A Bibliometric Analysis of H. J. Eysenck's Research Output: Clarifying Controversy

Njål Andersen[1] Philip J. Corr[2] and Adrian Furnham[1]

[1] Norwegian Business School, Nydalen, Oslo, Norway
2. Department of Psychology, City, University of London, London

Correspondence: Njal@Beinspired.no

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Abstract

We present a bibliometric analysis of a large corpus of research work by H. J. Eysenck (1916-1997), who was one of the most famous and productive psychologists of the 20th century. It utilizes new bibliometric methods to update an analysis of Rushton (2001), examining how articles cluster in terms of themes and co-authors. We present our analysis in the light of a recent investigation by King's College London, which concluded that a number of Eysenck's papers are 'unsafe' and they recommended that journal editors should consider their retraction. We enquire about the relationship between these personality and fatal disease papers and the wider body of Eysenck's work. Our analysis revealed that these papers stand apart from his many other seminal contributions to psychological knowledge; and, even if they were all retracted, this would have little impact on the main corpus of his work. Clearly his work occurs in cluster topics with associated different groups of same co-authors. Our analysis and presentation shines a new light on the contribution of Britain's most productive, but sometimes controversial, psychologist.

1. Introduction

Hans Eysenck was Britain's most prolific writer and researcher in psychology. Over the course of 50 years, he produced a large and influential body of work that helped shape modern-day scientific and professional psychology (see Corr, 2016a). Like all prominent scientists, he had his admirers and detractors. This is evident in the various books written about him (Buchanan, 2010; Gibson, 1981); and it is also clear from his own autobiography which appeared in more than one edition (Eysenck, 1997). In addition, his work attracted large edited volumes (e.g. Modgil & Modgil, 1986; Nyborg, 1997) which serve to showcase the enormous breadth of his work. There have also been other reflections on his life and work (Revelle & Oehlberg, 2008), entries in Encyclopedias (e.g., Mcloughlin, 2002), and even observations by his son, Michael (M. Eysenck, 2011, 2013) .

Eysenck was notable for the quality, quantity and range of his research interests and unusually large number of publications. Starting as a PhD student during WWII to the year of his death, a stream of papers appeared on topics as diverse as astrology and criminology (for the full range, see Corr, 2016b). Eysenck was both an experimental and correlational psychologist and strongly advocated that good research required both approaches.

Several years after Eysenck died, Rushton (2001) published a scientometric review of Eysenck's work, where he stated:

> *"According to Eysenck's Personal Citation Report from the ISI for 1981-1998, which is a complete inventory of his journal publications during the last 17 years of his life, aged 64-81, there were 625 articles on which he was an author or co-author. Including articles, book reviews and letters to the editors (but omitting books and chapters in books), these earned a total of 2183 citations. This phenomenal output amounts to 37 items a year and includes 124 papers, eight reviews, six proceedings*

> *papers, 16 notes, 384 book reviews, and 56 letters to the editor. Fifty-eight of the publications were those on which Eysenck was not the primary author and they accumulated 1080 citations (49% of the total)…."* (p. 26)

By any count, this is a remarkable level of research activity, and contributed to ensure that Eysenck was the most cited living psychologist of his day and the third most cited psychologist of all time (Haggbloom et al., 2002). Such an enduring legacy makes it pertinent to continue to examine and evaluate his contributions. In his article celebrating Eysenck's intellectual legacy, Rushton (2001) extensively used citation scores. Applying new bibliometric software tools, we can examine this body of work in more detail, and thereby offer new and deeper insights into the nature and structure of Eysenck's research achievements.

Eysenck is best remembered for his contribution to personality research; however, his work in many other fields achieved varying levels of success, and sometimes ridicule (e.g., parapsychology and astrology). Drawing on a bibliometric coupling analysis of his published journal articles, available through ISI Web of Science (WoS), we identify clusters of articles representing both the development of his research into personality over time, and other fields to which he contributed.

While Eysenck's research into personality traits and genetics are well discussed (Rushton, 2001), his work on personality in relation to smoking, cancer and cardiovascular disease have received less attention in terms citation analysis. This is an important issue given the controversy that surrounds the truly remarkable and, to some people, unbelievable results (discussed by Corr, 2016b). In this specific field as well as others, there are different ways of viewing this aspect of Eysenck's work. Some see it as a scientific embarrassment, even a 'scandal' (Pelosi, 2019) , while others prefer to see it as evidence of a researcher unafraid of

venturing into ever-new fields. With a large number of successes, a few misses are only to be expected – some might even applaud them as the inevitable outcome of an adventurous scientific. Indeed, studies on creativity and innovation recognize the value of large numbers of ideas as a starting point for generating valuable innovations (Boeddrich, 2004) - factors including the willingness to take risks, divergent thinking and the ability to define problems, are associated with higher creativity (Ma, 2009). When a body of work includes both success and misses, the extent and implications of the misses should be examined and dealt with accordingly.

Although a majority of Eysenck's articles are single authored, and a large number written with his wife, Sybil, it is worth nothing he had a large network of collaborators, numbering 122 in the sample examined in this article. As noted by Rushton (2001), this included PhD students in the department he founded and headed; however, it is not limited to them, and his network of collaborators evolved over lifetime – many of the people who worked with Eysenck or knew very well his work and style of working contributed to a special issue to celebrate the centenary of his birth (see Corr, 2016c). A co-authorship analysis offers a visual representation of such collaboration, showing both the groups who worked with him, and how they changed over the years. Such a set of collaborators is consistent with research on creativity (Uzzi & Spiro, 2005), which shows that the most successful creative teams include a stable core and renewal/new perspectives. Eysenck was a master of this approach, working with experts in field he entered and impacted – although others accused him of being something of a gadfly, entering new fields but never quite mastering them (see Corr, 2016b).

