

**The Research Field of Translational Psychological Treatment: A Bibliometric Analysis
of Strengths and Weaknesses**

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Abstract

Psychotherapy researchers have emphasized the importance of a paradigm shift toward translational psychological treatment. However, the publication landscape on this topic is uncharted. This makes it difficult to assess the state of translational psychotherapy research. Hence, we developed a framework that leverages machine learning to find relevant studies. Based on this, we bibliometrically analyzed 682 publications to provide insights for the integration and development of the research field. Specifically, citation and network analyses were performed to examine the strengths and weaknesses of the research field. Six main findings emerged: 1. Machine learning proved valuable in finding eligible publications and generating an open dataset. 2. Translation comes primarily from physiological psychology/neuroscience and experimental psychology, with a focus on fear and anxiety. 3. Translational research is characterized by international collaborations. 4. It has an impact within and beyond academia. 5. The lack of standardized terminology might threaten scientific progress. 6. There is thematic fragmentation in the field. To foster a paradigm shift towards translational psychological treatment, a consistent terminology would greatly facilitate its development and dissemination.

Keywords: translational research, basic science, screening automation, active learning, terminology

Introduction

Translational psychological treatment is a complex research field that aims to translate or transfer current findings or principles from basic research into innovative psychological interventions by optimizing and/or further improving evidence-based treatments and/or creating new treatment approaches („from laboratory to everyday life and treatment“) (Blackwell & Woud, 2022; Ehring et al., 2022; Richter et al., 2017; Stice & Jansen, 2018). During the last decades, extensive basic research has been conducted in clinical psychology, biopsychology, neuroscience, cognitive science, and psychological therapy (e.g., Gennaro et al., 2019; Horn et al., 2020; Krampen & Perrez, 2015; Richter et al., 2021; van den Hout et al., 2017). However, bridging the translational gap between basic research and psychological treatments remains a challenge. Beyond different traditional approaches to psychological therapy, treatment research still lacks a comprehensive conceptual translational framework that brings together the wide variety of basic findings, different models, perspectives, core ingredients and mechanisms of change towards improved translation to intervention, improved efficacy and effectiveness of psychological therapy, and improved translation to routine care (Emmelkamp et al., 2014; Hayes et al., 2020).

Despite the confirmed effectiveness of psychological treatment, some patients with mental disorders benefit only to a limited extent or not at all from the established treatment approaches (e.g., Cuijpers et al., 2016; Grawe et al., 2001; Hofmann et al., 2012; Lambert, 2017). Approximately one-third to one-half of all patients in psychological treatment must be classified as nonresponders, and response rates for the most common disorders such as depression rarely exceed 50% (Lambert, 2017). Translational psychological treatment is driven by the vision that treatment can be optimized by incorporating findings from basic research (e.g., experimental psychopathology) and by focusing on the underlying psychological processes and mechanisms of change. Although there is still not enough

research on mediating and moderating factors (e.g. therapeutic alliance, nonspecific and specific factors) and their chronological sequence (Hofmann et al., 2020; Kazantzis et al., 2018; Kazdin, 2007), a more rigorous consideration of these factors and processes has the potential to improve treatment approaches (Rief et al., 2022). In addition, the transferability of the evidence-based findings to routine care, as well as dissemination and implementation into daily routine care, are issues that have hindered translational psychotherapy¹ research to date and need to be addressed (Clark, 2018). Of note, the quality of the exchange between basic science and application can also be seen as a sign of maturity of a scientific field in general.

Therefore, psychotherapy researchers have emphasized the importance of a paradigm shift towards translational psychological treatment that takes into account the complexity of underlying individual psychological processes, etiological factors, and mechanisms, and allows for flexible, integrative evidence-based treatments beyond the orientation to different traditions of psychological therapy, but with general concepts of necessary treatment competencies (Grawe, 2004a; Hayes & Hofmann, 2018; Thoma & Abbass, 2022). Given the potential benefits of translational research for psychological treatment on the one hand, and its poor implementation in research practice on the other, the PsyChange Network has been established. This collaborative network encompasses several independent but interrelated projects such as enhancing networking between scientists in basic and treatment research as well as developing new paradigms of psychological treatment based on translational research.

Background

¹ In this manuscript, we will use the term “psychotherapy” as a synonym to “psychological treatments”. We are aware that the English term “psychotherapy” is sometimes used for very specific treatment approaches, but internationally, the translation of “psychotherapy” is the more often used term compared to “psychological treatments”.

The term *translational research* has been widely used and applied in the scientific literature for more than two decades. A systematic review by Fort et al. (2017) indicated a consensus-based five-phase definition of translational research, which includes 1) processes of basic research in humans, 2) translation of basic research into pilot testing in humans, 3) translation into effective treatments and clinical guidelines, 4) implementation and dissemination research and 5) outcome and effectiveness studies in populations. In (bio) medicine, translational research has become an important concept for the implementation of basic research into effective forms of treatment („from bench to bedside and back again“) (Drolet & Lorenzi, 2011). Since the turn of the 21st century, the number of publications has increased abruptly and translational research constitutes an established area in (bio) medical research (e.g., Butler, 2008; Krueger et al., 2019; Roberts et al., 2012; Rubio et al., 2010). In psychiatry, a similar trend to translational research can be observed (e.g., Fulford et al., 2014; Onitsuka et al., 2022), which is also documented by the founding of the journal *Translational Psychiatry*. In psychological treatment, translational research is proceeding more slowly compared to the dynamic development in psychiatry and other (bio)medical research (e.g., Butler, 2008; Rubio et al., 2010; Roberts et al., 2012; Krueger et al., 2019).

Translational research in clinical psychology investigates psychological processes underlying the development and maintenance of psychopathology to foster the development of innovative psychological interventions and evidence-based treatments for mental disorders (Ehring et al., 2022; Stice & Jansen, 2018). Translational psychological treatment can also be defined as *reciprocal* translation in which not only findings from basic research are translated into clinical practice, but also vice versa from clinical practice into (laboratory) experimental paradigms (Richter et al., 2017). Translational approaches to transfer basic findings from experimental studies or paradigms into clinical applications or interventions (e.g.,

interpretation training to target negative repetitive negative thinking) exist for various mental disorders (e.g., Glashouwer et al., 2018; Hirsch et al., 2018; Kessler et al., 2018).

However, only few overviews on the translation of principles from basic research to psychological treatments exist. Krampen and Perrez (2015) scientometrically analyzed the publication output of clinical psychology and treatment research between 1980 and 2014 in Anglo-American and German-speaking countries. Overall, clinical psychology publications dominated the total publication output of psychological research (> 40%). More similarities than differences between both country communities were evident. However, the relative proportion of publications on psychological treatments was considerably higher in German-speaking regions, whereas in Anglo-American countries more contributions on health psychology and behavioral medicine were found. The intradisciplinary integration of the clinical psychology literature was characterized by a high import from other subdisciplines of psychology (Krampen & Perrez, 2015).

A recent review by Ehring et al. (2022) examined the translation of basic clinical research (biological, cognitive, behavioral) into effective psychological treatments. Forty evidence-based psychological treatments recommended in the current APA's Division 12 and the clinical NICE guidelines for five major groups of mental disorders (depression, anxiety disorders, substance disorders: alcohol, drugs; schizophrenia) were considered. The strength of the link between basic research (i.e., evidence-based testing of theoretical models prior to treatment development) and treatment development was analyzed. Only 25% of treatments showed a very strong link between basic research and treatment development (e.g., behavioral activation for depression, exposure for specific phobias, cognitive-behavioral therapy for panic disorder), and further 20% showed a strong link (e.g., acceptance and commitment therapy, mindfulness-based cognitive therapy for depression, cognitive-behavioral therapy for social anxiety disorder). These findings suggest an insufficient

translation from basic research into clinical innovation. Ehring et al. (2022) propose an increased attention to robust and replicable research findings, a stronger focus on experimental psychopathology, a stronger emphasis on mechanisms of change and moderators of clinical interventions, increased attention to clinical subgroups, and an emphasis on improving existing interventions rather than developing new ones.

One reason for the relative paucity of overviews on translational psychological treatment may be the difficulty of finding them. In a special issue on “Translating Basic Science into Clinical Practice” (edited by Stice & Jansen, 2018), only five of the eleven articles (including the editorial) use the term “translation” (or grammatical variants) in either title or abstract. The term “basic” is used in only two publications. A search for “basic” in the author keywords would have retrieved only one of the articles, while “translation” was included in none of the author keywords. From the perspective of information retrieval, this raises the questions 1) How can the status quo of research on translational psychological treatment be assessed if it is not clear how to find respective studies? and 2) How can the field move forward if the construct itself is not referred to in a consistent manner?

