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A new perspective on trends in psychology

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ABSTRACT

The current paper aimed to analyze quantitatively the trends of four major schools of thought in scientific Psychology (neuroscience, cognitivism, behaviorism, psychoanalysis) and their intersections, covering the period from 1979 to 2020. We utilized a rigorous methodology across three distinct sources: Mainstream Psychology (MP), Highly Influential Journal (HIJ), and non-English papers (NEP). Our findings align with previous research in two aspects: psychoanalysis and behaviorism have significantly declined, cognitivism remains a prominent trend. However, we deviate from prior studies by recognizing that neuroscience may be considered the most influential trend and that trends exhibit less linearity than previously assumed. We also acknowledge the significance of NEP, which manifest an independent pattern as compared to the other sources and that may reveal what happens in the "periphery" of Psychology. It is noteworthy that NEP demonstrated a still lively contribution from psychoanalysis. Our study also highlights the insularity and lack of cross-fertilization among psychological subdisciplines, despite the widespread claims to the contrary. It eventually supports the inference that scientific Psychology is a non-paradigmatic or pre-paradigmatic discipline, pointing out the dominance of applied psychology and confuting the notion of overarching "grand theories".

Quantitative analysis of theoretical psychological issues is an emerging field of study that has shown potential (Fanelli, 2010; Fanelli and Glänzel, 2013; Roeckelein, 1996a, 1996b, 1997, Simonton, 2002, ch.13, 2004, 2015; Yang & Chiu, 2009). Researchers have explored the use of quantitative methods to analyze trends of psychological subdisciplines, yielding valuable insights (Friman, Allen, Kerwin, & Larzelere, 1993; Robins, Gosling, & Craik, 1999; Spear, 2007; Tracy, Robins & Gosling, 2004; Webster, 2007).

The quantification of subdisciplines' trends emerged as a response to the claims about a "cognitive revolution" which positioned cognitivism as the dominant paradigm in psychology (Robins et al., 1999; Tracy et al., 2004). However, these claims were met with counterarguments from behaviorist scholars (Salzinger, 1994; Pierce, 1996 in Robins et al., 1999). Recognizing that subjective evaluations of the prominence of a particular school of thought are highly prone to personal bias, researchers turned to quantitative analysis to provide a more objective assessment of the prominence of different subdisciplines (Friman et al., 1993; Tracy et al., 2004).

To achieve this, the authors utilized bibliometric indexes to evaluate the prominence of various psychological sub-disciplines (such as cognitivism, psychoanalysis, and behaviorism) over a specific time-period. The underlying rationale of these bibliometric indexes is that the more frequently a sub-discipline is cited, the greater its prominence within the field of psychology. Through these measures, it becomes possible to objectively confirm or refute the rise and decline of different subdisciplines and determine whether any of them have attained the status of a "paradigm" thereby establishing psychology as a "normal science" (Kuhn, 1962/1996). The existing studies consistently indicate a decline in behaviorism and psychoanalysis, the prevailing influence of cognitivism, and the recent emergence of neuroscience. However, several methodological and theoretical challenges remain to be addressed. These include developing a sensible and rigorous analysis, identifying the intersections between different sub-disciplines, and investigating trends across different sources of research.

Indeed, it is worth noting that previous studies have primarily focused on influential North American psychology, often represented by flagship journals, and have neglected peripheral fields. In contrast, our study aims to provide a more comprehensive and nuanced understanding by examining trends across Highly Influential Journals (HIJ), Mainstream Psychology (MP), and non-English papers (NEP). With a novel methodology, we seek to explore previously uninvestigated issues. Specifically, we are interested in determining if there is a prominent trend in psychology that can be considered paradigmatic. Additionally, we investigate whether the evolution of these trends aligns with

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previous studies and how it varies across different sources.

1. History of the empirical analyses of trends in psychology

The study conducted by Friman et al. (1993) was one of the pioneering empirical investigations into the trends of subdisciplines within the field of Psychology. The authors specifically focused on psychoanalysis, behaviorism, and cognitivism during the years 1979–1988, utilizing data obtained from the Social Science Journal of Citation Reports (SSJCR). In their research, the authors selected four influential journals that represented each subdiscipline, taking into consideration various criteria, including a relatively high Impact Factor (IF)[1] (for further details see Friman et al., 1993, pp. 659-660). For instance, *Cognitive Psychology*, *Cognition*, *Journal of Experimental Psychology: Learning, Memory, and Cognition*, and *Memory & Cognition*, aligned with the cognitive approach.

In the study conducted by Friman et al. (1993), the four selected journals representing each sub-discipline were examined using four different indexes: IF, Immediacy Index (II),[2] citation number (the number of times the journal has been cited during a given year), and source items (the number of citable items the journal has produced during a given year). These indexes were calculated for each journal on an annual basis, and then averaged across the four journals to obtain single indexes for each sub-discipline. The three indexes were eventually plotted against each other. The main finding of the study indicated a significant increase in prominence for the cognitive school of thought. However, it was observed that the citation numbers and source items for behaviorism and psychoanalysis, although lower than those of cognitivism, were not substantially inferior. Despite the rise of the cognitive school, the study did not provide evidence for a clear-cut Kuhnian paradigmatic shift. Additionally, when considering the broader context of the social sciences, all three sub-disciplines (cognitive, behaviorism, and psychoanalysis) performed relatively well in comparison to other indexed journals in the SSJCR.

In our opinion, a more comprehensive and nuanced analysis was conducted by Robins et al. (1999) and replicated in 2004 by Tracy et al. (2004). These studies focused on four sub-disciplines within psychology: psychoanalysis, cognitivism, behaviorism, and neuroscience. To obtain a more accurate assessment of the historical trends in psychology, the authors employed three distinct methods utilizing the online database PsycINFO:

1. The sub-disciplines were identified through the use of specific keywords. For instance, the search term "psychoanal*" was employed to capture articles related to the psychoanalytic school. The asterisk (*) acts as a wildcard, allowing PsycINFO to search for words beginning with the specified stem, such as "psychoanalysis" and "psychoanalytic," among others. Specific keywords were selected for each subdiscipline (for more detailed information, refer to Robins et al., 1999; Tracy et al., 2004). The authors then conducted an *unqualified search*, which retrieves articles containing the search keyword(s) in various locations, including the article title, abstract, subject index, and indexed keywords (Ebsco, n.d., a). This process was repeated annually from 1950 to 1997 (2002 in the second study). However, the authors restricted their search to "flagship" journals. The selected flagship journals were *American Psychologist*, *Annual Review of Psychology*, *Psychological Bulletin*, and *Psychological Review*. These journals were chosen because they are considered to reflect current trends and define the agenda for future research. Additionally, they strive to publish articles representing the entire field of psychology (Robins et al., 1999, p. 118). Furthermore, they ranked among the most frequently cited journals in psychology from 1977 to 1996 (2002 in the second study) according to the SSJCR. Finally, the authors plotted the percentage of articles published by the flagship journals that included the respective keyword(s) against each other, providing an overview of the trends in each sub-discipline over time.
2. In addition to journal articles, dissertations indexed in PsycINFO were also included in the analysis using the same methodology. Dissertations were deemed significant because they represent the focus of attention for the upcoming generation of researchers (Robins et al., 1999, p. 119). The period under investigation for dissertations spanned from 1967 to 1994 (2002 in the second study).
3. The third index employed in the study followed a similar approach to that used by Friman et al. (1993). For each sub-discipline, the authors identified four prominent journals based on their Impact Factor (IF) and evaluations by journal editors. They then calculated the frequency with which articles published in these specialized journals (e.g., International Journal of Psychoanalysis) were cited by the flagship journals. This citation index was computed annually from 1977 to 1996 (2001 in the second study).