This bibliometric study uses the latest methodology to investigate the research legacy of a famous, yet controversial, psychologist. As a result of his prolific research and broad range of interests, Eysenck's body of work is an interesting case study that may help

illuminate some of the issues surrounding research and researchers whose ideas are catalysts for whole new areas of science. Specifically, we conducted a bibliometric coupling analysis of his published journal articles, to identify the different areas of his research, and the extent they overlap or are independent. A second analysis, co-authorship analysis, showed the range of collaborators he had through his career, and how they to a large extent are restricted to a specific topic, as identified in the coupling analysis.

1.1. New Light on an Old Controversy

Over the past decade, the field of social psychology experienced a series of shocks, as previously celebrated researchers like Diederik Stapel were exposed for forging data (Levelt, Drenth, & Noort, 2012). Questions were raised about the validity of the analysis and methods behind influential studies, such as the "Power Pose" (Simmons & Simonsohn, 2017). These shocks had several ramifications. As a positive development, more attention is now given to robust methodology, terms such as "HARKing" and "p-hacking" are commonplace, and an increasing number of journals require pre-registration of studies to help focus on the quality of methods, with the promise to publish regardless of findings. Furthermore, a replication movement has emerged, where collections of labs are re-examining central studies in an attempt to identify generally accepted effects which are neither statistical artifacts nor heavily contextually dependent – quite aside from outright fraud. These consequences and developments represent important advances for the field.

All of this should be seen in the context of the different types of work needed to advance science. One is creative studies that open up new perspectives and opportunities, going where others have not yet gone. Such studies need to gain traction, but they need to be examined in detail, refined or refuted: this is a second type of work. A third type of work is

that of replication to distinguish statistical artifacts from robust new findings. The needs of each type of work are different.

Replication requires access to large datasets and rigorous attention to methods. Refining, refuting or advancing an idea, requires an ability to explore boundary conditions, explanatory mechanisms and seeing broader contexts. Creative and innovative new ideas requires taking risks, proposing ideas where there is little groundwork, established measures or procedures. With risk, there can be large rewards, but also grand failures. How we respond to such research, and researchers, may impact the rate of development.

In the context of Eysenck's scientific output, this is a relevant topic especially when seen against the background of doubt cast on the veridicality of papers that Eysenck co-authored. In 2019, 26 of his papers (all coauthored with Grossarth-Maticek) were "considered unsafe" by an enquiry by King's College London. It is an important issue because at the time of his death, Eysenck was the living psychologist most frequently cited in the peer-reviewed scientific journal literature (Haggbloom et al., 2002; Rushton, 2001). He was also the controversial, for example being cited as the most controversial of 55 intelligence researchers (Carl & Woodley of Menie, 2019). Eysenck's Google Scholar index at the beginning of 2020 was over 114,000, with an H Statistic of 140, and rising – there is evidence of over 40 publications receiving citations of more than 1,000. (There may be some inaccuracies in this analysis because of some confusion with his wife, S.B. Eysenck, and his son, M. Eysenck, but there is no doubt whatsoever that Eysenck was one of the most influential psychologists of the 20th century and still quoted extensively over nearly 25 years after his death.)

A bibliometric analysis can help to clarify this debate, and this is the main purpose of this paper. Our analysis examines whether the 'unsafe' body of Eysenck's research poisons

the well of the whole corpus of his work, or whether it stands apart and is something of a late-career aberration. In addition, we offer a visualization of the extent of the troubled articles.

2. Method

Bibliometric analysis methods enable the quantitative evaluation of a body of published articles, text and citation data. The methods applied in this study are bibliometric coupling and co-authorship analyses, in order to identify the structure of Eysenck's body of research and to identify the ties that form the structure of his collaborations. The bibliometric coupling results show how articles cluster based on the similarity of reference lists, which are subsequently mapped visually (van Eck & Waltman, 2010). Science mapping using bibliometric methods requires several distinct steps namely compiling a corpus of articles, cleaning and analyzing the data, and visualizing and interpreting the results (Zupic & Čater, 2015). In addition to science mapping, we employ social network analysis to further analyze the resulting bibliometric network graphs. The bibliographic data for this study are collected from *The Social Sciences Citation Index® (SSCI*), available online through the *Web of Science (WoS).*

2.1. Search Strategy

In WoS we used the author search for "HJ Eysenck", and "H Eysenck" which returned 1,240 results. Of these, 402 were journal articles and review studies, which are included in the bibliometric analysis. The remaining entries include book reviews (628), letters (107), notes (33), meeting abstracts (30), and editorial material (23) and duplicates (7) which are excluded from further analyses.

The methods employed in the VOSviewer 1.6.11 software (Waltman, van Eck, & Noyons, 2010) are generally seen to represent best practice in the science mapping literature (Lee, Felps, & Baruch, 2014). This software was used to extract key-terms, estimate clusters and visually map the results. Microsoft Excel was used to clean the data, by identifying authors

whose name varies in the entries, and calculate the cluster interaction scores. The Gephi 0.9.2 software was used to estimate the centrality measure.