To the best of our knowledge, there has been no systematic approach to the exhaustive identification of translational psychological treatment publications. Furthermore, there is no comprehensive overview of the relevant research landscape. Therefore, a bibliometric topography is needed in order to assess the status quo of research on translational psychological treatment in terms of publication volume, terminology, research networks, fragmentation, and impact. This would help to identify barriers at the very beginning of the research cycle (“information phase / literature search”) and the very end (“publication phase”). Such a *structural* overview can provide useful insights for the integration and development of the research field and paves the way for subsequent in-depth literature reviews.

Aims

The aims of the current study are twofold:

1. To map the research landscape of translational psychological treatment bibliometrically
2. To explore the strengths and weaknesses of the field from a bibliometric perspective

To map the research landscape, we will examine publication volume, journals, regional differences, subfields of psychological science, and study methodology. This will provide an overview of the size and main characteristics of the research field. Regarding strengths and weaknesses from a bibliometric point of view, we will analyze citation impact levels, altmetric attention, and research collaboration networks, as well as the terminology and similarity of the publications. The inspection of terminological consistency (e.g., “translational” vs. “using basic science to develop interventions” vs. other phrasings) will reveal potential barriers in the retrievability of publications. Derived from publication similarity networks, a potential fragmentation of the research field into different, independent realms are of further interest, as disciplinary fragmentation could hinder scientific progress (Baliatti et al., 2015).

Method

Transparency and Openness

All datasets and code scripts for reproducing the analyses, as well as detailed information on software versions, can be found in the ESM at [link included after publication]. As we aimed to systematically search for eligible studies, we follow MARS and JARS guidelines for reporting (Cooper, 2018). This exploratory study’s design and its analysis were not pre-registered.

Methodological Rationale

We focused on publications that addressed the translation of knowledge from basic psychological science to psychological interventions. However, translational efforts are not always explicitly labeled as “translational research”, making database queries for finding eligible studies challenging: Searching explicitly for “translational” will increase the proportion of eligible studies in the search results at the cost of missing many relevant publications. Conversely, a rather broad query (e.g., “psychological treatment AND social psychology”) will yield many irrelevant results that cannot be screened individually. Furthermore, translational research can refer to different phases (see Fort et al., 2017). Here, however, only translation from basic science to interventions is of interest (not dissemination or effectiveness in populations). Finally, the semantic relationships in the wording of study abstracts that actually reveal the translation of interest (e.g., “drawing upon Theory X from social psychology, we developed an intervention”) pose a further challenge to non-semantic literature database searches.

To address this issue, we performed a systematic literature search at four levels of semantic granularity plus special issues, complemented by citation mining, and a reference list of relevant authors. To identify eligible records in the resulting pool of candidate publications without screening all the records, we employed machine learning to automate screening: We trained a classification model by manually screening a subset of the candidate papers to predict the inclusion probability of unseen records. This drastically reduced the screening time while maintaining a high recall, i.e., finding all papers of interest without screening the entire candidate pool (Burgard & Bittermann, 2023). Figure 1 illustrates our approach in a modified PRISM chart, which is briefly described in the next section, and, in more detail, in the ESM.

Data

Inclusion and Exclusion Criteria

The current study's subject of interest is the translation of basic science into psychological interventions. We included journal articles and dissertations providing

- evidence of a basic psychology construct (theory, model, concept) being used to (further) develop, apply, test, evaluate, or improve a psychological treatment, training, or intervention,
- evidence of psychotherapy research or clinical psychology (disorders) being used to (further) develop or test theories, models, or constructs of basic psychology, or
- general research methodological or theoretical considerations for translational research in psychology (including other subfields than clinical psychology).

Accordingly, we excluded publications that did not deal with psychological treatment or translation from basic science, false positives (e.g., translational abstracts, language translation), and books.

Identification: Search Strategies

We performed a systematic literature search in the psychology-specific reference databases *PsycInfo* (produced by the American Psychological Association; APA) and *PSYINDEX* (produced by ZPID – Leibniz Institute for Psychology, Germany) in September 2022. A total of 153,687 records were retrieved, which were supplemented with 458 publications from special issues on translational research. All search queries are provided in the ESM. To complement our search strategy, we used citation mining (also referred to as snowballing in systematic literature studies) of a recently published review article (Ehring et al., 2022) to find papers that may not have been detected by our search queries.

These two sources (i.e., database queries and citation mining) were considered for training the Rayyan machine learning classifier (Ouzzani et al., 2016; “Prediction & Active Learning” in Figure 1). In addition, we gathered all 6,224 publications from a list of authors

that were known to have published on the topic of translational psychological treatment (“Author reference list”). This list of authors was compiled by the authors of the current manuscript and is provided in the ESM. The one remaining source in Figure 1 is “other eligible papers”. These were papers found by the authors but not detected by the classifier, as well as relevant publications that were published in the meantime.

Screening: Manual Screening and Machine Learning

By manually screening the publications found with the explicit “translational” search, we generated a training dataset for the predictive machine learning classifier built into Rayyan. The reason for screening this subset of the systematic search is that most inclusions could be expected when searching for “translational” (and keywords related to psychological treatment) in the database, thus providing enough training data for the algorithm while keeping the screening workload to a minimum. The 1,847 records were blindly screened by three coders, yielding 246 inclusions (13.32%). To improve the prediction model, the training data was augmented by the 22 included references of Ehrling et al. (2022), along with six not yet included articles from a special issue, and 12 relevant publications known to the authors.

The resulting dataset of 286 inclusions and 1,601 exclusions was used to train the Rayyan machine learning classifier. Rayyan employs a support vector machine that “learns” the relationship between textual features of the publications and the inclusion/exclusion decision. Once the model is computed, inclusion probabilities are assigned to the unscreened publications. Screening is then continued with the most probable publications, with decisions being fed back to the algorithm to further improve the performance of the model (i.e., active learning). After two rounds of active learning, all further predictions with an inclusion probability of .9 or higher were automatically included (i.e., without manual screening; sample-based precision = .98 – see method details and Table S1 in the ESM). This model was

applied to two additional datasets (citation mining of reviews and special issues, as well as the complete author references list).

Included: Final Dataset and Metadata Retrieval

The final dataset consisted of 682 publications. Of these, 167 (24.49%) were not included in the initial results of the database queries. Although we performed a fairly broad systematic search, a quarter of all included studies could not be found using the database queries, demonstrating the difficulty of identifying publications on the topic of translational psychological treatment.

As the papers in our final dataset came from different sources, we used the APIs of OpenAlex, Semantic Scholar, and CrossRef to retrieve standardized metadata. As a proxy for impact outside academia, we analyzed altmetric attention. It is important to note that altmetric attention does not equal impact (Sugimoto, 2015). However, in the field of translational medicine, Llewellyn and Nehl (2022) found that altmetric attention can serve as an indicator of potential impact and translational advancement. All APIs were queried in November 2022. In addition, we collected the metadata “Methodology” and, for psychological subfields, “APA PsycInfo Classification Code” from PsycInfo and PSYINDEX.

Analytical Procedures

Regarding RQ1 (bibliometric mapping), all frequency analyses (publication volume, journals, regional differences, subfields of psychological science, study method) were carried out in the R programming language (R Core Team, 2022) and with the package *bibliometrix* (Aria & Cuccurullo, 2017). For network analysis, we used the free VOSviewer tool version 1.6.18 (van Eck & Waltmann, 2010) with default settings for network layout and clustering. VOSviewer allows for the construction and visualization of bibliometric networks. We analyzed three types of networks to address RQ2 (strengths and weaknesses):

First, we created a co-authorship network aggregated at the institutional level. In this way, the network reveals institutes that are both well connected (i.e., many collaborations) and impactful (i.e., large number of citations in our dataset). Second, we created a term co-occurrence network to get an overview of the publications' contents. Specifically, we were interested in whether the term “translational” was rather central in the network and well connected to other terms (i.e., it frequently co-occurs with terms from different research areas), or whether “translational” only co-occurred within a specific semantic space. Third, we inspected publication similarity using bibliographic coupling (Kessler, 1963): Two publications are coupled if they both cite a third reference. The more common citations two publications have, the higher the probability that both address the same subject. We utilized this approach to determine whether research on translational psychological treatment has a more homogeneous structure or is published in fragmented strands of literature.

