Framing psychology as a discipline (1950-1999): A large-scale term co-occurrence analysis of scientific literature in psychology

Flis, I.; Eck, N.J. van

Framing Psychology as a Discipline (1950-1999): A large-scale term co-occurrence analysis of scientific literature in psychology

Authors:

Ivan Flis, Descartes Centre, Utrecht University, Netherlands

Nees Jan van Eck, CWTS, Leiden University, Netherlands

This is a post-peer-review (post-print) version of the manuscript published in APA's journal *History of Psychology*.

The data used to produce the visualizations and extra clarifications can be found on the manuscript's Figshare project page:

https://figshare.com/projects/Framing_Psychology_article_maps/16467

"Excitement and pink lemonade." That's how Lee Cronbach described the state of psychology in his presidential address, on September 2, 1957, to the assembled members of the American Psychological Association:

> No man can be acquainted with all of psychology today, as our convention program proves. The scene resembles that of a circus, but a circus grander and more bustling than any Barnum ever envisioned – a veritable week-long diet of excitement and pink lemonade. Three days of smartly paced performance are required just to display the new tricks the animal trainers have taught their charges. We admire the agile paper-readers swinging high above us in the theoretical blue, saved from disaster by only a few gossamer threads of fact, and we gasp as one symposiast thrusts his head bravely between another's sharp toothed jaws. This 18-ring display of energies and talents gives plentiful evidence that psychology is going places. But whither? (p. 671).

This was the key question: whither? In other words, where was psychology going? Or, more generally: what was it that was going? And thus, similarly: where has 'it' been? Cronbach's metaphorical circus is a common *topos* for many psychologists, but usually under a more down-to-earth name: psychology's crisis of disunity. Much has been written about it since the 1950s. And not only by psychologists - just looking at the history of the naming conventions trying to delimit psychology as a science is indicative of how interesting this question was and is for historians and sociologists.[1]

[1] For a sample of the many treatments of disunity by psychologists, see Staats (1983, 1991), Koch, (1993), Koch and Leary (1992), Green (1992a, 2015), Stam (2004), Sternberg, (2005), Henriques (2003); see a special section of *Theory & Psychology* dedicated to Henriques' ToK project (Henriques, 2008). The question of unification has often been labeled as a crisis (e.g. Goertzen, 2008). For more on the intellectual and social histories of these umbrella terms naming psychology, see the *Introduction* in Erickson et al. (2013) on moral/social/behavioral sciences; Pooley and Solovey (2010) and Pooley (2016)

Cronbach, in 1957 and in 1975, described what he called the two disciplines of scientific psychology. The schism he identified was between "correlational" and "experimental" psychology. On the correlational side, psychologists looked at the existing differences between subjects and devised statistical procedures to analyze them. The data on which their science was built were the many variables on which people could differ – everything from intelligence to various measures of personality. On the experimental side, psychologists designed experiments in which they tried to keep all things constant and isolate the influence of a particular experimental intervention. The data about how that treatment affected the subjects - and how varying the treatment the experimenter could get different results - was the bedrock of their approach. These two broadly sketched lines of research, according to Cronbach, were methodological traditions with their own histories, communities, and rules.

Was Cronbach's description warranted? Considering the many pitched debates among psychologists about the nature and boundaries of their discipline throughout the twentieth century, it sounds plausible. Cronbach felt it was one of the most important questions to tackle at the time – in his previously quoted presidential address, he wrote that the different methodological traditions limited psychology, and that investigators should dedicate themselves to "scientific psychology as a whole" (1957, p. 671). His later evaluations were less optimistic (Cronbach, 1975). Even today, some methodologists agree with Cronbach's description of the state of research in the field (Borsboom, Kievit, Cervone, & Hood, 2009).

---

on behavioral/social sciences; and for the inter- and multidisciplinary history of the cognitive sciences, see Cohen-Cole (2007). For a Foucauldian conception of 'psy sciences' see Nikolas Rose (1990, 1996). These labels are not only different names for psychology - they also act as conceptual workhorses for wider boundary-making (Gieryn, 1999) of psychology's association with different social sciences, philosophies, natural sciences, and medicine.

