

Psychology

Joint Self-Evaluation

2017-2022

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University
Rotterdam** 

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 **Utrecht
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Preface

With great pleasure we present this joint self-evaluation report of psychology research in eight Dutch universities. Using quantitative markers, the report concisely reviews the disseminated output against an international context. Although 2017-2022 was a tempestuous period with substantial contextual challenges, the Dutch psychology research steered due success with great scientific output.

Representing eight Dutch universities, we concerted our efforts when evaluating our strategies and achievements in the psychology research. It has been the first time for all of us to follow the Strategy Evaluation Protocol (SEP 2021–2027). This new SEP challenged us to slightly deviate from the beaten track and to primarily focus on narrative evaluations of the individual research achievements. To supplement this by more quantitative evidence, we combined forces and created a joint self-evaluation that quantitatively illustrates especially our collaborative successes.

We adopted an Open Science approach to bibliometry. While this required tremendous energy of our universities' research intelligence staff, it guarantees transparency of data collection and analysis. The report is accompanied by an [online dashboard](#) that allows for zooming into further details at will.

Joint initiatives can be paramount as they relate to the sector plan 2022 of the *Social Sciences and Humanities*, that contains an overarching mission for making optimal use of the diversity of research units in the Netherlands. The current evaluation can be an excellent opportunity to pinpoint future aims that are shared on a national level. The joint self-evaluation underscores a high research quality that comes with profound societal relevance, often a consequence of interdisciplinary collaboration on endeavours that go beyond specialized domains and disciplines. The sector plan 2022 is an invitation to all to continue and further improve our collaborative knowledge transfer.

Collecting and integrating information required aligning a diversity of sources and data types and orchestrating the ways to present it across universities. We sincerely thank all those who diligently contributed to the report, in particular the policy officers of the participating research units for harmonising all input and the universities' research intelligence teams for the tireless generation of bibliometric figures.

We particularly thank Ravenna Aarnoutse for her untiring attempts to straighten the often-divergent thinking of the research directors, for battling IT-systems and databases, and for her endless help in writing.

On behalf of all directors of research,

Prof. Dr. Andreas Daffertshofer

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1. Introduction

As part of their quality assurance cycle, all academic research in the Netherlands is evaluated every six years. The executive board of the relevant university, the board of the Dutch Research Council (NWO), or the board of the Royal Netherlands Academy of Arts and Sciences (KNAW) commissions the research assessment and determines which research units are to be evaluated each year. For the coordination of the assessment, all research organizations associated with the Universities of the Netherlands (UNL), KNAW and NWO use the Strategy Evaluation Protocol (SEP).

The main goal of the assessment is to evaluate a research unit's achievements in view of its aims and strategy. In the individual self-evaluation, the unit reflects on the past six years, here for the period 2017-22, and outlines its future focus in a coherent narrative argument, supported by factual evidence wherever possible. There should be a direct link between aims and strategy and achievements and a motivated choice for (the type of) robust data underpinning the self-evaluation.

SEP assessments are meant to monitor and to help improving the quality of research also in relation to its societal relevance. This contributes to fulfil every university's duty of accountability towards government and society, and the respective boards may use the outcomes for quality assurance purposes and institutional strategy development.

The current assessment addresses the research domain psychology and spans eight of the twelve general universities in The Netherlands: Erasmus University Rotterdam (EUR); Leiden University (UL), Maastricht University (UM), Open Universiteit (OU), University of Amsterdam (UvA), University of Groningen (RUG), Utrecht University (UU), and Vrije Universiteit Amsterdam (VU). Next to their individual self-evaluations, the participating universities here provide an overarching analysis of the research foci including their societal impact and how they jointly contribute to the international positioning of Dutch psychology research. This is meant to identify collaborative and synergistic research across the participating research units but also collaborations with other universities, be that within or outside the Netherlands. It also allows for benchmarking the Netherlands against relevant European countries and the United States of America.

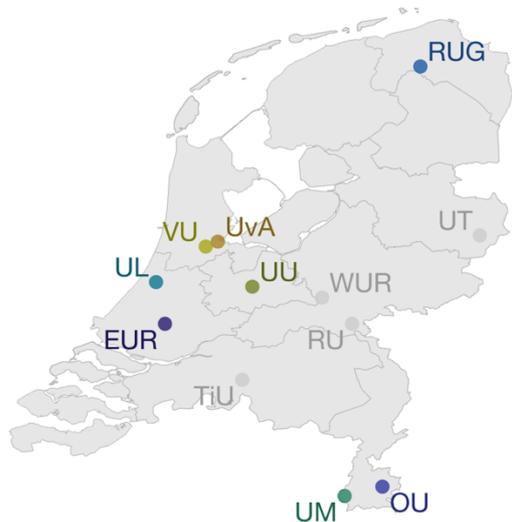


Figure 1.1: Geographical locations of the eight participating universities (in colour). For the sake of completeness, we also indicate the remaining four universities (in grey): Tilburg University (TiU), University of Twente (UT), Radboud University Nijmegen RU), and Wageningen University (WUR).¹

Given the current developments in Dutch research funding, the evaluation also relates the research to the recently launched [sector plan](#) of the Social Sciences and Humanities (SSH). The accompanying deployment of M€ 70 per annum for the next decade will certainly help to identify untapped opportunities for the nearby future.

All measures and outcomes listed here can be found in a publicly accessible [online dashboard](#). Further unit-specific outcomes can be found in the individual self-evaluations.

¹ The four universities did not participate because most of their research on psychology is integrated in research institutes inseparably crossing domains (e.g., engineering, physiology, and medical sciences) that are being assessed in their entirety. Note that their research works did enter our international benchmarking.

2. Methods

For this overarching analysis we incorporated research output items over the period 2017-2021² and summarised them under a single umbrella term *work*. For instance, we counted SCI-papers, books, and book chapters equally. These types of works reflect the traditional and, hence, most common form of dissemination of scientific results.

