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A LITERATURE REVIEW AND BIBLIOMETRIC ANALYSIS OF MIND AND ARTIFICIAL CONSCIOUSNESS WORLDWIDE OVER THE YEAR 2000 – 2022

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ABSTRACT

In the 21st century, as part of the fourth industrial revolution, artificial intelligence (AI), is one of the most important and well-known technology. AI also has made it possible to execute human tasks without the need for humans. However, there is one important concern with consciousness. This is because consciousness is one of the most defining qualities between AI and humans. So, this study presents a literature review and bibliometric analysis of artificial and mind consciousness research around the world from 2000 to 2022 in order to provide researchers and scholars around the world with an overview of the results and trends in artificial and mind consciousness research. A textual query on two databases; Scopus (289 papers), and Web of Science (303 papers) using the term "artificial consciousness" OR "mind consciousness" was performed on 10 June 2022 retrieving 509 scholarly papers from 2000 to 2022 related to artificial and mind consciousness studies for in-depth analysis. Bibliometric analysis were performed using Rstudio software version 4.2.0 and biblioshiniy for bibliometrix to visualize and analyze trends of artificial and mind consciousness research. This bibliometric analysis was analyzed the annual scientific publication growth, the most productive authors, most frequent word has been using, most famous journal name, and which countries has highest collaboration with other country. According to the findings of the analysis, there is significant inconsistency in global trends in annual scientific production, with the number of publications increasing and decreasing. Among all countries, United States (USA) contributed the most publications in the field of artificial and mind consciousness research. According to the findings has show the most relevant authors is Kelley TM (Scopus), and Patel AD (WoS). Moreover, the most relevant journals articles in artificial and mind consciousness studies is Procedia Computer Science (Scopus), and Journal Of Consciousness Studies (WoS). The implication of this study is can help new researchers in this field by providing information on relevant publications and authors to consult when conducting research on this topic. Furthermore, this research helps other researchers understand current trends in this area of study. As a result, the justification for doing this study is to provide the first bibliometric analysis and to fill research gaps in bibliometric studies of artificial consciousness and the mind by providing information in the form of a literature review, overview, and guidelines.

Keywords: bibliometric analysis; artificial consciousness; consciousness; mind consciousness; Rstudio

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Journal of Social Sciences and Humanities
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INTRODUCTION

Regarding consciousness, Descartes was the first scholar to provide a comprehensive analysis of the phenomenon (Chittick, 2011). He presented this aspect from the dualism-based approach known as Cartesian Doubt. It is best recognised by the Latin phrase cogito ergo sum, which translates to "I think, therefore I exist". Based on the phrase, he decided that he had an conscious mind. This is due to his consciousness of when he is thinking (Ahmad Sunawari Long, 2021). Consequently, contemporary philosophers of the mind continue to research this aspect and it has merged with other disciplines (Blackmore, 2017). At the end of the 19th century, extensive study into consciousness began. It was because the issue was a huge concern at that moment. In the 19th and 20th centuries, research on aspects of consciousness and the human brain began to develop (LeDoux et al., 2020). Consciousness is a difficult-to-explain factor, hence this problem has been termed "The hard problem of consciousness"(Blackmore, 2017; Blackmore, 2006; Solms, 2019). Artificial consciousness is another name for AI consciousness (AC). The explanation is as follows:

> *"Artificial consciousness (also known as machine consciousness or synthetic consciousness) refers to a non-biological, human created machine that is aware of its own existence" (LLP, 2021).*

Moreover, AI is often referred to as "machine consciousness" (MC) (Gamez, 2008). There is a discussion of AC in the works of Professor John Searle. He has pointed out that the machine cannot think; in reality, it is simply capable of changing symbols but cannot comprehend them. By presenting the Chinese room experiment, he has explained (Russell & Norvig, 2020). Scholars are increasingly interested in consciousness-related discussions in order to dive further into the topic. To far, several hypotheses have been proposed to explain how AI may have its own consciousness (Wu et al., 2020). Global neural workspace theory (GNW) and integrated information theory (IIT) are among the key ideas used to describe the notion of AI consciousness. In summary, the AI consciousness identified in GNW is a computer capable of undergoing processes comparable to those of the human brain (cortex). In the meanwhile, AI consciousness from the perspective of IIT must be viewed holistically due to the fact that human consciousness varies throughout time (Stephan & Klima, 2021).

The study and measurement of texts and information is referred to as bibliometric analysis. Bibliometric analysis is a common way for finding new information and relating future demands to current research and technology. In a number of scenarios, it is often used to investigate major topics in technical, scientific, or social databases (Kumari et la., 2019). In academic and professional groups, bibliometric approaches are used in ways that go beyond lists of scientific publications and citations. The topic of global trends in mind and artificial consciousness research may be revealed by bibliometerics analysis research. It may assist in the comprehension of trends in the evolution of artificial consciousness and the mind. Our results will benefit academics and scholars in determining the present state of global mind and artificial consciousness using two databases, Scopus and Web of Science (WoS). This research was conducted using Rstudio 4.2.0, the most recent version. A researcher is using Rstudio to access the biblioshiny web-interface in order to do bibliometrics research on mind and artificial consciousness research (Fakruhayat et al., 2022).

Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

As a result, this article will present a literature review and bibliometric analysis of mind and artificial consciousness using two databases, Scopus and WoS, to identify the research areas with the greatest research output analysis of annual scientific publication, country scientific production and the most cited countries, most relevant authors, most relevant journals and journals growth, most frequent words and cooccurrence network, and collaboration am This study's significance is that it may assist new researchers in this field by providing information on important publications and authors to contact when conducting research on this issue. The goal of this study is to provide the first research article that conducts a literature review on the concepts of mind and artificial consciousness research, uses bibliometric analysis to evaluate existing knowledge of mind and artificial consciousness, and uses network analysis to identify hot issues and research trends for a better understanding. This study's contribution is that it may assist researchers or academics who are new to consciousness research by offering information on which publications and authors to consult while doing so. As a result, researchers advise that future research should assess and concentrate on articles in other databases to see whether comparable tendencies exist for mind and artificial awareness, as well as more widespread exposure to the issue.

REVIEW OF LITERATURE

Consciousness

Consciousness, in general, is a concept that is still difficult to grasp. The idea of this awareness is extensively debated among philosophers, yet it remains incomprehensible and ambiguous (Ahmad Sunawari Long, 2021; Blackmore, 2017). Consciousness, according to Chalmers (2003), is a component that may govern behaviour, monitor a person's internal condition, and so on. Furthermore, according to U.T.Place (2002), consciousness is a process that occurs in the human mind but cannot be precisely described. Furthermore, according to Khalidah Ali and Muhaimim Sulam (2018), awareness is a process in which a person becomes aware of his or her surroundings via a series of encounters. The process may occur without the need for a cause, justification, or reasoning. Consciousness, according to Tzortzis (2016), is a state that humans go through and acquire via internal experience. Furthermore, human awareness is an aspect that may motivate human thinking to be aware of the situation of the environment, according to Ahmad Sunawari Long (2021). Furthermore, according to Max Velmans, consciousness is a kind of element that offers human beings everyday awareness, such as daily actions made by human beings (Blackmore, 2006). Consciousness, according to the dictionary, is a condition in which a person is aware of the environment via self-experience (Merriam-Webster, n.d.). Furthermore, as mentioned by Gennaro, some have claimed that the idea of awareness is vague (2012). There are also alternative viewpoints on the element that it cannot be named while being an entity, which has been a dilemma for philosophers in interpreting the idea of consciousness (Blackmore, 2017).