Results

Mapping the Landscape

The year of publication of the 682 publications in the dataset ranged from 1982 to 2022. License information was available for 601 studies. Of these, 37.1% were published in open access. The total publication volume by year and open access is shown in Figure 2. The annual growth rate is 10.61%. The peak in 2018 can be explained by two special issues released in that year (Milton & Holmes, 2018; Stice & Jansen, 2018). The most common publication outlets for translational psychotherapy research are shown in Figure 3. *Behavior Research and Therapy* published 8.50% of the 682 publications in the corpus, followed by the *Journal of Consulting and Clinical Psychology* (4.11%) and the *Journal of Applied Behavior Analysis* (2.79%).

With regard to regional differences, Figure 4 shows the ten most productive countries. Most studies were published by authors from the United States (21.99%), followed by

Germany (12.17%) and the Netherlands (5.43%). Among the top ten countries, Belgium has the largest share of multiple-country publications (84.74% of the studies by Belgian authors), while most studies by authors from the United States are single-country publications (68.67%). The average proportion of multiple-country collaborations is 59.08%.

The most common psychological subfields are depicted in Figure 5. As publications can be indexed with multiple subfields, the network plot is based on the co-occurrence of subfields in the database metadata. Thus, circles are subfields (with their size being proportional to their overall frequency) and connections are co-occurrences (with their strength being proportional to the number of co-occurrences). Physiological psychology and neuroscience (9.77%), experimental psychology (5.89%), and health psychology (2.33%) are the subfields from which knowledge is most often translated into psychological interventions. The only subfield not connected to the network is “Educational Psychology”. A total of three studies from this subfield were included because they address general issues of translation in psychological science (see section “Inclusion Criteria”). As the APA database classification system is “designed to describe the content of the APA PsycInfo database, not the field of psychology” (APA, 2022), Figure 5 also shows other areas of psychological research that are not congruent with psychological subfields (e.g., “Non-Psychological Disorders”, which refers to physical and somatoform disorders, learning disorders, speech and language disorders, and environmental toxins). In terms of study methodology, our dataset falls into two main categories: Quantitative studies (51.22%) are the most common, followed by literature reviews (21.60%).

Strengths and Weaknesses

Research Impact and Collaborations

In order to examine the strengths and weaknesses of research on translational psychological treatment from a bibliometric perspective, we first examined the citation

impact (with citation data from December 2022). As shown in Table 1, papers on translational psychological treatment were most frequently cited by scientific articles within clinical psychology and treatment research (median = 12 citations). However, 74.62% of the publications were cited at least once outside of psychology (median = 2), e.g., in medicine ($M = 6.09$ citations, $SD = 24.00$, $max = 318$), computer science ($M = 1.15$ citations, $SD = 3.97$, $max = 63$), and biology ($M = 0.61$ citations, $SD = 6.34$, $max = 160$). According to altmetrics (December 2022), 13.93% of the publications were mentioned at least once in news outlets and 64.52% were mentioned at least once in tweets. The majority of tweets were posted by members of the public (81.09% of all tweets related to publications in the dataset).

The total citation impact and the collaboration patterns of involved institutes are shown in Figure 6: The larger the font size, the more citations of an institute (when correcting for the year of their publications). The highest (normalized) citation impact was observed for the University of Nevada, Reno (77.97 normalized citations; 8,354 total citations), followed by Boston University (54.39 normalized citations; 2,439 total citations).

The highest number of unique collaborations (i.e., *degree centrality* = the number of links in the network plot) was found for the University of Amsterdam ($n = 30$), followed by the University of California, Los Angeles (UCLA, $n = 29$). These two also had the highest number of publications in the dataset ($n = 35$ and $n = 34$) and the highest *betweenness centrality*: By dividing the number of shortest paths that pass through an institute by the total number of shortest paths, high values of betweenness centrality indicate institutes that connect subnetworks. With regard to Figure 6, the UCLA (betweenness centrality = 410.94) and the University of Amsterdam (218.40) can be interpreted as “bridges” between the USA and Europe (although there is no clear-cut distinction). A full table for all institutes in Figure 6 is provided in the ESM.

Terminology and Publication Similarity

Figure 7 shows a term co-occurrence network as a clustered density plot: terms that frequently appear together in titles and abstracts of publications are located in the same cluster (the six colored clouds). The term “translational research” is located at the bottom of the red cluster, beneath “translation”, “translational science”, and “basic research” (not visible in the static figure; see interactive version at https://t1p.de/translational_terms). The rather small fonts reflect the fact that only few publications use these terms explicitly in titles/abstracts: “translational” appears in 197 of the 682 titles and abstracts (28.89%), “basic science” or “basic research” in 69 (10.12%) titles/abstracts.

The red cluster (117 terms) refers to rather generic terms of research. The location of “translational research” in this cluster, close to the edge of the network, indicates that this term is poorly connected to terms in other clusters. In fact, “translational research” is only connected to two terms outside its cluster: “bpd” (bipolar disorder) in the yellowish cluster (23 terms; rather mixed topics) and “dcs” (D-cycloserine) in the green cluster (88 terms; disorders and experimental designs). Hence, three clusters are not connected to the term “translational research”: The blue cluster (65 terms; behavioral interventions), the purple cluster (13 terms; cognitive aspects of depression and anxiety), and the turquoise cluster (11 terms; behavior analysis). Please note that this does not mean that the phrase “translational research” is not used at all in publications of these clusters, but that “translational research” does not co-occur with representative terms of these clusters (only terms with a minimum frequency of ten are shown in the plot). In summary, among the more frequent terms in the dataset, “translational research” is mostly used in research on bipolar disorder and D-cycloserine.

This turquoise cluster is more distant from the others in Figure 7. This is reflected in Figure 8, which shows a density plot of a publication similarity network. Here, similar papers are juxtaposed, with “prototypical papers” highlighted with a larger font. Of note, a small

“isle” on the left is separated from the “main island” on the right. This indicates that the dataset contains a group of publications that are very similar to each other but different from the rest: Publications related to behavior analysis. This corresponds to the rather high proportion of articles published in the *Journal of Applied Behavior Analysis* (see Figure 3). In addition, 43 (6.30%) of all 682 publications in the dataset are not included in Figure 8 because no similar papers could be determined via bibliographic coupling. In addition to the insular publications on behavior analysis, this indicates a thematic fragmentation in translational psychotherapy research.

Discussion

The aim of this study was to bibliometrically map the research field of translational psychological treatment in order to identify its strengths and weaknesses. The main challenge that we encountered was at the very beginning of this study project: the collection of eligible publications. Studies that translated knowledge from basic psychological science to psychological treatments could not be reliably identified in literature databases using “translational research” or related search terms. Therefore, we presented a framework that leverages machine learning to find relevant publications. In the end, our dataset comprised 682 studies that we analyzed using bibliometric and network analytic methods. There were six main findings:

1. An open bibliographic dataset for translational psychological treatment

Powered by the OpenAlex project (<https://openalex.org/>), we provide our dataset of translational psychological treatment publications, along with metadata, as open data via [https://drive.google.com/file/d/1fwU_1fQOyg_b3nQMbHGfCg-gH4pRSfFx/; final repository link after review]. The dataset can be used to reproduce our results or for further research. The classification model in Rayyan is trained and can be used to automatically find translational papers in a new bibliographic dataset. For implementing a respective Rayyan

project, we provide information in the ESM on the studies used as training data along with instructions on how to import them into Rayyan. The training dataset can also be used for various machine learning classifiers.

2. Translation comes primarily from physiological psychology/neuroscience and experimental psychology, with a focus on fear and anxiety

Besides “clinical psychology”, most studies in our dataset were labeled by PsycInfo or PSYNDEX as “physiological psychology and neuroscience” or “experimental psychology“, indicating that these are the subfields where translation into psychological treatments occurs most frequently (see Figure 5). A dominance of physiological and neuroscientific research input was also found by Krampen and Perrez (2015) for the German-speaking countries. This is in line with the recent high prevalence of neuroscientific topics in psychological treatment research and clinical psychology (Gennaro et al., 2019; Richter et al., 2021). Moreover, the term co-occurrence network in Figure 7 revealed that the treatment of fear and anxiety disorders is a very common topic in the dataset. Many articles on this topic have a strong focus on the underlying physiological and neuroscientific processes (e.g., Kindt, 2018; Milad et al., 2014).