Considering the popularity of the unity/disunity debates among psychologists and historians, we approach the question of disciplinary formation by reframing it into a history of methods. Such a move is not without precedent – if we take a look at relevant historiography much work has been done on the history of psychology's methods in the 20th century by Andrew Winston (1988; 1990; 2005; MacMartin & Winston, 2000), Kurt Danziger (1985; 1990; 1996; Danziger & Dzinas; 1997), and Henderikus Stam (1992; 2000; 2004). They have addressed the role of the methodological meta-language, particular research designs, and statistics used in psychological research. Their work brings to light the development of methodological uniformity in psychological research in the period, but they do not frame their analysis along the lines of Cronbach's correlational/experimental distinction. If there is a kind of methodological uniformity developing in the late 20th century psychology, how does this uniformity fit Cronbach's two streams of scientific psychology? And even more fundamentally, how does the historians' idea that research methodologies were converging fit with Cronbach's (and other psychologists') narrative of disunity? We aim to explore exactly that through a large-scale analysis of the content of psychological journals.

Cronbach's two disciplines of scientific psychology and the work of Danziger, Winston, and Stam are our starting point for a *bibliometric* analysis. Historians have identified the philosophical and social forces underscoring the methodological imperative internalized by psychologists in the 20th century. In the same period, the research output of psychologists experienced a staggering growth, as is the case for most of science (see De Solla Price, 1986; also see *Figure 1* in this article). Psychology, the "traditional history" of the discipline in the 20th century would tell us (Walsh, Teo, & Baydala, 2014, p. xiii), also went through important changes – the cognitive revolution, the rise of evidence-based therapies and various professional psychologies, the advent of neuroscience; just to name a few. If we

take a bird's-eye view of psychological research, made possible by new ways of analyzing large amounts of data, can we identify a) the growth of the literature b) the fundamental changes in the content of the science c) the methodological traditions akin to the ones Cronbach talks about?

We aim to show that even though the growth of the literature was massive, the *fundamental changes* in the content of psychological research were not structural. The structure of the field remained the same, and at the center was a methodological core. As for the content of psychological research (whether we call it theories, paradigms, or psychological knowledge), we can hardly talk about psychology expanding; it is more appropriate to talk about facts accumulating;[2] facts which are generated and justified within a closed system of supposed methodological uniformity. The scientific edifice in the 1990s has become larger, but it is structurally very much alike to what Cronbach saw in the 1950s. Our study is a first of its kind in trying to document the supposed disunity of late 20th century psychology through empirical methods of analyzing the scientific literature on a massive scale.

Method

Articles published in *History of Psychology* (both the journal and the historical discipline) usually do not have a method section. We have decided to include one despite it being uncommon,

[2] A good metaphor for this kind of haphazard accumulation of facts is an "exploding confetti factory" which Ruud Abma (2013, p. 115) discusses in his book on the fraudster Diederik Stapel. The knowledge explosion was originally described as a confetti factory in a book review by Barclay (1973). Collections of facts generated by psychological research cannot be called paradigms or theoretical systems. They are collections bounded by certain methodological and institutional traditions. For more on what it means to generate and constitute facts in psychology, see the work of Mary Smyth (2001a; 2001b; 2004) and the critical synthesis on psychology's textbook fact-making by Ivan Flis (2016).

agreeing with Green, Feinerer, and Burman (2015a, p. 17) that "it seemed advisable [to include a Method section] because we used a set of technical procedures that are unfamiliar to most historians…[and] an explicit "Method" section seemed to be the most efficient way to convey this information." Here we will introduce the dataset we are working with, the rationale behind turning to digital history, and the computational tools we use in our analysis.