AI Consciousness

The presence of AI has been recognised since Alan Turing presented AI to the world via his work, indicating that computers, or AI, can think (Turing, 1950). Artificial consciousness (AC),

Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

sometimes known as AI consciousness, is a fundamental component of AI. AC is the consciousness acquired by AI, according to Lewis Silkin (2021). Based on the foregoing argument, it may be inferred that AC is AI's non-biological consciousness that is aware of its own existence. Furthermore, Manzotti (2007) claims that AC is a discipline focused at replicating important aspects of consciousness using non-biological components. He went on to explain that this discipline is intrinsically tied to the field of artificial intelligence. Furthermore, according to Richardo Sanz, there are three main motivations for pursuing studies in AC (Chella & Manzotti, 2011; Manzotti, 2007):
(i) implement and design machines that resemble humans (cognitive robots);
(ii) understand the nature of consciousness (cognitive science);
(iii) implement and design more efficient control systems

Pro-Machine

Many people believe that AC will become a reality in the future. Our is due to the fact that AI has matured into a technology that is prevalent in this period, leading many people to believe that AC exists (Buttazzo, 2001). Additionally, according to Regalado (2014), AC may be generated if the hardware used to create it is the correct hardware. The following is how it was explained:

> *"I am not saying consciousness is a magic soul. It is something physical. Consciousness is always supervening onto the physical. But it takes a particular type of hardware to instantiate it. A computer made up of transistors, moving charge on and off a gate, with each gate being connected to a small number of other gates, is just a very different cause-and-effect structure than what we have in the brain, where you have one neuron connected to 10,000 input neurons and projecting to 10,000 other neurons. But if you were to build the computer in the appropriate way, like a neuromorphic computer [see "Thinking in Silicon"], it could be conscious"(Regalado, 2014).*

Furthermore, some AI researchers believe that the human brain is a computer (McDermott, 2007). As a result of the researcher's findings, several additional topics are being explored among the community of scholars that favour AC.

Anti-Machine

Following that, Chrisley (2008) claims that there are still some who do not believe in AI consciousness. This is due to certain groups' arguments, such as the topic of Chinese rooms, qualia, and so on, which argue that AC will not be achieved in the future. No one, according to Fodor, understands the consciousness possessed by entities other than humans (Deacon, 2011). Furthermore, according to Hildt (2019), the majority of researchers still do not believe in sentient machines or robots.

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Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

RESEARCH METHODOLOGY

Data Source and Search Strategy

A comprehensive search was undertaken on June 10, 2022, utilising the Scopus online database and the Web of Science (WoS). Searches were done in a single day to prevent the possible bias induced by daily database updates. For this retrospective analysis, researcher selected papers on the mind and artificial consciousness that were indexed by Scopus and WoS between 2000 and 2022. The search algorithms utilised in each database are explained below.

Topic: "artificial consciousness" OR "mind consciousness".
Refined by: Document types in Scopus (There Was No Restriction On The Type).
Criteria : "titles, abstract and keywords (topic area)"
Year Published: 2000-2022.
Languages: English

Articles related to research study of mind and artificial consciousness have been downloaded in *CSV (Scopus) and *Bib (WoS) format. Downloaded articles contain important information such as publication title, author name and affiliation, abstract, keywords and references. The article database has been imported in Rstudio software version 4.2.0. The software assists in processing the data analysis. Using the topic keywords "artificial consciousness" OR "mind consciousness", a total of 278 articles from Scopus and 309 articles from WoS were obtained. After a refine process in the context of the period range 2000-2022, with only English articles selected, a total of 239 articles from the Scopus database and 270 articles from WoS were retrieved. Biblioshiny for bibliometrix has also been used to see and evaluate trends in the form of bibliometric maps. It also can create data sets and make them available to researcher and it also may supply additional resources.

Table 1: The search string

Database Search string	Search string strategy key term
Scopus	TITLE-ABS-KEY ("artificial consciousness" OR "mind consciousness") AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011) OR LIMIT-TO (PUBYEAR , 2010) OR LIMIT-TO (PUBYEAR , 2009) OR LIMIT-TO (PUBYEAR , 2008) OR LIMIT-TO (PUBYEAR , 2007) OR LIMIT-TO (PUBYEAR , 2006) OR LIMIT-TO (PUBYEAR , 2005) OR LIMIT-TO (PUBYEAR , 2004) OR LIMIT-TO (PUBYEAR , 2003) OR LIMIT-TO (PUBYEAR , 2002) OR LIMIT-TO (PUBYEAR , 2001) OR LIMIT-TO (PUBYEAR , 2000)) AND (LIMIT-TO (LANGUAGE , "English"))
Web of Science	ALL=("artificial consciousness" OR "mind consciousness")

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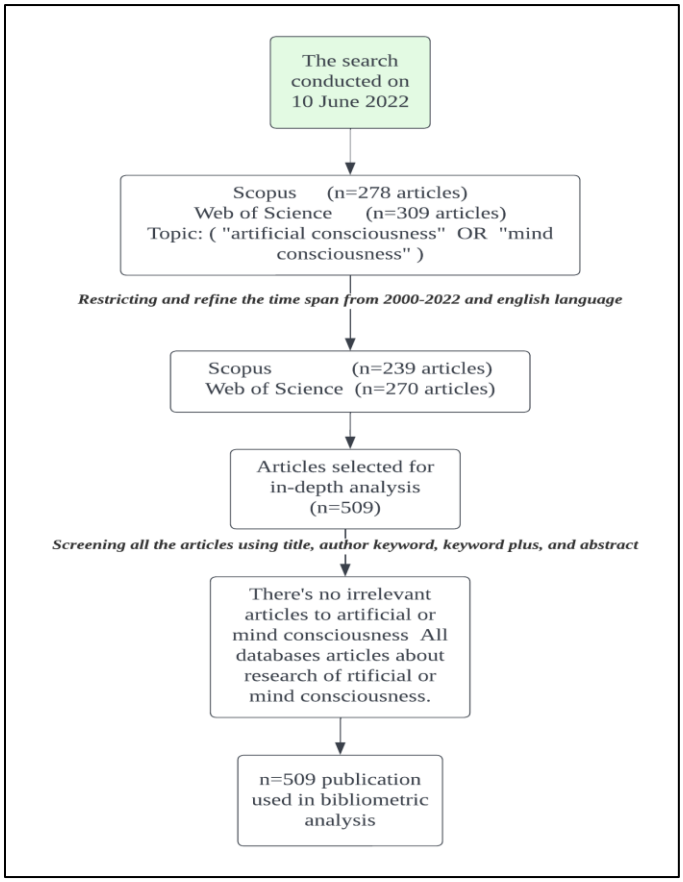
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

Figure 1: Flowchart for study selection



Eligibility Criteria and Study Selection

Only publications published between the year 2000 until 2022 that focused on mind and artificial consciousness are considered for this category. In addition, there is a language restriction on this article which is restricted to english language.