3. Translational psychotherapy research is characterized by international collaborations

Among the ten most productive countries with regard to publication output, the average proportion of multi-country collaborations was 57.76%. In recent years, international research collaboration has grown steadily in general science (e.g., Hsiehchen et al., 2018) as well as in psychology (Coccia & Bozeman, 2016; Kliegl & Bates, 2011). In psychotherapy research, international collaborations with samples from different countries promise cross-cultural insights and greater generalizability of findings (e.g., Orlinsky et al., 1999). At a more abstract level, one of the benefits of international collaborations may be higher quality

and more impactful research projects. Recent studies indicate that the level of economic development of the collaborating countries has a positive impact on the quality of the internationally co-authored journal articles (Thelwall et al., 2022). A closer look at the top ten countries in translational psychotherapy research reveals that all these countries show “very high human development” according to the Human Development Index (Human Development Reports, n.d.). Collaborations led by authors from developed countries were also found to have a positive effect on citation impact, which may be due to national differences in research funding (Zhou et al., 2020). This might indicate that the research field of translational psychological treatment is not only well connected internationally, but also of high quality and impact. While study quality was outside the scope of this study and remains to be examined, the impact is discussed in the next section.

The analysis of collaboration networks (see Figure 6) revealed the USA and Europe as core networks. Regional differences were found for single-country publications (highest share in the USA, Netherlands, Canada, and the UK) and for the mean publication year: German institutes have only relatively recently begun to publish on translational psychological treatment, but with notable output. However, the three most cited institutions are from the USA (when correcting for publication year).

The delay in translational psychotherapy research in Germany may be explained by the historical proximity and integration of psychological treatment into the disease model of medicine, the demarcation/delimitation of basic and applied disciplines in psychology, and the dominance of neurobiological research, which complicates the translation from basic psychological disciplines (e.g., Grawe, 2004b; Kanning et al., 2007; Wampold, 2001). In German-speaking countries, however, the call for psychological treatment to relate to basic research is associated with Klaus Grawe. In the 1990s, Grawe outlined a "general psychotherapy" (Grawe, 2004a) that is no longer oriented towards treatment theories of

traditional schools with weak empirical evidence, but to the current state of scientific psychology (Lutz et al., 2021). The establishment of outpatient clinics at universities in Germany in the course of the Psychotherapists Act of 1999 was the first step towards creating the required structures for comprehensive psychological treatment research (Fydrich & Unger, 2013). However, in Germany, the basic position of deriving psychological treatment research from psychology as the "parent science" (Wittchen & Rief, 2015) was only recently confirmed by the Science Council in 2018 (Wissenschaftsrat, 2018).

4. Translational psychotherapy research has impact – beyond clinical psychology and beyond academia

We analyzed the impact of translational psychotherapy research within academia in terms of citations. The mean number of citations for the studies in our dataset was 67.39, although the distribution was heavily skewed by some high-impact publications (max = 3,848). Nevertheless, the median of 21 citations is higher than the mean for translational medicine ($M = 17.68$) and slightly higher than for general clinical psychology and psychological treatment research ($M = 20.05$)². Thus, even after correcting for extreme cases with high citations, translational psychotherapy research has a comparably high citation impact.

Not surprisingly, translational research was most often cited within the field of clinical psychology and psychological treatment. However, we found that 74.63% of the publications were cited at least once outside of psychology. This was most often the case in the fields of medicine, computer science, and biology. While medicine and biology have an expected overlap with psychological treatment (e.g., neural underpinnings of treatment), the reception in computer science seems surprising. This could be explained by the interest and

² We queried www.LENS.org in February 2023 for the same period of publication years and document types as described in the methods section, and OpenAlex fields of study "Clinical Psychology / Psychotherapist" and "Translational Medicine" (see ESM for full search queries).

recent developments in artificial intelligence, focusing on the development of artificial neural networks that mimic human behavior (van de Ven et al., 2020), measurement tools based on psychological constructs (Xiao et al., 2016), and online or virtual platforms for therapy and healthcare (Langrial et al., 2014).

As a proxy for impact outside academia, we inspected mentions on Twitter and in news outlets. Most Twitter mentions were made by members from the public. As researchers tend to use Twitter for promoting their research findings or share interesting publications with their peers (e.g., Côté & Darling, 2018), one would expect them to mention translational psychotherapy research the most. In part, this can be explained by research articles with topics that attract the attention of a wide audience. By far the most Twitter mentions by members of the public (8,252 mentions of James et al., 2015) and in the news (95 mentions of Iyadurai et al., 2018) related to research on the reducing effects of computer games on intrusive memories. Video gaming – and especially its effects on psychological properties and social behavior – has been a controversial topic in recent years (see Greitemeyer, 2022) and has thus received a lot of attention. However, there are other topics of public interest on Twitter that are addressed in translational psychotherapy research, such as exposure therapy augmentation (Weisman & Rodebaugh, 2018; 90 mentions), process-based therapy (Hayes & Hofmann, 2017; 71 mentions), or MDMA-assisted psychological treatment for PTSD (Feduccia & Mithoefer, 2018; 55 mentions).

5. The lack of standardized terminology hampers findability which might hinder scientific progress

The ideal research cycle begins with a review of the current state of knowledge by finding and reading the literature. In the case of translational psychological treatment, this is a particularly challenging task: the lack of a standardized terminology makes it difficult to formulate search queries, which in turn hampers findability. In the current study, a term co-

occurrence network (see Figure 7) revealed that the terms “translational” and “basic science/research” are not very common in translational psychotherapy research, at least in titles and abstracts. Furthermore, these terms are not well connected in the term network, i.e., many studies of translational research in psychological treatment use different descriptions (e.g., process-based) or no explicit label at all. The co-occurrence network did not reveal any commonly used and translation-related terms.

In conclusion, translational psychotherapy research needs to employ a consistent terminology to improve the identification of relevant research outputs. Without a common terminology, researchers may not be aware of models and approaches already discussed in the literature and may “reinvent the wheel”. Inconsistent terminology can further affect research synthesis, communication within and outside the field, collaborations, and the translation of research findings in diverse settings (Colquhoun et al., 2014). From a bibliometric perspective, the assessment of the research field is biased unless all relevant studies are included. For instance, if we had analyzed only those studies found with an explicit search on translational psychological treatment, we would have found lower rates of annual growth rate, mean and median citations/mentions, and open access, as well as a different authorship landscape.

Inconsistent terminology and the need for a common nomenclature are not specific to translational psychological treatment. Haeny et al. (2021) report the same issue in the field of anti-racist clinical research. The authors argue that “using a shared nomenclature will result in more effective and equitable health care” (ibid., p. 891). In the context of Internet-delivered interventions, Smoktunowicz et al. (2020) emphasize the negative effects of inconsistent terminology on the communication between researchers, students, clinicians, the general public, the media, and policy makers. They propose a common glossary and list three factors for its successful dissemination: 1) influential researchers adopting and using the

terms, 2) recommendation of terms by publication outlets, and 3) establishing a single information source for reference. The APA's *Thesaurus of Psychological Index Terms* (Tuleya, 2007) could be such an information source, and the addition of the term "translational research" seems desirable. Nevertheless, even the use of "translational research" as an author keyword would significantly improve findability. In any case, the research community of translational psychological treatment needs to agree on common terms and adhere to a consistent labeling of their studies, and influential researchers and journals could take the lead in that matter.

6. A thematic fragmentation in the research field of translational psychological treatment – more research needed

Our results indicate a thematic fragmentation within translational psychotherapy research. Yet, we would like to stress that fragmentation of a research field by itself is not always an indicator of negative development. Sometimes, research is more exploratory and points toward a positive diversity and a dynamic heterogeneity. More research is needed to elucidate this issue. Nonetheless, fragmentation combined with low self-referentiality and inconsistent terminology (or ambivalent nomenclature) can be assumed as a serious threat to scientific progress: the field's lack of self-awareness leads to reduced collaboration and a failure in building on previous research (Bialetti et al., 2015). An analysis of inter-document citation rates as a proxy for self-referentiality of the field (Levy et al., 2020) could help to evaluate the thematic fragmentation as shown in our results.

