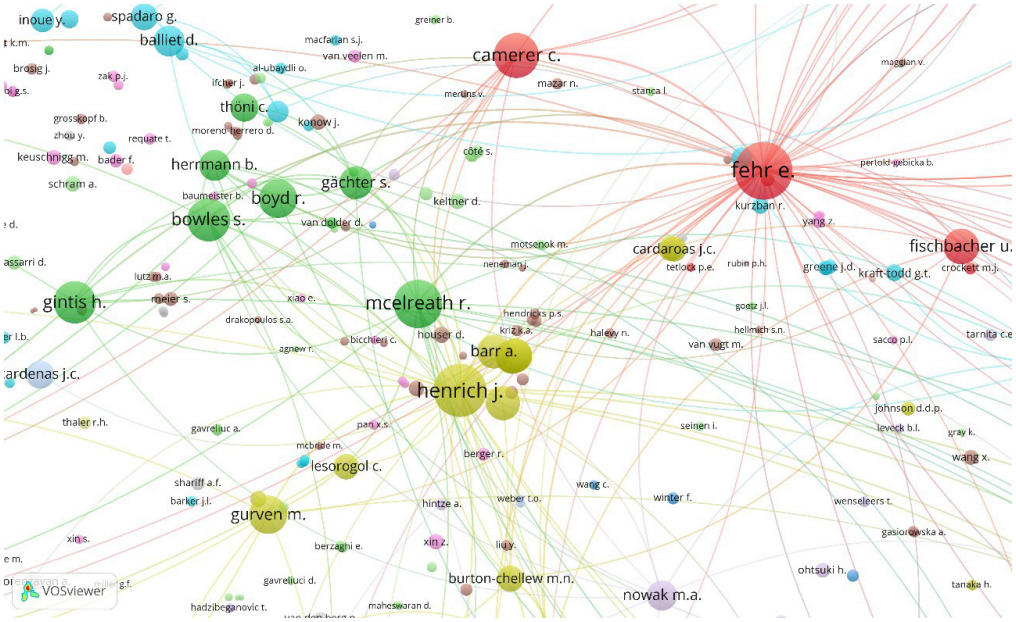

Figure 21: Citation network of the 2000 most cited authors (1989 items; most connected). A zoom on the main group with the most cited authors. Weights on total link strength.

3.2.2 Central Papers

Table 20: Top 20 of the most reciprocally cited papers within the sample.

label	Links	Citations	Norm. cit.
henrich j. (2001)	**571**	1500	23,71
fehr e. (2003)	**231**	2161	21,61
herrmann b. (2008)	**178**	1131	17,14
camerer c.f. (2006)	**160**	461	4,04
henrich j. (2006)	**158**	1038	9,09
henrich j. (2010)	**154**	767	15,62
sanfey a.g. (2003)	**153**	2266	22,66
charness g. (2002)	**143**	1933	20,46
hamari j. (2013)	**136**	482	13,58
spadaro g. (2022)	**113**	**7**	3,49
levitt s.d. (2007)	**107**	1492	18,66
nowak m.a. (2006)	**105**	3744	32,79
engel c. (2011)	**105**	890	18,30
fehr e. (2002)	**99**	783	8,29
gintis h. (2003a)	**96**	637	6,37
fehr e. (2008)	**91**	895	13,56
oosterbeek h. (2004)	**90**	485	4,88
henrich j. (2004b)	**89**	567	5,70
bowles s. (1998)	**85**	970	17,38
thielmann i. (2020)	**80**	235	21,68
fehr e. (2004b)	**77**	884	8,89

The links correspond to the number of citations a paper has received from other authors in the sample or vice versa. Papers with a very low citation frequency but a high link value indicate papers that mainly cite others and are rarely cited themselves (highlighted by numbers in bold). At least up to the time of data collection.

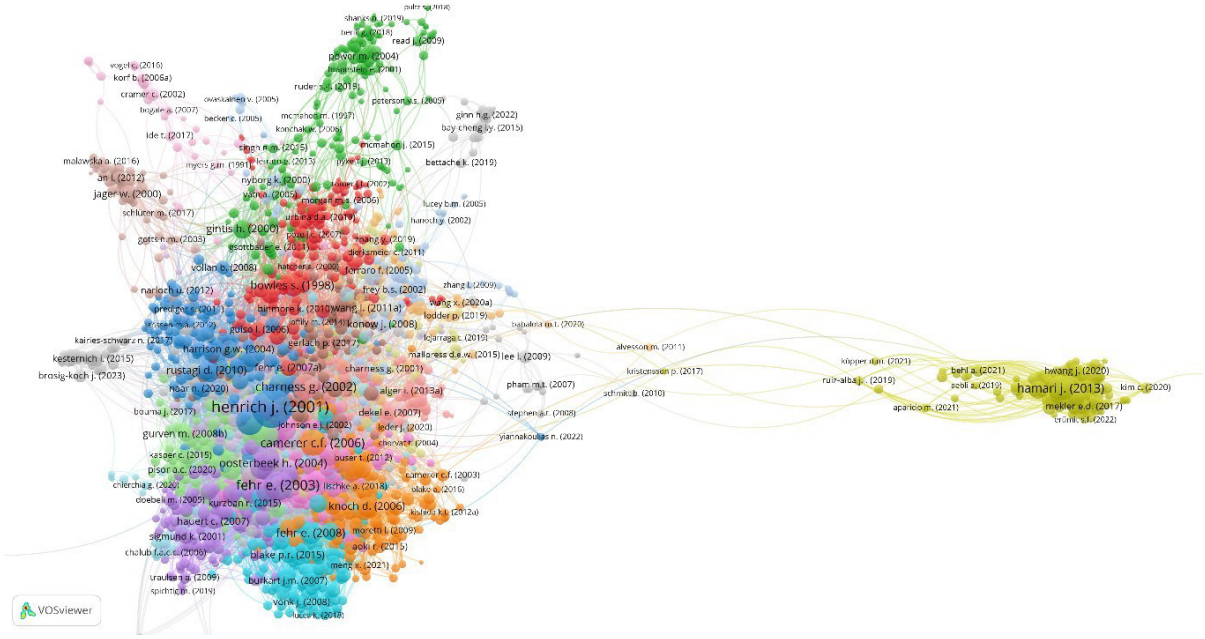

Figure 22: Citation Network. Unit: Documents. Weights on links. Overview of the most reciprocally cited papers. 2068 items. Resolution 0,9.

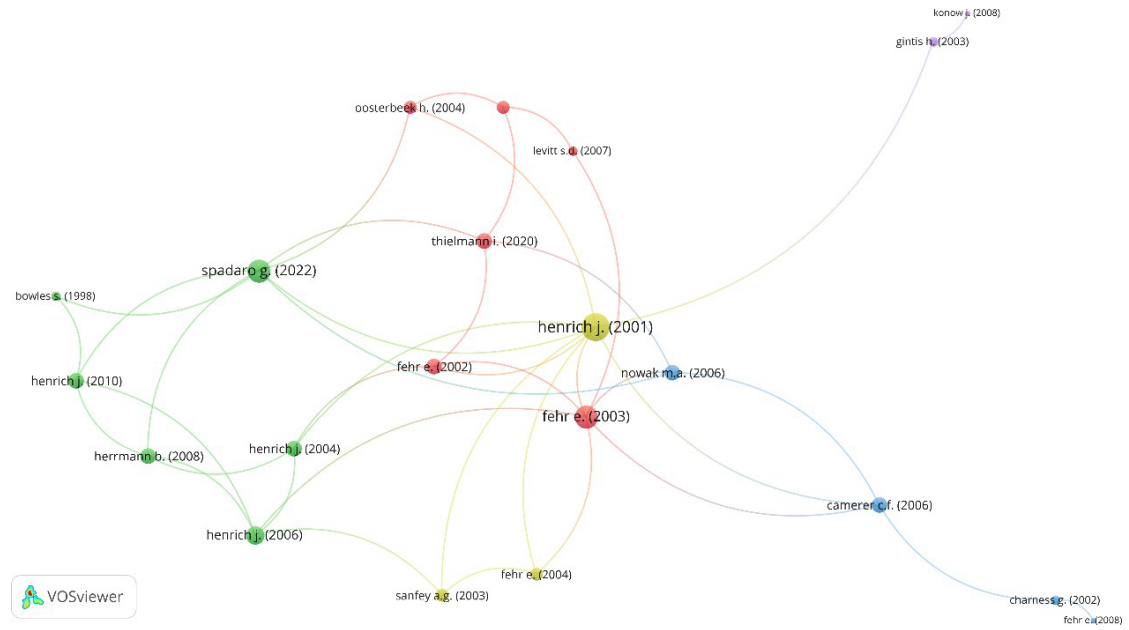

Figure 23: Citation Network. Unit: Documents. Weights on links. The top 21 most reciprocally cited papers.

Table 20 shows the most reciprocally cited paper within the data set. Therefore, Henrich et al. (2001) is the most cited, or "citing", paper in the sample. Also in the explicit data set. Since the publication year is relatively old, it is safe to say that most of the links are due to citations by the other authors. Even more papers by Henrich, J. are present in the top 20 as well as papers by Fehr, E.

3.2.3 Central Topics

For the evaluation of the central topics, a co-occurrence network with terms was not performed for the implicit discourse, because VOSviewer was not able to distinguish between reasonable and unreasonable terms, which is caused by the large amount of data in the implicit discourse.

Table 21: Central topics obtained by cluster analysis. All links: sum of the links of the documents in each cluster. Cluster topic is not necessarily the topic of the central paper.

Nr	Cluster	Central Paper	Cluster Topic	all links
1	Cl. 3	henrich j. (2001)	experiments: prosocial behavior, cooperation, preferences, rationality	2571
2	Cl. 5	fehr e. (2003)	evolution of cooperation, altruism, reciprocity, punishment	2471
3	Cl. 4	hamari j. (2013)	gamification, economy	1818
4	Cl. 7	sanfey a.g. (2003)	neurology/neuroeconomics: decision-making, fairness, emotions	1765
5	Cl. 6	fehr e. (2008)	inequality aversion, social norms and ethnicity, human social psychology	1650
6	Cl. 9	engel c. (2011)	dictator games, social heuristics, prosocial behavior	1491
7	Cl. 11	henrich j. (2010)	cooperation, fairness in various communities: religious, hunter-gatherer	1333
8	Cl. 1	bowles s. (1998)	endogenous preferences, moral, trust	1249
9	Cl. 8	mazar n. (2008)	interaction economics on specific groups: students, economists, politicians, gender (sex)	1026
10	Cl. 10	charness g. (2002)	social Preferences	979
11	Cl. 2	gintis h. (2000)	climate change, environment, evolution, ecology, feminism, neoliberalism, foucault	904
12	Cl. 14	oosterbeek h. (2004)	ultimatum game experiments, trust, reciprocity, altruism	808
13	Cl. 12	thaler r.h. (2000)	happiness, well-being, environment	685
14	Cl. 15	akerlof g.a. (1982)	fair payment, indirect reciprocity, norms	574
15	Cl. 16	wang l. (2011a)	antisociality, greed due to inconspicuous priming by economy	439
16	Cl. 17	jager w. (2000)	ecological economics	436

The cluster analysis (Table 21) shows some thematic overlap between the different clusters. However, for most clusters, a specific common topic could be identified. Figure 24 shows the corresponding image of the clusters. The criteria for the evaluation of the cluster topics are, on the one hand, their visual prominence and, on the other hand, their importance within the discourse as determined by the number of links and citations. The cluster size and resolution were chosen to produce sufficiently visible clusters. The resolution „determines the level of detail of the clustering“ (Van Eck & Waltman, 2023, p. 23). Increasing or decreasing the parameters did not lead to a significantly better result.