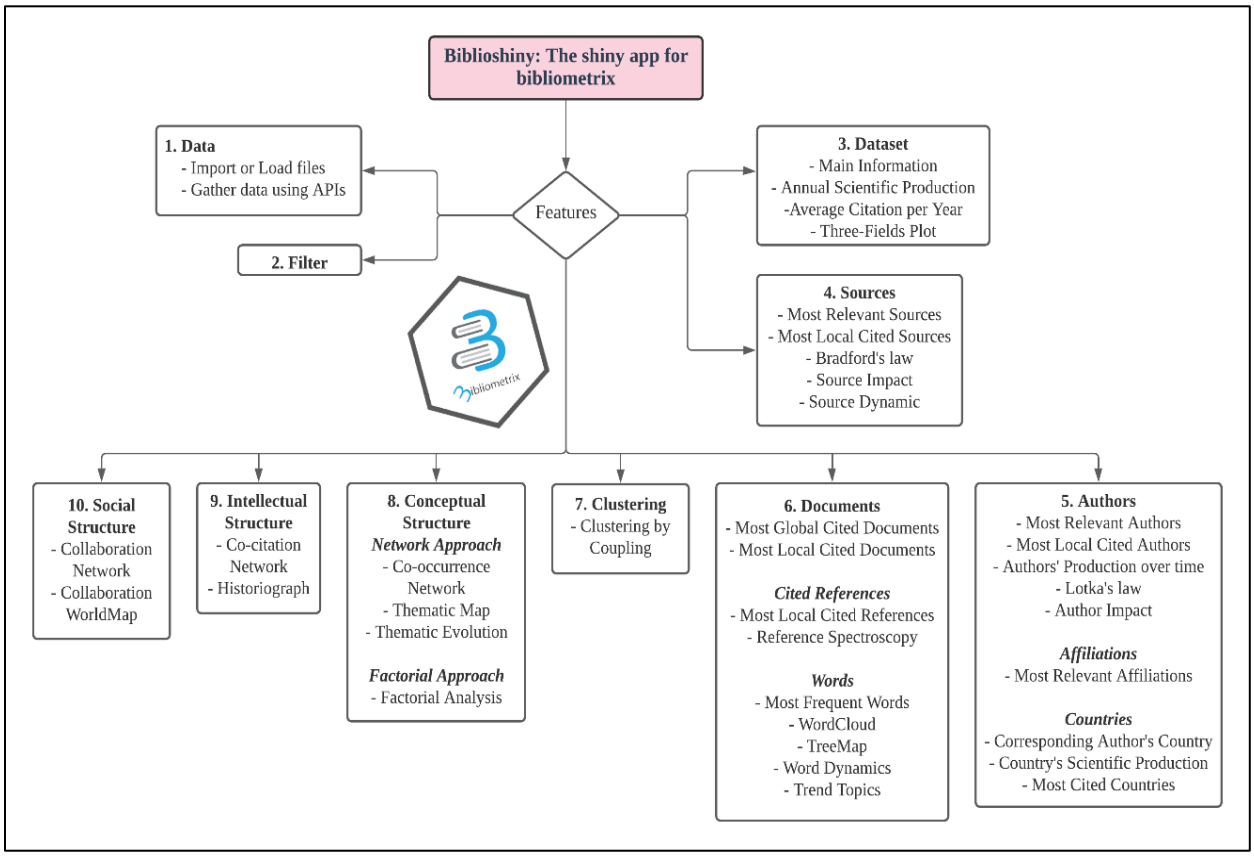
Data Analysis

The researchers used Windows 11 to install Rstudio in its most up-to-date version, 4.2.0. In order to install the bibliometrix, researchers should first open Rstudio and then type >install.packages ("bibliometrix") in the terminal window of Rstudio. The researcher should then type >library (bibliometrix) and biblioshiny (bibliometrix) in the command line of RStudio in order to launch the biblioshiny web-interface. The researcher also need to import the files into the biblioshiny interface which have been downloaded from Scopus and WoS (Fakruhayat et al., 2022). A bibliometric analysis of artificial consciousness and mind consciousness using two databases from Scopus and Web of Science has been performed in order to acquire a research output analysis of

Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

annual scientific production, country scientific production, most relevant authors, most relevant journals, most frequent words and co-occurrence network, and collaboration among countries.

Figure 2: Features of Biblioshiny application for bibliometrix



Source: Fakruhayat et al., (2022)

RESEARCH FINDINGS

Using the search strategy has been mention above, researhcers retrieved 509 databases of publication from two different indexed such as Scopus and WoS in relevant topic to “artificial consciousness” and “mind consciousness” in the year 2000 until 2022.

Annual Scientific Production

Between the years 2000 and 2022, there were a total of 509 publications published in the field of consciousness studies that were indexed in Scopus (239 articles) and Web of Science (270 articles). Between the years 2000 and 2022, the year 2018 have seen the most articles added to the Scopus index (25 out of 239), followed by 2020 (19 out of 239), while the year 2004 had the fewest articles added (1 out of 239 article). In addition, the pattern of publishing between the years 2000

Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

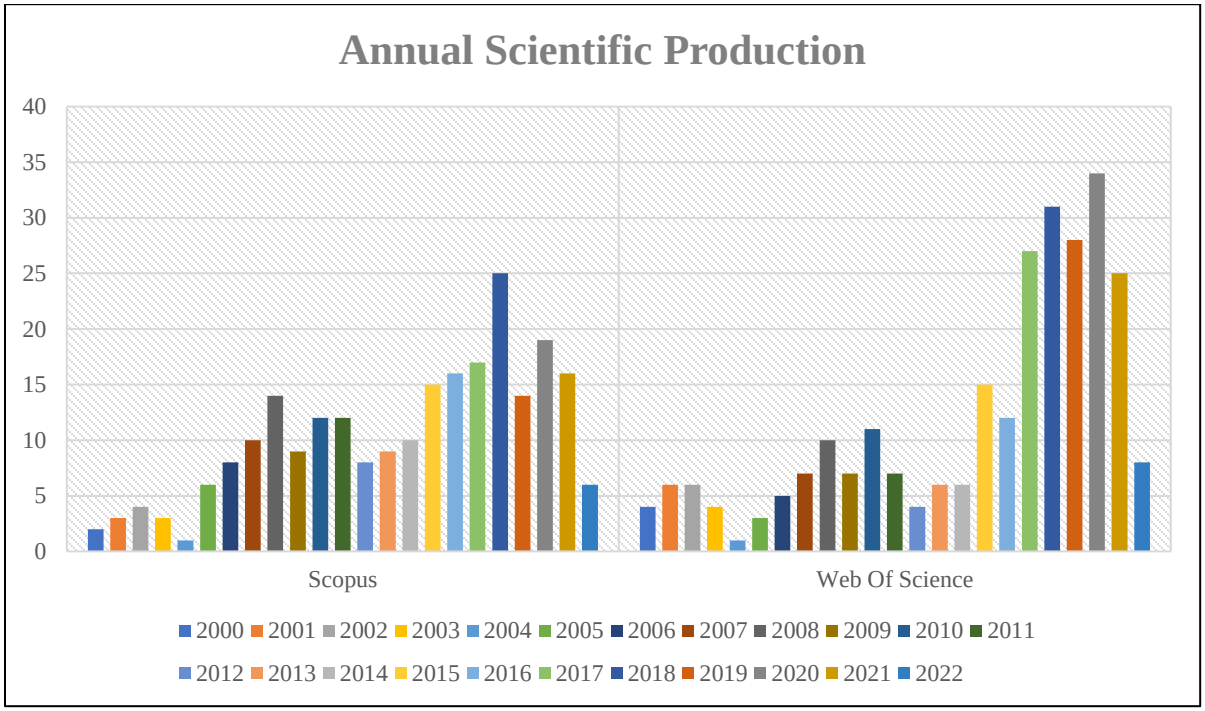
and 2022 shows a large amount of inconsistency in global trends in annual scientific production. The number of publications has shown both an increase and a decrease throughout this time period. The annual scientific production shown in Web of Science indicated that the greatest number of articles was published in the year 2020 (34 out of a total of 269 articles), meanwhile the lowest number of articles was produced in the year 2004 with only one publication being recorded for that year. Additionally, the global trends of annual scientific production showed a significant growth, with the number of publications growing since 2016, although sometimes decreasing. This indicates an overall increasing trend. In addition, the annual growth rate was found at 5.12% (Scopus), and 3.2%, respectively (WoS).