2.1 Data sources

We relied on the universities' local current research information systems ([CRISs](#))³ that we combined with two data sources:

- [OpenAlex](#) – an open-source and open-access database of scholarly works and metadata; and
- [Altmetric](#) – a commercial database providing mentions of scholarly works in non-academic publications.

From OpenAlex, we retrieved so-called *concepts* to categorise individual works. The concepts served to illustrate how the research was distributed over different fields of academic research, and how this distribution changed over time. OpenAlex was also used to retrieve the citation counts of every work. From Altmetric we included mentions of works in mainstream media and policy documents and considered this a measure of societal impact of academic research.

To guarantee agreement of sources, we matched the digital document identifier (DOI) from the works in the local CRISs with those in OpenAlex and Altmetric. While this is a mandatory step when automatising the bibliometric assessment, one must acknowledge that, as of to date, not all the disseminated research output has a DOI. In fact, by constraining the current analysis to works with DOI, unfortunately we had to exclude on average 16% of the works of the CRIS-s lists; for OU and UU this even amounted to 40% and 24% respectively of the provided works, whereas, e.g., RUG only submitted works with DOI.

2.2 Concepts – labelling fields of academic research

Concepts are labels that OpenAlex assigns to individual works. They represent the field of academic research to which the work belongs. The assignment is automated and based on the work's title, abstract, and keywords, as well as the corresponding journal's title (if applicable). A work is typically assigned to multiple concepts, indicating its relevance in different fields of research, although not necessarily to the same extent. In OpenAlex, concepts have a hierarchical structure. There are nineteen general *level-0 concepts* (e.g., 'psychology', 'medicine', 'biology', 'mathematics', and so on) and the hierarchy branches level of level into more than 40,000 *level-5 concepts* (e.g., 'mental chronometry'). In the current analysis, all the included works were added to their assigned concepts to quantify the distributions of works over different fields of academic research, and to illustrate how they evolved over time. Further information including more technical documentation is available in *Appendix A*.

The majority of works in our data were automatically assigned to the level-0 concept 'psychology' and one of seven corresponding level-1 concepts, namely: '[applied psychology](#)' (application of psychological theories or findings); '[clinical psychology](#)' (integration of science and clinical knowledge); '[cognitive psychology](#)' and '[cognitive science](#)' (study of the mind and its processes); '[developmental psychology](#)' (study of cognitive and social-emotional changes over the course of life); '[neuroscience](#)' (study of the nervous system); and '[social psychology](#)' (study of social behaviour).⁴ The remaining works were labelled either with concepts from other level-0 concepts like 'medicine' or 'biology', or with level-2 concepts or lower. We edited some labels manually to better accommodate more psychology-specific themes. For example, at level-0 several papers on statistics and methodology were automatically assigned to 'computer science' or 'mathematics' and we

² For technical and administrative reasons, we here only include data up to 2021.

³ For the International benchmarking included works from all Dutch research units as outlined in §2.7.

⁴ In an early draft analysis, OpenAlex suggested additional level-1 concepts such as criminology, psychoanalysis, pedagogy, psychotherapy, communication, mathematics education, and psychiatry. However, an evaluation of sampled works revealed that these level-1 concepts disagreed with the level-0 'psychology' assignment, for which the respective works have been reassigned to appropriate level-1 concepts.

grouped them manually under a new concept '[methodology/statistics](#)'. Moreover, '[health psychology](#)' (study of behavioural processes in healthcare and illness) is a default level-2 concept but appeared sufficiently frequent to warrant inclusion in the analysis by showing it next to the level-1 concepts.⁵ The remaining works under level-0 'Psychology' that could not be assigned to one of the level-1 subcategories have been bundled under category '[other](#)'.⁶ In total we considered ten concepts or fields of academic research.

2.3 Citation score

Next to mere counting of research output, OpenAlex can also serve as a source for citations from other academic works. It provides raw citation counts that do not correct for intrinsic differences between research fields that are unrelated to the academic impact of the published research. We used these raw counts to construct a *concept-weighted citation score* (CWCS). For this we normalised the citation count to the total citation count per year of publication and per concept. That is, the CWCS scores citation counts individual publications relative to the corresponding field of academic research, which allows for comparing within fields of research and between years of publication.

The CWCS is closely related to the Field-Weighted Citation Index (FWCI) available in Elsevier's Scopus database that is being used in the individual self-evaluations of several of the participating research units. For example, a publication with a CWCS of 1.25 has received 25% more citations than the average publication within the same concept and year of publication. We would like to note that in contrast to Elsevier's SciVal-approach, which relies on journal fields, we employ OpenAlex's concepts. Moreover, our citation counts are not limited to the last three years. For these reasons, CWCS-values typically exceed FWCI-values.

2.4 Collaborative efforts

To identify collaborative and synergistic research across the participating research units and collaborations with other (inter-)national partners, we defined four types of collaborations: *consortium*, *national*, *international*, and *none*. *Consortium* refers to joint works within the group of the eight participating research units. This category overlaps with national collaborations but may also include international partners. *None* refers to works without visible connections to research units other than the primary one. In more detail, after retrieving the list of unique affiliations for every work, we applied the following rules to assign works to collaboration types:

- *none* = the work stems from a single affiliation,⁷
- *consortium* = two or more distinct affiliations from the participating research units,
- *national* = two or more distinct affiliations and the number of Dutch affiliations is larger than 50% of all affiliations,
- *international* = two or more distinct affiliations and the number of Dutch affiliations is smaller than or equal to 50% of all unique affiliations.

The collaboration types *none*, *national*, and *international* are mutually exclusive.

2.5 SSH themes

According to the 2022 SSH sector plan future cooperation of the Dutch universities will receive specific focus around five different themes that are interdisciplinary in nature, while nurtured from the disciplinary base. The themes were chosen as: 'youth resilience', 'mental disorders', 'the human factor in new technologies', 'social transition and behavioural change', and 'social inequality and diversity'⁸, or in Dutch: 'veerkracht bij de jeugd', 'psychische aandoeningen', 'de menselijke factor in nieuwe technologieën', 'maatschappelijke transitie en gedragsveranderingen', and 'maatschappelijke ongelijkheid en diversiteit', respectively.