2.2. Analytical strategy

Bibliographic coupling analysis is used to examine the reference lists of documents in the corpus, identifying where two or more articles share a common reference. The degree of overlap between article's reference list represent the strength of connection between them (Kessler, 1963). Greater overlap means two documents share a large proportion of references, and thus a probability that the content are on related topics. Conversely, little overlap indicates the documents are based on distinct literatures, with few commonalities. We constructed a two-dimensional map using VOSviewer, which determined the layout using a unified framework for mapping and clustering (van Eck & Waltman, 2011). The terms are mapped so that the distance between them indicate their relatedness, and are grouped in clusters, indicating a common theme. The size of the circle indicates the number of citations the article has received in the WoS database. Articles without a reference list, or that has no references in common with other articles, are not placed in a cluster. This was the case for 24 articles in our corpus, largely consisting short articles of a single, or only a few pages.

As citations are necessarily retrospective, newer articles have a wider range of possible sources to cite, consequentially, articles on the same topic will tend to cluster more closely with other articles on the same topic from the same time period, than they will with articles from different time periods. When applying the method to a corpus that spans more than 5 decades, as is the case in this study, a topic that receives continued attention over a long period will likely be spread over several clusters, as the underlying research newer articles are based on, expands.

Co-author analysis (Acedo, Barroso, Casanueva, & Galán, 2006) is used to identify a network of researchers, by creating a link between co-authors of each article in the corpus.

When aggregated, the more frequently two authors have collaborated, the stronger the link. Further, the date of each co-authorship is noted, and the average year of collaboration is reported. As the current corpus consists of Eysenck's body of published articles, his name occurs in all the articles and is consequently excluded from the analysis - a common practice for this type of network analysis (Perry, Pescosolido, & Borgatti, 2018).

The network measure eigenvector centrality (hereafter referred to as 'centrality') is a measure of the importance of a given node in a network diagram, calculated by the range and importance of other connecting nodes (Bonacich, 1972). The measure is used to rank the items in each of the network clusters. Further, to evaluate the extent of overlap between clusters in the bibliometric coupling analysis, we examine the ties of the articles in each cluster and calculate the proportion of the ties that go to articles in the same cluster, and those that go to other clusters. A low score indicates there are very few references in common between the clusters, while a high indicates a high degree of commonality. As such it represents a measure of how closely related the clusters are.

3. Results

In this section we show the structure of Eysenck's published articles, identified by the bibliometric coupling analysis, and the structure and extent of his collaboration, in a co-authorship analysis.

3.1. Bibliometric coupling

The results of the bibliometric coupling analysis are shown in two network diagrams. Figure 1a shows how the articles were assigned to clusters, identified by different colours. Figure 1b shows the publication year of each article, where the colour scale indicates the year of publication on a sliding scale. The full list of articles in each cluster, with associated metrics, are presented in Appendix A1. The proportion of links within and between the clusters, indicating degree of similarity, is presented in Table 1.

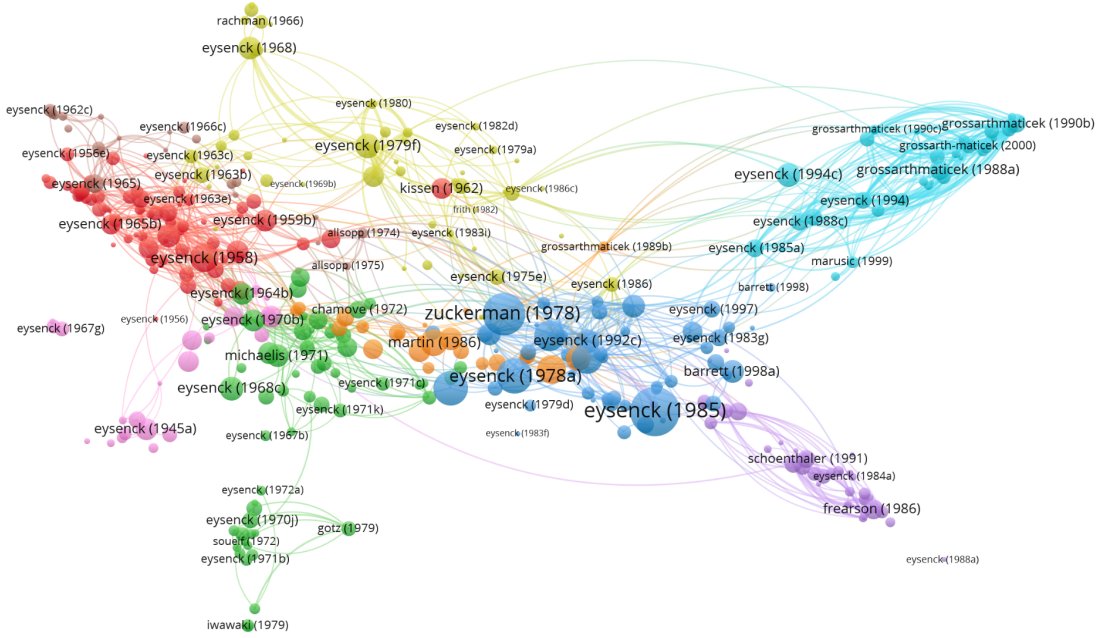
We identified ten clusters, where five relate to Eysenck's evolving work on personality, cluster 9 (Pink) represents his early work, where the average publication year was 1954, followed by the cluster 1 (Red) (avg. publication year 1961), the cluster 2 (Green) (avg. publication year 1971), cluster 7 (Orange) (avg. publication year 1977) and the cluster 3 (Blue) (avg. publication year 1985). A visual inspection of the network graph, shows that his work on personality in the late 1960s and early 1970s, shown in cluster 2, is divided into two parts, one covering his mainstream personality research, while the other, his work on personality and aesthetics. Cluster 7 (Orange) include much of his work on the genetic perspective on personality, and how hereditary it is. These five clusters are heavily interlinked, where between 76% and 89% of all the links in each cluster, link either within the same cluster, or one of the other four, indicating a high degree of similarity.