There are two characteristics that stand out when examining the networks. First, one can see how remote cluster 4 is from the other clusters. Second, it is obvious how tight the other clusters are to each other. Some clusters can be easily separated, but others overlap very much, especially clusters 14 and 15 are so entangled with the rest that they are hardly recognizable. Some clusters are also very widely dispersed. Cluster 12, for example, stretches from the place of the numbering, through clusters 1 and 2, and ends between 2 and 17.

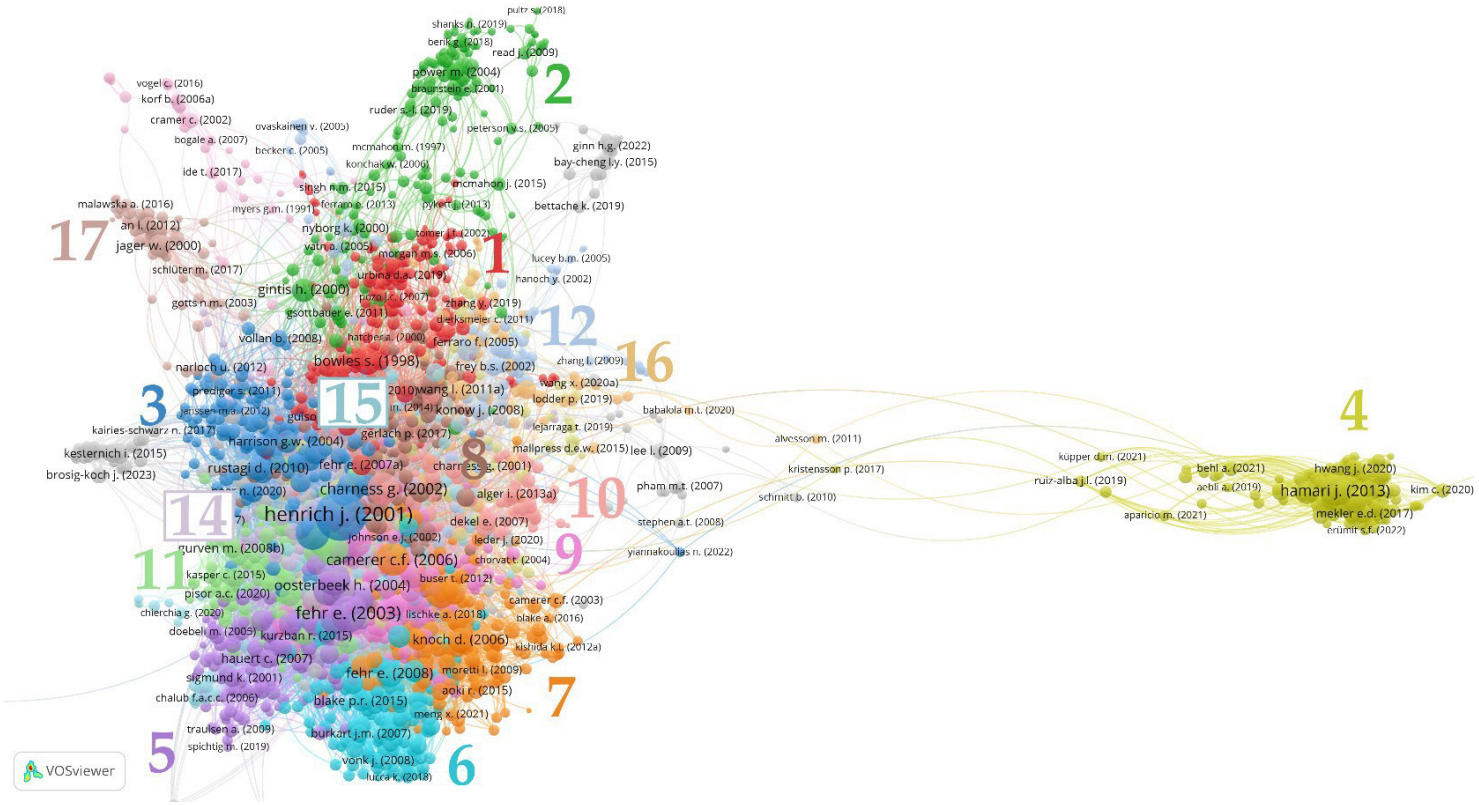

Figure 24: Citation network. Unit: documents. 2068 items. Min. Cluster size: 5. Resolution: 0,9. Numbering refers to cluster number.

Co-Occurrence Keywords

Table 22: Top 30 keywords listed by occurrences. The total link strength (T.L.S.) serves as a measure of how often the keywords occur with other keywords in the sample.

Nr	Label	Occ.	T.L.S.	Avg. pub. year
1	cooperation	298	933	2014,00
2	neoliberalism	263	630	2017,59
3	altruism	205	655	2012,89
4	decision-making	200	505	2014,80
5	gender	188	470	2011,79
6	gamification	178	296	2019,37
7	homo economicus	177	505	2015,21
8	behavioral economics	151	397	2015,84
9	fairness	139	416	2013,42
9	experiments	139	382	2014,00
10	trust	123	360	2014,42
11	culture	122	336	2015,20
12	ethics	112	323	2013,72
13	rationality	111	306	2012,05
14	economics	110	328	2014,61
14	ultimatum game	110	319	2012,15
15	reciprocity	107	338	2013,29
16	game theory	106	282	2012,47
17	social norm	101	246	2015,14
18	emotion	100	252	2015,56
19	institutions	98	259	2013,57
20	social preferences	95	277	2016,36
21	sustainability	93	208	2015,22
22	experimental economics	85	215	2011,75
23	evolution	84	257	2011,52
24	dictator game	81	255	2014,89
25	public good	72	214	2014,22
26	happiness	69	180	2013,80
27	value	68	184	2014,82
28	methodology	64	167	2009,91
29	foucault	63	208	2016,73
29	pro-social behavior	63	177	2016,68
29	governmentality	63	172	2015,65
30	entrepreneurship	62	149	2016,02

Table 23: Keywords and the average year of publication of the papers in which they appear. Min. 100 Total link strength. Min. average normalized citation: 1.

Label	Avg. pub. year	T. link strength	Occ.	Avg. citations
gamification	**2019,37**	296	178	60,71
engagement	**2018,97**	103	36	72,06
corporate social responsibility	**2017,50**	126	60	24,05
pro-social behavior	**2016,73**	177	63	90,08
motivation	**2016,66**	163	58	63,40
heuristics	**2016,41**	126	41	74,66
social preferences	**2016,36**	277	95	34,20
inequality	**2016,33**	114	42	45,60
entrepreneurship	**2016,02**	149	62	25,52
well-being	**2015,60**	112	42	74,71
sustainability	**2015,22**	208	93	40,11
culture	**2015,20**	336	122	29,64
social norm	**2015,14**	246	101	36,39
dictator game	**2014,89**	255	81	46,52
value	**2014,82**	184	68	37,53
decision-making	**2014,80**	505	200	43,22
conflict	**2014,65**	119	43	29,56
governance	**2014,47**	140	55	28,11
trust	**2014,42**	360	123	40,25
development	**2014,20**	159	54	35,24
cooperation	**2014,00**	933	298	41,84
happiness	**2013,80**	180	69	76,19
social dilemmas	**2013,64**	192	59	55,29
norms	**2013,61**	135	44	33,91
sustainable development	**2013,36**	101	45	40,87
reciprocity	**2013,29**	338	107	50,82
altruism	**2012,89**	655	205	60,53
punishment	**2012,82**	191	50	82,46
learning	**2012,79**	148	47	42,30
neuroeconomics	**2012,51**	120	41	53,17
game theory	**2012,47**	282	106	58,81
cognition	**2012,39**	109	33	37,82
reputation	**2012,18**	106	34	72,71
evolution	**2011,52**	257	84	62,60