⁵ In the [online dashboard](#) we also show '[forensic psychology](#)' (intersection with the judicial system) as well as '[industrial and organizational psychology](#)' (study of behaviour in the workplace).

⁶ Initially, this 'other' category covered 17% of all output, with many works from level-0 concepts other than 'psychology'. The most prevalent were 'medicine', 'computer science', 'mathematics', and 'biology'. Reassignment to appropriate level-1 concepts within the 'psychology' branch reduced the portion to less than 4%.

⁷ This can be the case of single authorships, or if all authors are affiliated with the same institute. Note, however, that for authors with multiple affiliations, each affiliation is considered in the analysis.

⁸ E.g., on the theme 'social transition and behavioural change', public administration experts, sociologists, political scientists, social geographers, climate scientists and behavioural scientists can be brought together, and each university can bring in its own disciplinary expertise.

Bringing together researchers from different universities on these themes is meant to prevent fragmentation and overlap and allows for better coordination of (future) research lines. Every university chose up to three research themes in line with its profile and future priorities, following a so-called Breimer approach.

Table 2.1: Breimer table adopted from the SSH sector plan 2022 but slightly modified.*

	EUR	RU	OU	TiU	RUG	UL	UM	UU	UT	UvA	VU	WUR
youth resilience	●	●		●	●	●		●			●	
mental disorders					●	●	●			●		
the human factor in new technologies		●	●				●	●	●	●	●	●
social transition and behavioural change	●		●	●	●	●			●			●
social inequality and diversity	●	●	●	●			●	●		●	●	●

* The four non-participating universities are depicted in grey.

When addressing SSH themes in the evaluation of the research in psychology, one should realise that SSH, i.e., Social Sciences and Humanities, covers more scientific disciplines, e.g., social sciences and pedagogical sciences, and that our findings summarise past contributions rather than future foci. Yet, we consider it insightful to estimate to which degree the profiles of the participating research units already aligned with this future theme-assignment during the past evaluation period.

We mapped the level-1 concepts outlined above to the SSH themes whenever possible using the expertise of the participating research units. We would like to note that again a single work might have been categorized in multiple themes, i.e., the mapping we used is not isomorph. We provide the absolute and relative work counts in the [online dashboard](#).

2.6 Societal impact

In the self-evaluations the institutes reflect on the societal relevance of their research considering their own ambitions and strategy using a tailored set of indicators. This accommodates the diverse routes to achieve societal impact. To simplify the analysis, we chose to quantify societal impact of our joint academic research by the attention it received outside of academia. We extracted mentions in media and policy documents from the [Altmetric](#) database. Mentions in media can be considered a measure of interest of and relevance for the public, while mentions in policy documents indicate the relevance of scientific findings for officials.

2.7 International benchmarking

To place the research performance in an international context, we chose to compare the Netherlands (NL) to output from seven other countries: the United States (US) given the total size of its output and its important role in the field; the United Kingdom (GB) and Germany (DE) for their major role in European research; as well as Sweden (SE), Switzerland (CH), Belgium (BE), and Denmark (DK) for their similar socio-economic structure and comparable size.

For this international benchmark we solely relied on data retrieved from OpenAlex and, more importantly, we included works from all Dutch research units. To focus on academic research output, the affiliation type was restricted to 'educational', which includes technical universities and universities of applied sciences, but excludes university medical centres and other non-educational institutes (e.g., private research facilities, companies, etc.).⁹ These results may hence not directly compare to those from our other analyses.

We collected all works with level-0 concept 'psychology' and an affiliation with at least one university from one of the countries. We compared the output on three different measures: the average number of citations per work (overall and by concept), the total number of publications (also overall and by concept), and the distribution of total output over concepts.¹⁰

⁹ The institutional typification is available under: <https://ror.readme.io/docs/ror-data-structure#types>.

¹⁰ Note that we did not apply the re-labelling of concepts used in other sections. Re-labelling makes conceptual sense when applied to CRIS data, where we are certain that the works are relevant for psychology. Here, this was not the case.

3. Results

As said, our analysis was based on work counts per research unit and per OpenAlex concept from which we distilled the CWCS as marker of research impact. We also analysed the societal impact via Altmetric outcomes. Here we start with our review of the first, i.e., the more traditional indicators of research quality and research impact.

3.1 Research output

For the period 2017 to 2021, the institutes jointly produced slightly more than 13,000 works. As expected, the total output differed between the eight participating units due to the difference in research full-time equivalence (FTE). All numbers are provided in Tables C.1 and C.2 in the *Appendix*.

The concept assignment revealed several larger fields, ranging from 2,500 to about 7,300 works. The largest four were: 'clinical psychology', 'social psychology', 'cognitive psychology' (especially when merged with 'cognitive science'), and 'developmental psychology'; see Figure 3.1.

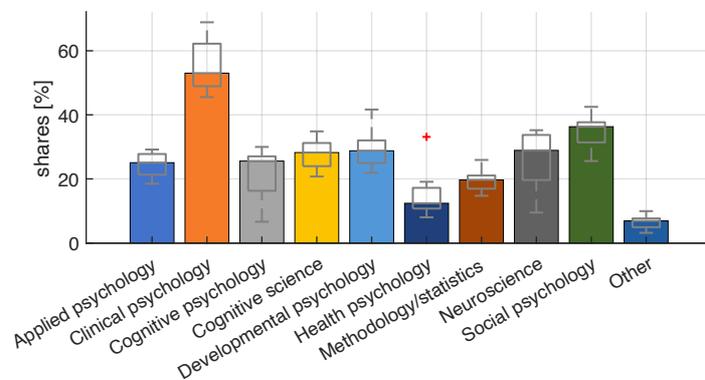


Figure 3.1: Distribution of fields of academic research when combining the eight research units. The bars represent the concept shares, i.e., the numbers of works relative to the total output.