Cluster 8 (Brown), represents his work on motivation and learning, where the average publication year is 1968 and cluster 4 (Yellow) his work on behavior therapy and psychotherapy. Cluster 5 (Purple) on personality and intelligence has 68% of all its links within the cluster, indicating a high degree of independence. Cluster 6 (Teal), on personality as it relates to cancer and coronary heart disease, has a very high degree of independence, as 81% of all links are within the cluster. As shown visually on the network diagram, it indicates the topics are based on separate literatures than his main body of work on personality. All articles identified by the King's Collage London enquiry (King's College London, 2019) are in cluster 6. To indicate their relation to the rest of the corpus, we show these in figure 1c, where the identified articles are marked in grey. Though not shown, the majority of the other articles in this cluster appear in the list of scientific contributions Marks (2019) recommend for further investigation (it should be noted that allocation to a cluster is algorithmically decided, and some articles may have been assigned to one, rather than another cluster by small margins). For further evidence of the extent clusters 5 and 6 are based on separate

literatures, we have included a co-citation analysis in Appendix B, with the same result. There is a final cluster, consisting of three articles on anesthetics and personality, which is not included in the map, as they do not share sufficient common references with the rest of the articles.

Figure 1a

Network Visualization of the Bibliometric Coupling Analysis of HJ Eysenck's Published Articles – Clustered by Topic.



Note. Size of the circle shows the relative number of citations, the proximity between circles indicate similarity, as gauged by how many references they share and the weight of the line indicates the number of shared references (set minimum to 3 for clarity). Cluster 9 (pink); early work on personality, cluster 1 (Red) dimensions of personality, cluster 2 (Green) Personality, children and aesthetics, cluster 7 (Orange) personality and genetics, cluster 3 (Blue) structure and dimensions of personality, cluster 8 (Brown) motivation and learning, cluster 4 (Yellow) behavior therapy and psychotherapy, cluster 5 (Purple) personality and intelligence, cluster 6 (Teal) on personality as it relates to cancer and coronary heart disease.

Figure 1b

Network Visualization of the Bibliometric Coupling Analysis of HJ Eysenck's Published Articles – by Publication Year.

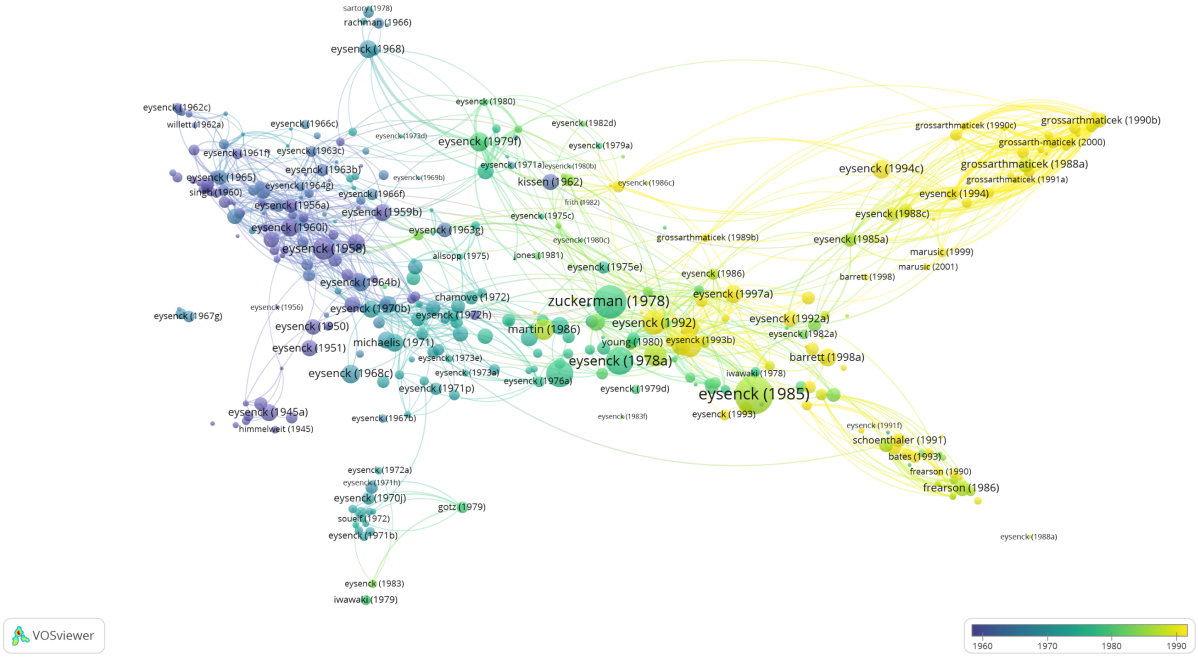
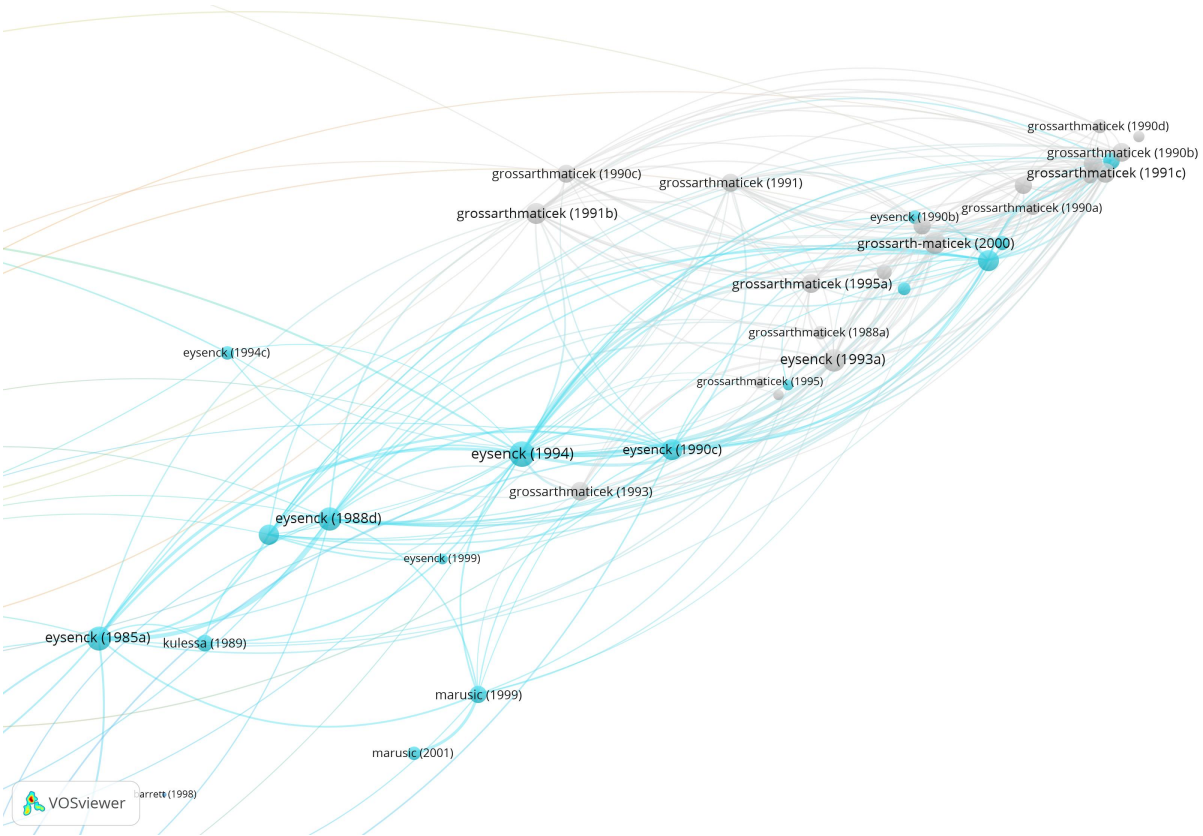