The results obtained through this multi-method approach were clear and consistent. Cognitivism showed a steady growth over the years, with its direct citations in flagship journals increasing significantly from around 3% in 1950–1952 to nearly 18% in 1995–1997. On the other hand, behaviorism and psychoanalysis experienced a continuous decline. Tracy et al. (2004) went as far as declaring the "death" of the psychoanalytic perspective and the demise of behaviorism, suggesting the presence of a well-established "cognitive revolution" within psychology. In contrast, the growth of neuroscience, although present, was not as dramatic as expected, considering the widespread perception of the "decade of the brain" in the 1990s. It is worth noting that the neuroscientific approach had flourished outside the realm of psychology, as evident from the citations of leading neuroscientific journals in *Science* or the increasing annual subscriptions to the *Society of Neuroscience* since the 1970s. However, psychoanalysis remained popular in the humanities, as highlighted by Friman et al. (1993). Therefore, this additional data do not fully capture the prevalence of neuroscience *within* the field of psychology. Furthermore, the authors cautioned against interpreting the "cognitive revolution" as a paradigm in Kuhnian terms. Despite its influence and significance, none of the psychological sub-disciplines can claim to be a paradigm in the sense defined by Thomas Kuhn.

Spear (2007) conducted a comprehensive analysis of trends in general psychology and offered a thorough critique of the bibliometric indexes that had been utilized in previous studies. In addition, Spear employed a different method to re-evaluate the trends in the field. The author identified several issues with past methodologies:

1. In addition to flagship journals, other influential journals in the field of psychology, such as the Journal of Personality and Social Psychology (JSSP) or the Journal of Counseling and Clinical Psychology (JCCP[3]), also possess high IFs. The author highlighted that these journals should not be overlooked, as they contribute significantly to the field and have a comparable level of influence.

[1] The Impact Factor of a journal in a specific year can be calculated as the ratio between the total number of citations received by the journal's articles during the preceding two years and the total number of papers published by the journal in that same period. Essentially, it represents the average number of times a paper published in the journal is cited within a two-year timeframe.

[2] The Immediacy Index of a journal in a specific year can be calculated by dividing the total number of citations received by the journal in that year by the total number of papers published by the journal in the same year. This index provides an indication of how frequently the average paper from the journal is cited within the year of its publication.

[3] The mentioned journals had an IF comparable to that of the "flagship journals" when Spear conducted his analysis (2004).

2. The proportion of flagship publications dedicated to a specific subdiscipline, such as cognitivism or behaviorism, represents a small part of the total references. Even the peak in 1995 - 18% representing cognitivism - remains a relatively minor component compared to the overall volume of publications. Previous analyses might have overlooked the significant contribution of *applied/professional* Psychology, which constitutes a substantial portion of the field (Henriques, 2019; Yang & Chiu, 2009).
3. The concept of a "mainstream" in Psychology represented by flagship publications is problematic due to the absence of a paradigmatic status in the field (see also Zagaria, Ando', & Zennaro, 2020).

Keeping these considerations in mind, the author examined five subdisciplines: psychoanalysis, behaviorism, cognitivism, neuroscience, and neurocognitivism (the intersection of neuroscience and cognitivism). Two significant changes were made to the methodology: the use of the keyword "neuro*" to capture neuroscientific contributions more comprehensively,[4] and the investigation of *all referenced peer-reviewed article*s in PsycINFO from 1950 to 2005. The revised methodology produced similar results to previous studies, confirming the rise of cognitivism and the decline of psychoanalysis and behaviorism. However, it also revealed a notable increase in the prominence of neuroscience, which was comparable to cognitivism by 2005. By that year, cognitive and neuroscience keywords appeared with frequencies of approximately 13.2% and 11.9% respectively.[5] Additionally, the investigation of the intersection of cognitivist and neuroscientific keywords showed a gradual growth of "neurocognitivism" from 1980 onwards, reaching about 3% in 2005. Despite these findings, the author cautioned against interpreting neuroscience or cognitivism as paradigms, emphasizing that psychology as a whole does not have a paradigmatic status. Furthermore, an analysis of Psychology Ph.D. tabulations by the National Science Foundation (NSF, a) indicated that "clinical" psychology may be the most popular approach within the field (Spear, 2007).

Singer (2022) conducted a recent study that replicated Friman's (1993) investigation of psychoanalysis, behaviorism, and cognitivism. The author analyzed IF, II, and citation count averaged across influential journals for each subdiscipline at four time points: 1988, 1998, 2008, and 2018. Additionally, annual IF and citation counts were computed from 1997 to 2019 for the top journal in each discipline (*International Journal of Psychoanalysis, Journal of Applied Behavior Analysis*, and *Cognitive Psychology*). Joint-point regressions were employed to identify significant changes in the slopes over time. The results indicate that psychoanalysis continues to decline, cognitivism is still on the rise, and behaviorism is also increasing, although to a lesser extent compared to cognitivism.

Please note that in this brief review, we focused on studies that specifically examined historical trends in psychology. We did not include studies such as Kiselica and Ruscio (2014), which explored clinical subdisciplines, or Yang and Chiu (2009), which examined the structural and dynamical composition of psychology. Additionally, studies like Bittermann and Fischer (2018)and Wieczorek et al. (2021), which analyzed micro-topics in the psychological discourse, were not considered in this review.

2. Limitations of previous studies

Several methodological problems may be identified in the studies conducted thus far. Firstly, both Friman and colleagues (1993) and Singer (2022) studies suffer from the use of raw citation count without considering it in relation to the total number of published papers. This lack of proportionality can result in misleading conclusions. For instance, a citation count of 30 out of 40 papers is significantly different from 30 out of 100 papers, despite the raw count appearing equal on the surface. Secondly, the selection of "authoritative" journals as representative of the whole field of Psychology is perilous, because thoretically laden contributions (such as those we expect to find in these journals) seem to be the minority in Psychology. It is also not completely anchored to objective metrics, and it assumes that each paper published in them is fully theoretically committed to the journal in which it is published.

This issue becomes more pronounced when considering Singer's (2022) study, which used journals selected *thirty years prior* (Friman et al., 1993) as data sources. Thirdly, both Friman et al. (1993) and Singer (2022) studies did not consider neuroscience. Lastly, Singer's (2022) study employed the Web of Science database, which includes *citations from sources outside the field of Psychology itself*. This confounding factor further complicates the analysis and may introduce biases in the results.

Robins and colleagues (1999) and Tracy et al. (2004) presented more informative studies, but with some limitations as well. First, as noted by Spear (2007) flagship publications (*American Psychologist*, *Annual Review of Psychology, Psychological Bulletin,* and *Psychological Review*) are just among the ones with the highest IF. If we look at the IF from 2015 to 2020 in the category "Psychology" of the JCR, we always find *Annual Review of Psychology* and *Psychological Bulletin* (flagship journals) in the first two positions and *Psychological Review* (another flagship journal) fifth or sixth. However, we also find *Psychotherapy and Psychosomatics* never going below the fourth rank, *Journal of Child Psychology and Psychiatry* never going below the sixth rank and *Psychological Medicine* never going below the seventh rank. If we look at the total number of citations we find similar results, with *Psychological Bulletin* and *Psychological Review* always at the first two places and *Psychological Medicine* at the third. The flagship publications are not the only frequently cited journals.