We show the median values over the participating units where the boxes indicate the 25% and 75% quantiles. The whiskers extend to the most extreme data points (outliers are plotted individually using the '+' marker symbol).

This finding prevails when looking at the individual research units. For instance, works labelled 'clinical psychology' accounted for an average of 55% spanning the range of 46% (EUR) to 69% (OU and VU) of the total number of works. On average 35% of works have been labelled 'social psychology', ranging from 25% (VU) to 43% (EUR). Together 'cognitive psychology' and 'cognitive science' accounted for approximately 25% of total works, varying from 14% (OU) to 31% (UU and UvA); see also Table C.3 and Figure C.1. Recall that works have typically been assigned to multiple concepts.

Zooming into level-2 in OpenAlex analysis revealed further that within 'clinical psychology' the focus was on [cognition](#), [anxiety](#); [psychological intervention](#); and [perception](#). For 'social psychology' this was predominantly [context](#), whereas for 'cognitive psychology' the sub-topics were more diverse with a substantial representation in [affect](#) and in [perspective](#) – see our [online dashboard](#) for further details.

The research production slightly increased over the evaluation period as illustrated in Figure 3.2.

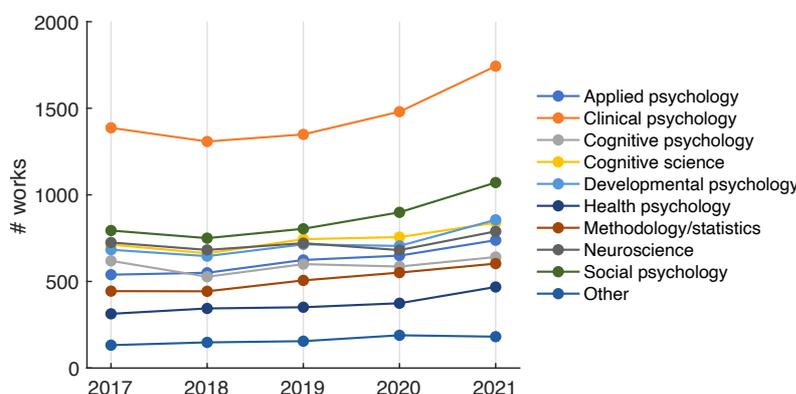


Figure 3.2: Research output (work counts of all participating units) per concept over the evaluation period 2017-2021. Across the board the output counts remained steady, or dissemination increased. 'Clinical psychology' and 'social psychology' experienced the largest total increase, which might be related to Covid-19 induced attention to the respective research fields.

3.2 Citations

While counting disseminated academic output indicates productivity, our CWCS can be considered more informative for the quality and impact of the research. Looking at the average citation scores over the evaluation period for the different research units clearly revealed a very high quality of research (mean CWCS = 3.30, median CWCS = 3.06, range 1.59 to 5.86), which finds support in the individual self-evaluations. This picture hardly changed over time as shown in Figure 3.3; see also Table C.4 in the *Appendix*.

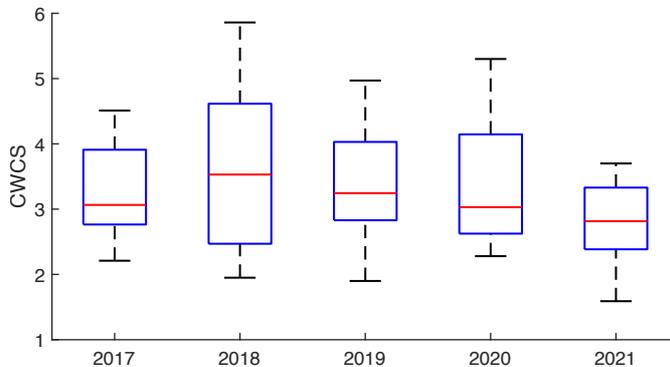


Figure 3.3: Median CWCS as a function of time for all research units. By and large the number of citations remained steady with a minor decline toward the end of the evaluation period, presumably related to worldwide effects of the Covid-19 pandemic.

Bottom and top values of the boxes indicate the 25% and 75% quantiles, respectively; whiskers extend to the most extreme data points.

3.3 Collaborative efforts

Overall, the output could be divided evenly over the three collaboration types, *none*, *national*, and *international*. Works of *international* collaborations turned out to be more cited than the average of either the participating research unit itself or that of the concepts assigned to the works. By contrast, there seems to be no systematic difference in citation rates between works resulting from *national* collaborations or those realised without collaboration (category *none*).

Consortium collaborations, i.e., joint works across the participating units are sketched in Figure 3.4 and in Figure 3.4 for the individual fields of research. The corresponding share of *consortium* collaborations of the total number of works ranged from about 12% (UM) to 27% (UvA), while 21% were internal collaborations.

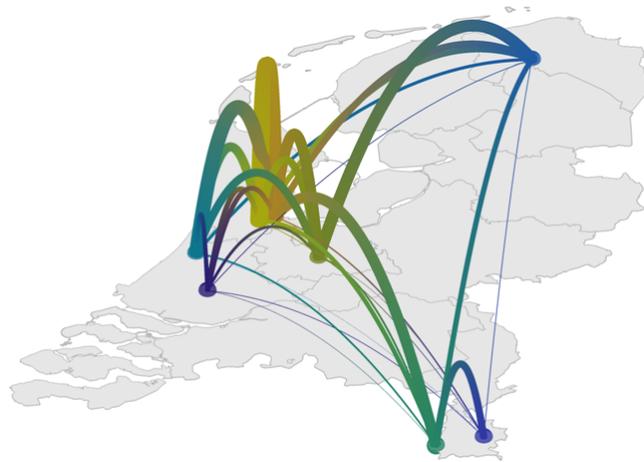


Figure 3.4: Network of collaborations across the participating research units. The thickness and height of the edges indicate the total number of joint papers; see the [online dashboard](#) and Table C.5 in the *Appendix*. There we also show the network of collaboration normalised separately to every individual research unit to avoid a bias to the corresponding total research output.

