The Growth of Psychology and its Corrective Mechanisms  
A Bibliometric Analysis (1963-2012)

- Proposed Independent Comment -

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A search in PsycINFO learns that the psychological literature anno 2012 covered 141,102 articles published in 2,523 peer-reviewed journals. Specific searches show that in the last year, 1265 psychological articles used the term meta-analysis in the abstract, 684 were corrigenda/errata, 41 were retraction notices, and 835 involved comments or critiques. Moreover, 557 articles contained the term replication in their abstract, while the abstracts of 62 articles featured the term reanalysis. Another 167 articles appear to concern disconfirmations as they included “falsify/falsifies’”, “contradict(s)”, or “disconfirm(s)” in the abstract. To put these numbers in historical perspective, we repeated these searches for the last 50 years. The resulting data shed light on the growth of the psychological literature and trends in corrective mechanisms therein. We used unambiguous search-strings related to common corrective mechanisms (i.e., avoiding terms compounded by substance) to shed light on the appearance of relevant articles. Counts per year are depicted in Figure 1 for total number of articles and journals, publications related to meta-analysis, critiques/comments, disconfirmations, errata/corrigenda, retractions, replications, and re-analyses. The data, search strings, and database limits are given in the appendix.

The number of articles (Panel A) has grown sharply from 5907 in 1963 to 141,102 in 2012. This aligns with the increasing number of journals listed in PsycINFO (line in Panel A), which went from 182 to 2523. Increases in specific types of articles should be viewed relative to the total number of articles by year, so Panels B-H include both the raw counts as bars and the percentages as lines. We tested for trends using standard logistic regressions of records/articles with year and the square of yearas predictors, and additionally with period (1963-1987 vs. 1988-2012) as dichotomous predictor. All trends mentioned below were significant (α=.05).

Panel B shows an increasing number of articles with “meta-analysis” in the abstract, starting with the development of meta-analysis in the late 1970s. The increase in meta-analytic articles is disproportionate in the sense that their relative occurrence went up from 0.2% in the 1980s to 0.9% in the last years.

Panel C reports the number of articles with critique or comment in the title. Despite the rising numbers of such critical articles in PsycINFO, their relative appearance is quite constant, with a slight drop since 1987.

Panel D includes the number of articles with “disconfirm(s)”, “falsify/falsifies’”, or “contradict(s)” in the abstract. Despite the growing count per year, the relative appearance of articles that appear to fit Popper’s philosophy was higher in the period 1973-1985 (around 0.2%) than in the last 25 years (around 0.1%).

Panel E depicts the trend line and the number of articles with erratum or corrigendum in the title (we did not search with “correction” because of its substantive meaning). Results show a near-absence of errata/corrigenda in most of the 1980s and a disproportionate increase in (self-)corrections since 1987.

Papers may be retracted because of gross errors, failures to replicate, or scientific misconduct. Panel F highlights a sharp increase in the number and relative frequency of retracted papers in the last decade. The increase is disproportionate even if we exclude the year 2012, which features many retractions by Diederik Stapel. In psychology, the yearly retraction rate of published articles is currently around 0.02%, which aligns with the recent (increasing) rate documented across the whole of science ([Van Noorden, 2011](#_ENREF_3)).

Replication concerns a core corrective mechanism of science ([Asendorpf et al., 2013](#_ENREF_1)). Panel G depicts the number and rate of articles that contained the word replication in their abstract. Only few such (apparent) failures to replicate get published ([cf. Makel, Plucker, & Hegarty, 2012](#_ENREF_2)). The rate of these articles was around 0.50% in the period 1963-1979 and slightly lower at around 0.33% in the last two decades.

Another corrective mechanism concerns (independent) re-analyses of the data. Although the number of articles with the term reanalysis in the abstract (Panel H) has increased over the years, the relative frequency dropped steadily since 1987. This is striking given that sharing electronic data for re-analysis should have become easier in the last decades.