Another limitation observed in studies like Robins et al. (1999), Tracy et al. (2004), and Spear (2007) relates to the selection of search keywords. The chosen keywords, such as "psychoanal*" for psychoanalysis," neurosci*" or "neuropsy*" for neuroscience,[6] "reinforc*" and "conditioning" for behaviorism, and "cognit*" for cognitivism, may be considered limited in scope. A more comprehensive set of keywords could provide a better representation of the respective sub-disciplines. Terms like "brain" or "white matter" for neuroscience, "transference" for psychoanalysis, or "Skinner" for behaviorism might be included to capture a wider range of contributions. Additionally, the unqualified search approach employed in these studies raises concerns. Depending on the platform used (e.g., Proquest, Ovid, Ebsco, PsycNet), the default search settings in PsycINFO can vary (APA Database Support, February 2022, personal communication; Burman, 2018). Different versions of online user guides provided by these platforms demonstrate variations in default search parameters (e.g., Ebsco, n.d.*a*; Ovid, n.d.). Moreover, the unqualified search can include new field codes as time goes on, as happened in 2016 with the introduction of the Medical Subject Headings (the "official" names for the biomedical-relevant lexicon) (APA, n.d., *a*). This use hinders to a certain degree the comparison of the studies between each other.

Eventually, previous studies have not investigated the intersection of the different sub-disciplines - the only exception being the study

[4] He believed that using only "neurosci*" and "neuropsy*", as done in previous studies by Robins et al. (1999) and Tracy et al. (2004), may have excluded many significant contributions. However, he excluded from the neuro* search terms relating to the psychodynamic concept of *neurosis* (i.e., neurosis, neuroses, neurotic*, psychoneurosis, psychoneuroses, and psychoneurotic).

[5] A similar pattern was found in the database PsycARTICLES to exclude the result as an artifact of an over-inclusive analysis (PyscARTICLES includes a more restrictive set of journals and it dates back only to 1984).

[6] Spear (2007) slightly modified the search keywords using neuro* (NOT neurotic, neurosis etc) for neuroscience.

conducted by Spear (2007) about the intersection between neuroscience and cognitivism. For instance, if the majority of behavioristic contributions after 1970 were part of cognitivism as cognitive-behavioral psychotherapy, that would have been overlooked by past analysis, thus overestimating the behavioristic contributions.

Previous analyses have often failed to differentiate between the mainstream and peripheral aspects of psychology, often treating influential North American psychology as representative of the entire field. However, by examining NEP, we can explore the relationship between NEP and the more dominant trends in psychology. It is important to investigate whether NEP primarily reflect delayed versions of trends identified in influential psychology or if they have distinct patterns of their own. Additionally, NEP is likely to have stronger connections to applied/professional psychology, an area that has received insufficient attention in previous analyses but holds significant importance within the broader field of psychology (Henriques, 2019; Yang & Chiu, 2009).

3. Method

The changes to the previous methodologies are consistent.

3.1. Specific field codes

We did not rely on the "unqualified search", which is simply typing into the search bar the keywords. We focused on some specific field codes instead. The field codes are the following: Abstract [AB], Keywords/Key Concepts/Identifiers [KW], Tests and Measures [TM], Title (including the translated version if in non-English language) [TI], Subjects/Subject Headings/Index Terms[DE] [7] and Medical Subject Headings [MA]. Searching by field code also automatically deactivates the "apply equivalent subject" option in Ebsco advanced search, automatically matching unspecified terms to their official counterpart in the APA Thesaurus (e.g. "workplace injury" matches for "work-related injuries", which is also linked to "occupational injuries" and "occupational-related injuries") (Ebsco, n.d., *b*). This new method has been chosen because it it can be easily replicated.

3.2. An expanded set of keywords

A different set of keywords was adopted to enhance the sensibility of the analysis. The limits associated with a restricted set of keywords were already pointed out in many commentaries to Robins et al. (1999) *target article*. We selected the following "seed terms" partially following authors of previous studies.

- "cognit*" for cognitivism (Robins et al., 1999; Tracy et al., 2004)
- "psychoanal*" (Robins et al., 1999; Tracy et al., 2004) OR "psychodynam*" (introduced in this study) for psychoanalysis
- "conditioning" OR "reinforc*" for behaviorism (Robins et al., 1999; Tracy et al., 2004) [8] OR "conditioned" OR "unconditioned" (introduced in this study)
- "neur*" (NOT neurosis, neuroses, neurot*) - inspired by Spear (2007) but modified - OR "brain" OR "nerv*" (introduced in this study) for neuroscience;

However, we wanted to have a more nuanced and expanded set of keywords, so we looked at the following terms in the APA Thesaurus;

- Cognitive Psychology
- Behaviorism
- Neurosciences
- Psychoanalysis/Psychodynamics

Looking at each word, we then selected in the APA Thesaurus the "narrower terms'' and "related terms"[9] associated with it that best suited, in our opinion, the subdiscipline (e.g. "white matter" for neurosciences, "Freud" for Psychoanalysis, etc). We also investigated the "narrower terms" and "related terms" of the first "narrower terms" themselves, and so on. We ended up with a list of descriptors per subdiscipline (see Appendix A, https://osf.io/dk52w/?view_only=58010522a7d643fd958320dafeb45258). Thereafter we "pruned" the list of descriptors excluding potentially ambiguous terms and terms already "included" in the seed words (e.g. "neurology" is already included in the search "neur*").

To decide which descriptor would have been included in the analysis, we run an analysis in PsycInfo, limited to peer-review journals indexed from 1887 until 2020[10] only in the codes specified above, investigating the association between each seed term(s) and each descriptor term, to quantify which amongst the latter ones were the most descriptive (i.e. appeared the most time associated with the seed terms) (for the frequency tables, see Appendix C, while for the specific syntax for the analysis implemented see Appendix B; https://osf.io/dk52w/?view_only=58010522a7d643fd958320dafeb45258). We then selected ten descriptors for each subdiscipline based on their frequencies (the number of descriptors selected changed according to the already existing seed words). In the end, the descriptors selected were the following ones:

- Cognitivism: **cognit*, artificial intelligen*, attentional bias*, concept* formation, executive function*, heuristic*, human channel capacity, human information storage, mental model*, schema**
- Behaviorism: **conditioning, conditioned, unconditioned, reinforc*, autoshaping, behavioral contrast*, discrimination learning, reinstatement, reward learning, skinner**
- Neuroscience: **neur* (NOT neurosis, neuroses, neurot*), brain, nerv*, axon*, cerebr*, dendrit*, gray matter, spinal cord, synaps*, white matter**
- Pyschoanalysis: **psychoanal*, psychodynam*, countertransferen*, ego, enactment*, freud*, jung*, object* relation*, projective measure*, transferen***

3.3. Sources

1 *MP*. First, we searched all peer-reviewed journals in PsycINFO, like Spear (2007), to get an analysis not bounded exclusively to

[7] We run the analysis on the Ebsco platform. Note that the acronym for the field code might slightly change from platform to platform; but these field codes should be consistent across different platforms (APA, n.d.*b*). Note also that at the time of searching the code DE in PsycInfo run on EBSCO had a minor bug: searching within this field code also searched for MESH terms [MA field code] (APA personal communication, November 2022). So for example the syntax **DE ("X" AND "Y")** was equivalent to **(DE ("X") AND DE("Y")) OR (DE ("X") AND MA("Y")) OR (MA ("X") AND DE("Y")) OR (MA ("X") AND MA("Y"))**. This bug has not substantial consequences on the search. It forced us though to include the field code MA to control for its influence.