Interaction was particularly strong between VU and UvA, and between OU and UM and to a somewhat lesser extent between UvA and UL. This may be explained by their geographical proximity to one another. Zooming in on selected concepts, one can for instance observe that the UU and RUG collaborated intensely on ‘applied psychology’, ‘clinical psychology’ and on ‘methodology & statistics’.

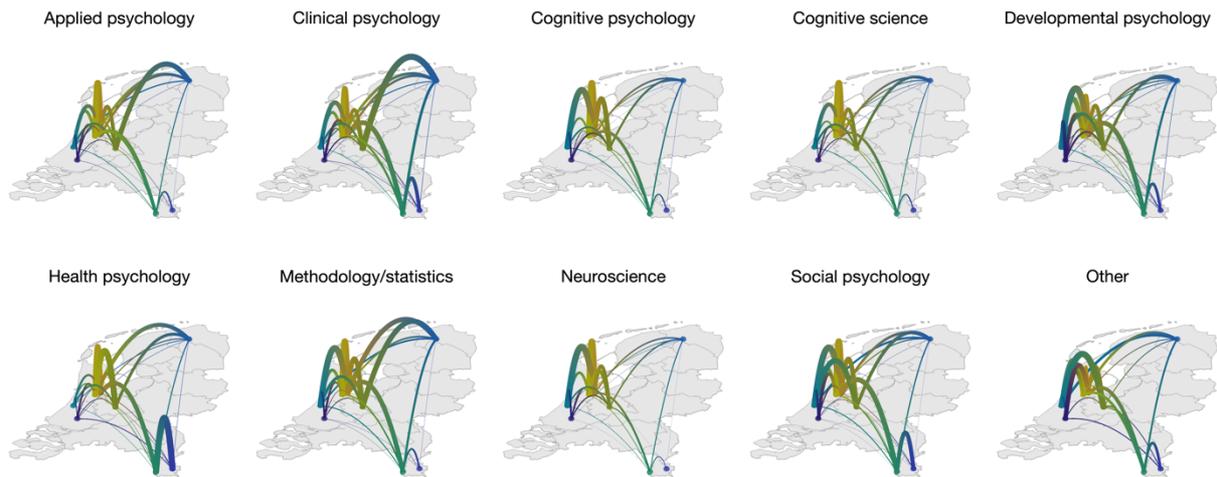


Figure 3.5: Network of collaborations across the participating research units per field of research (concept). As in Figure 3.4, the thickness and height of the edges indicate the total number of joint papers; see the [online dashboard](#) and Table C.5.

3.4 SSH themes

Filling the (normalised) work counts in Breimer-like tables did not resemble the pattern of Table 2.1. While this may have been caused by our manual mapping of OpenAlex concepts to the SSH themes, we are tempted to accept that mere counting of works does not yet agree with the strategically chosen future foci outlined in the [SSH sector plan 2022](#).

The SSH theme *mental disorders* turned out to have the overall largest share of output during the evaluation period; see Table 3.1, top panel. There, output was stable over the years, ranging between 40% and 79% of annual total output for any of the universities. The theme *social transition and behavioural change* had the second highest output, followed by *youth resilience*. They accounted to about 30% and 20%, respectively. By contrast, the work counts for *social inequality and diversity* and for *the human factor in new technologies* were much smaller, presumably because they represent topics that gained popularity only in recent years.

For the three most established themes, relative contributions largely agreed across the participating research units. For *social inequality and diversity*, the output share at UU and VU was larger compared to the overall share. *The human factor in new technologies* has recently seen considerable growth at EUR, but given the small sample size it seems too early to speak of a trend; all the numbers can be found in our [online dashboard](#).

Table 3.1: Breimer tables as realised over the evaluation period. The circle diameters are given by the raw work counts normalised to the total output per research unit and normalised to the total output per SSH theme.

	EUR	RU	OU	TiU	RUG	UL	UM	UU	UT	UvA	VU	WUR
youth resilience	●		●		●	●	●	●		●	●	
mental disorders	●		●		●	●	●	●		●	●	
the human factor in new technologies	●		●		●	●	●	●		●	●	
social transition and behavioural change	●		●		●	●	●	●		●	●	
social inequality and diversity	●		●		●	●	●	●		●	●	

As mentioned earlier, SSH, i.e., Social Sciences and Humanities, covers more disciplines than what has been analysed here. Next to research in psychology, the Breimer Table 2.1 also addresses research in social sciences (including sociology and pedagogical sciences) that clearly cover the theme ‘social inequality and diversity’ more than psychology alone.

3.5 Societal impact

More than 1,900 of the incorporated works were mentioned in the news (Figure 3.6 and Table C.6 in the *Appendix*). Approximately 2,100 different media outlets mentioned them almost 19,000 times. And more than 400 academic research works entered more than 400 different policy documents with a total of more than 600 citations; see Table C.7 in the *Appendix*.

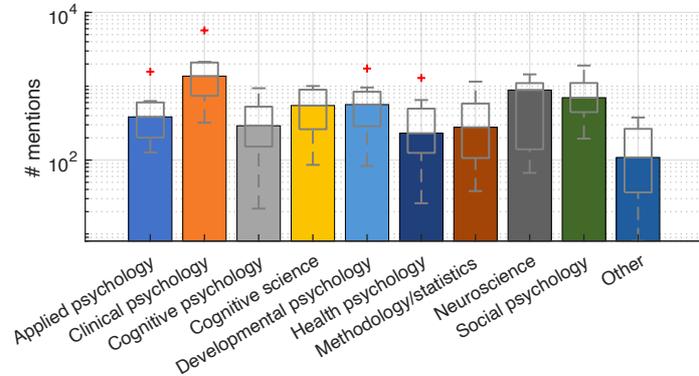


Figure 3.6: Mentions in the news per concept. The corresponding numbers can be found in Table C.6. Please notice the logarithmic scale used to ease comparison across fields of academic research. The bars indicate the median over the participating research units and the boxes indicate the 25% and 75% quantiles. The whiskers extend to the most extreme data points not considered outliers (outliers are plotted individually using the '+' marker symbol).