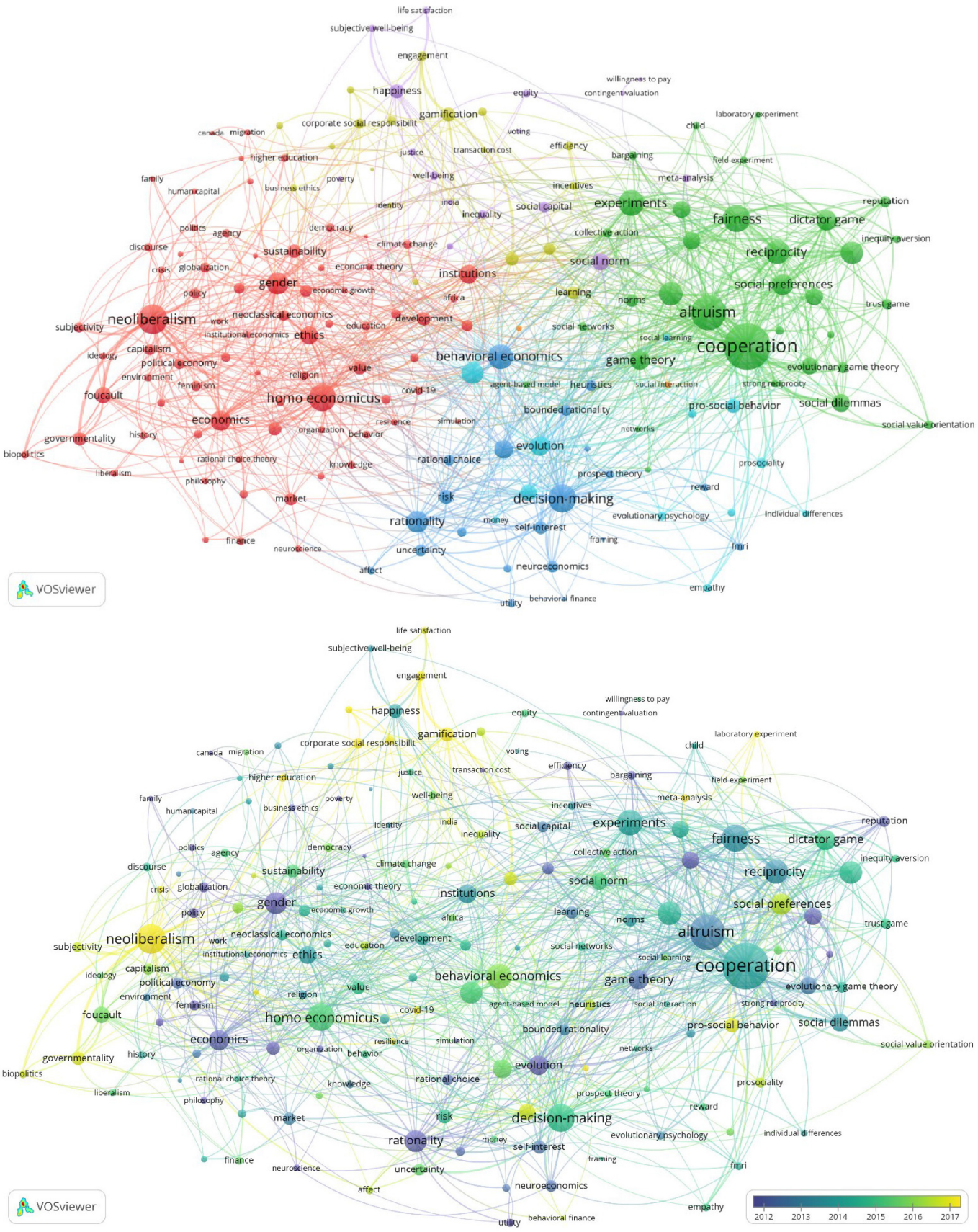

Figure 25: Co-Occurrence of keywords. Min. 20 Occurrences. 177 items. Weights on the total link strength. The bottom overlay visualization also shows the average publication years of the papers in which the keywords occur.

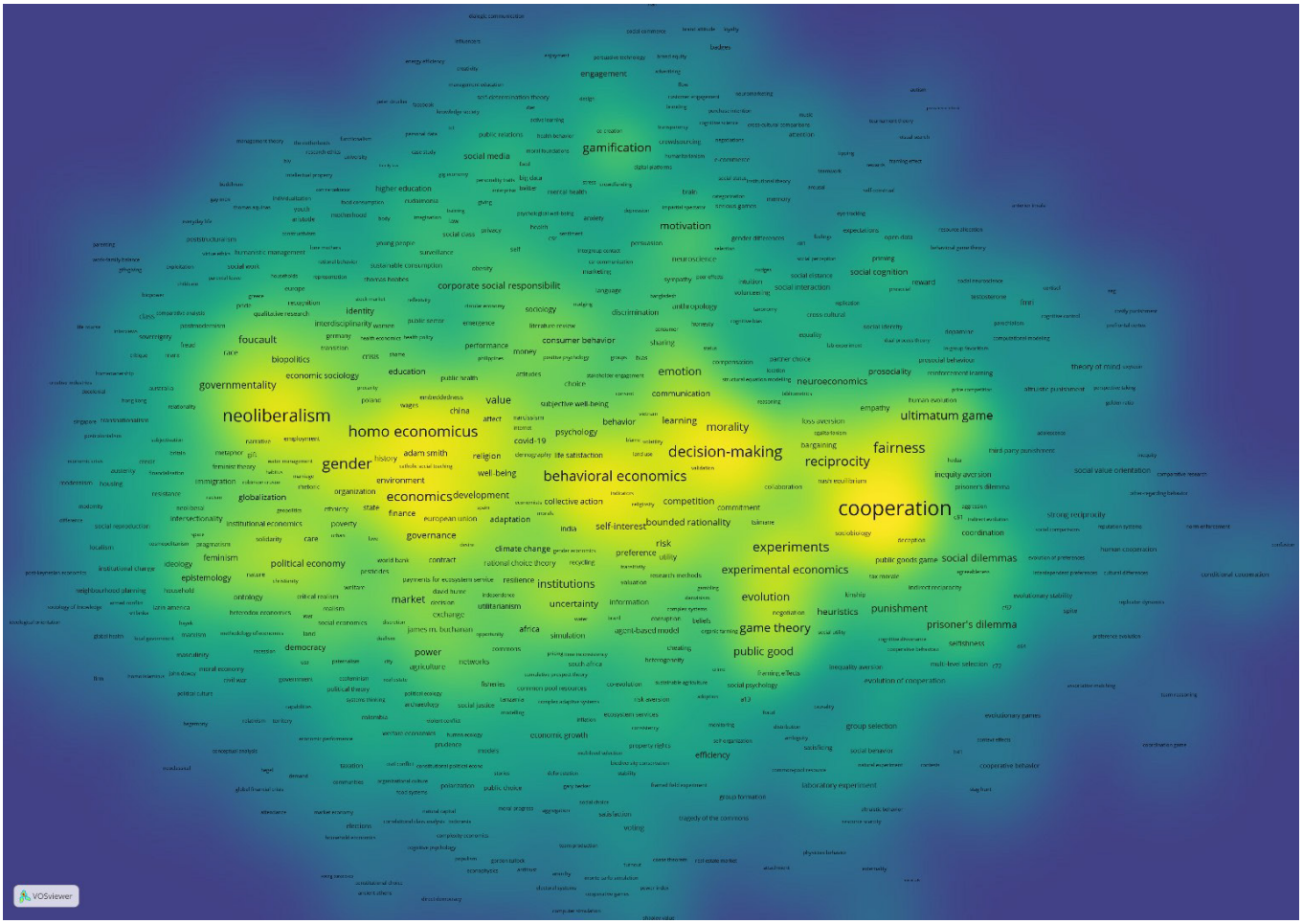

Figure 26: Co-Occurrence of keywords. Min. 20 Occurrences. 1480 items. Density Visualization. The hot spots are shown with the highest density of keywords.

The importance of a keyword is determined by the number of times it occurs in the papers of the discourse. The total link strength corresponds to the number of times a keyword appears together with other keywords in the sample. This is certainly another measure of relevance, but even more striking are the words associated with it, which provide a broader picture of the topics in scientific discourse. The most frequent keywords are shown in Table 22, together with their total link strength and the average publication year of the papers in which they appear. Table 23 is instead an overview of the chronological order of the most recent important keywords, defined by a minimum total link strength and a minimum of average normalized citations. Figure 25 shows the connections and the time dimensions of the most frequent keywords.

Figure 26 shows the hot spots of the network areas with the highest density of keywords. Depending on the perspective, there are about 7 agglomerations: neoliberalism, gender, homo economicus, economics, behavioral economics, decision-making, and cooperation. Another slightly less dense area can be found under decision-making and close to cooperation with experiments and game theory. Keywords in the orbit of these terms are related in one way or another.

Figure 27 shows the difference in the network between weighting based on total link strength and weighting based on occurrence.

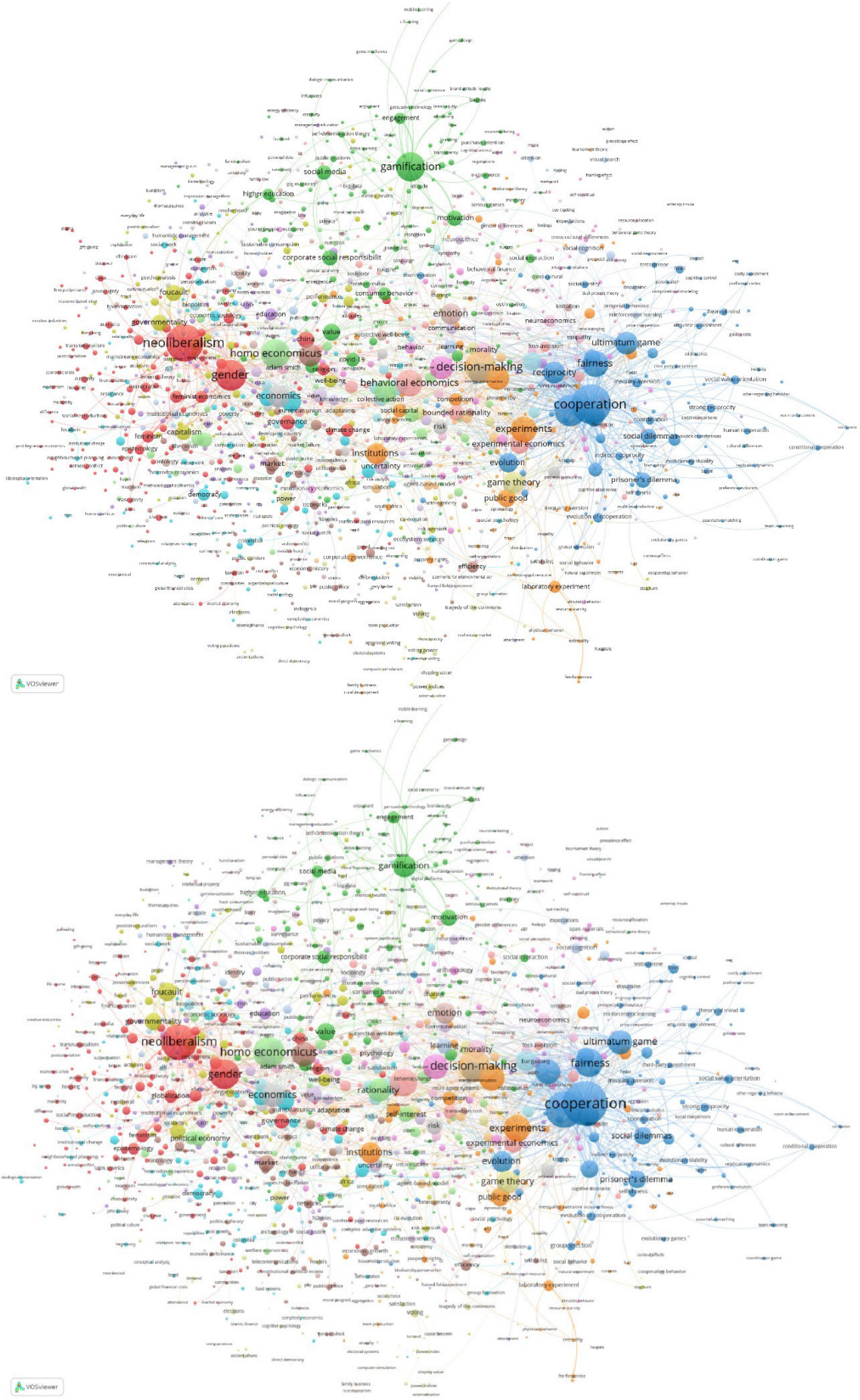

Figure 27: Co-Occurrence of keywords. Min. 4 Occurrences. 1480 items. The upper image shows the weight on occurrences and the bottom image shows the weight on total link strength.