[8] The word "behavior" is too lax to be representative of behaviorism alone (Robins et al., 1999; Tracy et al., 2004).

[9] The APA Thesaurus shows a hierarchical structure, in which terms are linked to equally specific ones – *related terms* - e.g. "information processing model" is a related term in respect to "cognition"; and to more specific ones – *narrower terms* - e.g. animal cognition is a "narrower term" in respect to "cognition".

[10] 1887 is the lower temporal bound given automatically by PsycInfo when indicating peer-reviewed journals as a specification (*see* also Burman, 2018); 2020 was chosen to be coherent with the latter syntaxes.

"influential" journals. This is labeled MP and it is thought to reflect the more common trends in psychology.

2 *HIJ*. We separately focused on the four journals with the highest IF year by year, without necessarily committing to specific "flagship journals". The IF has been computed from 1979 on by the JCR, so the period we investigated has been 1979–2020.[11] In Table 1 all the journals that at least once appeared in the first four IF per year have been reported.

3 *NEP*. Our analysis is driven by the hypothesis that trends in "mainstream" and "highly influential" psychology differ from trends observed in non-English papers (NEP), which provide insights into the periphery of Psychology (see the section "Non English Papers as an independent field of investigation"). Note that although the search keywords used in studies are in English while the papers themselves may be in a different language, it is typical for the title, subject headings, tests, measures, abstracts, and authors' keywords to be translated into English. As a consequence, NEP might be investigated through English keywords.

3.4. NEP as an independent field of investigation

The dominance of English as the primary language in scientific contributions has steadily increased over time, with its usage rising from less than 70% in 1980 to over 80% in 1990, and exceeding 90% in 2000 (Montgomery, 2013, p. 90; Gordin, 2015, p. 294). It is worth noting that the percentage may be higher when considering elite journals in the natural sciences (Montgomery, 2013, p. 90; Gordin, 2015, p. 294). In the field of psychology, as indexed in PsycInfo, the proportion of NEP is even lower. On average, NEP accounted for 7% of the total papers during the investigated period from 1979 to 2020, but this percentage has recently declined to 3% in 2020 (see Appendix D; https://osf.io/dk52w/?view_only=58010522a7d643fd958320dafeb45258).

There has been even a decrease in the *absolute number* of NEP, from 8416 papers in 2009 to 4500 papers in 2020 (see Appendix D). However, a more informative figure (Fig. 1) that displays the proportion of NEP as compared to the total number of papers in MP reveals an even more pronounced difference. The interpretation of this figure is as follows: if the line appears relatively flat, it indicates a trend like that of mainstream journals, which exhibits growth. Conversely, if the line points upwards, it suggests a more rapid growth than mainstream journals, while a downward trend indicates slower growth or an actual decrease.

The figure highlights the growth of NEP within the broader field of psychology until 1988, peaking at approximately 10% between 1982 and 1991. However, a noticeable decline occurred in the 1990s, with NEP currently accounting for around 3% of the field. The steady absolute decline from 2009 onward also shows that - with the reasonable assumption of the total number of papers being approximately equal per journals year after year - many journals publishing in non-English language are closing.

The indication of "peripherality" in NEP extends beyond mere proportionality. Studies have provided evidence establishing an association between the use of languages other than English and scientific exposure. Research suggests that publishing in English is associated with higher citation rates compared to publishing in other languages, even when controlling for factors such as the journal, year of publication, and paper length (Di Bitetti & Ferreras, 2017). Furthermore, this linguistic choice reflects the authors' diverse intentions. Scholars choose to publish in English when they aim to gain international recognition and advance their careers (López-Navarro, Moreno, Quintanilla, & Rey-Rocha, 2015; Stockemer & Wigginton, 2019). On the other hand, publishing in their native language is more common when researchers want to communicate with their local scientific community (López-Navarro et al., 2015).

3.5. Interdisciplinary intersection

In our analysis, we delved into interdisciplinary intersections that have received limited attention in previous studies. Alongside the cognitivism and neuroscience intersection explored by Spear (2007), we also examined additional intersections. Specifically, we investigated the intersections of cognitivism and behaviorism, cognitivism and psychoanalysis, psychoanalysis and neuroscience, and behaviorism and neuroscience. These intersections were chosen for their theoretical significance: cognitive neuroscience represents a distinct field, cognitivism and behaviorism have strong associations in cognitive-behavioral therapy, and psychoanalysis has witnessed influences from both cognitivist assumptions (Imbasciati, 2002, 2003) and neuroscientific ones (Solms & Turnbull, 2011). Additionally, we recognized the emerging field of behavioral neuroscience, which warrants attention. The only intersection we excluded was between psychoanalysis and behaviorism, as these research traditions have traditionally remained separate.

3.6. Temporal "breaks" and syntaxes

We conducted the search every three years, starting from 1979. This approach was similar to that used by Spear (2007). Although the search was planned to conclude in 2018, we also included the year 2020 to capture the most recent trends. Our search utilized the seed term along with its best descriptors, employing a disjunctive operator between them. We specifically focused on the mentioned sources within specific field codes. Appendix B provides detailed information on the syntax used for the search (see https://osf.io/dk52w/?view_only=58010522a7d643fd958320dafeb45258).

Furthermore, our analysis did not rely on raw counts of subdiscipline-laden papers per year in a specific source. Instead, we calculated the proportion by comparing the number of sub-discipline-laden papers to the total number of papers published in the same source during the same year. For instance, if journal X published 200 papers in 1983 and 50 of them were categorized as "cognitivist" papers, the proportion of cognitivist papers in journal X for 1983 would be 25%. We applied this approach to all sources and, in the case of highly influential journals, we averaged the percentages across the four sources to obtain a single percentage per year per subdiscipline.

4. Results

Contrary to the perceptions of previous research, our findings indicate that the trends in the investigated subdisciplines are more diverse, contrasting, and stable over time (see Fig. 2). While other research may have suggested dramatic or rapid growth or decline in certain subdisciplines, our analysis does not support such conclusions.[12] Instead, we observe that cognitivism and neuroscience consistently emerge as major trends in all three sources, although their relative importance varies. The significance of pure behaviorism has declined steadily over time and is now diminished in all three sources. Psychoanalysis, although marginal in general, continues to exert a notable influence in NEP. The majority of intersection are found to be insignificant in all three sources, with proportions consistently below 1% or occasionally slightly higher. The only noteworthy exception is the intersection between cognitivism and neuroscience, and to a lesser extent, the

[11] Please note that the online version of JCR only includes tabulations of IF after 1999; in order to get the past data, we had to find the scanned paper version of JCR from 1979 to 1999. Note that we could not find the JCR for 1977 and 1978.

[12] However, note that previous research investigated trends earlier than 1979, capturing the shift from behaviorism to cognitivism. Tracy et al. (2004) argued that this transition began in the early 1970s. The relative significance of the different "schools" may have stabilized by the 1980s, leading to a state of equilibrium as emphasized in the present study.

Table 1
Highly influential journals in Psychology.