Media attention could be identified in 92 different countries primarily in Western Europe and North America. Policy impact is concentrated in the more general Global North.

3.6 International benchmarking

As expected, in terms of mere output counts, the Netherlands falls behind the much larger US, UK, and Germany. However, in terms of average citations per work, the Netherlands does exceptionally well, as do all the other smaller countries. This also holds for each of the individual concepts, see our [online dashboard](#).

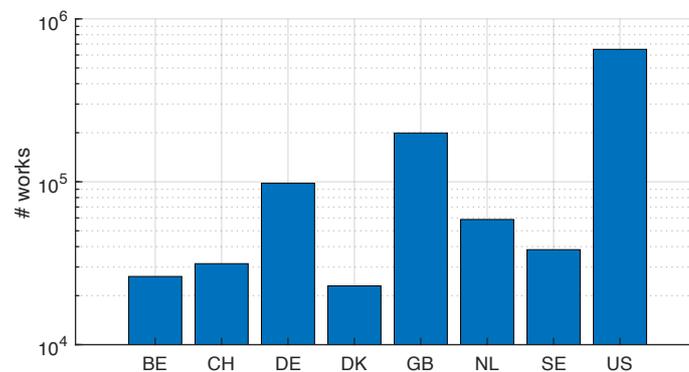


Figure 3.7: Total number of works per country.

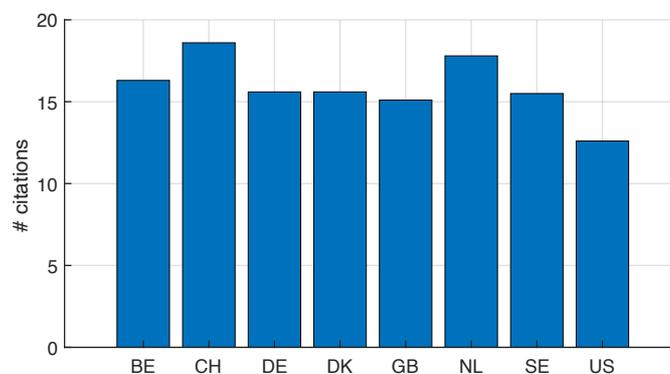


Figure 3.8: Average number of citations per country.

4. Contemplation

This overarching analysis of the psychology research output of the participating eight research units clearly reveals their tremendous productivity. Across the board, the research comes with a strong research impact (measured via concept weighted citation scores) and a likely strong societal impact (measured via mentions in the media and policy documents). Placing this in an international context clearly shows that, despite the smallness of the Netherlands, the research quality is particularly high irrespective of the subfield of psychology. While most participating research units already cover many aspects of research, our analysis shows that intense collaborative networks warrant substantial contributions over the entire spectrum of research in the vast domain of psychology.

We believe that the joint efforts profoundly add to the international positioning of Dutch research. It guaranteed resilience in difficult times due to the Covid-19 pandemic which hardly affected quantity and quality of the research output. This finding cannot be stressed enough since the difficult times have also been and still are accompanied by financial challenges. Many participating research units are funded as social science institutions while their research increasingly relies on cost-intensive life science-oriented approaches including psychophysiological techniques and neuroimaging. Research funding should hence be levelled with science and technology and/or medical sciences institutions to overcome the structural underfunding of psychology research.

The future focus will be partly guided by the [SSH sector plan](#) and the accompanying deployment of M€ 70 per year for the next decade. Our inventory of the past research emphases clarified that some of the participating universities plan to capitalise on their current strengths, whereas others seek to complete their portfolio by forwarding themes that are currently less prominent or simply 'too recent' – this particularly applies to the theme *the human factor in new technologies*.

Combining this analysis with the individual self-evaluations may serve to underline strategic choices and embedding individual activities in a broader context. The individual qualities and 'niches' serve an important function in illustrating the multi-faceted nature and completeness of the overarching nation-wide research in psychology. The individual and collective qualities of the participating units should primarily be measured on an international scale, rather than to contrast and compare with each other. We trust that this brief report can help to identify what is needed to maintain a high-quality of research, sustainable in a world of fierce international competition, with individual, university-specific evaluations as showcase(s).

Appendix

A. Data collection

All participating universities provided a list of disseminated works to the Research Intelligence team at the Vrije Universiteit Amsterdam (VU-RI). Each of these lists were compiled from the local CRIS, verified by the respective research units. The VU-RI team extracted the corresponding digital object identifiers (DOIs) and matched them to those stored in the OpenAlex database using OpenAlex's API. The resulting set of matched publications served for all subsequent analyses (except for the international benchmarking that solely relied on records of the OpenAlex database).

Not all publications from the CRIS output lists contained a DOI, since output types other than journal articles often lack a DOI. We did consider an alternative by matching on other non-standardised metadata, for example, the publication title and author names. While this would have allowed for the inclusion of items without a DOI, such a type of textual matching may not provide reliable results due to possible differences between data sources. The number of publications without a DOI was on average 15%, ranging between 40% for the OU and 7% for UM (RUG only provided works with DOI).

The matched set was complemented by metadata from OpenAlex and from Altmetric Explorer (also matched on the DOI). All concept and citation counts were retrieved from OpenAlex. Altmetric Explorer served as source for mentions in media and policy documents that were included in the analysis of societal impact.