Table 2: Annual scientific production in artificial and mind consciousness research

Year	Scopus	Web of Science
2000	2	4
2001	3	6
2002	4	6
2003	3	4
2004	1	1
2005	6	3
2006	8	5
2007	10	7
2008	14	10
2009	9	7
2010	12	11
2011	12	7
2012	8	4
2013	9	6
2014	10	6
2015	15	15
2016	16	12
2017	17	27
2018	25	31
2019	14	28
2020	19	34
2021	16	25
2022	6	8

e-Bangi Faculty of Social Sciences and Humanities Universiti Kebangsaan Malaysia
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

Figure 3: Annual Scientific Production in artificial and mind consciousness research



Country Scientific Production

The results of a global analysis of the country scientific production are shown in Table 3. The findings from this study highlight the top 10 countries across the world in terms of the scientific production on the subject of the mind and artificial consciousness.

The databases Scopus and Web of Science revealed the top 10 countries around the world in terms of the country scientific production that has been produced between the years 2000 and 2022. The results indicated that there were a total of 33 countries throughout the world that contributed to Scopus, whereas there were 34 countries that contributed to Web of Science on this analysis output. The United States of America (USA) has published around 114 articles related to this research, making it the country that has published this article the most in Scopus. Afterward, the United Kingdom (UK) came in second with 45 articles, then Italy and Japan tied for third with 39 articles respectively, and finally Canada came in 10th with 8 articles. However, according to Web of Science, Canada is the country with the most publications published worldwide, with around 330 total. It was then followed by the United States of America (USA), which had published around 302 articles, and the United Kingdom (UK), which had 146 articles. After that came Italy with 78 articles, and Germany in 10th place, with 18 articles.

e-Bangi Faculty of Social Sciences and Humanities Universiti Kebangsaan Malaysia
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

Table 3: Country scientific production in artificial and mind consciousness research

	Scopus		Web Of Science	
No	**Country**	**Freqency**	**Country**	**Freqency**
1	USA	114	Canada	330
2	UK	45	USA	302
3	Italy	39	UK	146
4	Japan	39	Italy	78
5	Brazil	31	Japan	51
6	China	19	Australia	30
7	India	18	China	29
8	France	16	France	28
9	Spain	16	Netherlands	25
10	Canada	8	Germany	18

Figure 4: Country scientific production indexed by Scopus

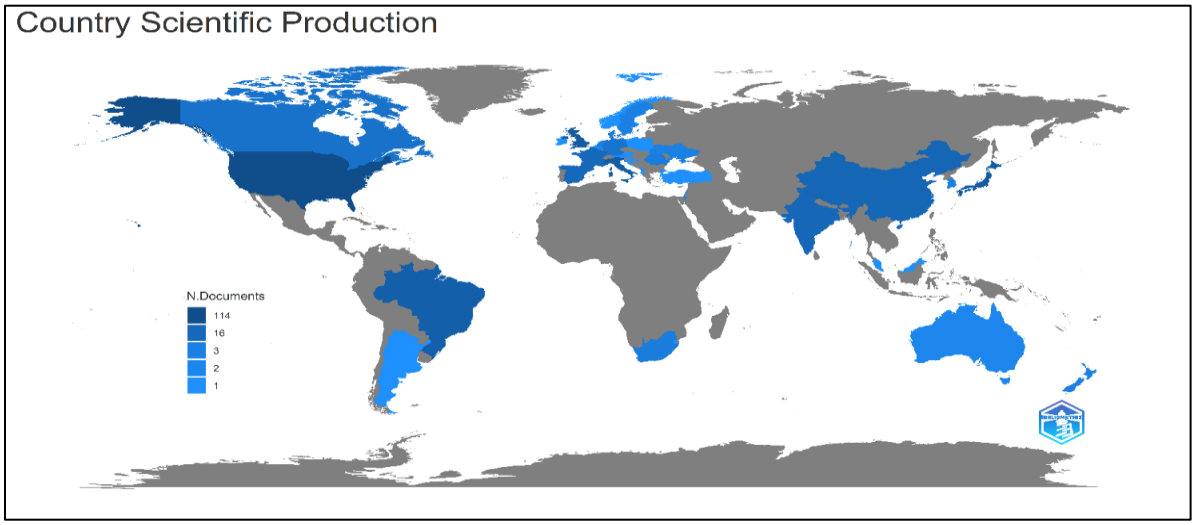
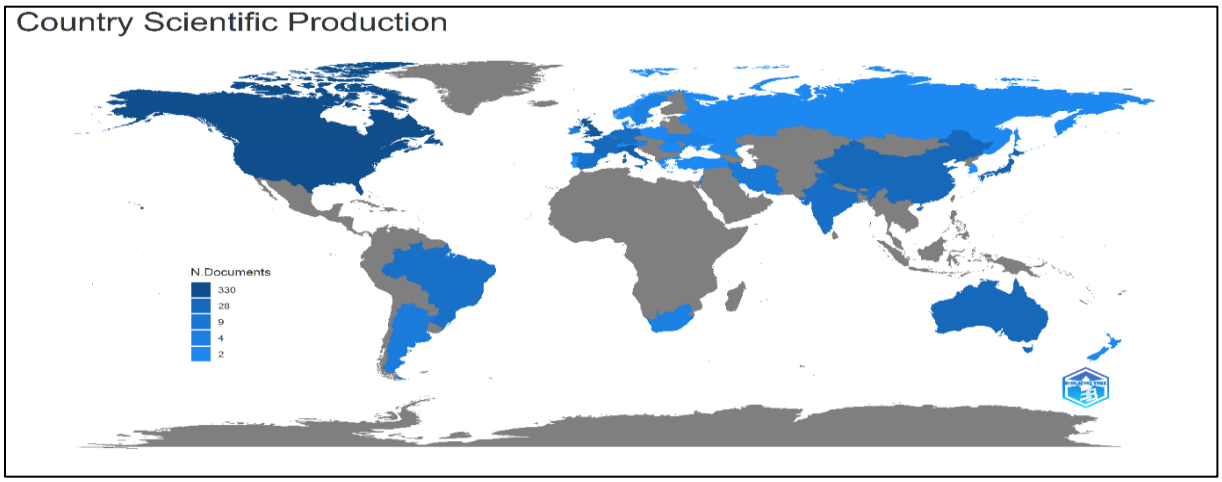


Figure 5: Country scientific production indexed by Web of Science



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Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