Psychological Review
Annual Review of Psychology
Psychological Bulletin
Psychosomatic Medicine
Journal of Comparative and Physiological Psychology
Progress in Psychobiology and Physiological Psychology
Journal of Experimental Psychology: Animal Behavior Processes
American Psychologist
Contemporary Psychology
Behavioral and Brain Sciences
Cognitive Psychology
Psychotherapy and Psychosomatics
Neurobiology of Learning and Memory
Psychological Medicine
Annual Review of Clinical Psychology

Note. The table lists all the journals having been at least once in the top four IF ranks from 1979 to 2020 in the category Psychology of the JCR. Having based our analysis every three years we did not investigate each single one of the listed journals. Note also that Progress in Psychobiology and Physiological Psychology, likely due to a bug, was not accepted as a journal source in PsycInfo, so we had to exclude its contributions in 1982 and 1988.

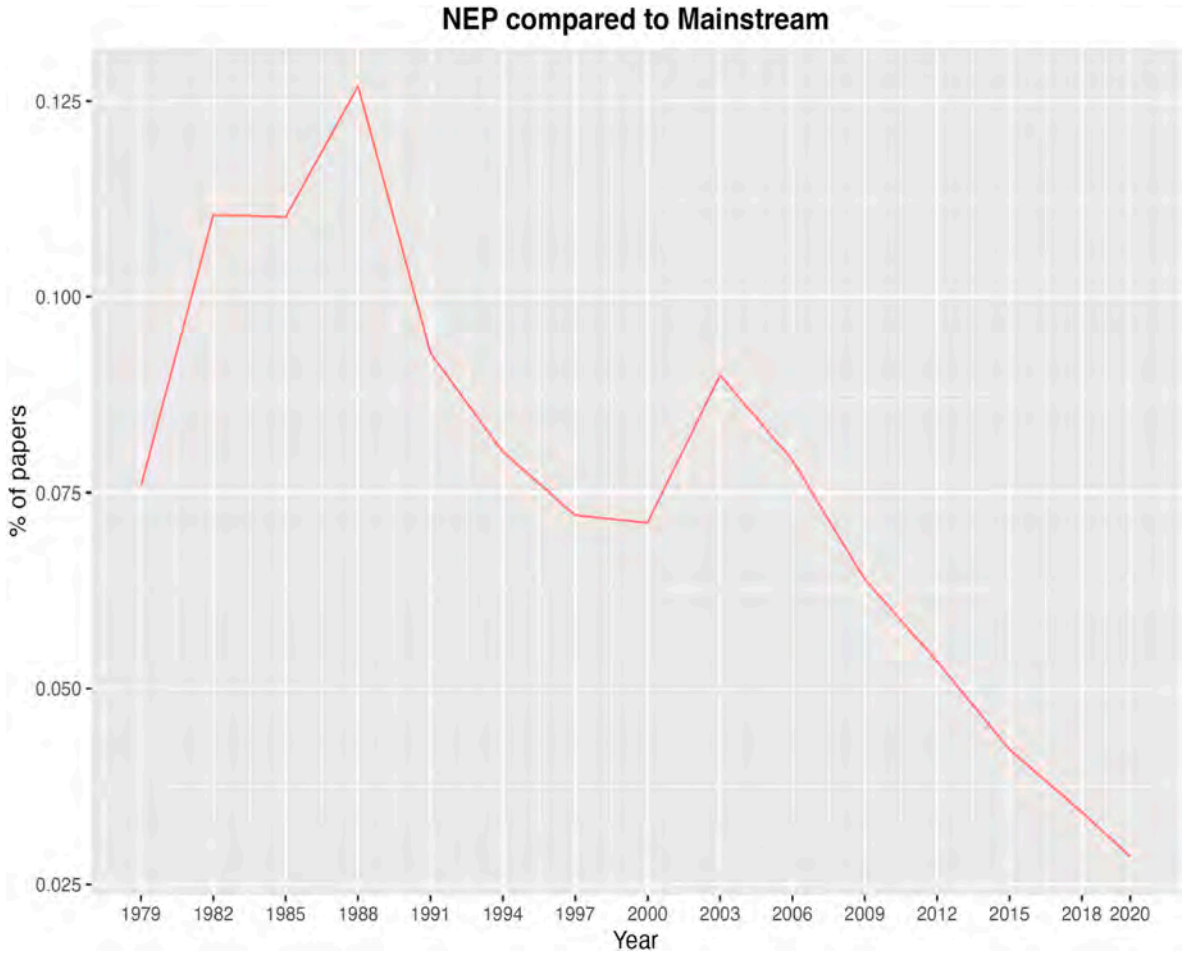

Fig. 1. Non English Papers compared to Mainstream Psychology
(see Appendix D,https://osf.io/dk52w/?view_only=58010522a7d643fd958320dafeb45258).

intersection between behaviorism and neuroscience. We focused solely on cognitive neuroscience in our plotted analysis, excluding behavioral neuroscience, which maintained a stable representation of 1% throughout the entire period investigated in MP. The exclusion of behavioral neuroscience was done to avoid introducing unnecessary complexity and potential confusion in the figure. However, for those interested, an additional graph depicting behavioral neuroscience can be found in Appendix D, as long as all detailed results (https://osf.io/dk52w/?view_only=58010522a7d643fd958320dafeb45258).

These findings challenge previous perceptions and provide a more nuanced understanding of the trends within the field. The results will now be discussed in more detail, categorized according to the different sources: MP, HIJ, and NEP.