4 DISCUSSION

In order to shed light on the scientific discourse as a whole, different insights are needed. The main questions about the central entities, the authors, the papers, and the topics are of utmost importance to be answered to understand the dynamics of a discourse. The approach of implementing this with a bibliographic network provides a rather superficial but also holistic view. The downside is that in a very heterogeneous scientific field, it is difficult to get the appropriate data. Even a reasonably large amount of data may not be sufficient to identify significant trends if the data are too diverse and, therefore, accumulations are rare. Thus, using the two different sets of data, the explicit and the implicit, was a fair approach to compensate for this. The explicit data set is of course the most accurate, as the criteria – authors want to actively participate in the discourse by using the term Homo economicus in prominent positions – apply to all papers in the data. The implicit dataset instead has a certain amount of statistical noise, but in combination, it provides additional data to enhance the main trends, if there are any. The results show that this approach worked. In the following, these trends, the central authors, papers, and topics are explained in detail.

The Central Authors

As stated earlier, a central author has a strong social network and collaborates extensively with colleagues. Productivity, measured by the publication of thematically relevant papers, is also important as it demonstrates a commitment to advancing research in the field. Finally, citation frequency is a common indicator of expert status. While a researcher may be considered a central author if they fulfil at least one of these criteria, the greatest authority is perhaps the author who performs well in all of them.

When it comes to collaboration, the co-authorship networks of the explicit and implicit data show a very different picture. This is due to some methodological limitations of the data set. The explicit dataset is too small to make significant statements. The implicit data set, on the other hand, presents a different set of challenges. First, since the data include papers that have at least one reference containing Homo economicus or similar but no other criteria related to this topic, there is a high probability that some papers have nothing to do with the main topic. Therefore, as already mentioned, some statistical noise is to be expected.

The second and largest limitation is the size of the data set. With this size, it is not possible to create networks with all the data. At a certain point, VOSviewer

is no longer able to calculate clusters when they reach a certain number. Therefore, it is necessary to perform the calculation with only a part of the data. This leads to various challenges and ultimately to unavoidable unwanted distortions in the results. This is especially true for co-authorship networks. With the data used here, a limit of about 2000 to 2500 authors was observed. This means that in order to compute the co-authorship network, it is necessary to reduce the number of authors from 16078 to about 2000. The most obvious approach is to limit the data to the most relevant authors. One way to do this is to increase the requirements for authors to be included in the network. This can be achieved by limiting the number of documents and the number of citations an author must have to be included in the network analysis. One problem that arises, for example, is when an author has co-authored with many other colleagues who themselves have very few documents or citations. What happens is that if the limit is too high, these co-authors are ultimately not included in the analysis, which has a direct impact on the co-authorship scores of the first author. Therefore, authors who are usually considered to be very collaborative may not be recognized as such in the network because most of their co-authors are missing from the analysis.

Another way to solve this problem is to limit the output to an optional number of the highest values. This is basically a reasonable approach to producing better results, but it leaves another problem. Authors who collaborate with several other authors on a single document. These authors actually receive high co-authorship scores. One might say that this is a legitimate assumption that these authors collaborate a lot, but probably many others would argue that an author who publishes 10 papers each with another different colleague is considered more collaborative than an author who co-authored one paper with 10 other authors. Although VOSviewer offers a feature to ignore papers with more than a certain number of authors, this can also lead to biased results. After all, it is difficult to determine the appropriate number of co-authors. The difference between a network based on papers with different co-author limits is shown in Figure 15 and Figure 16. This becomes particularly clear when looking at Müller, B., who holds the first position in the network with a maximum of 25 co-authors (Table 15), but drops to position 11 when a maximum of 15 co-authors is allowed (Table 16). However, to compensate for this, different networks were run with different settings, and by analyzing similar patterns, conclusions can be drawn.

Therefore, as the results suggest, Fehr, E. can be considered one of the most collaborative authors, as he is the only author who holds top positions in all

rankings. Likewise, Henrich, J. is also one of the most collaborative authors, with a significant difference from Fehr, E., which is that Henrich, J. has only one document in the explicit discourse. The assumption here is that although he is generally a collaborative author, when it comes to research explicitly on Homo economicus, Fehr, E. performs better. The authors McElreath, R., Janssen, M.A., Li, Y., Takagishi, H., Yamagishi, T., and Kiyonari, T. are similar to Henrich, J. in that they all appear in the explicit data set but do not rank very high. In the implicit discourse, however, they occupy much better positions in the ranking. The latter four authors seem to form some kind of group and have co-authored many papers in this discourse. Other notable collaborative authors of the explicit discourse are Camerer, C. and Gintis, H. Both ranked lower in the implicit discourse but were still in good positions, 36th and 169th, respectively. When focusing on the implicit discourse Gurven, M., Schlüter, M., Müller, B., Ebstein R.P., Groeneveld J., and Liu Y. are also worth mentioning.

Productivity can be measured by the number of documents an author publishes on a given topic. When comparing the explicit and the implicit discourse, the only authors who appear in both top lists are Fehr, E., Frey, B.S., Gintis, H., and Gowdy, J.M. Other researchers who appear to be highly productive on one of the lists do not play a significant role in the other rankings. This confirms the importance of these four authors. Fehr, E., Gintis, H., and Gowdy, J.M. are also among the most prominent authors when focusing on their mutual citation frequency. Reciprocal citations are perhaps one of the most crucial factors in assessing the importance of an author. Henrich, J., Camerer, C., Bowles, S., Boyd, R. and McElreath, R. are therefore also worth mentioning.

After comparing all of these aspects, it is safe to conclude that Fehr, E., Henrich, J., Gintis, H., Camerer, C., and Gowdy, J.M. are among the most important and central authors in this discourse.

Moving down the chart, there are a few more authors who occupy high positions in almost every ranking. These authors include Bowles, S., Boyd, R., McElreath, R., Ruiz-Villaverde, A., and Hamari, J. Of particular interest are the last two authors, who play a somewhat different role. To gain a more comprehensive understanding, it is important to closely examine the networks and view each author individually. Ruiz-Villaverde, A. appears to be an author who is publishing more recently. The publication years of the papers he co-authored and of the one paper in which he is the sole author range from 2019 to 2023. Since most of the papers are included in the explicit data set, his research is strongly focused on Homo economicus as a whole and not only on partial aspects. In

addition, as shown in Figure 4, Ruiz-Villaverde, A. is a connecting link between his colleagues. By definition, he can potentially be considered a rising star. Rising stars are well-connected, collaborative, and productive young scientists who, because of their early career stage, do not have many citations (Li et al., 2009).

Hamari, J., on the other hand, is in some ways an outlier. He plays a very central role within his field of science, which is „gamification". In fact, he and his colleagues form a fairly large cluster, as shown in Figure 20 and Cluster 4 in Figure 24. However, the high citation rates are actually due to one single paper by Hamari (2013) in which the term Homo economicus appears in the title. The paper deals with Homo economicus as an actor who acts in a utilitarian way, while in contrast, there is Homo ludens, who exhibits playfully motivated behavior. The gamification of economic domains attempts to transform purely utilitarian behavior into playful behavior in order to increase interaction between participants. Accordingly, this paper meets the criteria for the explicit discourse. However, since this paper is very often cited not only by colleagues, but also by Hamari, J. himself, the picture of a large group of scientists emerges who are intensively researching on Homo economicus. In fact, the connection is made exclusively through this one paper. Otherwise, none of the other authors would fulfill the criteria for both the explicit and implicit data sets. However, the strange role that Hamari, J. plays in the data is visible in other networks. In the explicit data set, there is only this one paper anyway, and it only stands out in the first analysis when it comes to total citations. In the implicit data set, on the other hand, the group's remote position relative to the rest of the authors or papers is immediately apparent. Similar to the roller coaster ride of the rankings. In every evaluation where a strong association with the discourse is required, Hamari, J. falls comparatively behind. Something that is not so strongly observed with other prominent authors. Nevertheless, it would be wrong to conclude that Hamari, J. has nothing to do with the discourse. On the contrary, his research occupies a niche of its own. In fact, Hamari, J. himself, deals with gamification in the context of economics - specifically sharing economy, collaborative consumption, crowdsourcing, and consumer behavior (Gamification Group, n.d.). The non-negligible connection to the rest, which can be seen in the citation networks, supports this assumption. Furthermore, it can be concluded that these results indicate a potential opportunity for new collaborations.

Central Papers

When discussing central papers, Hamari (2013) can also be considered central in its particular role. Its general citations are high as well, which is also of great

importance. After all, a generally low-cited paper that may still be important within a community, as shown by cross-citations, needs to have its influence debated if it does not otherwise receive much attention. An example that might illustrate this is Camerer and Fehr (2006) and Henrich et al. (2006). Both are almost equally ranked in terms of reciprocal citations, but Henrich et al. (2006) received more than twice as many citations. Nevertheless, reciprocal citations are still very important for the overall discourse, and in this respect, Henrich et al. (2001) and Camerer and Fehr (2006) can be considered the two most important papers, as both are in the top rankings. Moreover, both are from the explicit data set, indicating their strong relevance to the discourse. Other significant papers from the explicit data set include Thaler (2000) and Read (2009), both of which play a central role in their respective clusters (Table 7). Read (2009) is particularly noteworthy as it serves as a connecting link for many other papers due to its strong thematic overlap. Another prominent paper is Davis et al. (1997), which is in fact the most cited paper in the explicit data set. In his paper, the author promotes the stewardship theory, which, in contrast to the prevailing agency theory of the time, is not based on the assumptions of Homo economicus. However, while it does address assumptions about human behavior in economics and even proposes alternatives, it appears to be a standard economics paper. Thus, the score for reciprocal citations is quite low.

In the implicit discourse, Fehr and Fischbacher (2003) is worth mentioning, as well as Herrmann et al. (2008), since both rank second and third in the reciprocal citations list. In addition, Fehr and Fischbacher (2003) is also one of the most generally cited papers, together with Nowak (2006), Sanfey et al. (2003), and Charness and Rabin (2002). Moreover, all of them also rank quite highly in terms of reciprocal citations.