Assuming that the search terms reflect articles’ content and that types of articles in PsycINFO have remained comparable in relevant aspects, our results highlight the following publication trends. The strong growth of the psychological literature is coupled with a sharp increase in the (relative) number of meta-analytic articles, which suggests an increasing demand for meta-analyses to collate the expanding number of empirical results. Retractions have been on the rise in psychology, as they have in other fields. Similarly, the (relative) number of errata/corrigenda has increased since 1989. These trends may be due to growing scrutiny by readers in the online era and rising awareness of misconduct ([Van Noorden, 2011](#_ENREF_3)). The relative number of articles that concern comments, replications, re-analyses of data, or disconfirmations was lower in the last 25 years as compared to earlier periods, reflecting perhaps a growth in journals’ emphasis on publishing novel results. Also, the drop in relative frequency in published re-analyses since the 1980s may reflect the common failure to share data for reanalysis due to substandard documentation and archiving of data ([Wicherts, Bakker, & Molenaar, 2011](#_ENREF_4); [Wicherts, Borsboom, Kats, & Molenaar, 2006](#_ENREF_5)).

**References**

Asendorpf, J. B., Conner, M., Fruyt, F. D., Houwer, J. D., Denissen, J. J. A., Fiedler, K., et al. (2013). Recommendations for increasing replicability in psychology. *European Journal of Personality, 27*, 108-119. doi: 10.1002/per.1919

Makel, M. C., Plucker, J. A., & Hegarty, B. (2012). Replications in Psychology Research How Often Do They Really Occur? *Perspectives on Psychological Science, 7*, 537-542. doi: 10.1177/1745691612460688

Van Noorden, R. (2011). Science publishing: The trouble with retractions. *Nature, 478*, 26-28. doi: 10.1038/478026a

Wicherts, J. M., Bakker, M., & Molenaar, D. (2011). Willingness to share research data is related to the strength of the evidence and the quality of reporting of statistical results. *PLoS ONE, 6*, e26828. doi: 10.1371/journal.pone.0026828

Wicherts, J. M., Borsboom, D., Kats, J., & Molenaar, D. (2006). The poor availability of psychological research data for reanalysis. *American Psychologist, 61*, 726-728. doi: 10.1037/0003-066X.61.7.726

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| --- | --- |
|  | |
| A | B |
| C | D |
| E | F |
| G | H |

*Figure 1.* Absolute yearly frequencies (bars) and yearly percentages (lines) of articles in peer-reviewed journals in PsycINFO from 1963-2012 concerning meta-analysis (Panel B), comments/critiques (Panel C), disconfirmations (Panel D), errata/corrigenda (Panel E), retractions (Panel F), replications (Panel G), and re-analyses (Panel H). Panel A gives the total number of articles (bars) and the number of journals (line) listed in PsycINFO.