Figure 1b: Network visualization of the bibliometric coupling analysis of HJ Eysenck's published articles. Size of the circle shows the relative number of citations, the proximity between circles indicate similarity, as gauged by how many references they share and the weight of the line indicates the number of shared references (set minimum to 3 for clarity). Colour scale indicates year of publication of each article.

Figure 1c

An Enlarged and Modified Section of Figure 1a,



An enlarged and modified section of figure 1a, where 20 of the manuscripts identified by the King's College London enquiry are marked in grey (Erratum and notes identified in the enquiry are not part of the study corpus, thus not in the network map).

Table 1

The Proportion of Ties Within and Between the Bibliometric Coupling Clusters

From \ To cluster	To C1	To C2	To C3	To C4	To C5	To C6	To C7	To C8	To C9	To C10	Proportion of all ties
From C1	*0.67*	0.08	0.04	0.07	0.00	0.01	0.03	0.05	0.04	0.00	0.24
From C2	0.17	*0.52*	0.13	0.06	0.01	0.01	0.03	0.04	0.03	0.00	0.11
From C3	0.06	0.08	*0.55*	0.07	0.07	0.07	0.05	0.02	0.02	0.00	0.19
From C4	0.16	0.07	0.14	*0.49*	0.02	0.04	0.02	0.04	0.02	0.00	0.10
From C5	0.02	0.01	0.17	0.03	*0.68*	0.03	0.04	0.01	0.02	0.00	0.08
From C6	0.02	0.01	0.10	0.03	0.01	*0.81*	0.02	0.00	0.00	0.00	0.14
From C7	0.16	0.06	0.20	0.04	0.06	0.06	*0.38*	0.01	0.03	0.00	0.05
From C8	0.25	0.10	0.09	0.09	0.01	0.01	0.01	*0.43*	0.02	0.00	0.05
From C9	0.34	0.09	0.11	0.05	0.04	0.01	0.05	0.03	*0.29*	0.00	0.03
From C10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*1.00*	0.00

Note: (Colours refer to those in figure 1) C9 (pink); early work on personality, C1 (Red) dimensions of personality, C2 (Green) Personality, children and aesthetics, C7 (Orange) personality and genetics, C3 (Blue) structure and dimensions of personality, C8 (Brown) motivation and learning, C4 (Yellow) behavior therapy and psychotherapy, C5 (Purple) personality and intelligence, C6 (Teal) on personality as it relates to cancer and coronary heart disease. The proportion of ties from each cluster that is shared with other clusters. The diagonal shows the proportion of links within a cluster. The proportion of all ties column refers to how many of all ties in the network, are the cluster.