Central Topics

In an attempt to categorize the large number of topics, seven major topic groups plus some isolated niche topics could be distinguished. However, this should be seen as an approximation, as there are, of course, many overlaps and individual areas that could certainly be placed in other groups or in several groups at the same time. In addition, the categories were formulated from the perspective of anthropology or human ecology. Accordingly, these classifications should not be taken as absolutes, but are primarily intended to provide a better overview. In order of importance in the discourse, the largest group would be „Behavior“ with cooperation, altruism, self-interest, experiments, evolution, reciprocity, decision-making, rational choice, game theory, social and endogenous preferences,

inequality aversion, fairness, and consumer behavior. The second group, „Society, Politics," is also very important, with topics such as neoliberalism, liberalism, critique of economic theory, Foucault, governmentality, economy, capitalism, globalization, higher education, market, culture, institutions, public goods, constitutional political economy, gender, and feminism. The third group already contains strong overlaps with the previous groups and can be labeled „philosophy" with topics such as (social) norms, morality, value, (business) ethics, happiness, subjectivity, greed, and economic doctrine. The fourth group is generally concerned with „Homo economicus", which means that it deals with the genealogy of Homo economicus, alternative theoretical Homo models, critique, Adam Smith, history, and development. The fifth group is not very broad, but it differs somewhat from the others in that it shares a common theme of research, which is „Neurology". This includes neuroeconomics and neuroscience. Disciplines in which researchers study and test hypotheses about human behavior derived from scientists are basically found in the first group (Fehr & Camerer, 2007; Rilling & Sanfey, 2011; Sanfey et al., 2003). The sixth group has emerged primarily from a „human ecology" perspective, as it includes sustainability, biopolitics, environment, ecological economics, degrowth, resource depletion, climate change, and ecology. „Gamification" as the seventh group simply goes back to the working group around Hamari, J. This topic is relatively prominent in the discourse, but not to the same extent relevant. This can be seen in the networks in Figure 27. The strong difference that can be observed when comparing „gamification" is due to the different weighting, occurrence, and total link strength. With the occurrence weighting, gamification is relatively prominent due to the many articles, but it falls back when it comes to total link strength. The reason for this is that the sample includes many papers by Hamari and his colleagues, and therefore gamification appears many times in the sample, but since their field of research is not yet strongly associated with the work of economists, their keywords do not appear together very often.

Finally, there is also a group which can be called „Islamic Economics", which does not play a central role in the overall discourse, but nevertheless has some representatives. This group that also includes the neologism Homo islamicus, deals with questions of morality in economics, and discusses them from the perspective of the teachings of the Qur'an (Mahyudi, 2016).

A way to gain a comprehensive insight into these groups is to examine the central papers, which provide an ideal basis for discussing the most important topics. In Henrich et al. (2001), as the leading paper in the implicit cluster 3, and perhaps of the entire discourse, the authors describe behavioral experiments such as

ultimatum, community, and dictator games to demonstrate how individual behavior deviates from the standard assumptions of neoclassical economics. The idea of pure self-interest was not supported. Gintis (2000), who examines many aspects such as cooperation and free riders, and Camerer and Fehr (2006), who test for the emergence and maintenance of cooperation as well as rationality, also report deviations from neoclassical predictions in their studies. Experimental studies play a crucial role in the discourse, as they are a common approach to studying human behavior. Several types of games are commonly used. In particular, the Ultimatum Game, which is heavily discussed in cluster 14 (Bahry & Wilson, 2006; Chuah et al., 2007; Güth & Kocher, 2014; Oosterbeek et al., 2004) but also Engel (2011) from cluster 6. Levitt and List (2007) argue about the role and validity of laboratory and field experiments. Tests have even been conducted to create psychological profiles of real people who supposedly behave like Homo economicus (Yamagishi et al., 2014).

Anyway, in many of the studies, the authors claim that the assumptions about human behavior in economics do not correspond to their results. Cooperation and social interactions are the crucial features that influence the different outcomes. Any such thing as a universal pattern of behavior in the economy cannot be confirmed (Henrich et al., 2001).

In addition, differences between societies were discussed, and similar results were observed. Herrmann et al. (2008) support this with experiments in different societies and the role of antisocial punishment. Differences across societies are also the focus of research in the implicit cluster 11. Apicella et al. (2012) examine cooperation in hunter-gatherer societies, and Spadaro et al. (2022) even conduct a meta-analysis of different communities. Religious groups, among others, are the focus of Henrich et al. (2010). Differences in behavior between the sexes in these games are also the subject of research in the discourse (Eckel & Grossman, 2001; Seguino et al., 1996).

The central topics in Fehr and Fischbacher (2003) are altruism, selfishness, and cooperation. Various aspects of the underlying mechanisms are discussed. The „social heuristic hypothesis" is discussed in Rand et al. (2014), a theory that cooperation is a more intuitive behavior than a well-considered action. Peysakhovich et al. (2014) investigate different correlations between cooperation and other factors like time or normative punishment. The evolution of cooperation, kin selection, and indirect and direct reciprocity are the main issues in Henrich et al. (2006), Nowak (2006), Seinen and Schram (2006) and Grund et al. (2013). The evolutional foundation of cooperation and prosocial behavior

(Murphy et al., 2011; Thielmann et al., 2020) is also the subject of research in implicit cluster 9. Brosnan and De Waal (2003) even examine inequality aversion in monkeys and conclude that there is a strong evolutionary basis for it. Prosocial and altruistic behavior can also be studied and observed in children (Benenson et al., 2007; Blake et al., 2015; House et al., 2013).

Many authors also build a connection between social preferences and effects on norms in markets, politics, and society as a whole (Bowles, 1998, 2008; Fehr & Gintis, 2007). The political and social aspects are discussed with great importance. These include Read (2009), Hamann (2009) and Dilts (2011),which deal with Foucault and his theories on the role of the state, the influence of the economy on society, and neoliberalism. Furthermore, the neoclassical economic school and its moral implications were discussed (Bowles & Gintis, 2000; Tomer, 2001; Urbina & Ruiz-Villaverde, 2019). The effects of the neoclassical school of economics on students, politicians, economists themselves, gender, and scientists are also of great importance and are thoroughly examined, for example, in Molinsky et al. (2012) and Laband and Beil (1999). In fact, there is a whole field of research devoted to the chicken-and-egg problem. Do economics students themselves become less generous people as a result of the teaching of Homo economicus, or do more selfish people tend to study economics? Apparently, many authors have found differences between business students and others (Etzioni, 2015; Miragaya-Casillas et al., 2023; Nixon et al., 2018; Wang et al., 2011). Brennan and Hamlin (1995) instead deal with a research discipline called „constitutional political economy“ that focuses on constitutional issues and uses economic methods. However, they do not share the values behind Homo economicus. Other societal issues include unemployment (Wright, 2012) and market wages (Akerlof, 1982) and the role of feminism in economics (Power, 2004).

Equally important in the discourse is the role of norms and morality. Therefore, it is the subject of research in many other papers (Alger & Weibull, 2013; Bowles, 1998; Fehr et al., 2008; Lewis & Mackenzie, 2000) along with psychology and social preferences (Charness & Rabin, 2002; Chudek & Henrich, 2011; Sobel, 2005). Also, studies about happiness and wellbeing in an economic context are part of the discourse (Becchetti et al., 2008; Blanchflower & Oswald, 2004; Charness & Grosskopf, 2001; Frey & Stutzer, 2002; Konow & Earley, 2008; Kroll, 2011).

There are also several papers dealing with the concept of Homo economicus. They examine the origins, history and development, classification, and underlying ideas that led to the concept (Crosthwaite, 2013; Morgan, 2006; Ng & Tseng, 2008)

Another area of high relevance to the research questions of this master's thesis is the investigation of environmental issues regarding homo economicus. This includes papers that deal with the environmental impact of an economic system based on the values of homo economicus (An, 2012; Gsottbauer & van den Bergh, 2011; Jager et al., 2000; Kalimeris, 2018)

The specific role and chronological classification of each topic can also be assessed by examining the position and connections in the networks. Since answering the question of the role of sustainability in the discourse is the stated aim of this thesis, it will be specifically addressed.

When studying the keyword network, some terms stand out significantly. The keywords shown in Figure 26 are the leading topics in the discourse. The largest of these is cooperation, with altruism and social preferences nearby. Above this hotspot are the keywords reciprocity, and fairness, and a little further away is the ultimatum game. Below it, also a bit more distant but also prominent, are social dilemmas, punishment, and the prisoner’s dilemma. The strongest links to cooperation (minimum link strength 15) do have altruism, fairness, reciprocity, trust, experiments, evolution, public good, punishment, prisoner's dilemma, social dilemmas, and reputation (Figure 28). This is entirely consistent with the conclusions drawn from the rankings and cluster analysis. Therefore, these topics belong to the first thematic group. Research in this area seems to dominate the discourse.

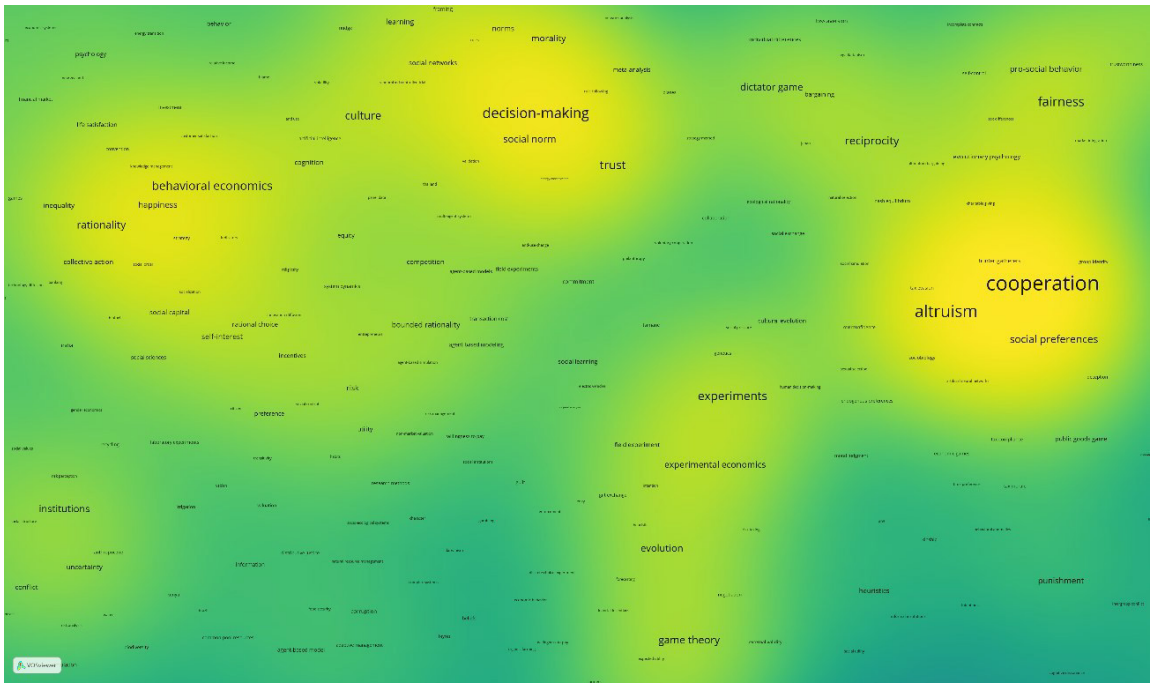

Figure 28: Co-Occurrence of Keywords. Min. of 20 occurrences. 1480 items. Density Visualization. A zoom on the main clusters from Figure 27.