**Appendix**

Table A1. Data table for the counts in Figure 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | articles | journals | meta-analyses | critiques | retractions | errata | reanalyses | replications | disconfirms |
| 1963 | 5907 | 182 | 0 | 77 | 0 | 24 | 3 | 27 | 7 |
| 1964 | 6627 | 198 | 0 | 65 | 0 | 13 | 1 | 47 | 7 |
| 1965 | 7478 | 208 | 0 | 48 | 0 | 10 | 2 | 41 | 7 |
| 1966 | 8654 | 234 | 0 | 69 | 0 | 6 | 4 | 47 | 9 |
| 1967 | 10603 | 249 | 0 | 52 | 0 | 15 | 8 | 46 | 11 |
| 1968 | 12278 | 263 | 0 | 74 | 0 | 16 | 5 | 53 | 11 |
| 1969 | 11955 | 284 | 0 | 89 | 0 | 22 | 12 | 60 | 14 |
| 1970 | 11814 | 303 | 0 | 77 | 0 | 22 | 8 | 59 | 14 |
| 1971 | 13315 | 333 | 0 | 83 | 0 | 16 | 8 | 75 | 18 |
| 1972 | 14272 | 368 | 0 | 106 | 0 | 14 | 10 | 83 | 19 |
| 1973 | 16489 | 405 | 0 | 107 | 0 | 24 | 15 | 76 | 35 |
| 1974 | 18223 | 432 | 0 | 103 | 0 | 17 | 16 | 65 | 37 |
| 1975 | 17950 | 459 | 0 | 112 | 0 | 19 | 16 | 71 | 31 |
| 1976 | 19030 | 478 | 0 | 156 | 0 | 30 | 19 | 79 | 41 |
| 1977 | 19944 | 504 | 0 | 130 | 0 | 18 | 22 | 89 | 34 |
| 1978 | 20163 | 519 | 4 | 167 | 0 | 21 | 32 | 117 | 52 |
| 1979 | 16903 | 537 | 4 | 156 | 0 | 2 | 22 | 100 | 39 |
| 1980 | 17782 | 559 | 10 | 132 | 0 | 3 | 20 | 66 | 43 |
| 1981 | 19471 | 607 | 11 | 173 | 0 | 1 | 26 | 72 | 36 |
| 1982 | 26511 | 676 | 34 | 215 | 0 | 1 | 35 | 85 | 47 |
| 1983 | 28692 | 726 | 56 | 273 | 0 | 2 | 40 | 101 | 74 |
| 1984 | 30046 | 760 | 57 | 297 | 0 | 3 | 40 | 111 | 71 |
| 1985 | 32772 | 796 | 67 | 312 | 0 | 3 | 48 | 117 | 72 |
| 1986 | 35452 | 840 | 71 | 390 | 0 | 3 | 28 | 95 | 50 |
| 1987 | 32876 | 878 | 69 | 249 | 0 | 5 | 40 | 73 | 46 |
| 1988 | 32978 | 916 | 69 | 223 | 0 | 8 | 29 | 79 | 38 |
| 1989 | 36227 | 962 | 77 | 300 | 2 | 71 | 35 | 93 | 57 |
| 1990 | 36804 | 1007 | 103 | 304 | 1 | 59 | 28 | 101 | 49 |
| 1991 | 38468 | 1051 | 99 | 361 | 0 | 87 | 46 | 109 | 43 |
| 1992 | 40805 | 1119 | 112 | 333 | 0 | 111 | 32 | 117 | 60 |
| 1993 | 42369 | 1167 | 146 | 362 | 0 | 122 | 39 | 118 | 56 |
| 1994 | 45055 | 1218 | 135 | 453 | 0 | 131 | 40 | 125 | 59 |
| 1995 | 45421 | 1261 | 200 | 460 | 0 | 102 | 34 | 132 | 49 |
| 1996 | 45687 | 1302 | 153 | 398 | 0 | 77 | 45 | 125 | 51 |
| 1997 | 46580 | 1337 | 183 | 375 | 0 | 92 | 44 | 136 | 57 |
| 1998 | 49832 | 1397 | 190 | 398 | 0 | 141 | 32 | 182 | 72 |
| 1999 | 51411 | 1450 | 223 | 417 | 1 | 120 | 44 | 182 | 75 |
| 2000 | 54002 | 1553 | 216 | 395 | 0 | 110 | 49 | 162 | 62 |
| 2001 | 58591 | 1682 | 280 | 388 | 4 | 138 | 36 | 194 | 74 |
| 2002 | 66077 | 1761 | 287 | 673 | 3 | 194 | 38 | 176 | 81 |

(table continues on next page)

Table 1 (continued)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | articles | journals | meta-analyses | critiques | retractions | errata | reanalyses | replications | disconfirms |
| 2003 | 77422 | 1818 | 402 | 800 | 4 | 237 | 43 | 244 | 99 |
| 2004 | 83056 | 1902 | 431 | 772 | 2 | 218 | 47 | 282 | 108 |
| 2005 | 90412 | 2040 | 521 | 717 | 1 | 297 | 59 | 292 | 108 |
| 2006 | 100929 | 2162 | 568 | 748 | 6 | 463 | 60 | 351 | 95 |
| 2007 | 109010 | 2290 | 655 | 682 | 4 | 474 | 51 | 380 | 147 |
| 2008 | 123485 | 2389 | 780 | 698 | 10 | 517 | 62 | 428 | 152 |
| 2009 | 130483 | 2442 | 892 | 668 | 19 | 575 | 69 | 477 | 158 |
| 2010 | 134512 | 2477 | 1019 | 722 | 13 | 690 | 60 | 521 | 166 |
| 2011 | 142797 | 2501 | 1273 | 722 | 20 | 717 | 78 | 534 | 175 |
| 2012 | 141102 | 2523 | 1265 | 835 | 41 | 684 | 62 | 557 | 167 |

Table A2

Search terms used in PsycINFO

Category Boolean/Phrase:

articles PY 1963

meta-analysis PY 2012 AND AB meta-analysis

retraction\* PY 2012 AND TI retraction

corrigenda PY 1963 AND (TI corrigendum or TI erratum)

critique PY 2012 AND (TI critique OR TI comment)

reanalysis PY 2012 AND (AB reanalysis)

replication PY 2012 AND (AB replication)

disconfirms PY 1963 AND (AB falsifies OR AB contradicts OR AB disconfirms)

Note: Searches conducted between 12/8/13 and 15/8/13 with the limiter “Publication Type: Peer Reviewed Journal”; \*For retractions, we used a manual search to avoid inclusion of irrelevant papers