3.2. Co-authorship analysis

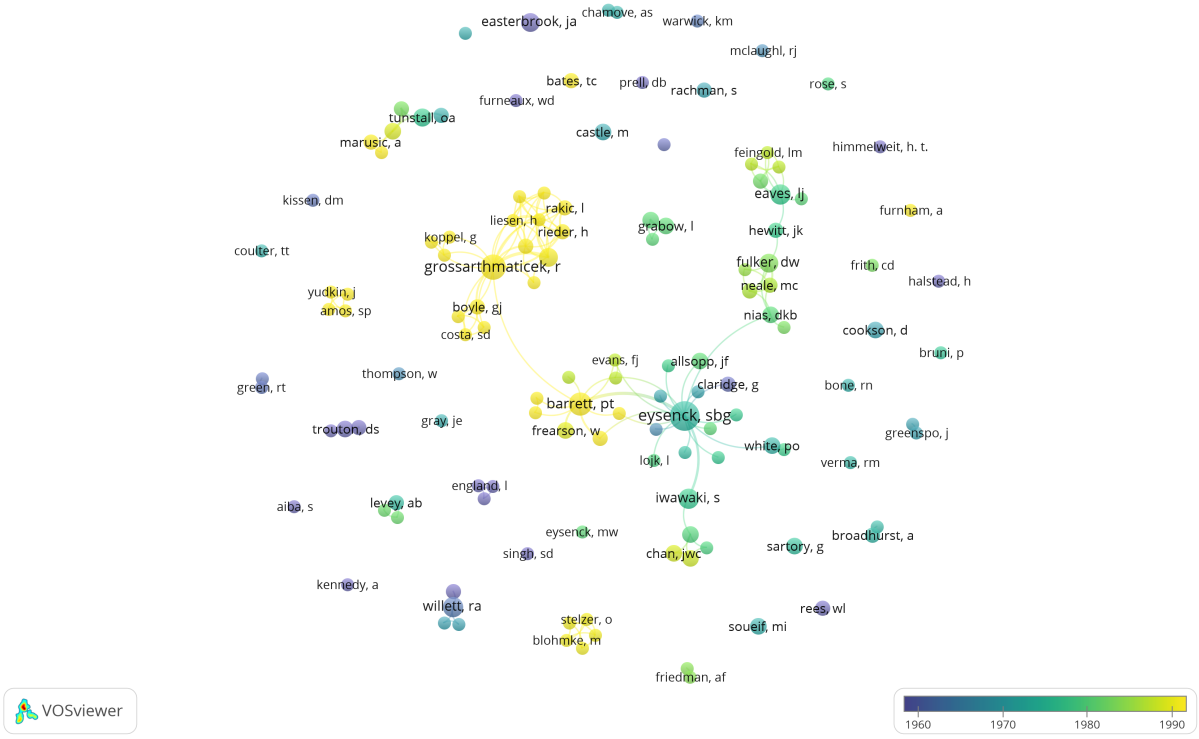
In addition to being prolific, Eysenck worked with a range of other scholars through his career. In our sample, he co-authored articles with 129 other scholars, both as part of teams and in dyadic relationships (see Figure 2). There are a few scholars with whom he collaborated extensively, including his wife, SBG Eysenck, and Paul Barrett, his onetime research assistant. It is clear he also published nearly 30 papers with Grossarth-Maticek. However, with the vast majority of his collaborators, he only penned one or two articles, with a constant renewal of collaborators over time.

A second point to note, is that examining the co-authorships in relation to the bibliometric coupling clusters discussed above, we see there is relatively little overlap between the clusters, indicating that collaborations tended to be on a topic or an idea, while with others he was inspired into new areas, such as aesthetics, intelligence and health. We

have organized the list of co-authors by the clusters identified in the coupling analysis, and list them by number of collaborations, and average year of co-authorship, in Table 2.

Figure 2

Co-Authorship Network Graph of Authors who Collaborated with H J Eysenck



Note. Size of circle indicate number of articles the author co-authored HJ Eysenck. Colour scale shows average publication year of the collaborated works. Ties between authors indicate the co-authors who worked together on the Eysenck articles.

Table 2

Eysenck's Co-Authors, Organized by Clusters Identified in the Bibliometric Coupling Analysis.

Co-author, by cluster	Author contributed to articles in more than one cluster	Number of articles by author	Avg. publication year for full collaborations
Cluster 9 (Pink): Early work on personality			
Author			
EYSENCK, SBG	x	3	1974
FURNEAUX, WD		1	1945
HALSTEAD, H		1	1945
HIMMELWEIT, HT		1	1945
MCLAUGHL.RJ		1	1966
PRELL, DB		1	1951
REES, WL		2	1945
Cluster 1 (Red): Dimensions of personality			
Author			
AIBA, S		1	1957
CASEY, S		1	1957
CLARIDGE, G		2	1961
EASTERBROOK, JA		5	1960
ENGLAND, L		1	1960
EYSENCK, SBG	x	5	1974
HOLLAND, H		2	1957
KENNEDY, A		1	1952
KISSEN, DM		1	1962
LEVEY, AB	x	1	1974
MAXWELL, AE		1	1961
SINGH, SD		1	1960
SLATER, P	x	1	1960
TARRANT, M		1	1960
TROUTON, DS		3	1957
WARWICK, KM		1	1963
WHITE, PO	x	1	1973
WILLETT, RA	x	1	1963
WOOLF, M		1	1960