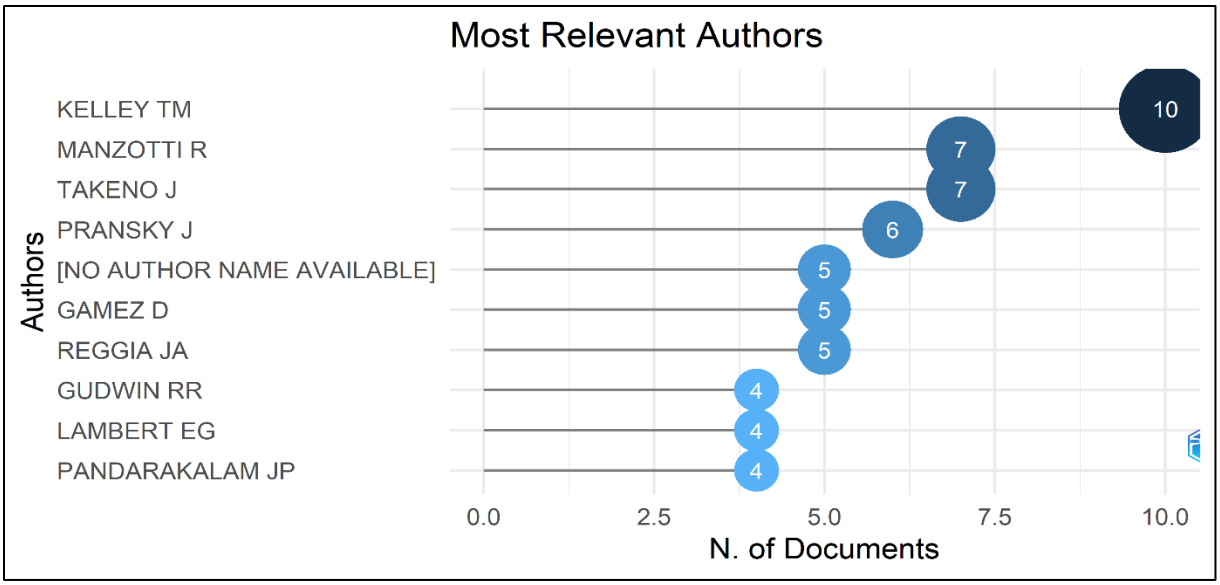
Most Relevant Authors

The analysis of the research related to mind and artificial consciousness has identified a total of 357 in the 239 publications that have been published in Scopus database. Table below are shown thye list of top 10 authors. According to the results of the analysis, it was found that an author going by the name of Kelley TM contributed the largest number of article publications in the field of this research, which was a total of 10 articles. Next on the list are researchers Manzotti R and Takeno J, who has published 7 articles respectively; Pransky J, who has published 6 articles; and Pandarakalam JP, who has published 4 articles; all of these authors are among the top 10 most significant authors in mind and artificial consciousness research.

Table 4: Most relevant authors in artificial and mind consciousness research (Scopus)

Top 10 Most Relevant Author in Mind and Artificial Consciousness Research			
Authors	**Articles**	**Articles Fractionalized**	**Percentage (%)**
Kelley TM	10	4.07	4.2
Manzotti R	7	3.25	2.9
Takeno J	7	1.87	2.9
Pransky J	6	2.20	2.5
[No Author Name Available]	5	5.00	2.1
Gamez D	5	4.00	2.1
Reggia JA	5	2.33	2.1
Gudwin RR	4	1.67	1.7
Lambert EG	4	1.20	1.7
Pandarakalam JP	4	4.00	1.7

Figure 6: Most relevant authors in artificial and mind consciousness research indexed by Scopus



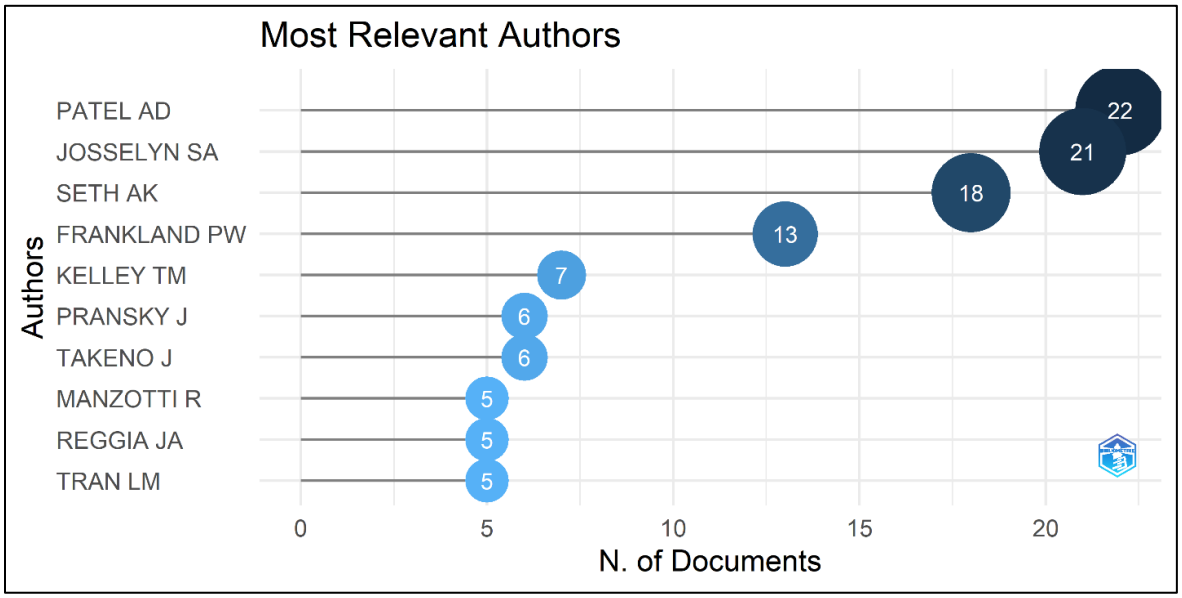
e-Bangi Faculty of Social Sciences and Humanities Universiti Kebangsaan Malaysia
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

There are 527 authors identified in the 270 database of mind and artificial consciousness research articles published in Web of Science journals (Table 5). The top ten authors are listed below. According to the findings of the analysis, the author with the most article publications was Patel AD, who published a total of 22 articles. Josselyn SA, who has published 21 articles, Seth AK, who has published 18 articles, and Tran LM, who has published 5 articles, round out the top ten most influential authors in mind and artificial consciousness research publications.

Table 5: Most relevant authors in artificial and mind consciousness research (WoS)

Top 10 Most Relevant Author in Mind and Artificial Consciousness Research			
Authors	**Articles**	**Articles Fractionalized**	**Percentage (%)**
Patel AD	22	8.57	8.1
Josselyn SA	21	6.56	7.8
Seth AK	18	6.48	6.7
Frankland PW	13	3.21	4.8
Kelley TM	7	2.58	2.6
Pransky J	6	2.25	2.2
Takeno J	6	1.62	2.2
Manzotti R	5	2.25	1.9
Reggia JA	5	2.33	1.9
Tran Lm	5	0.92	1.9

Figure 7: Most relevant authors in artificial and mind consciousness research indexed by Web of Science



Most Relevant Journals (Sources)

The analysis of the most relevant journal articles in mind and artificial consciousness research revealed that overall 174 journals in 239 publications in the Scopus database. Table 6 lists the top ten most relevant journal in mind and artificial consciousness research from 174 journals. The

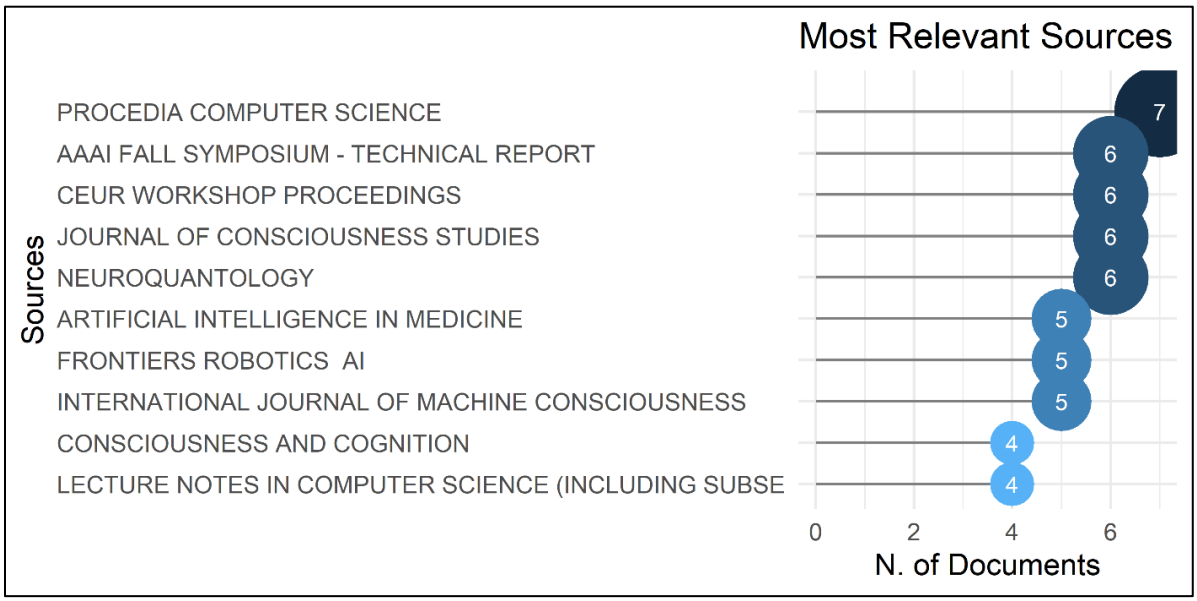
e-Bangi Faculty of Social Sciences and Humanities Universiti Kebangsaan Malaysia
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