B. Concept assignment via OpenAlex

As explained in the body text, using the OpenAlex database, all analysed works were labelled with *concepts* that indicate relevance of the work for a particular field of academic research. OpenAlex employs an algorithm that was trained to replicate results from the Microsoft Academic Graph (MAG) labelling. The hierarchy in the OpenAlex Concept labels follows the hierarchy between topics from [Wikidata](#) as specified in the [OpenAlex documentation](#) and the corresponding [technical white paper](#). A technical account of the MAG Field-of-Science labelling method can be found in [Shen, Ma, & Wang \(2018\)](#).¹¹

In brief, the labelling algorithm uses title, keywords, and abstract for a particular work and compares them semantically to the text from a pre-selected set of Wikipedia lemmas. Subsequently it determines a numerical score to every article-lemma pair: the higher the score, the higher the likelihood that the text from the article and the lemma agree. If the score exceeds a given threshold, then the publication is labelled with the title of the corresponding Wikipedia lemma. The level-0 and level-1 concepts are assigned via the well-established classification scheme from [Science-Metrix](#). Lower-level candidate lemmas are established by excluding certain topics, e.g., those that largely agree with already existing (accepted) ones. Lemmas about persons are not considered suitable.

¹¹ Shen, Z., Ma, H., & Wang, K. (2018). A web-scale system for scientific knowledge exploration. [arXiv:1805.12216](#).

C. Supplementary figures and tables

C.1 Work counts

Table C.1: Average research FTEs per participating research unit.

EUR	OU	RUG	UL	UM	UU	UvA	VU
41.1	22.4	104.6	108.8	133.5	131.2	129.9	107.7

Table C.2: Total numbers of works per research unit and OpenAlex concept.

	EUR	OU	RUG	UL	UM	UU	UvA	VU	Total
Applied psychology	278	128	541	393	450	410	470	720	3100
Clinical psychology	434	312	1081	834	1354	934	1089	1919	7267
Cognitive psychology	240	30	351	420	633	522	686	414	2973
Cognitive science	263	94	533	467	731	647	742	587	3714
Developmental psychology	397	151	483	497	534	556	632	711	3604
Health psychology	128	150	225	175	373	198	183	532	1850
Methodology/statistics	193	79	426	334	359	355	593	458	2547
Neuroscience	254	43	396	564	858	579	746	538	3598
Social psychology	405	175	719	595	659	675	818	712	4318
Other	62	45	158	80	179	135	112	88	805
Total	953	453	1983	1619	2437	1857	2288	2785	13166

Table C.3: Number of works per research unit and concept, relative to the total number of works per research unit. Figures are in percent (%). Recall that the works have typically been assigned to multiple concepts for which the totals do not add to 100%.

	EUR	OU	RUG	UL	UM	UU	UvA	VU	Total
Applied psychology	29.2	28.3	27.3	24.3	18.5	22.1	20.5	25.9	23.5
Clinical psychology	45.5	68.9	54.5	51.5	55.6	50.3	47.6	68.9	55.2
Cognitive psychology	25.2	6.6	17.7	25.9	26.0	28.1	30.0	14.9	22.6
Cognitive science	27.6	20.8	26.9	28.8	30.0	34.8	32.4	21.1	28.2
Developmental psychology	41.7	33.3	24.4	30.7	21.9	29.9	27.6	25.5	27.4
Health psychology	13.4	33.1	11.3	10.8	15.3	10.7	8.0	19.1	14.1
Methodology/statistics	20.3	17.4	21.5	20.6	14.7	19.1	25.9	16.4	19.3
Neuroscience	26.7	9.5	20.0	34.8	35.2	31.2	32.6	19.3	27.3
Social psychology	42.5	38.6	36.3	36.8	27.0	36.3	35.8	25.6	32.8
Other	6.5	9.9	8.0	4.9	7.4	7.4	4.9	3.2	6.1

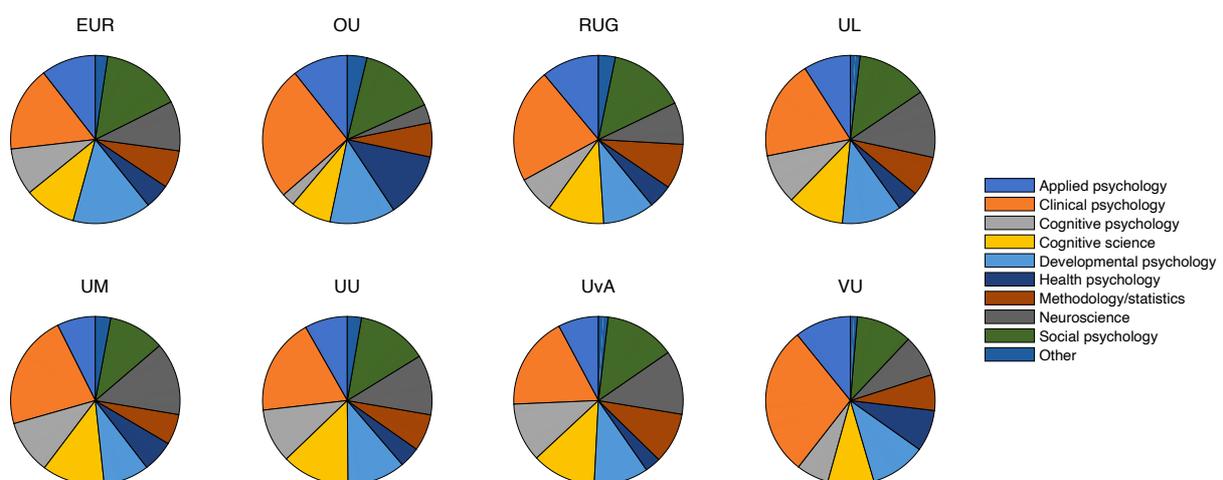


Figure C.1: Distribution of fields of academic research for each of the eight participating research units; cf. Table C.3.

C.2 Citation scores

Table C.4: Average concept-weighted citation scores (CWCS) over time. Recall that a publication with a CWCS of 1.25 has received 25% more citations than the average publication within the same (set of) concepts and year of publication.