Cluster 8 (Brown): Motivation and learning			
Author			
ALLSOPP, JF	x	2	1980
BROADHURST, A		2	1973
GRAY, JE		1	1971
ISELER, A		1	1969
SARTORY, GE	x	1	1975
SLATER, P	x	1	1960
STAR, K		1	1969
THOMPSON, W		1	1966
TUNSTALL, OA		4	1977
WILLETT, RA	x	5	1963
WILSON, GD		2	1972

Cluster 2 (Green): Personality and children; Aesthetics			
Author			
BORISY, AR		1	1979
CASTLE, M		3	1970
CHAMOVE, AS		1	1972
CHAN JWC	x	1	1987
COOKSON, D		3	1969
EASTING, G		1	1970
EYSENCK, SBG	x	23	1974
GOTZ, KO		3	1979
HARLOW, HF		1	1972
IWAWAKI, S	x	3	1977
LYNN, R	x	1	1987
MICHAELIS, W		1	1971
NIAS, DKB	x	1	1980
RACHMAN, S	x	1	1970
RUSSELL, T		1	1970
RUST, J		1	1977
SHAW, L		1	1974
SOUEIF, MI		3	1972
SYED, IA		1	1966
VERMA, RM		1	1973
WHITE, PO	x	1	1973
		1	

Cluster 4 (Yellow): Behaviour therapy and psychotherapy			
Author			
FRITH, CD		1	1982
FULKER, DW	x	1	1983
GREENSPO.J		1	1969
HEWITT, JK	x	1	1978
JONES, J		1	1981
LEVEY, AB	x	1	1974
MARTIN, I		1	1981
RACHMAN, S	x	1	1970
SARTORY, GE	x	2	1975
SIMKINS, L		1	1969

Cluster 7 (Orange): Personality and genetics			
Author			
ADELAJA, O		1	1977
BLIZARD, RA		1	1984
BRUNI, P		1	1976
COULTER, TT		1	1972
EAVES, LJ		7	1978
EYSENCK, SBG	x	1	1974
FEINGOLD, LM		1	1986
FULKER, DW	x	1	1983
GREEN, RT		1	1962
GROSSARTH-MATICEK, R	x	1	1991
HEATH, AC		1	1986
HEWITT, JK	x	1	1978
JARDINE, R		1	1986
MARTIN, NG		2	1982
NEALE, MC		2	1985
NIAS, DKB	x	1	1980
RUSHTON, JP		2	1985
STACEY, BG		1	1962
VETTER, H	x	1	1989
YOUNG, PA		1	1980

Cluster 10 (No Colour): Anesthetics and personality			
Author			
GRABOW, L		3	1980
SCHUBERT, F		1	1980
PYHEL, N		3	1980

Cluster 3 (Blue): The structure and dimensions of personality			
Author			
ALLSOPP, JF	x	1	1980
BARRETT, PT	x	6	1992
COX, DN		1	1982
EVANS, FJ		1	1986
EYSENCK, MW		1	1980
EYSENCK, SBG	x	14	1974
FULKER, DW	x	2	1983
FURNHAM, A		1	1993
HANIN, Y		1	1991
HUMPHERY, N		1	1980
IWAWAKI, S	x	4	1977
LOJK, L		1	1979
MAYO, J		1	1978
NIAS, DKB	x	1	1980
PETRIDES, KV		2	1998
SPIELBERGER, C		1	1986
WHITE, PO	x	1	1973
ZUCKERMAN, M		1	1978

Cluster 5 (Purple): Personality and intelligence			
Author			
AMOS, SP		1	1991
BARRETT, PT	x	8	1992
BATES, TC		2	1993
CHAN JWC	x	2	1987
EYSENCK, SBG	x	1	1974
FREARSON, W		3	1988
FRIEDMAN, AF		1	1983
KLINE, P		1	1996
LUCKING, S		1	1986
LYNN, R	x	2	1987
PALTIEL, L		1	1996
PERITZ, E		1	1991
SCHOENTHALER, SJ		1	1991
WAKEFIELD, JA		1	1983
YUDKIN, J		1	1991

Cluster 6 (Teal): Personality, cancer and Coronary heart disease			
Author			
BARRETT, PT	x	1	1992
BLOHMKE, M		1	1989
BOYLE, GJ		2	1998
COOPER, CL		1	1989
COSTA, SD		1	2000
DIEL, IJ		1	2000
FREESEMANN, C		1	1990
FRENTZELBEYME, R		1	1991
GALLASCH, G		2	1991
GROSSARTH-MATICEK, R	x	21	1991
GUDJONSSON, GH		3	1988
HEEB, J		1	2000
JAGSCHITZ, P		1	1989
KANAZIR, DT		1	1990
KOPPEL, G		1	1997
KULESSA, CHE		1	1989
LIESEN, H		1	1990
MARUSIC, A		2	2000
PFEIFER, A		1	1997
RAKIC, L		2	1990
RIEDER, H		2	1990
SCHMIDT, P		1	1997
STARC, R		1	1999
STELZER, O		1	1989
UHLENBRUCK, G		1	1990
VETTER, H	x	4	1989

Note: Authors who appear in two or more clusters are indicated, and the number of publications in each cluster listed. The average year of publication for each collaborator refers to all articles they published with HJ Eysenck, across all clusters.

4. Discussion

In the examination of any scientist who works over several decades, it is clear that interest and research in topics waxes and wanes, and this occurs for many reasons such as technical advancements, funding opportunities, and having answered initial questions posed. Some people are more "focused" than others working within the same sub-discipline (e.g. cognitive psychology) and using the same methodology (e.g. experimental methods). Others,

seem to have interests and research in very broad and even unrelated areas as a function of their enquiring mind and personality.