most popular journals, according to the findings of the analysis, are Procedia Computer Science, which has seven articles published. The journals name of AAAI Fall Symposium - Technical Report came in second with 6 articles published, followed by journals name of Ceur Workshop Proceedings with 6 articles, and so on. Lecture Notes In Computer Science (Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics) ranked 10th, with four published publications.

Table 6: Most relevant journals in artificial and mind consciousness research (Scopus)

Most Relevant Journals Articles In Mind and Artificial Consciousness Research	
Sources	**Articles**
Procedia Computer Science	7
AAAI Fall Symposium - Technical Report	6
Ceur Workshop Proceedings	6
Journal Of Consciousness Studies	6
Neuroquantology	6
Artificial Intelligence In Medicine	5
Frontiers Robotics AI	5
International Journal Of Machine Consciousness	5
Consciousness And Cognition	4
Lecture Notes In Computer Science (Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics)	4

Figure 8: Most relevant journals in artificial and mind consciousness research indexed by Scopus



The analysis of the most significant journal articles in the discipline of mind and artificial consciousness research revealed 201 different journals in 270 publications in the Web of Science database. Table 7 provides the top ten journal in the analysis of mind and artificial consciousness

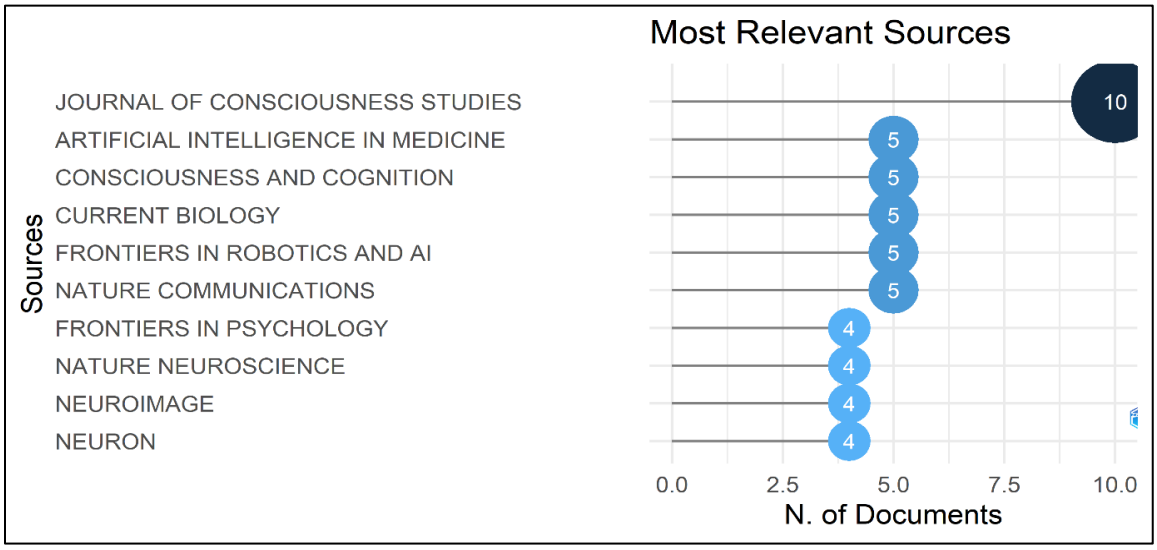
e-Bangi Faculty of Social Sciences and Humanities Universiti Kebangsaan Malaysia
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

that are regarded to be the most important out of a total of 201 journal. According to the findings of the investigation, one of the most commonly journals that has been interest to publish the articles is Journal Of Consciousness Studies, which presently has 10 articles in the Web of Science database. Artificial Intelligence In Medicine journals came in second with 5 articles published, and so on. The Neuron journals placed 10th, with 4 articles published.

Table 7: Most relevant journals in artificial and mind consciousness research (WoS)

Most Relevant Journals Articles In Mind and Artificial Consciousness Research	
Sources	**Articles**
Journal Of Consciousness Studies	10
Artificial Intelligence In Medicine	5
Consciousness And Cognition	5
Current Biology	5
Frontiers In Robotics And AI	5
Nature Communications	5
Frontiers In Psychology	4
Nature Neuroscience	4
Neuroimage	4
Neuron	4

Figure 9: Most relevant journals in artificial and mind consciousness research indexed by Web of Science



Most Frequent Words On Mind And Artificial Consciousness Research

Keywords in research are one of the most important variables in selecting a study subject and may reveal scientific trends. The research of keyword co-occurrence networks will offer a clear overview of the connections between various keywords through nodes. There are 641 keywords were discovered to be used in mind and artificial consciousness research by researchers all over

Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

the world in the 239 articles related to mind and artificial consciousness research published in the Scopus database. Table 8 shows the top 20 most often used keywords in mind and artificial consciousness research studies as filtered by the author's keyword in Scopus database articles. In the mind and artificial consciousness research, the most often used keywords are "artificial consciousness" (57 occurrences), "consciousness" (34 occurrences), "machine consciousness" (21 occurrences), "artificial intelligence" (18 occurrences), and so on.

Table 8: Most Frequent Words On Mind and Artificial Consciousness Research (Scopus)

The most top 20 frequently utilized keywords in mind and artificial consciousness research	
Words	**Occurrences**
artificial consciousness	57
consciousness	34
machine consciousness	21
artificial intelligence	18
mind	10
innate mental health	9
phenomenal consciousness	7
phenomenology	7
synthetic phenomenology	7
robotics	6
the three principles	6
embodiment	5
emotion	5
global workspace theory	5
cognition	4
cognitive phenomenology	4
cognitive science	4
computational explanatory gap	4
emotions	4
evolution	4