Another promising approach is to measure the degree of fragmentation in a discipline by measuring the degree of clustering in the network of citations (Shwed & Bearman, 2010). This would further help to distinguish between fragmentation as malign disintegration and its potentially benign forms, such as specialization or the genesis of new emerging fields (Bower, 1993). As Lee (1994) argued decades ago, fragmentation might reflect the failure of

psychologists to adequately define their subject matter, due to the gap between practice and research. Hence, the core aim of translational psychological treatment should be to transcend the typical guilds and tribes of psychology and bring about this long-awaited change. As fragmentation is argued to be partially responsible for psychology's recent replicability crisis (Hibberd & Petocz, 2022), it is of paramount importance to give this matter proper thought leading to the prospect of unification by combining both philosophical approaches (Drob, 2003; Gaj, 2016; Yanchar & Slife, 1997) and methodological ones (Mizrahi, 2021).

Limitations and future research

A first limitation of the current study is its reliance on database metadata – without analyzing full texts. For future studies, the automated retrieval and integration of full texts into the machine learning (ML) classifier approach might be promising to increase the number of correctly identified papers. Ideally, full texts could be collected via DOI and screened by the ML classifier. More desirable, however, would be a standardized terminology for finding publications with concise search queries – thus making research on translational psychological treatment more accessible (see Andrews et al., 2016).

A second limitation is the use of only one ML classifier. While the Rayyan classifier achieved high precision in our study after two rounds of active learning (see ESM, “method details”), comparing different classifiers could potentially lead to better performance after shorter screening time. Rayyan provides an easy-to-use interface for screening papers, but the model itself cannot be altered or tweaked. Kebede et al. (2022) evaluated the performance of a variety of ML algorithms for semi-automated article screening and found that combining different algorithms yields best results. However, this often exceeds manageable demands of ML expertise in the researcher team.

A third limitation relates to the human workload in our framework for finding translational psychological treatment papers. The most time-consuming steps were the

definition of candidate paper pools (e.g., generating search queries, finding special issues, performing citation mining) and the manual screening required to train the classifier. Once model performance is satisfactory, the automatic screening is a matter of seconds. Recent advances in natural language understanding promise support for the screening phase. Large language models such as OpenAI's ChatGPT or Google's PaLM (Chowdhery et al., 2022) demonstrate capabilities of artificial intelligence that could lead to more automation in paper screening. Inclusion and exclusion criteria could be prompted to the model to provide a more human-like approach to eligibility decisions, going beyond the textual features that our model has learned after more than 3,000 manually screened papers. Future research needs to determine the potential of language models and few-shot classification to reduce the screening workload.

A fourth limitation refers to the limited insights on *content* level. The goal of our bibliometric analysis is to provide an overview at the level of publication processes. This aims at an assessment of the *structure* and impact of the research field. An analysis of the content of publications (via literature review) would be the next step to delve deeper into the research landscape. This would help to untangle different stages, methodologies, and designs in studies on translational psychological treatment and may empirically inform the development or testing of a conceptual model of translation (see Ehring et al., 2022).

Conclusion

The importance and visibility of translational psychotherapy research may be increased by addressing it as an exchange between different research areas in psychology and using standardized terminology and common nomenclature – or at least a common keyword for better visibility and findability of studies. Currently, machine learning-assisted literature screening is the only way to discover the full research landscape. The open publication

dataset provided in this study can be the starting point for future in-depth analyses such as a literature review or empirically informed conceptual considerations.

Author Note

Author Contributions

André Bittermann: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Visualization, Writing - Original Draft, Review & Editing

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Competing Interests

We have no competing interests to disclose.

Acknowledgements

We gratefully thank Sarah Marie Müller for her assistance in preparing the manuscript, Nina Hackmann for screening assistance, Maren Kotzur for contributing to the search queries, and Hannah Colar for Rayyan assistance.

Funding

This study was funded by the Hessian Ministry of Science and Arts (Hessisches Ministerium für Wissenschaft und Kunst, HMWK) innovation budget. Stefan Hofmann also receives financial support by the Alexander von Humboldt Foundation.

Electronic Supplementary Material (ESM)

We provide datasets, analysis code, and additional tables, on [link included after publication].

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TRANSLATIONAL PSYCHOLOGICAL TREATMENT BIBLIOMETRIC ANALYSIS

Table 1

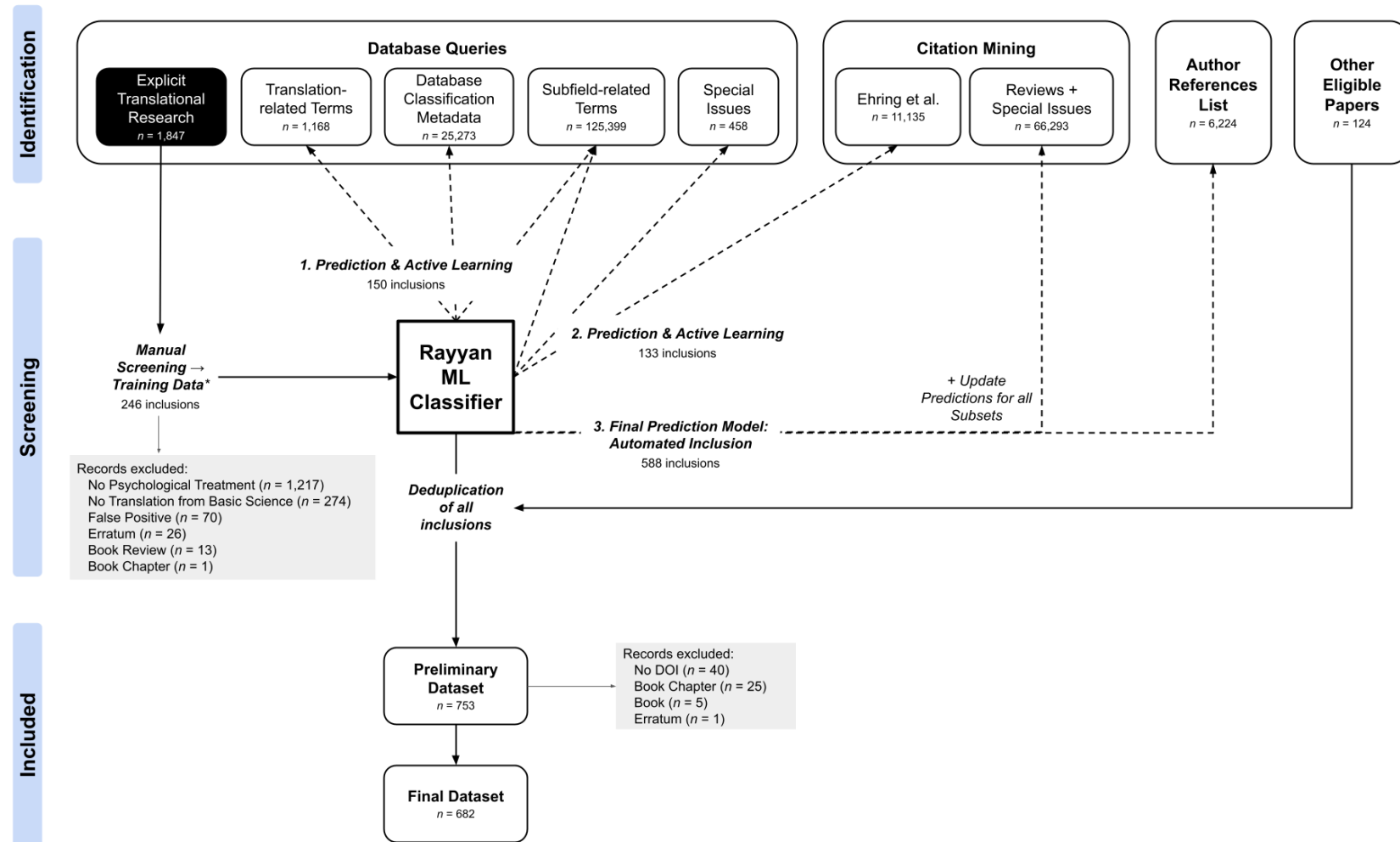
Citations and Mentions

	Citations				Twitter Mentions					News Mentions
	all	Clinical Psychology & Psychological Treatment	Psychology	Non-Psychology	all	research scientists	science communicators	practitioners	members of the public	
Median	21	12	5	2	2	0	0	0	1	0
M	67.39	39.86	17.91	9.70	20.61	2.07	0.65	1.18	16.71	0.80
SD	200.78	134.54	44.15	33.33	341.50	11.34	10.86	6.78	316.16	5.06
max	3,848	2,792	559	405	8,901	263	283	122	8,252	95

Note. For every publication in the dataset, the citing papers were assigned to one of three categories. The groups of Twitter users are according to altmetrics.