Hans Eysenck was famous for the breadth of his interests which changed over time and which can be seen by examining the articles presented in Appendix A. Critics of this style talk of "flighty", "whimsical" and "shallow", suggesting a lack of sustained and concentrated effort. Others talk of "renaissance man", "big picture" and "polymath". This analysis shows Eysenck to be someone who dipped into, dabbled with, but also made a serious scientific contribution to many different areas of psychology. He read widely in a number of languages and academic disciplines. In short, he scored very highly on "Openness-to Experience".

Further, because so much of scientific research is collaborative, personal friendships and relationships can have a dramatic influence on the topic, quality and quantity of research. Some research dyads thrive on the concept of complementarity: the one prefers study design, the other execution; the one writing up his study while the other prefers the analysis. Many researchers publish over time with the PhD students and research assistants and colleagues. As people "come and go" so relationships and co-authorships ebb and flow. Eysenck published with his wife over most of his academic life, but with other colleagues for a much shorter period of time. Changes in technology, especially the internet, means it is commonplace to research and write papers with people at geographically dispersed sites, indeed in different countries – this was much less easy during Eysenck's lifetime.

What lessons can we draw from Eysenck's body of work? His contribution to the field of psychology can hardly be overstated. He provided new and creative insights; he extended many of them through a wealth of studies; and he encouraged replication, also across countries and cultures. His work benefitted and probably grew in range, as a result of working with a wide range of collaborators. The result of the constant renewal of co-investigators, helped foster fresh thinking and progress.

However, we also see that when all three of the approaches to scientific development, namely creative innovation, extension and replication, are pursued by the same person, it may be easy to fall in love with one's own novel idea and be blinded in the pursuit to confirm it. This may consequently be at the expense of methodological rigor – perhaps leading to a lack of proper scrutiny of the data provided by Grossarth-Maticek. While this issue is yet not resolved, there is some recent evidence to lend support to some of their claims (Whitfield, Landers, Martin, & Boyle, 2020), the proximity in the bibliometric coupling analysis of many of the articles identified by Marks (2019) to those deemed "unsafe" by the enquiry at King's Collage London (2019) adds further support for the call to examine more of Eysenck's work, for this period of time and areas of study.

We also see that when a study, or set of studies are discredited, so is the researcher. Such an accusation may hold back a novel idea, as few, if any, researchers are likely to pick up and examine further a discredited idea. Thus, while it may be tempting to be careless with data when ideas are novel and methods to examine them are not well defined, the consequence of doing so are likely to also be the same idea's death knell.

Towards the end of his life, Eysenck wrote the article "Why Do Scientists cheat?" (1999), where he lays out the case for why some great scientists, including Newton, Freud and his own mentor, Burt, may have cheated in their scientific reporting, in order to promote creative, new ideas that were not well received by the establishment. "*Fraud is always bad, particularly in science. Can and should genius be forgiven because creativity is often persecuted? This is an ethical problem, and ethical problems are by definition insoluble – there are good arguments on both sides."* (Eysenck, 1999, p. 33-34 – it was published some two years after his death). While this may have been the case in earlier times, we believe this no longer can be viewed as an ethical problem. With the state of science today, with the

methods available, the innumerable outlets and opportunities for replication, there is no excuse for any shortcuts, regardless of the believed value held by the offending scientist.

5. Limitations and conclusion

Although bibliometric analyses can organize and yield both robust and valid results on a corpus of articles, there are limitations that should be acknowledged. First, as the analysis is based on reference lists, date of publication, authorship and other bibliographic data, rather than the content of each article, the method is not a substitute for extensive reading. Careful analysis of indiviudal articles are needed to evalute their contribution, quality and to distinguish between empirical and conceptual articles.

There are also several limitations to this study, some caused by the chosen design and by the use of the bibliometric method, others by the implementation. A limitation of all bibliometric studies stem from the nature of the analysis, where all data are treated equally. For example, there is a tendency of scientists to cite themselves, friends, colleagues and the same sources they are familiar with over a range of articles (Cole & Cole, 1974), resulting in articles seeming more similar than they in reality are, when analyzing references lists, which may in our case have influenced the bibliometric coupling results. As Eysenck was an author of all the papers, this effect may be compounded in our study.

A second set of weaknesses stems from the data, the selected corpus of articles. First, the corpus is a sample, rather than the full population of Eysenck's body of published articles. The reason for this is that not all his articles are available from databases that offer the bibliographic data needed; this is especially true for older articles, and those published in niche outlets. Further, errors in the database records occur. However, the sample is estimated to be sufficient for the analysis to be valid (Burt, 1983).

We do not believe that these limitation negatively impact the conclusions we have drawn on the basis of the most recent methods of bibliometric analysis.

In conclusion, we have shown by bibliometric analysis the specific themes of Eysenck's prolific research and his collaborations with many researchers around the globe. His output was truly amazing, yet some of it has come under recent attack for reporting what some claim are unbelievable results. For this reason, many of his papers in the personality and health psychology field have been declared 'unsafe' and flagged by journals as such. However, this body of work is very small in relationship with the bulk of his outputs over a span of 50 years. We have shown in our bibliometric analysis, whatever the fate of his work declared 'unsafe', this sits separately from his other work and, as such, it cannot be claimed that they poison the well of overall body of research Eysenck's work. At a more general level, this case underscores the importance of replicating research in order to test its veracity and generalizability, to root out results that are false or based on statistical artefacts, and thus ensure a solid scientific base from which new scientific research can blossom.

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