A short distance away is another cluster around decision-making, along with social norms, trust, morality, and culture. In between, but not in one line, but somewhat offset, are several keywords that suggest a thematic affiliation but are word by word further away from the two agglomerations of cooperation and decision-making. This includes, in increasing order of distance, experiments, experimental economics, evolution, game theory, and public good. As observed in the previous analysis, decision making is also a main topic in the first group, and experiments based on game theory are essential for the study of both cooperation and decision-making, and are therefore close but in between both agglomerations.

Right next to decision making is behavioral economics. The most dominant and closest keyword to this cluster is rationality. Culture also stands out here, which is very present between behavioral economics and decision making.

Homo economicus follows at some distance, and economics a little below (Figure 29). With a minimum link strength of 5, altruism, game theory, behavioral economics, rationality, self-interest, rational choice, economics, Adam Smith, neoliberalism, Foucault, governmentality, and Aristotle are the most strongly connected keywords, indicating the strong debate about the model and the neoclassical school of economics.

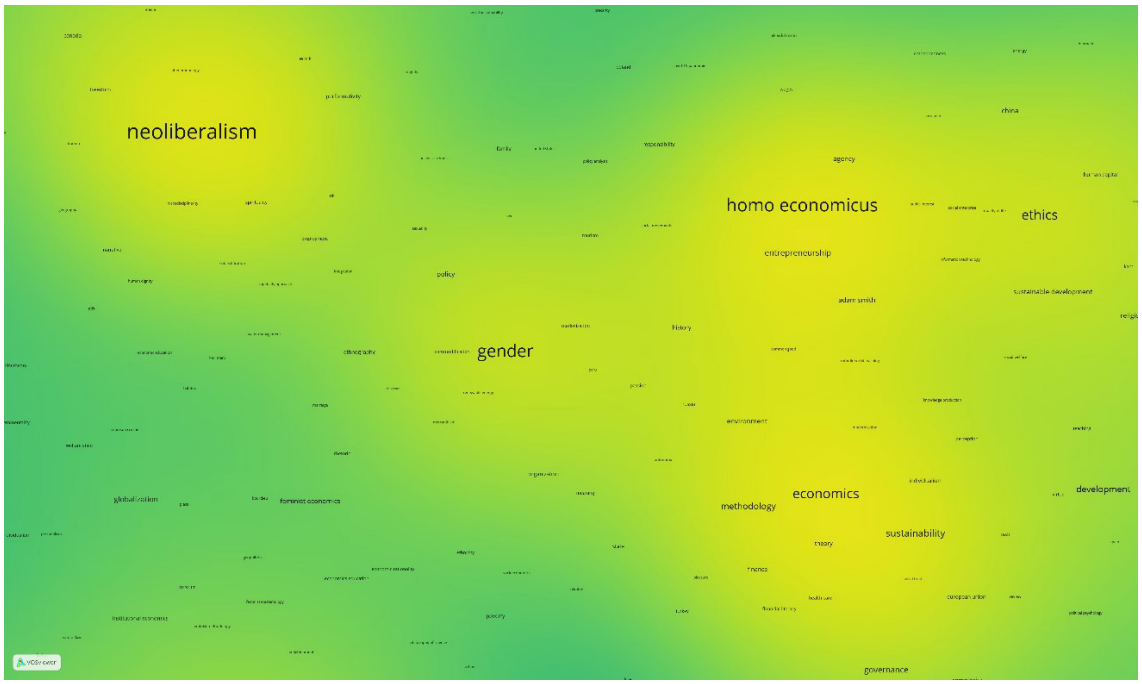

Figure 29: Co-Occurrence of Keywords. Min. 20 of occurrences. 1480 items. Density Visualization. A zoom on the main clusters from Figure 27.

Sustainability, methodology, and governance are close to economics. Ethics and sustainable development are close to Homo economicus. This seems to be a figurative representation of the role of sustainability in economics and Homo economicus. After all, sustainability is a matter of a responsible economy, which requires well-functioning governance based on a better understanding of human behavior in an economic context, contrary to Homo economicus. The keywords that are connected to sustainability are power, degrowth, well-being, sustainable development, ethics, corporate social responsibility, environment, technology, interdisciplinarity, gender, and climate change. Climate change, in turn, is connected to adaption, behavioral economics, ethics, and, of course, sustainability.

The characteristic combination of keywords could indicate research on a direct connection between Homo economicus and sustainability issues, but the results do not allow for such a conclusion with certainty. The keyword sustainable consumption appeared only 12 times in the papers. Whether the awareness of the importance of this kind of research, postulated at the beginning, is also part of the discourse, cannot be clearly answered here. Nevertheless, the themes are present in the discourse, and considering the number of keywords in the data set, sustainability and all related keywords are relatively prominent. Thus, sustainability and even climate change do play a role in the discourse.

The second major hotspot, neoliberalism, is on the far left of the image. Some of the strongest connected keywords with a minimum link strength of 5 are homo economicus, gender, Foucault, governmentality, globalization, capitalism, debt, rights, immigration, ideology, Marxism, finance, human capital, biopolitics, and higher education. This topic area offers perhaps the greatest starting point for research in the area of the global challenges mentioned at the beginning. Work that questions the existing economic system, explores alternative theories, and seeks to understand the big picture can best integrate issues such as climate change and sustainability. Authors and networks associated with these topics may have the potential to address many of these agendas in an interdisciplinary way. A closer look at this scientific community is certainly worth the effort.

Between Homo economicus and neoliberalism is the very dominant keyword gender, which, despite its frequency, does not seem to form a large cluster of its own, which means that not so many other keywords accumulate around it. A conclusion that could be drawn is that although gender plays a certain role in the discourse, it is discussed in a certain isolated way, or the research on it is very specific. Nevertheless, the most strongly linked keywords with a minimum link strength of 5 are neoliberalism, globalization, feminism, feminist economics, intersectionality, care, feminist theory, family, work, class, race, woman, education, and time use. Sustainability is not listed because the connection does not meet the threshold. This group can be seen as an extension of the previous one. This is also illustrated by the position between homo economicus, economics, and neoliberalism. There is also a strong connection to the latter. Again, it can be seen that the discourse on homo economicus also has a strong social or socio-critical component.

Another important aspect that can be examined in the networks is the time dimension. Of the main topics, neoliberalism (average publication year: 2017,58) is the most recent, as well as gamification (average publication year: 2019,37), shown in Figure 30. Interestingly, as shown in Figure 31, sustainability (average publication year: 2015,22), while not old, is not as recent as one might expect given the latest global developments. Furthermore, gender is surprisingly much older (average publication year: 2006,88), which raises the question of whether research on these topics is less important in the discourse today or whether there has been a shift in focus. This could explain why, at least for sustainability issues, corporate social responsibility and degrowth are relatively new.

Table 24 shows the major sustainability related keywords with their respective total link strength, occurrence, and average year of publication.

The conclusion that can be drawn from this is that, despite its current importance, the issue of sustainability plays less of a role in this discourse today than it did about 10 years ago. At the same time, of course, this can be seen as a mandate, or at least a lesson, to pay more attention to this issue again.

Table 24: Keywords related to sustainability from both data sets.

Label	T.L.S.	Occ	Avg. pub. year	Avg. Cit.
sustainability	208	93	2015,22	40,11
sustainable development	101	45	2013,36	40,87
climate change	92	43	2015,35	48,60
sustainable consumption	25	12	2014,42	79,83
degrowth	25	12	2017,33	33,83
social sustainability	13	5	2012,80	30,00
corporate social responsibility	12	6	2020,00	17,33
sustainable agriculture	7	7	2017,14	28,14

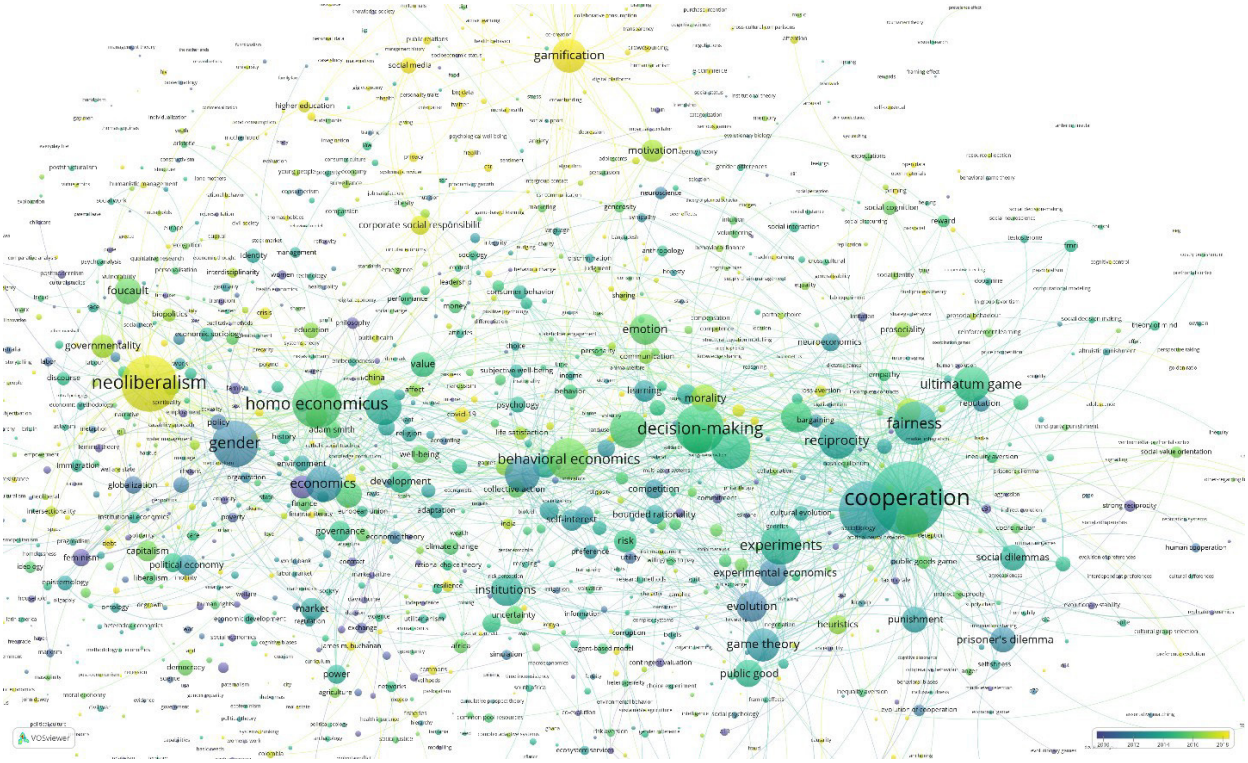

Figure 30: Co-Occurrence Keywords. Minimum 4 Occurrences. Weights on total link strength. Score on average publication year. Scale is the same as in Figure 31