	EUR	OU	RUG	UL	UM	UU	UvA	VU	Total
2017	3.48	2.21	2.84	3.13	3.00	2.69	4.51	4.34	3.44
2018	3.86	1.95	2.81	4.23	2.13	3.20	5.00	5.86	3.90
2019	4.17	1.90	2.78	3.36	3.13	2.88	3.89	4.97	3.57
2020	2.94	2.28	3.45	3.12	2.34	5.30	2.91	4.84	3.59
2021	3.66	1.59	2.93	2.60	2.17	2.70	3.00	3.70	2.94
Total	3.61	1.97	2.97	3.28	2.53	3.38	3.81	4.67	3.46

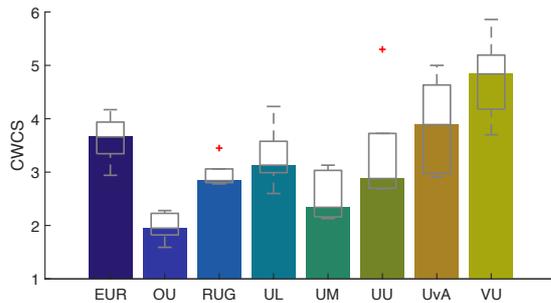


Figure C.2: Median total CWCS (estimated over time). Boxes indicate the 25% and 75% quantiles, and the whiskers extend to the most extreme data points not considered outliers (outliers are plotted individually using the '+' marker symbol).

C.3 Collaborative works

Table C.5: Total number collaborative works between the participating research units.

	EUR	OU	RUG	UL	UM	UU	UvA	VU	Total
EUR		6	7	39	4	26	44	47	173
OU	6		7	2	66	4	13	7	105
RUG	7	7		29	48	109	61	52	313
UL	39	2	29		16	73	130	82	371
UM	4	66	48	16		18	98	40	290
UU	26	4	109	73	18		98	68	396
UvA	44	13	61	130	98	98		164	608
VU	47	7	52	82	40	68	164		460
Total	173	105	313	371	290	396	608	460	2716

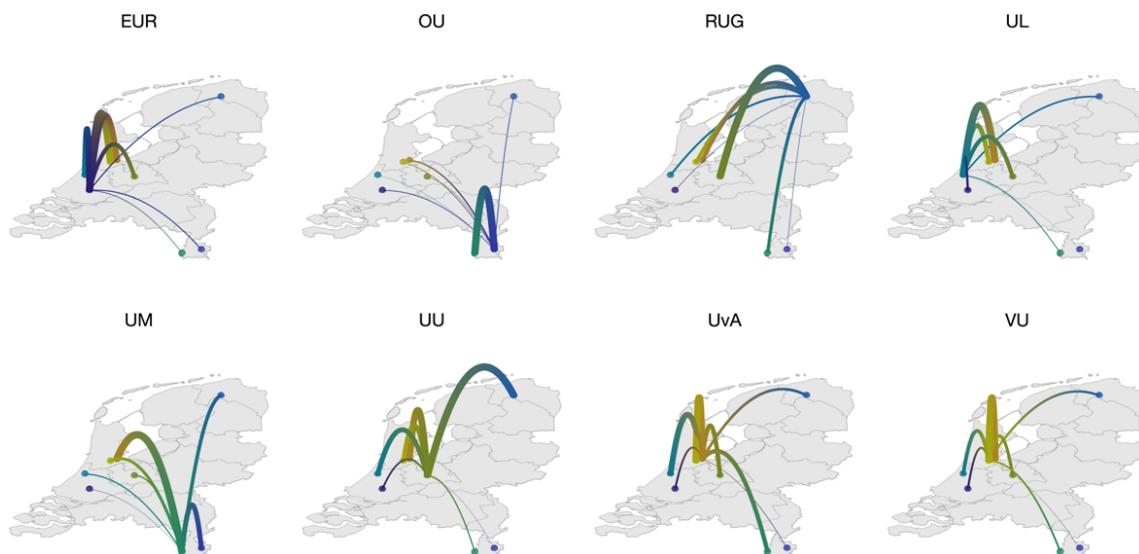


Figure C.3: Collaborations from every research unit to the others. In each panel a different research unit is indicated as central node; edge scaling is given by the total number of joint works, but in contrast to Figure 3.4 of the body text, here the scaling is normalised to the central nodes' total number of collaborative works.

C.4 Societal impact

Table C.6: Total numbers of mentions in the news per concept (recall that works are typically assigned to multiple concepts for which the total may differ from the sum per column).

	EUR	OU	RUG	UL	UM	UU	UvA	VU
Applied psychology	127	163	349	419	629	240	577	1572
Clinical psychology	320	450	1033	1473	2051	2137	1267	5697
Cognitive psychology	128	22	176	504	553	221	939	362
Cognitive science	86	90	433	964	832	465	631	1005
Developmental psychology	221	83	354	961	597	531	722	1735
Health psychology	162	26	344	137	300	650	113	1292
Methodology/statistics	60	38	191	365	153	580	584	1154
Neuroscience	129	67	151	1447	891	918	1285	884
Social psychology	195	309	786	582	729	670	1425	1905
Other	25	8	189	50	167	340	48	377
Total	575	480	1683	2394	3227	2915	2946	6999

Table C.7: Total numbers of mentions in the policy documents per concept (recall that works are typically assigned to multiple concepts for which the total may differ from the sum per column).

	EUR	OU	RUG	UL	UM	UU	UvA	VU
Applied psychology	15	5	30	32	18	26	29	116
Clinical psychology	23	13	52	45	57	69	52	212
Cognitive psychology	5	0	6	11	4	6	11	7
Cognitive science	7	4	10	11	8	18	21	14
Developmental psychology	20	8	21	17	11	18	18	79
Health psychology	19	9	13	15	24	42	11	98
Methodology/statistics	15	0	21	13	9	11	32	19
Neuroscience	3	2	7	6	8	14	11	4
Social psychology	1	8	36	31	18	33	33	38
Other	8	2	18	4	10	27	6	22
Total	52	15	91	81	76	95	98	271