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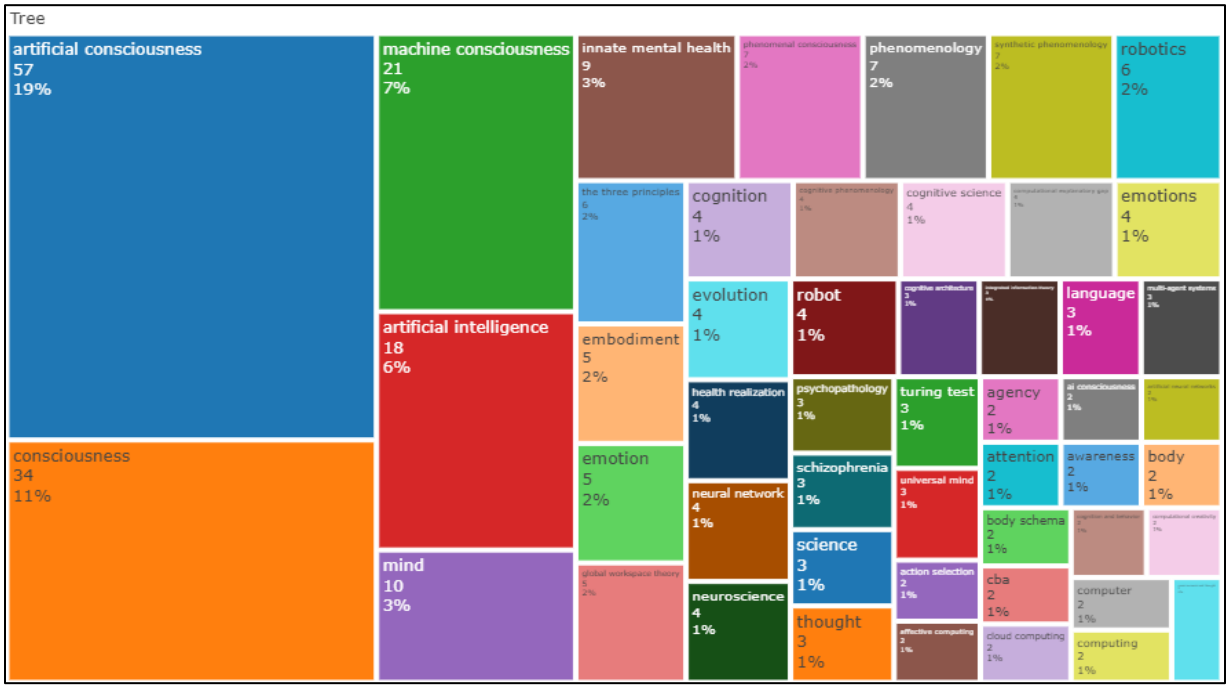
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

Figure 10: Most Frequent Words On Mind and Artificial Consciousness Research index by Scopus



Researchers from all around the world discovered 669 keywords used in mind and artificial consciousness research in the 270 publications related to mind and artificial consciousness research published in the Web of Science database. Table 9 displays the top 20 most often used keywords in mind and artificial consciousness research studies in Web of Science database articles, as filtered by the author's keyword. According to the results of the analysis, the most frequently used keywords in the mind and artificial consciousness research discipline are "artificial consciousness" (41 occurrences), "consciousness" (38 occurrences), "machine consciousness" (15 occurrences), "artificial intelligence" (15 occurrences), and so on.

Table 9: Most Frequent Words On Mind and Artificial Consciousness Research (WoS)

The most top 20 frequently utilized keywords in mind and artificial consciousness research	
Words	**Occurrences**
artificial consciousness	41
consciousness	38
machine consciousness	15
artificial intelligence	13
mind	10
music	9
phenomenology	7
intelligence	6
language	6
artificial	5
attention	5

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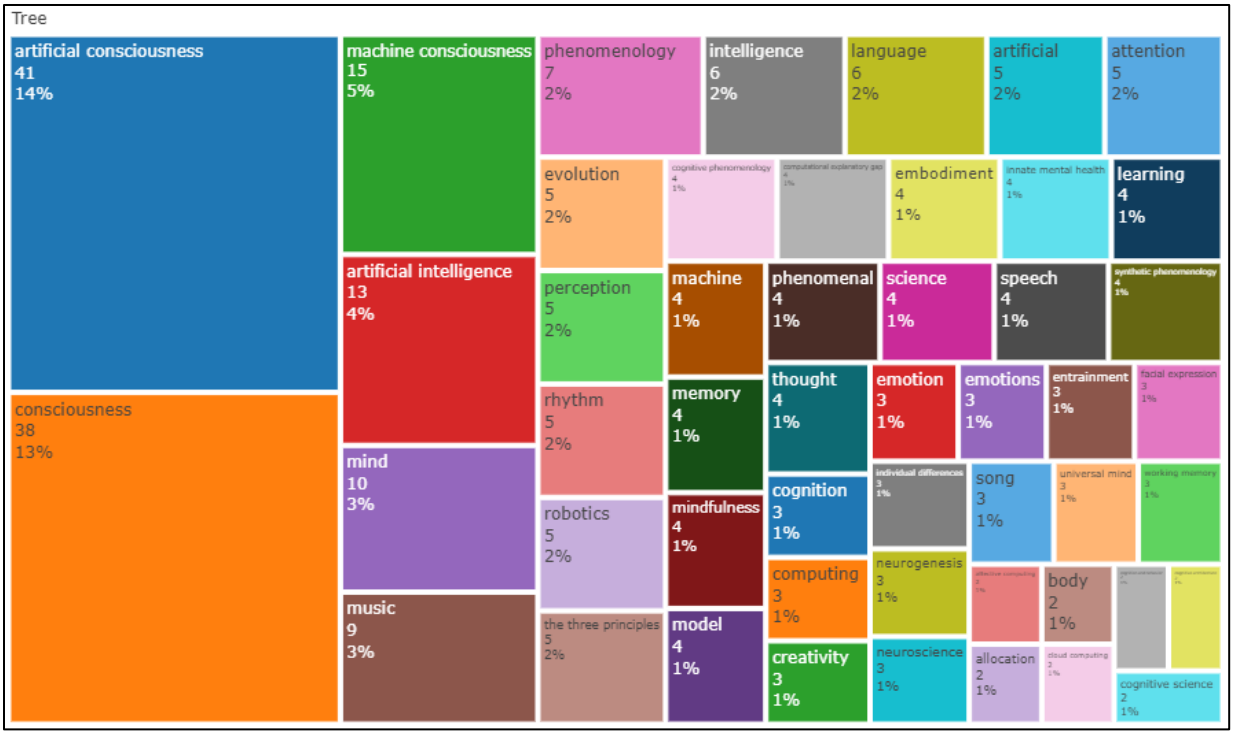
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

evolution	5
perception	5
rhythm	5
robotics	5
the three principles	5
cognitive phenomenology	4
computational explanatory gap	4
embodiment	4
innate mental health	4

Figure 11: Most Frequent Words On Mind and Artificial Consciousness Research index by Web of Science



Collaboration among Countries in Mind and Artificial Consciousness Research

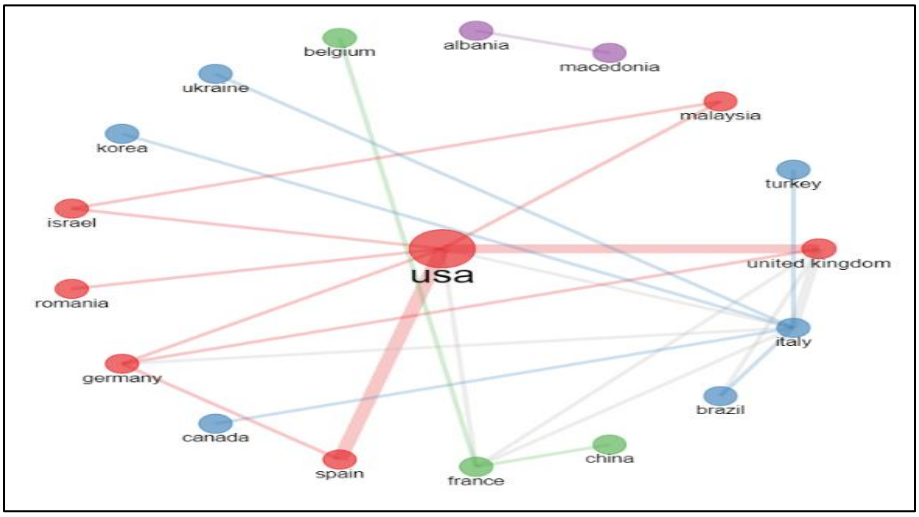
In this part, researchers look at global collaboration trends and significant trends at the country level. According to the researcher's results, there are 139 collaborations between countries in mind and artificial consciousness research throughout the world in the Scopus database. Table 10 shows the top 20 countries in terms of mind and artificial consciousness research collaboration. The highest frequency of collaboration countries was three times between the United States (USA) to Spain, three times between the United States and the United Kingdom, and two times between the United Kingdom and Italy. Furthermore, all other countries, beginning with Albania and Macedonia just one time and making good progress to the 20th position internationally in terms of partnership in mind and artificial consciousness research.