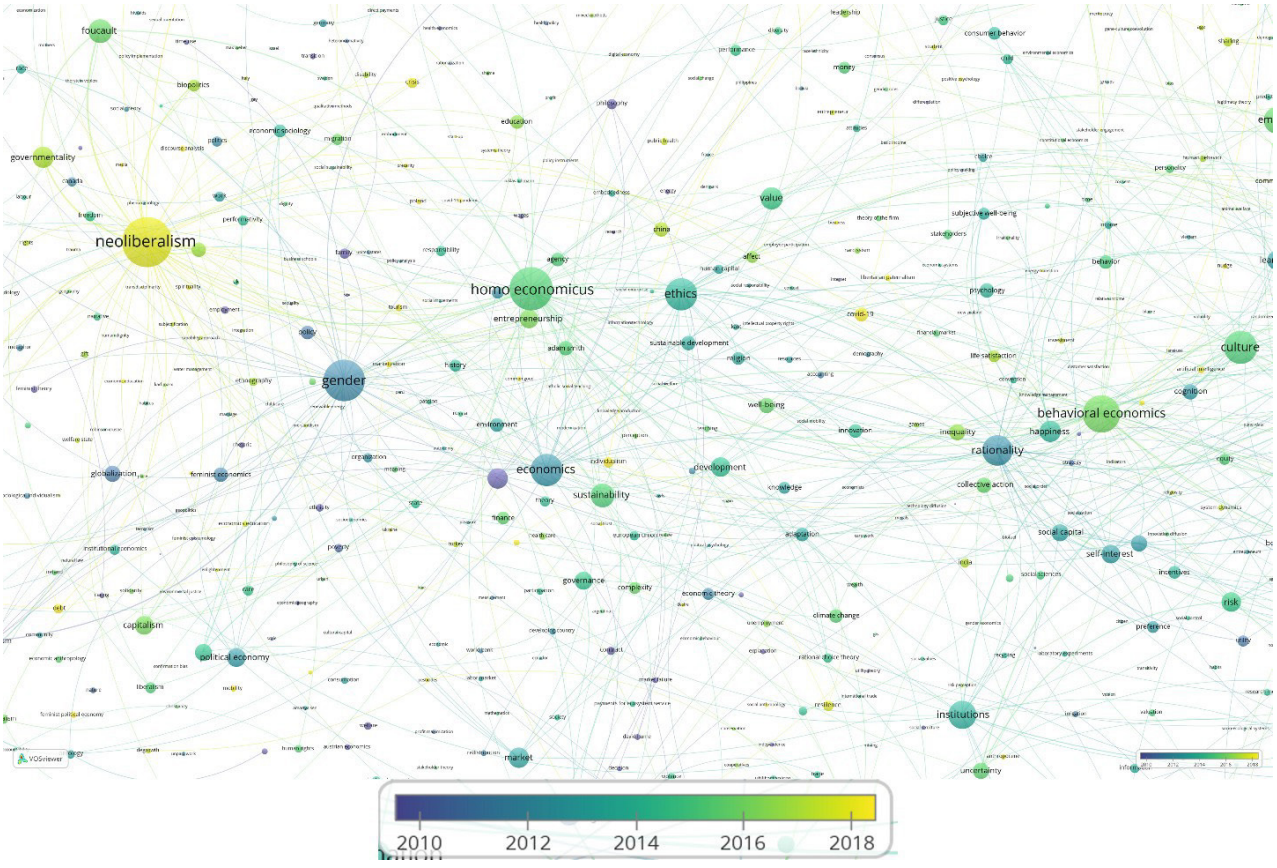

Figure 31: Co-Occurrence Keywords. Minimum 4 Occurrences. Weights on total link strength. Score on average publication year. Zoom on Homo economicus and surroundings. Sustainability is located in the middle next to "economics".

Overall Picture

When examining the various types of networks, different aspects of the discourse can be identified. The sometimes very different dynamics provide revealing insights into the behavior of the discourse. In general, the impression is confirmed that the discourse as a whole is very heterogeneous. Both in terms of the scientists and the topics.

At the same time, however, if one compares, for example, the co-authorship networks with the citation networks, it is noticeable that although collaboration seems to take place exclusively within certain communities, awareness of each other's work is very high. Nevertheless, collaboration in the explicit discourse seems to be quite weak. At least that is the conclusion of these results. One could assume, with great caution, that only a rather exclusive fraction of the community engages in open discussion about Homo economicus. In general, when comparing the co-authorship networks from the explicit and implicit discourses, it seems that placing the term Homo economicus in the foreground is not that important for most authors. After all, the implicit data set was surprisingly rich in corresponding papers, considering the relatively weak requirement of having the term only in the references. Thus, the number of studies on Homo economicus is not negligible, but obviously not all of them are very visible.

Another very surprising phenomenon when studying the co-authorship network in Figure 1 is the large number of documents that certainly use the term Homo economicus but are not connected to any other group at all. The main reason is certainly the incompleteness of the data due to the character of the two data sets mentioned above. This is also responsible for the many authors of the explicit data set who only come to light in the implicit discourse. However, many authors remain unconnected to the community as a whole. This again underscores the fact that there are many authors or groups of scholars doing their own thing.

For the implicit discourse, the picture is more homogeneous when it comes to the reciprocal citations of the documents. Of course, there are some papers that are only relevant to their respective clusters, and some of these clusters are far away from the main data cloud, but in this particular cloud, the overall connection is relatively even. This leads to the conclusion that there is a vital intellectual connection between most of the authors. Most of their work seems to be mutually acknowledged. Of course, the explicit discourse looks somewhat different, but still, when comparing the co-authorship network and the citation network, an increase in connectivity can be observed.

Another reason for the general heterogeneity is perhaps the wide range of topics. Certainly, as mentioned above, the first group of topics is a huge conglomerate of many, actually highly overlapping, topics, but it is easy to subdivide it into many other different subtopics. Consequently, the other groups are much more distinct from each other. Research into the evolutionary mechanisms of basic human behavior can be sharply distinguished from moral and ethical issues in society and politics, although they are nevertheless strongly linked. The same applies to neuroeconomics and environmental issues.

In summary, it was possible to identify an intellectual scientific community that was researching the basic mechanisms of human behavior, contrary to the assumptions of economics. Some very central authors have been identified who also frequently collaborate. In addition, there are several other well-connected communities researching other aspects of Homo economicus and the implications for society. The results did not show a very intensive collaboration between these groups, but a comparatively high number of mutual citations. Therefore, awareness of the scientific findings is somehow given. When examining the years of publication, it seems that the peak of productive and highly cited authors lies a few years back, at least on average. Nevertheless, some ambitious authors have been identified who have published more recently and may not yet be highly cited.

Limitation

The main restriction is, so to speak, inherent in the topic. Because if one intends to present the discourse on Homo economicus in a neutral and comprehensive way, one shouldn't search for the term Homo economicus alone. Because the term itself already implies a critique (Persky, 1995). Scientists for whom the assumptions about human behavior in an economic context, as defined by neoclassical economics, are legitimate rarely write papers in which they explicitly refer to Homo economicus. They simply operate with it. No biologist would explicitly explain in every paper the mechanisms of natural selection on which today's research is, of course, based. For example, Friedman (2007) spends pages discussing the problem of confusing economic experiments, which are supposed to make predictions about effects and counter-effects in the economy, with normative rules. In other words, he argues that the assumptions about human behavior made in the models serve only to achieve objective, reductionist predictability and are not meant to reflect reality. Not once does the term homo economicus, or economic man, appear. As a result, the discourse on Homo economicus can hardly be anything other than a critical discourse in which the behavioral assumptions are questioned. The proponents are therefore heavily underrepresented. However, this is only a limitation if one expects anything else, and it should be noted that this is indeed a critical discourse.

Another thing to consider is the use of only one database and, therefore, the issue of unbiased data and incompleteness. As mentioned in the method section, although Scopus is one of the most comprehensive databases, some key papers are certainly missing. And as seen in the analysis, one paper can shape a whole network completely differently. In addition, the results are only as good as the data, and as observed, some information from the papers is missing in the data set. For example, about 3200 of the sample papers do not contain any author keywords. This, of course, affects the results. Also, some papers do not have an abstract by default. Even the paper by Henrich et al. (2001), which is one of the central papers. And of course, there is no guarantee for the correctness of all other values in the data.

When it comes to the approach, the implementation of the analysis could also be done in a different way. Which networks are best suited for which questions was determined after careful research, but other constellations also have their advantages. It can also be argued that the selection of data could have been more precise. Finally, the very moderate requirements for papers dealing with Homo economicus may also be responsible for such a heterogeneous picture of the

discourse. This has also led to some outliers. However, the approach taken here was to avoid influencing as much as possible. For this reason, the "cardiovascular" group was generally left in the data and only excluded in individual cases. For the most part, this group was not included in the network presentations, as it often disturbed the overall picture. However, they were often included in the rankings, depending on the need, as they were not among the top rankings anyway. The justification for leaving this group out is particularly evident in Figure 20, which shows how little connection there is to the rest of the discourse.

Furthermore, similar to the argument of Ding and Yang (2022), the approach can be considered objective as a quantitative method, but the interpretation is not to a certain extent. Here, an attempt was made to maintain a sufficient degree of objectivity by limiting the results to the top scores for each research topic. This is because, for example, the authors who have achieved by far the most citations are undoubtedly considered important for the discourse.

The downside of all this, of course, is that in-depth investigations are completely left out. Furthermore, it is only possible to speak of an approximation of a possible picture of the discourse. An exact interpretation of every observed trend is not possible with this approach, and of course, there is no claim to completeness. Many certainly relevant developments, which can only be discovered in a deeper analysis, do not come to light here.

It is also important to note, even though it is clear in principle, that this is only a representation of the data using the criteria defined in this thesis. Observed trends are therefore only correct with respect to the preconditions that have to be present in the data set. For example, a productive author is only evaluated as such in the context of scientific papers whose title, abstract, keyword section, or references contain the term Homo economicus.