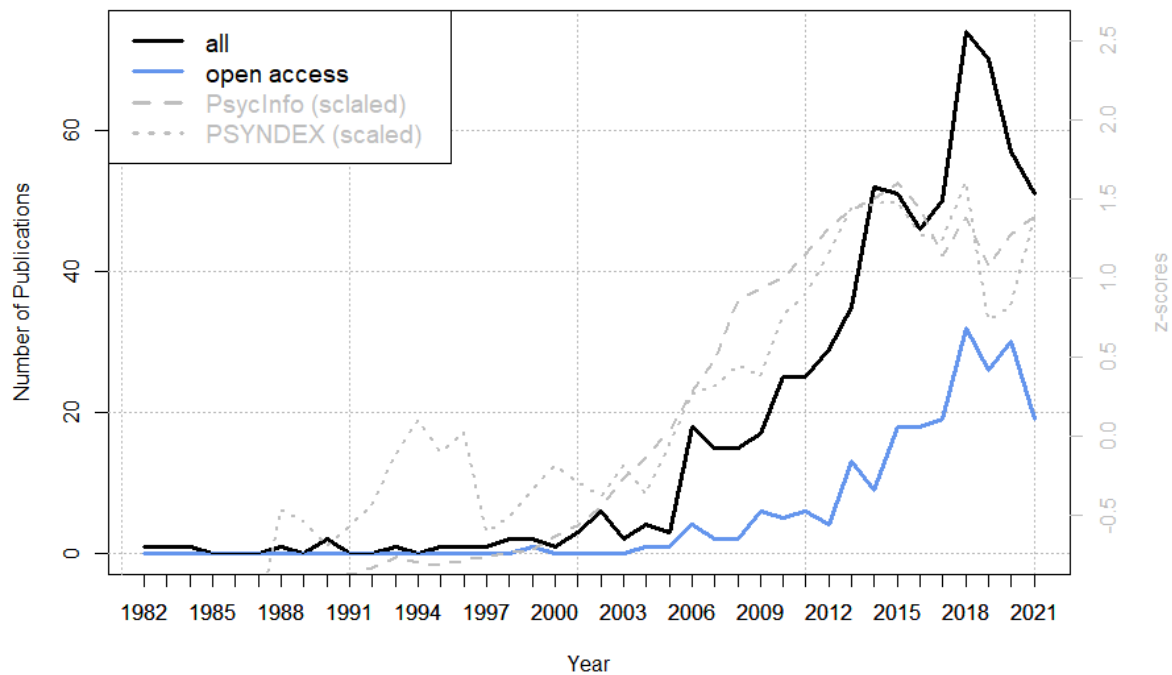
Figure 1

Modified PRISM chart illustrating our approach for finding translational psychotherapy publications

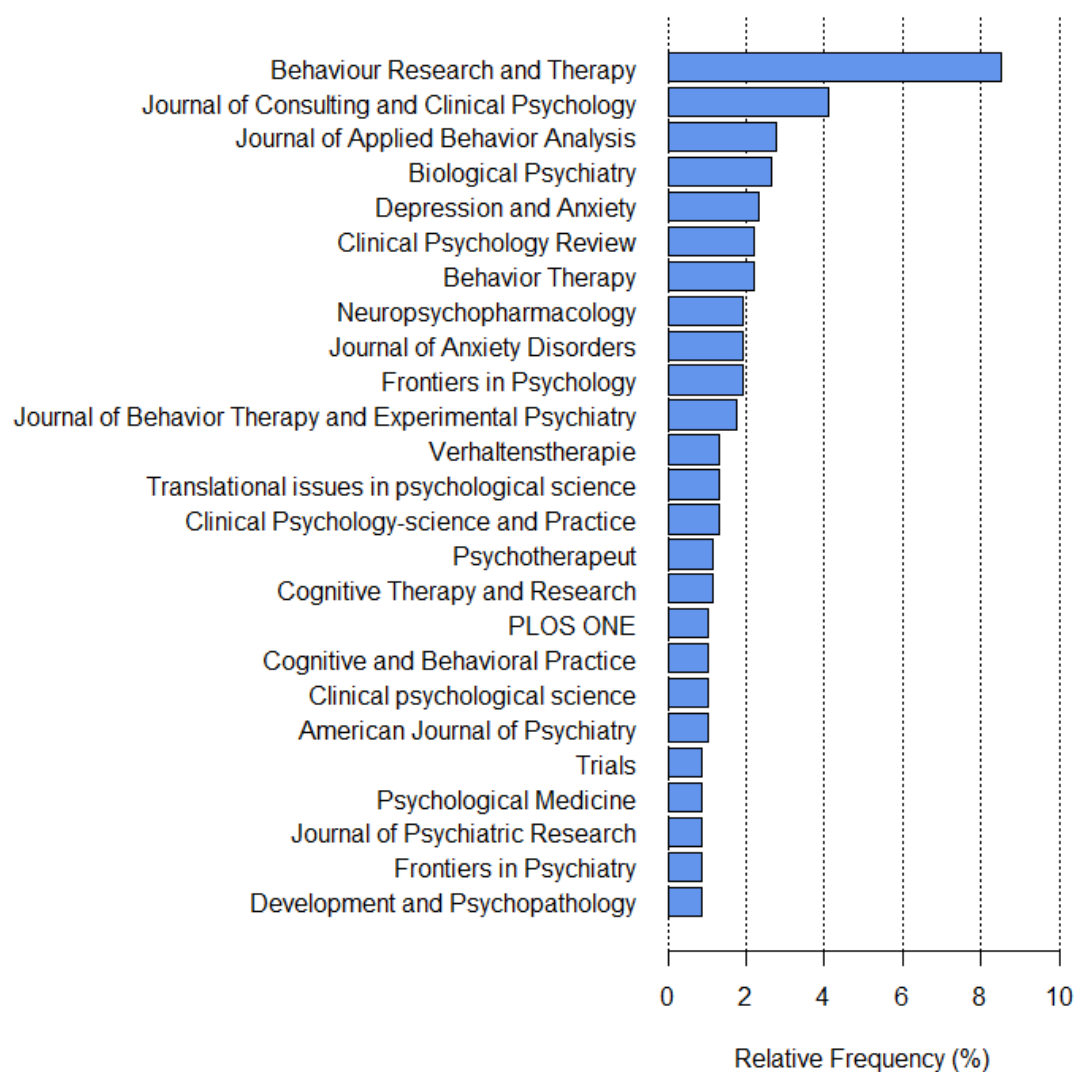


TRANSLATIONAL PSYCHOLOGICAL TREATMENT BIBLIOMETRIC ANALYSIS

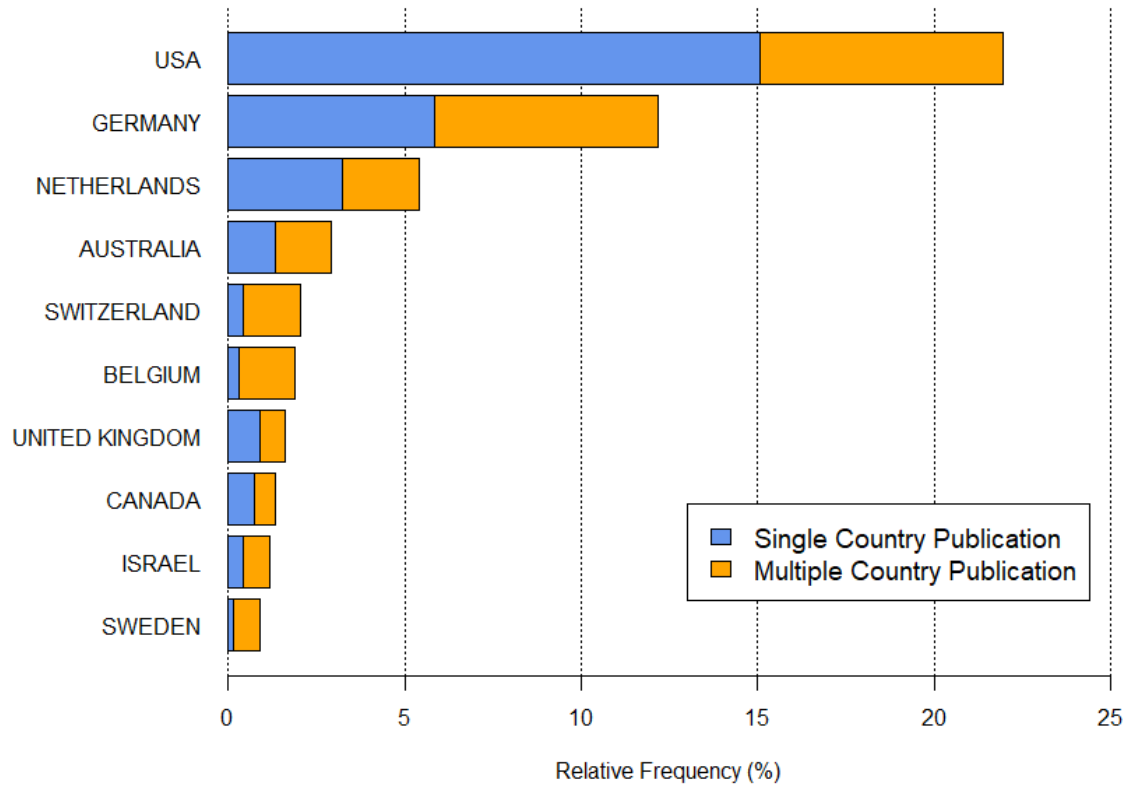
Note. ML = Machine Learning. *The training data of manually screened records was augmented with 40 additional relevant publications (see ESM for details). All screening (titles and abstracts) and prediction processes were performed in Rayyan software. After screening the results of an explicit search for translational psychological treatment studies (top left in black), we performed two rounds of active learning (i.e., screening of predictions as feedback to improve the model) until the inclusion rate of predicted papers was higher than 95%. Due to its size, the “Subfield-related Terms” subset was split by Rayyan into two separate prediction rounds. The final prediction model was applied to all subsets of candidate papers. In this step, we included predicted papers without screening.