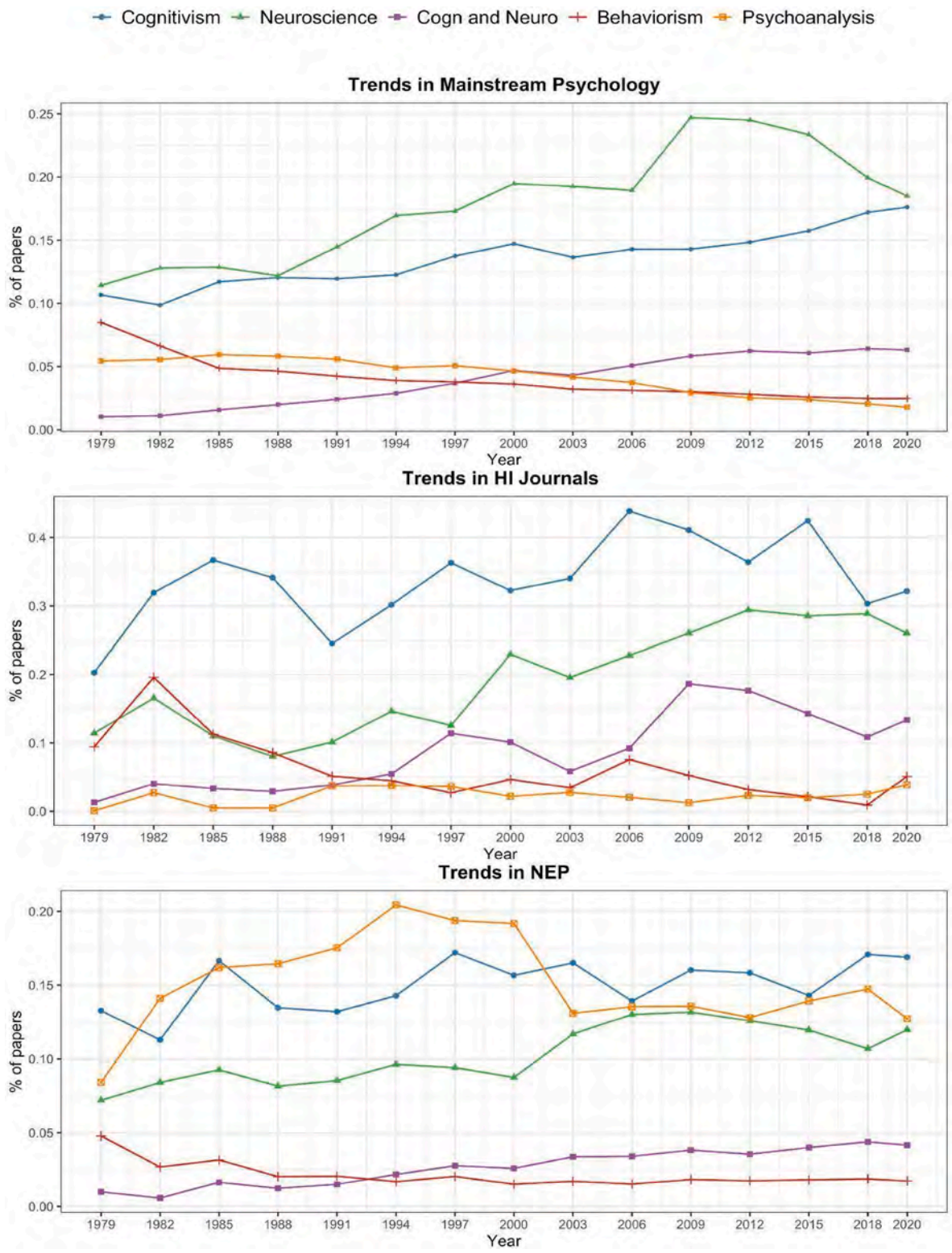

Fig. 2. Trends in psychology.

4.1. MP

In all peer-reviewed journals indexed in PsycInfo (labeled MP), trends are more regular and less scattered than in the other sources. That can be attributed to the larger number of papers included in the analysis (median: 55,580 papers per year, mean: 82,590.4 papers per year, sd: 54,985). There is also less variation between subdisciplines within this source. The dominant trend in mainstream psychology is neuroscience, which has held its dominance since the late 1970s. Starting at around 10% in 1979, neuroscience reached a plateau of 25% between 2009 and 2015, and then gradually declined to 20% in 2020. Cognitivism has shown a steady growth, starting at 10% and converging with neuroscience at 20% in 2020. Neurocognitivism has experienced growth as well, starting from nearly 0% and reaching slightly above 5% in 2020. On the

other hand, behaviorism had significant representation in 1979 (approximately 10%), but it has steadily declined and is now slightly above 0%. A similar declining pattern can be observed in psychoanalysis, with its initial representation starting at approximately 5%.

4.2. HIJ

From 1979 onwards, the cognitive school has been the most dominant subdiscipline and has consistently maintained its position without being surpassed by any other subdiscipline. It exhibits a steady but unstable growth, increasing from 20% in 1979 to approximately 30–35% by the end of the 2010s. In contrast, neuroscience has shown a more straightforward upward trend, starting at around 10% in 1979 and seemingly reaching a plateau of about 30% by the end of the 2010s (three times its original value). The steepest growth for neuroscience occurred at the end of the 1990s and the beginning of the 21st century. In recent years (2018 and 2020), neuroscience and cognitivism have demonstrated similar levels of relevance within this source. The neurocognitive approach, at lower percentages, mirrors that of cognitivism. However, in highly influential journals, almost 15% of contributions in 2020 can be categorized as neurocognitive- a significant proportion.

While behaviorism remained significant until the late 1980s (10–20%), it steadily declined and stabilized at less than 5%, although there is a small increase in 2020. Psychoanalysis has consistently remained marginal in highly influential journals during the period under investigation, with representation approximately lower than 5% or at best 5%.

It is important to note that these trends are heavily influenced by the selected sample, with a median of 155.5 (mean of 295.7) total papers investigated per year in highly influential journals (sd: 298.57).

4.3. NEP

In NEP (median of papers investigated per year: 4238; mean: 5023, sd: 2198), psychoanalysis initially held a significant position at around 10% in 1979, making it the most prominent approach until 2000 when it reached approximately 20%. After 2000, there was a slight decline, and it consistently remained slightly below cognitivism, stabilizing at around 15% until 2020. Cognitive psychology maintained a consistent presence at approximately 15% from 1979 onwards, without showing any clear signs of increase or decrease. Neuroscience began slightly below 10% in 1979 and gradually increased, particularly in the early 2000s. It reached a plateau of about 12% between 2006 and 2009 before decreasing to approximately 10% in 2020. Neurocognitivism experienced steady growth, starting from virtually non-existence in 1979 and reaching 5% in 2020. Behaviorism steadily declined from around 5% to becoming virtually non-existent after 2000.

5. Discussion

Overall, our findings provide a fresh and nuanced understanding of trends in Psychology. They align with previous research in observing the decline of behaviorism and psychoanalysis. The declining trends have been acknowledged in earlier studies (Robins et al., 1999; Tracy et al., 2004; Spear, 2007), and our results can be seen as the continuation of this ongoing process (Robins et al., 1999; Tracy et al., 2004; Spear, 2007). Additionally, our findings confirm the prominence of cognitive psychology, consistently with previous research.

However, many relevant differences can be appreciated: first, *the importance of neuroscience has been underestimated*. With the expanded set of keywords, our analysis reveals that neuroscience has consistently been the most dominant field in MP since 1979. It is important to note that MP represents a reliable and representative source, given its extensive coverage. The trends observed in this source exhibit a smoother pattern over time, making them more interpretable. Dominance of neuroscience is also observed in the other two sources - even though less markedly. The most significant growth of neuroscience appears to have occurred in the late 1990s (often referred to as "the decade of the brain") and the early 2010s. However, it is worth noting that neuroscience seems to have reached a plateau around 2009–2012 and is currently showing a gradual decline.

Cognitivism emerges as the other major trend in psychology, particularly in HIJ. In recent years, the contributions of cognitivism and neuroscience show a convergence in terms of their significance. It is important to note that the rise of cognitivism likely occurred before 1979, as previous research suggests (Robins et al., 1999; Tracy et al., 2004; Spear, 2007). Over the 40-year period investigated, cognitivism appears relatively stable with a tendency for growth. Additionally, the emergence of neurocognitivism, which combines cognitive and neuroscientific perspectives, is evident in all three sources, positioning it as the third most significant trend after cognitivism and neuroscience (excluding NEP, where it is the fourth). This trend highlights the increasing influence of research informed by both cognitive and neuroscientific frameworks.

Psychoanalysis, although not significant in MP and HIJ, has demonstrated dominance in the realm of NEP, and continues to hold significance, albeit with a slight decline. This finding suggests that psychoanalysis may be more closely associated with applied psychology, as explored in the concept of professional psychology (Henriques, 2019; Yang & Chiu, 2009).

It is likely that professional psychology is more connected to local languages and communities, with authors in peripheral/non English psychology aiming to communicate with their local audience rather than seeking international recognition and career advancement (López-Navarro et al., 2015). The discrepancy observed may also be attributed to the notion that psychoanalysis has transitioned from a generative theoretical approach to a practice lacking novel and testable predictions. In other words, it has shifted from being a progressive research program to a degenerative research program (Lakatos, 1978). Nevertheless, psychoanalysis appears to maintain its relevance in clinical practice.

Our study highlights the importance of considering different sources in assessing the relevance of various trends. While cognitivism is highly regarded in influential North American psychology, its significance is relatively limited in mainstream psychology and NEP. Similarly, although psychoanalysis may have marginal scientific/empirical significance, its contributions are more evident when considering NEP. Eventually, the contrast between theoretically laden and non-theoretically laden psychology is evident in our findings. Fig. 3 illustrates this contrast by rescaling the y-axis to show the proportion of theoretically laden contributions relative to the whole.