It can be argued that the method itself may not be the appropriate way to address this issue. An alternative would have been to conduct a standard literature review. However, in this case, it would not have been possible to analyze so many papers and especially their interrelationships. Moreover, who can guarantee complete objectivity or completeness in a literature review? In addition, it may have been necessary to use a quantitative approach to discover the heterogeneity of the discourse.

5 CONCLUSION

Given the importance of the research on Homo economicus, this thesis attempts to provide an overview of the scientific discourse on Homo economicus. For this purpose, the questions of who are the central authors, what are the central papers, and what are the central topics were answered. Furthermore, from a human ecology perspective, it is important to know to what extent sustainability issues play a role in the discourse. To answer these questions, bibliographic networks were created from two different data sets in order to better approach the complex topic. On the one hand, the works of authors who want to actively and explicitly participate in the discourse by including the term Homo economicus in the title, abstract, or keywords were examined. On the other hand, a dataset of articles in which the term appears in the references was used in order to significantly expand the scope of the information. This allows, for example, to obtain very precise results that are highly related to the topic, while at the same time amplifying small effects and making them more visible. The use of both data sets proved successful, and important authors such as Fehr, E., Henrich, J., Gintis, H., Camerer, C., and Gowdy, J.M. were highlighted. It was also possible to identify key papers such as Henrich et al. (2001), Camerer and Fehr (2006), Thaler (2000) , Herrmann et al. (2008), Fehr and Fischbacher (2003), Nowak (2006), Sanfey et al. (2003), and Charness and Rabin (2002).

The results of the topics were very diverse and showed the multifaceted character of the discourse. There are concerns and criticisms about the theoretical properties of the model, such as rationality and the desire for unrestricted profit maximization. These are also examined at different levels, both behavioral, neural, cognitive, and philosophical, moral. Criticism in the discourse ranges from recommendations for minor corrections of economic models based on homo economicus to fundamental questioning of Western economic doctrine.

Many papers also deal with the social implications of such an image of humans, especially when these ideas are applied uncritically to all areas of life. This may affect students, questions about wages, or, of particular interest to human ecology, how such a model affects the relationship between the environment and economic theory. The results show that the topic is present and even strongly related to Homo economicus and economics. At the same time, however, it receives only an average amount of attention.

Nevertheless, the results are, to some extent, a more superficial examination of the scientific literary landscape and cannot be compared with a more in-depth investigation. The approach used here, together with methodological restrictions, limits the ability to conduct a detailed qualitative analysis. Considering the effort required for data collection and network analysis, this leaves a somewhat pale aftertaste. There remains a desire for more in-depth insight into the topic. At the same time, and this is the enormous advantage of this methodological approach, such a quantitative analysis would hardly have been possible otherwise. Above all, the relationship of individual authors or topics to all others in the discourse could be made visible through the network analysis. In particular, questions about the role of sustainability can only be answered in the context of the overall discourse.

Therefore, one of the most important findings was that the method has enormous potential for identifying specific features that can then be explored in more in-depth studies. For example, the question of the not insignificant role of research on Foucault in the discourse. Or what role theological research plays in it. Another question that can be widened and is of particular interest to human ecologists is that of climate change. For example, who else among the authors is concerned with sustainability, how strongly are they networked, and where are the thematic points of contact in the discourse? Some points of contact have been identified. Probably the largest is the topic of neoliberalism. As a critical term against the prevailing economic doctrine, it already points to authors, works, and other topics that have potential for collaboration and could address the concerns of research on sustainability and climate change.

Finally, this thesis provides an excellent foundation for generating more specific research questions based on the findings in order to study the various aspects of the discourse. The results, therefore, leave one thing above all: the urge to explore the many trends that have been discovered.

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A. Appendix - Thesaurus Authors

label	replace by
camerer c.f.	camerer c.
chen s.-q.	chen s.
gowdy j.	gowdy j.m.
murove m.	murove m.f.
stringham e.	stringham e.p.
tomer j.	tomer j.f.
torglerb b.	torgler b.
wagner-tsukamoto s.	wagner-tsukamoto s.a.
zafirovski m.	zafirovski m.z.

B. Appendix - Thesaurus Keywords

label	replace by
human	
humans	
article	
adult	
male	
female	
homo oeconomicus	homo economicus
economic man	homo economicus
'economic man'	homo economicus
„economic man"	homo economicus
homo œconomicus	homo economicus
homo œconomicus	homo economicus
homo economics	homo economicus
homo economicu	homo economicus
homo-economicus	homo economicus
'homo economicus'	homo economicus
model of economic man (homo economicus)	homo economicus
model of self interest (homo economicus)	homo economicus
economic man (homo economicus)	homo economicus
„africa, northern"	northern africa
actor network theory	actor-network theory
advertising	advertizing

label	replace by
algorithms	algorithm
aquinas	Thomas Aquinas
becker	gary becker
behavioral models	behavioral model
behaviour	behavior
behaviour model	behavioral model
behavioural	behavioral
behavioural economics	behavioral economics
behavioural finance	behavioral finance
behavioural model	behavioral model
behavioural models	behavioral model
blood donors	blood donor
borderline personality disorder (bpd)	borderline personality disorder
buchanan	james m. buchanan
buchanan (james)	james m. buchanan
business cycles	business cycle
business educations	business education
charging behaviour	charging behavior
children	child
choise experiments	choise experiment
cities	city
common goods	common good
conceptual frameworks	conceptual framework

label	replace by
consumer attitudes	consumer attitude
consumer behaviour	consumer behavior
consumers	consumer
consumption behavior	consumer behavior
consumption behaviour	consumer behavior
contracts	contract
conventions	convention
corporate social responsiblity	corporate social responsibility
cosmetics	cosmetic
cultures	culture
dafoe	daniel dafoe
data driven	data-driven
decision - making	decision-making
decision making	decision-making
decisions makings	decision-making
defense mechanism	defence mechanisms
developing countries	developing country
dewey	john dewey
diets	diet
disasters	disaster
domestic wastes	domestic waste
dynamics	dynamic
economic system	economic systems
economic theories	economic theory
economic the-ory	economic theory
ecosystem service	ecosystem services
ecosystems	ecosystem
emotions	emotion
eu	european union
evidence weights	evidence weight
experiment	experiments
finances	finance
financial markets	financial market
flavonoids	flavonoid
foods	food
functional foods	functional food
genes	gene
geomagnetic forces	geomagnetic force
gini coefficients	gini coefficient
globalisation	globalization
greenhouse gas (ghg)	greenhouse gases
healthcare	health care
hobbes	thomas hobbes
homo empaticus	homo empathicus

label	replace by
human behaviour	human behavior
hume	david hume
ideal types	ideal type
institution	institutions
investments	investment
j. buchanan	james m. buchanan
james buchanan	james m. buchanan
labour markets	labor market
labour migration	labor migration
land-use planning	land use planning
life style	lifestyle
locke	john locke
marketisation	marketization
markets	market
mathematical model	mathematical models
mean-field theories	mean field theory
metaphors	metaphor
michel foucault	foucault
migrant workers	migrant worker
mill	john stuart mill
minority groups	minority group
monetary valuations	monetary valuation
moral preferences	moral preference
neighbourhood	neighborhood
neo-liberalism	neoliberalism
neurosciences	neuroscience
nonhuman	non-human
nutrients	nutrient
optimization models	optimization model
organizations	organization
parents	parent
passions	passion
patents	patent
performativ-ity of economics	performativity of economics
personality disorders	personality disorder
persons	person
physicians	physician
policy implications	policy implication
policymaking	policy making
political organization	political organisation
political systems	political system
preferences	preference

label	replace by
prisoner' dilemma	prisoner's dilemma
prisoner’s dilemma game	prisoner's dilemma
prisoners' dilemma	prisoner's dilemma
pro-environmental behaviors	pro-environmental behavior
prosocial behavior	pro-social behavior
psychol ogy	psychology
public goods	public good
questionnaires	questionnaire
randomized controlled trials	randomized controlled trial
rational behaviour	rational behavior
rational economic man	rational-economic man
rational-choice	rational choice
ra-tionality	rationality
religions	religion
schools	school
self care	self-care
self control	self-control
self help	self-help
sen	amartya sen
social aspects	social aspect
social classes	social class
social commerces	social commerce
social dilemma	social dilemmas
social interactions	social interaction
social network	social networks
social norms	social norm
social preference	social preferences
social problems	social problem
social science	social sciences
socio economics	socioeconomics
socio-biology	sociobiology
socio-economic education	socioeconomic education
socio-economics	socioeconomics
soil protection	soil-protection
spontaneous orders	spontaneous order
stakeholder	stakeholders
startups	start-up
stem cell	stem cells
story-telling	storytelling
students	student
subjective well being	subjective well-being
subjectivities	subjectivity
surrogate mothers	surrogate mother
surveys	survey
the state	state
the ultimatum game	ultimatum game
theories	theory
transaction costs	transaction cost
transitional economies	transitional economy
trust repairs	trust repair
turkey (republic)	turkey
universities	university
universitiy student	universitiy student
university students	universitiy student
values	value
virtues	virtue
volunteers	volunteer
vulnerable populations	vulnerable population
wellbeing	well-being

C. MODIFICATION DATA SET

Original Format		Modification
Chen, L.	➨	Chen Lei
Chen, X.	➨	Chen Xi
Chen, Z.	➨	Chen Zhong
Cui, Y.	➨	Cui Yubao
Liu, S.	➨	Liu Shuai
Wang, X.	➨	Wang Xi
Wang, Y.	➨	Wang Yuejin
Wilson D.	➨	Wilson D.W.
Yang, X.	➨	Yang Xiaowei
Zhang, L.	➨	Zhang Lu
Zhang, M.	➨	Zhang Ming
Zhang, X.	➨	Zhang Xuehe
Zhang, Y.	➨	Zhang Yanwei

Figure 32: Modifications of names in the data set.

Entry	Journal	Vol	Origin of Value
Alymov S. 2018		**14**	Issue
Beretta S. 2018	Psicologia della Salute	**2**	Issue
Bujdosó Z., Katona P., Kocs I., Major-Kathi V. 2015		**25**	Issue
Crosby J. 2018	Foucault Studies	**13**	Issue
Dilts A. 2011	Foucault Studies	**12**	Issue
Fessenbecker P., Yazell B. 2012	Minnesota Review	**96**	Issue
Giraudeau M. 2012	Foucault Studies	**13**	Issue
Hamann T.H. 2009	Foucault Studies	**6**	Issue
Harcourt B.E. 2021	Foucault Studies	**29**	Issue
Ivanova Y., Sokolov P. 2015		**4**	Issue
Li T.M. 2014	Foucault Studies	**18**	Issue
Primrose D. 2017		**80**	Issue

Figure 33: Modifying and adding values to the dataset.