Figure 2*Number of publications per year*

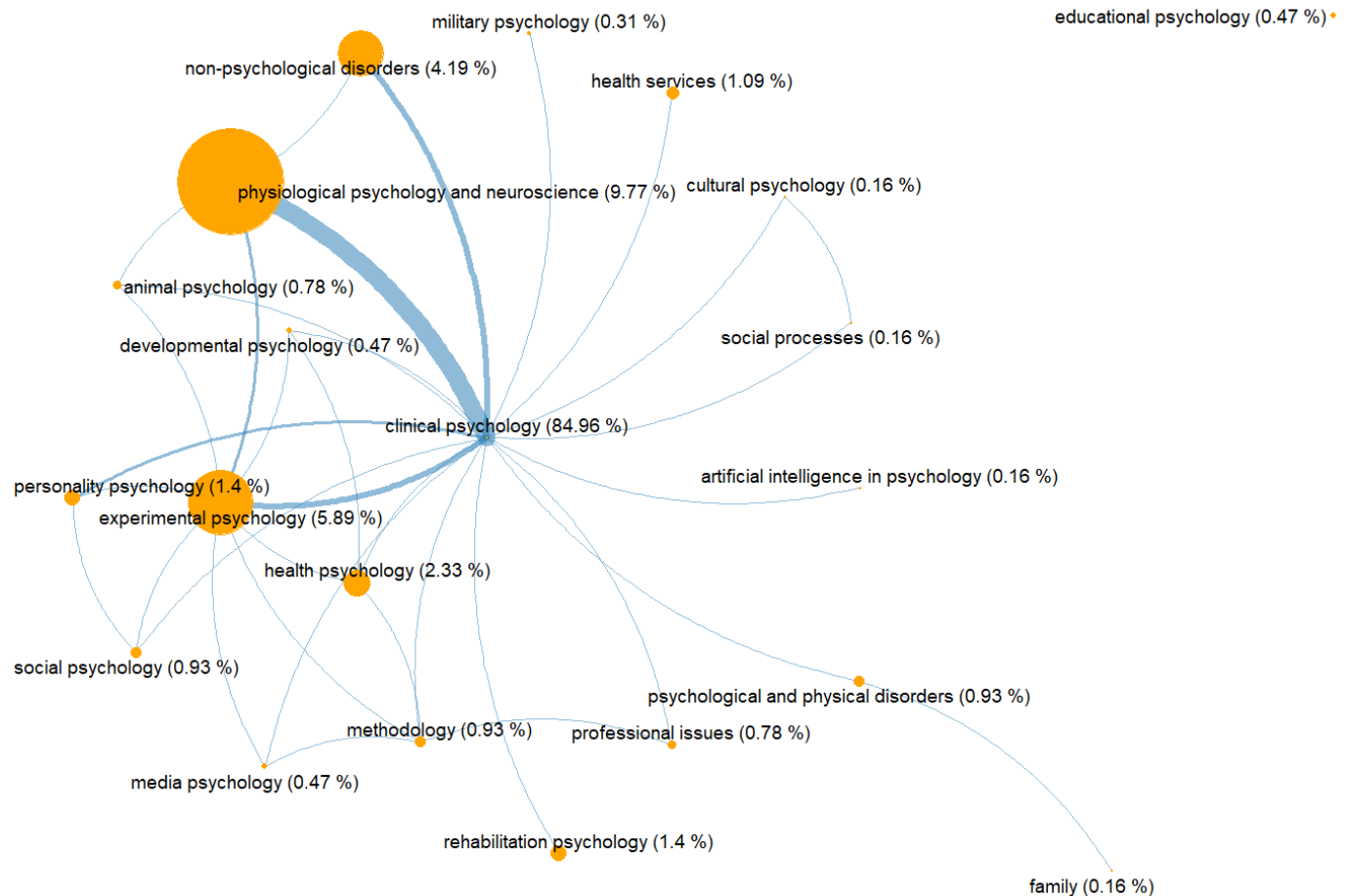
Note. To compare the publication volume of all translational papers in our dataset with the general trend in psychology literature, the gray lines depict z-scores of PsycInfo and PSYINDEX publication numbers (gray axis matched with z-scores of translational papers; black line). The correlation between translational publications per year and all database records is $r = .88$ for PsycInfo and $r = .79$ for PSYINDEX. Especially from 2016 to 2018, the increase in translational publication volume is higher than in general psychology literature. This is partly due to the publication of two special issues in 2018.

Figure 3*Most common journals*

Note. Frequencies relate to the total number of publications in the dataset ($N = 682$).

Figure 4*Most productive countries*

Note. Frequencies relate to the total number of publications in the dataset ($N = 682$).