It is clear that theoretically laden contributions make up a minority portion of the overall figure. Even when considering cognitivism and neuroscience as a combined subdiscipline, the proportion of theoretically laden contributions remains below 40% of the total.[13] These findings suggest that a significant portion, if not the most important part, of Psychology is not heavily theoretically laden but rather focused on the applied side (Henriques, 2019; Yang & Chiu, 2009). It also indicates that Psychology as a discipline remains nonparadigmatic or pre-paradigmatic (Cronbach, 1957; Friman et al., 1993; Heidbreder, 1933; Henriques, 2011; James, 1894; Kuhn, 1962/1996; Miller, 1985; Koch, 1993; Robins et al., 1999; Tracy et al., 2004; Spear, 2007; Vygotsky, 1927/2004; Toomela, 2020; Zagaria et al., 2020).

A recent study has suggested that the identity of Psychology may be

[13] Our investigation into other important intersections, such as cognitivism and behaviorism, cognitivism and psychoanalysis, neuroscience and psychoanalysis, and behaviorism and neuroscience, has consistently shown that their contributions are not significantly higher than 1%. Therefore, based on these findings, we can confidently state that no other OR conjunction is likely to be more relevant than the conjunction of cognitivism or neuroscience.

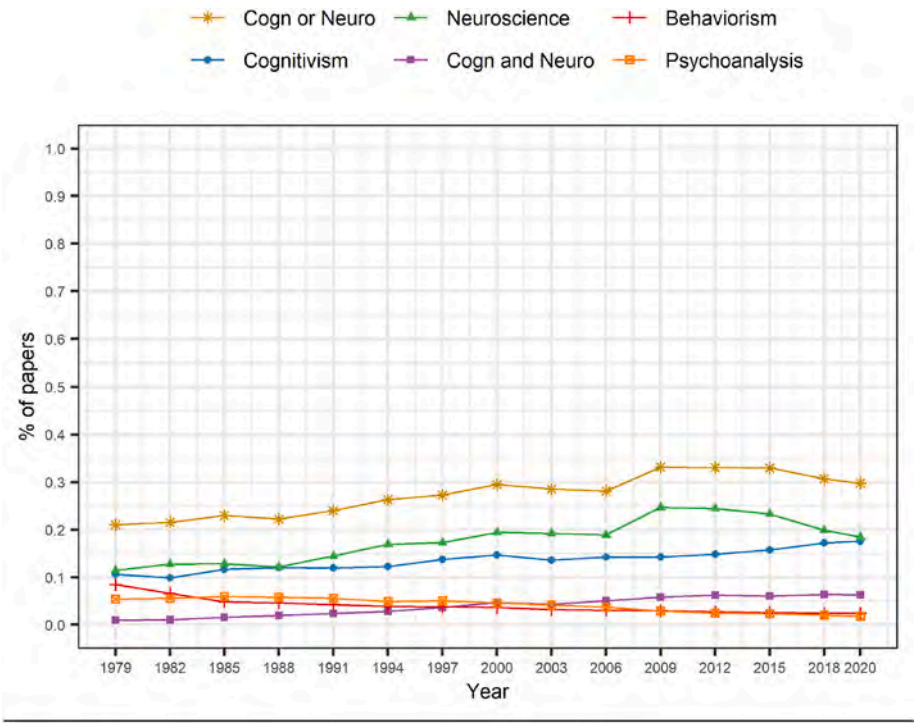

Fig. 3. Trends in mainstream Psychology rescaled.

sought not so much within its own domain but rather outside of it, specifically by considering it as a "hub science" between medicine/biology and the social sciences (Boyack, Klavans, & Borner, 2005; Cacioppo, 2007).

An interesting finding of our study is the limited significance of intersections between subdisciplines, with the exception of the intersection between neuroscience and cognitivism and to a lesser degree behaviorism and neuroscience. This observation challenges the notion of "eclecticism" or "interdisciplinarity" within Psychology and supports the view that Psychology tends to be a discipline characterized by strong insularity and limited communication between different schools of thought (Kiselica & Ruscio, 2014). Each school of thought appears to be predominantly focused on its own perspective and approaches, reinforcing the disciplinary boundaries within Psychology.

We should also note that the IF metric is substantially significant because trends in four journals only (HIJ) are approximately similar to that of a way larger database (MP). That proves these journals are influential and in line with the broader scientific audience. If four other journals from the sample of peer-reviewed journals were selected by chance and the same analysis on the evolution of trends (with the selected keywords, etc) had been run, we had probably obtained results very different compared to mainstream psychology.

If we try to unravel the implications of these results and envision what they suggest for the future of psychology, they likely indicate that the times are not yet ripe for a Kuhnian revolution. Upon deeper reflection, this might be linked to the fact that the two largest current scientific perspectives, namely cognitivism and neuroscience, are primarily descriptive approaches. In other words, neuroscience or cognitivism rarely answer all Tinbergen's (1963) four questions about *a)* the ancestral/phylogenetic function of a psychological mechanism, *b)* its phylogenetic history after arising, *c)* its development over the course of life, and finally *d)* how it functions in the present. Very often, neuroscience and cognitivism focus only on answering questions *d)* and sometimes *c)*, remaining somewhat incomplete.

Additionally, and complementarily, we believe that a reason preventing the unification of psychology is the reluctance of most researchers towards deep theoretical reflection, at the expense of frantic data collection and empty methodology, which often yield publishable but not theoretically significant outcomes. This situation becomes even more delicate today, given the implicit mandate of "publish or perish." In fact, an additional insight derived from our analysis is the average number of papers indexed on PsycInfo published daily (averaged over the period 2015–2020): 436.7, which means 159395.5 annually (see Appendix D). It is challenging to fathom the significance of each of these papers for Psychology.

In essence, the maturity of psychology as a science may be hindered by the following factors: the insufficient attention given to evolutionary explanations, the reliance on methodology without a robust theoretical foundation and the "publish or perish" culture in academia. Naturally, addressing these three deficits may be useful to enhance the current state of psychology.

6. Limitations

It is important to address the limitations associated with the chosen operationalization. Pettit (2016) highlighted several inherent limits of using a bibliometric approach to study history. Firstly, the focus on print culture may not encompass all aspects of culture in general. Other forms of communication, such as oral traditions, may play a significant role. Secondly, the concept of "continuous" interpretation, which emphasizes gradual changes over time, is favored over an "eventful" history where significant events mark qualitative shifts. Thirdly, words and phrases can change meaning across different contexts and time periods. This linguistic variability can introduce challenges in accurately interpreting and categorizing research contributions, particularly when examining trends over an extended period. Changes in terminology or shifts in the understanding of certain concepts may influence the prevalence and interpretation of different perspectives within psychology. Lastly, when considering prevalence in terms of what is considered "relevant" or "irrelevant," there are no absolute thresholds or universally agreed-upon benchmarks. The selection of time periods for analysis is also subject to some degree of arbitrariness, as different timeframes may yield different results and interpretations.