e-Bangi Faculty of Social Sciences and Humanities Universiti Kebangsaan Malaysia
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

Table 10: Collaboration among countries in mind and artificial consciousness research (Scopus)

Collaboration among countries in mind and artificial consciousness research		
From	**To**	**Frequency**
USA	Spain	3
USA	United Kingdom	3
United Kingdom	Italy	2
Albania	Macedonia	1
China	France	1
France	Belgium	1
Israel	Malaysia	1
Italy	Brazil	1
Italy	Canada	1
Italy	France	1
Italy	Germany	1
Italy	Korea	1
Italy	Turkey	1
Italy	Ukraine	1
Spain	Germany	1
United Kingdom	Brazil	1
United Kingdom	France	1
United Kingdom	Germany	1
USA	France	1
USA	Germany	1

Figure 12: Collaboration among countries in mind and artificial consciousness research indexed by Scopus



e-Bangi Faculty of Social Sciences and Humanities Universiti Kebangsaan Malaysia
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

According to the researcher's findings, there are a total of 73 country collaborations in the field of mind and artificial consciousness at Web of Science database globally. Table 10 shows the top 20 countries that collaborate with the most research on mind and artificial consciousness. The largest frequency of partnership nations is between Canada and the United States, with around 33 instances of collaboration. Other countries, such as Canada and the United Kingdom, have a frequency of partnership of 27 (USA-UK; 9 frequency) and etc. Finally, Canada and Switzerland are rated 20th due to their two times of cooperating on this research.

Table 11: Collaboration among countries in mind and artificial consciousness research (WoS)

Collaboration among countries in mind and artificial consciousness research		
From	**To**	**Frequency**
Canada	USA	33
Canada	United Kingdom	27
USA	United Kingdom	9
Canada	Australia	8
Canada	Italy	8
Canada	Japan	8
United Kingdom	Australia	8
United Kingdom	Italy	7
USA	Italy	5
Canada	Netherlands	4
USA	Germany	4
Canada	France	3
Canada	Germany	3
Italy	Australia	3
United Kingdom	Japan	3
United Kingdom	Netherlands	3
USA	France	3
USA	Japan	3
Canada	China	2
Canada	Switzerland	2

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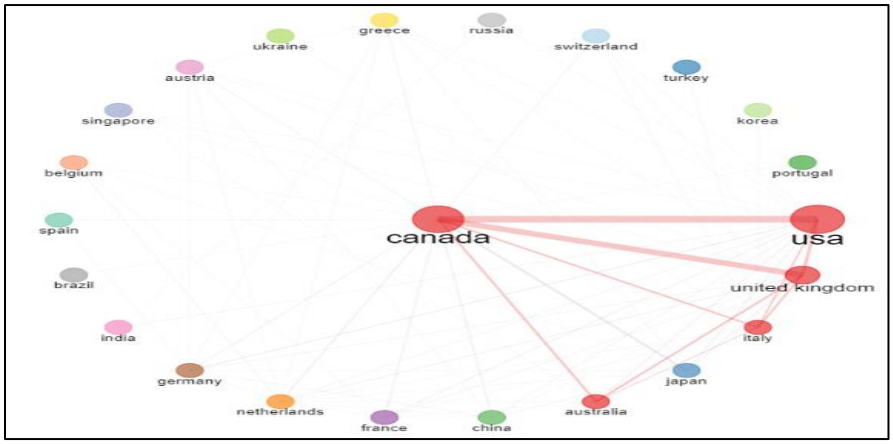
Journal of Social Sciences and Humanities
Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

Figure 13: Collaboration among countries in mind and artificial consciousness research indexed by WoS



DISCUSSION

Bibliometric analysis is a method of doing research that involves conducting statistical analysis on scientific articles in order to further explore reference relationships between publications and research trends in a certain discipline. This method of research is known as "bibliometrics". It is beneficial to compare the contributions made by researchers from various nations using this type of analysis (Şenel & Demir, 2018). A bibliometric analysis was conducted to evaluate global trends in research on mind and artificial consciousness, with a focus on particular topics within the field, over the course of a period of time extending from 2000 to 2022. This evaluation was carried out with the intention of providing an assessment of these trends. This research was conducted, to the best knowledge of the researcher, with the intention of filling the gaps left by a prior study of bibliometric analysis on the worldwide research on mind and artificial consciousness using the Scopus and Web of Science databases.

Researchers used the terms "artificial consciousness" OR "mind consciousness" as search topics in Scopus and Web of Science between the years 2000 and 2022 in order to create a list of relevant publications. The goal of the research is to concentrate on mind and artificial consciousness research around the world from the years 2000 to 2022. There are no restrictions placed on the types of articles that can be used in the research, and only articles written in English have been considered for final result. Following the filtering process, researchers were retrieved 509 articles from the Scopus and WoS databases for further investigation

An appealing bibliometric indication that may point to the expansion of a field of study is the number of scholarly publications in that field (Sun et al., 2018). For instance, if there has been a noticeable shift in the number of publications that have been published yearly, this would suggest that there has been a significant paradigm shift in the field of study. The researcher who conducted the present investigation came to the final result that the number of yearly scientific articles that can be found in the Scopus and Web of Science databases would rise, but not in a consistent manner, between the years 2000 and 2022. The rise in the number of researchers that promote

Vol. 19. No. 5 (2022). 1-23. ISSN: 1823-884x

mind and artificial consciousness research, are contribute to the growth of the mind and artificial consciousness study fields (Sharma etal., 2018).

The results of the analysis also show that the USA is the country with the highest number of scientific production and the most cited in Scopus while second in Wos, while Canada is the country with the most highest in WoS database rather than USA. This is not surprising because USA has many researcher in that area. For the result analysis of most relevant journal is by Procedia Computer Science with 7 articles in Scopus and Journal Of Consciousness Studies with 10 articles in WoS database. According to the results of the analysis, the most frequently used keywords in the mind and artificial consciousness research discipline are "artificial consciousness" (41 occurrences), "consciousness" (38 occurrences), "machine consciousness" (15 occurrences), "artificial intelligence" (15 occurrences), and so on. Currently, there are 139 collaborations among countries in mind and artificial consciousness research around the world in Scopus database and 73 collaborations among countries in WoS databases. Finally Scopus and WoS database, the top most publishing countries were the collaboration countries between the United States (USA) and Canada.

CONCLUSION

The purpose of this article is to present a bibliometric analysis of research on the mind and artificial consciousness in order to determine which fields have the highest annual growth in scientific publication, which authors are the most productive, which words are used the most frequently, which journal name is the most well-known, and which countries collaborate the most with other countries in this research. From the years 2000 through 2022, a total of 509 research papers were gathered from the Scopus and Web of Science (WOS) databases for the purpose of conducting a bibliometric analysis. This article aims to organise, show, and assess the methodical exchange of literature in mind and artificial consciousness using bibliometric methods. This bibliometric technique was used to identify key issues in consciousness research, and it may be used in the future to establish innovation in research. Because there have been relatively few studies on artificial consciousness and the mind in bibliometrics analysis articles and papers up until now, researchers want to fill in the research gaps in bibliometric studies of artificial consciousness and the mind in order to provide information in form of an overview and guidelines.

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