Figure 5*Co-occurrence network of psychological subfields other research areas*

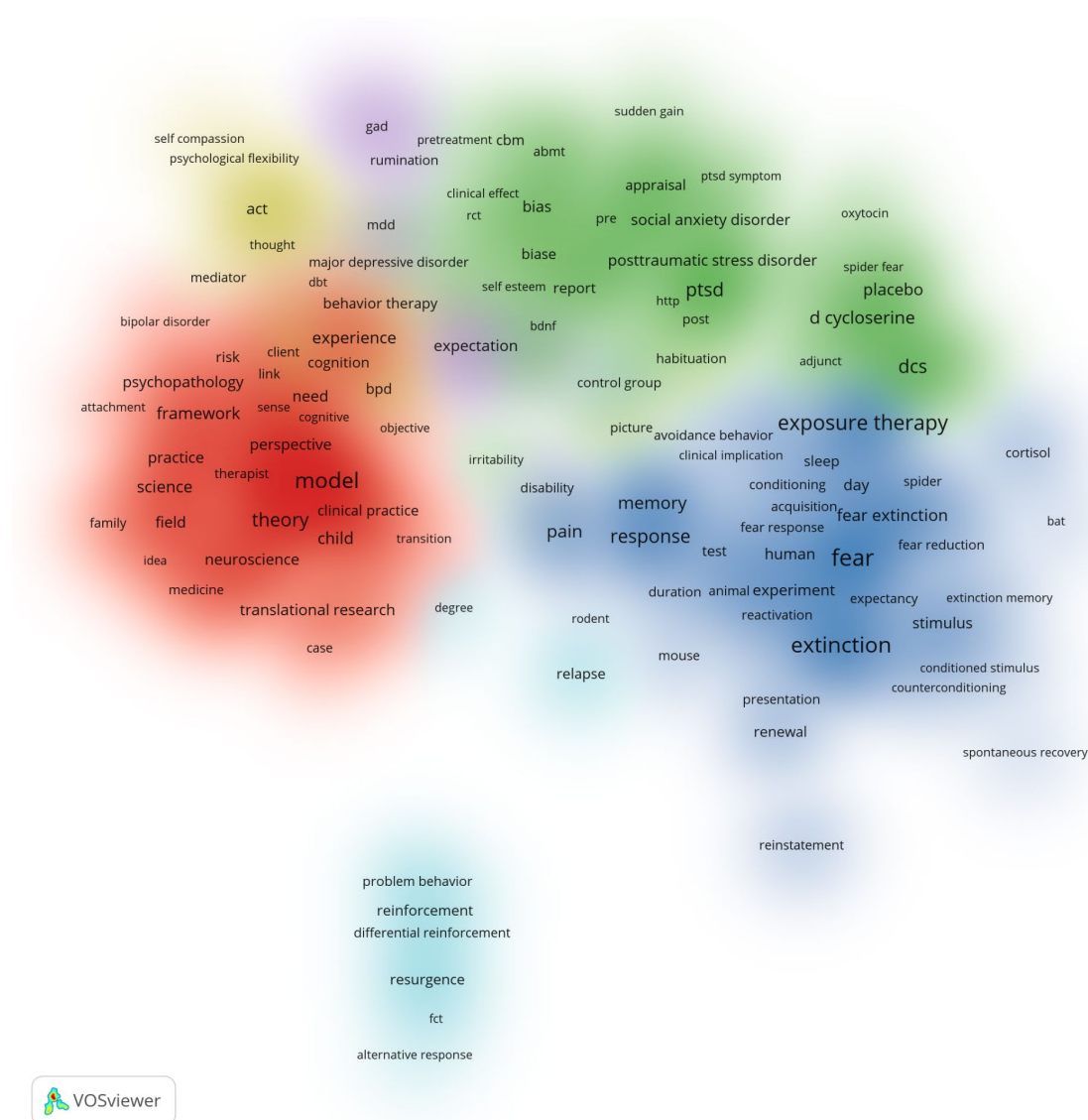
Note. The size of the circles is proportional to the subfield share in the dataset. Due to its dominating share and for better visibility, the circle for “Clinical Psychology” (center of the network) is omitted. Subfield information was available for 646 records. In PsycInfo and PSYINDEX, publications can be indexed with multiple subfields. Hence, the strength of the connections between subfields is proportional to their co-occurrence. The subfield that occurred most often (besides “Clinical Psychology”) was “Physiological Psychology and Neuroscience”. This subfield also co-occurred most often in publications indexed with “Clinical Psychology”. “Non-Psychological Disorders” comprise physical and somatoform disorders, learning disorders, speech and language disorders, and environmental toxins.

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Note. Font size is proportional to the number of citations of an institute corrected for publication year (normalized to take account for older publications naturally having a longer period to be cited). The University of Nevada and Boston University have the highest normalized citation impact. Connections refer to pairwise co-authorships: The more publications with authors from two institutes, the stronger the connection between these institutes. Institutes with more connections are located in the center of their clusters (e.g., University of California, University of Amsterdam). The colors refer to an institute's publications average publication year: Yellow indicates institutes that published rather recently on translational psychotherapy (mostly German institutes). To improve visibility, only institutes with a minimum of five publications are shown (70 of 770 institutes). A table with the number of publications, citations, and number of collaborations by institute is provided in the ESM. An interactive version of this network can be accessed via https://t1p.de/translational_collaboration.

Figure 7

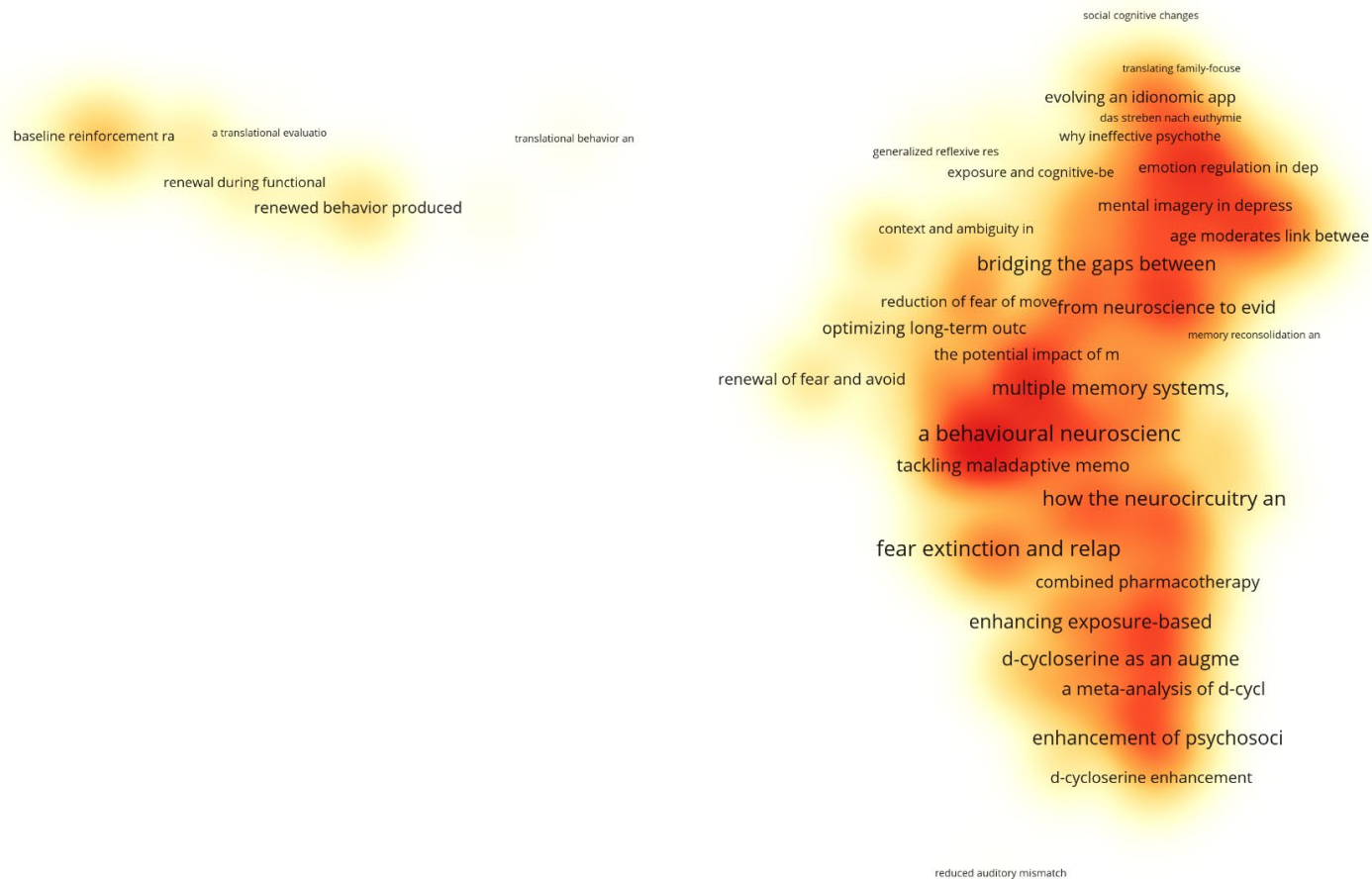
Term co-occurrence network (density plot), indicating non-standardized terminology



Note. Font size is proportional to term frequency. The more terms of a specific cluster and the more connections to terms of the same cluster, the stronger the color at that point in the plot. Notably, “translational research” is located at the bottom of the red cluster of rather generic terms. The rather small font indicates that only few publications use “translational research” explicitly in title or abstract. Its position at the edge of the network reflects that it is poorly connected to terms of other clusters. An interactive version of this network can be accessed via https://t1p.de/translational_terms.

Figure 8

Publication similarity network (density plot), indicating a thematic fragmentation



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Note. Text size of the publication titles is proportional to the total link strength of a publication (the number of similar publications and their degree of similarity). These publications are similar to many other publications in their network neighborhood. Pairwise publication similarity is determined using bibliographic coupling (shared references). The more similar the publications, the closer their position in the plot. For better readability, the network is visualized in an item density plot: The more publications in the neighborhood of a point and the more connections the neighboring items have, the closer the color of the point is to red. Please note that 43 of all 682 publications in the dataset were not connected to this network and are omitted from the plot. This – in addition to the insular publications on the left – indicates a thematic fragmentation of the research field. Please note that publications with few similar papers are not visible. For more details, see the interactive version of this network: https://t1p.de/translational_similarity.