However, we believe that scientific endeavors, unlike other forms of

culture mentioned by Pettit (2016), are inherently intertwined with their written content. This close connection between scientific research and written publications supports the validity and relevance of our bibliometric approach. Additionally, it is worth noting that Pettit himself acknowledged that when the smoothing is set to zero (as in our case), prevalence spikes can be utilized to infer special events.[14] This has been demonstrated in studies by Robin and colleagues and Tracy and colleagues, who recognized that the unusual spike in behavioristic contributions in 1992 was attributed to the American Psychologist articles commemorating the death of B.F. Skinner (Robins et al., 1999; Tracy et al., 2004) .[15]

Furthermore, we acknowledge that words and phrases can change in meaning over time. To address this concern, we employed an official and controlled lexicon, specifically the APA Thesaurus. By using a standardized and authoritative resource, we aimed to minimize the potential impact of semantic shifts on our analysis.

Lastly, it should be noted that our interpretations primarily relied on relative comparisons rather than absolute comparisons. By examining the proportions of trends in relation to each other and to the total contributions, we aimed to understand the relative dominance and changes in the field of psychology over time. In addition, we justified our choice of starting data in 1979 as it aligned with the first issue of the SSJCR. Burman (2018) provided further support for this choice by suggesting that the "index terms" derived from the APA Thesaurus became significantly descriptive only after the 1960s.

Another potential limitation of our study pertains to our operationalization of normal science and scientific revolution, based on Kuhn's theory (Kuhn, 1962/1996). It is important to acknowledge that we employed a somewhat simplified version of Kuhn's concept of "paradigm". Scholars familiar with Kuhn's work know that the concept of "paradigm" is complex and can be applied to both micro and macro research traditions (Kuhn, 1962/1996, ch. V). In our study we adopted a broader understanding of paradigm, specifically related to the state of normal science, where "puzzles" are solved and the underlying theory and methodology are no longer subject to debate (Kuhn, 1992/1996).[16] Hence, our interest lay in exploring whether a particular perspective had dominated others, rendering Psychology a "normal science."

It is worth noting that alternative operationalizations of the paradigm concept and subdisciplines have been proposed in other disciplines (Burmaoglu and Saritas, 2019; Lietz, 2020). However, none of these operationalizations were specifically designed to address psychological issues, and each of them involves a certain degree of arbitrariness, similar to our approach. Additionally, the concept of research program, as proposed by Lakatos (1978), has been advocated as a useful heuristic for studying trends in Psychology (Robins et al., 1999; Tracy et al., 2004). Nevertheless, we chose to adhere to the broad concept of a Kuhnian paradigm due to its simplicity, theoretical elegance, and acceptance in psychological studies (but see Driver-Linn, 2003).

Looking at the methodological issues, we do acknowledge that the search by keywords approach presents many limitations. The search by keywords brings with itself some implicit assumptions:

1 the presence of a given keywords means that the paper is "theoretically laden" (i.e., problem of false positives)
2 the field codes selected could be too inclusive or too exclusive
3 the set of keywords could be both too inclusive or too exclusive

We do believe, however, that our systematic approach in selecting the keywords has reached its goal, and that the field selected were rationally based and consistent.

Furthermore, our connection between NEP and "peripherality" may raise some concerns. Nonetheless, alternative approaches to operationalizing this concept are likely to encounter even greater challenges. For instance, relying on the content of publications, particularly hyper-specialized ones like mathematical psychology or philosophical psychology, to define the "periphery" would introduce even more subjectivity. Similarly, employing influence metrics such as low impact factor would yield a diverse collection of papers, encompassing those that are overlooked due to being out of trend, excessively specialized, or of lower quality, resulting in significant overlaps among these categories. Furthermore, utilizing cross-citation analysis to operationalize the periphery, focusing on journals with limited citations to and from other publications, would be insufficient as it would predominantly capture hyper-specialization rather than peripherality. Instead, we advocate for the utilization of non-English operationalization, despite its imperfections, as it effectively captures a fundamental aspect of center-periphery dynamics (refer to the "NEP as an independent field of investigation" section).

A reader sensitive to qualitative dynamics could object more radically that, despite these clarifications, our analysis does not investigate historical trends but rather the rise or decline of specific language associated with particular subdisciplines. It is impossible to have the definitive word on this matter (as is the case with any operationalization in psychology). However, in the spirit of consilience initiated by Wilson (1999), we would like to emphasize that our results align with previous studies, including those on trends (Friman et al., 1993; Robins et al., 1999; Spear, 2007; Tracy et al., 2004), those highlighting the lack of interdisciplinarity (Kiselica & Ruscio, 2014), as well as with studies using topic modeling that demonstrate the prominence of neurobiology (Bittermann & Fischer, 2018; Wieczorek et al., 2021) and the marginalization of psychoanalysis in the scientific lexicon (Wieczorek et al., 2021).[17]

7. Conclusion

Taking a more speculative and substantial perspective on the history of Psychology, it can be inferred from the current data that over the past 40 years, the major scientific discourses have predominantly centered around the brain. Many recent studies (Bittermann & Fischer, 2018; Tracy et al., 2004; Yeung, Goto, & Leung, 2017; Wieczorek et al., 2021) suggest an increasing importance in neuroscience within Psychology and more widely across all natural sciences, and Benjafield (2020) highlights how the vocabulary of Psychology is more dependent on Biology than vice versa. These observations suggest an imbalance favoring biologically-based theories over emergentist/spiritualistic ones, although it does not necessarily imply a complete endorsement of materialism by neuroscientists. Rather, it might signify only an *informal*

[14] On Google Ngram, which is the bibliometric tool mentioned by Pettit, a smoothing function is indeed applied. This function helps to reduce noise and provide a more accurate representation of the data. However, in our particular case, we did not make use of any smoothing functions.

[15] A similar post-hoc investigation of qualitative shift has been done by Burman (2018) in his analysis of PsycInfo history.

[16] It must be noted that on his own admission Kuhn was prompted to study the passage from pre-paradigmatic to paradigmatic science when he was invited to the "Center for Advanced Studies in the Behavioral Sciences" at Berkeley and he faced a dazzling theoretical and methodological chaos. He stated: "somehow, the practice of astronomy, physics, chemistry or biology normally fails to evoke the controversies over fundamentals that today seem endemic among, say, psychologists or sociologists. Attempting to discover the source of that difference led me to recognize the role in scientific research of what I since called <<paradigm>>" (Kuhn 1962/1996, p. ix-x).

[17] An inattentive reading may give the impression that psychoanalysis is the most prevalent topic. Although psychoanalysis may have the highest prevalence among these "micro" topics, its prevalence is ultimately similar to that of the Item Response Theory as a standalone psychometric methodology (in other words, psychoanalysis is as important as a subtopic of psychometrics). If we imagine aggregating all the subtopics into broader clusters, the prevalence would likely be similar to ours.

inclination towards biologically-based explanations. It is noteworthy that psychological researchers rarely adopt a clear ontological standpoint on "mind" and "behavior" and generally avoid extensive engagement with philosophical and theoretical issues (Henriques, 2011; Zagaria et al., 2020).

All things considered, the enduring and relatively stable patterns observed over a 40-year period are indicative of the robustness and vitality of Psychology as a discipline. These patterns demonstrate that the theoretical assumptions regarding the mind have exhibited relative stability over an extended duration.

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This article does not contain any studies with human participants or animals performed by any of the authors.

Consent for publication

All the authors mentioned in the manuscript have agreed for authorship, read and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.

CRediT authorship contribution statement

Andrea Zagaria: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization. **Luigi Lombardi:** Formal analysis, Investigation, Methodology, Software, Validation.

Declaration of competing interest

Andrea Zagaria declares that he has no conflict of interest. Luigi Lombardi declares that he has no conflict of interest.

Data availability

https://osf.io/dk52w/?view_only=None

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