Our approach is based on data-mining terms from scientific journals. We use the VOSviewer software developed for scientific literature analysis by scientometricians (Van Eck & Waltman, 2010, 2014; http://www.vosviewer.com). Instead of coaxing out future research fronts, we turn our gaze backwards and use the same tools to reconstruct research fields in the past. We take a sample of 676,393[3] articles published in journals indexed in PsycINFO[4] from 1950 to 1999, and conduct an analysis of the relevant terms they use in their abstracts and titles. These terms are visualized in two-dimensional co-occurrence maps of the discipline in the following way: the larger the number of abstracts/titles which contain the same two terms together, the closer those terms will appear in the map. In this way, the abstracts/titles are used to generate terms, then the co-occurrences of these terms

[3] The present study is the first of its kind considering the scope: we cover as much psychology as possible to extract large-scale historical trends from the literature. Pioneering work on applying digital analysis to history of psychology has been done by Christopher Green's group of historians at York University (Green, 2017; Green, Feinerer, & Burman, 2013, 2014, 2015a, 2015b; Pettit, Serykh, & Green, 2015; Burman, Green, & Shanker, 2015; Young & Green, 2013; Green & Feinerer, 2015), but on a smaller scale and in a different time period.

[4] An interesting approach to discourse-vocabulary-discipline investigation is the work of John Benjafield (2012, 2013). He also uses PsycINFO and tries to historically investigate psychology through the terms used by psychologists but his approach is quite different from ours. Closer to our work is that of Burman, Green, and Shanker (2015), who investigate self-regulation using PsycINFO's controlled vocabulary. The main difference being that our vocabulary is text-mined, not controlled.

structure them into a map. We see the co-occurrence maps as a proxy for the discipline of psychology in the period when the articles in our corpus were published.

Arguments for digital history

Why use term-mining? When Green, Feinerer, & Burman (2015a) used "distant reading" to analyze the trends in *Psychological Review* from 1894 to 1908 they made the argument that "there is far too much source material to be handled by the means that historians traditionally use." They describe the problem as follows: "To capture it all, the individual historian needs a way of handling, organizing, and manipulating this large mass of historical material without having to individually read, interpret, and situate each of these thousands of items" (p.16). The problem has become exacerbated since the 1950s when our analysis starts, because the production of literature, in absolute numbers, doubled with each decade of the second half of the twentieth century. Given the literature explosion, using digital tools to try and analyze disciplinary formation is not just a novel tool, but a crucial one.

However, literature size is not reason enough to turn to digital humanities. The number of texts was almost always too big for comprehensive overviews – the meaningful synthesis of such unsurveyable amounts of information is the bread and butter of historians of science. A more compelling reason for taking the digital approach to historical analysis of disciplinary formation is that it allows us to take a perspective that is not based on prominent authors, their publications, and the fields with which they were associated. There is a certain democracy of large numbers involved in taking the term-mining perspective, where the terms that dominate texts frame our view - not analytical categories like individual or institutional reputation. The *Big Names* still exert their influence over historical trajectories

of terms by virtue of their importance, but by taking the term-mining road, they are not the point from which we start as historians.

Considering the above, we can take a very minimal definition of what psychology was in the period 1950-1999: Whatever the academics and practitioners in the examined period called by that name. More than a thousand journals are included in the analysis.[5] We were guided by maximum inclusivity - to include as many voices published in academic journals on psychological topics, and then analyze them *en masse*. The idea behind the approach is to control for essentialist perspectives on what the core of the discipline was. We subscribe to a rudimentary empiricism of the digital age: we do not focus on experimental psychology, or behaviorism, or the cognitive sciences, or the various applied psychologies - we include as many data points covering all of them and more, and then analyze the patterns that arise out of the data.[6]

As far as our philosophical position toward digital humanities goes - what are the patterns we are analyzing and are they good proxies for disciplinary formation? In that, we are dynamic nominalists

[5] For a full list of journals and the number of publications in the data set see https://figshare.com/account/projects/16467/articles/4232273

[6] A historian of psychology might read our two reasons for using digital methods as unqualified endorsements of the *New History of Psychology* (Furomoto, 1989; and a re-evaluation in Lovett, 2006). Although we share some views with Laurel Furomoto, we do not see various approaches to history of psychology as incompatible. Our approach is yet another contribution to history of psychology as a "divided discipline" (Weidman, 2016, p. 252), adding another tool to the "historian's toolbox" (Green, 2016; p. 218).

(Hacking, 2006).[7] The mass of dots in the maps presented here are constellations of terms that contain echoes of intellectual traditions of psychologists. We are picking up bits and pieces – several hundreds of thousands - of the writing found in journals and trying to fashion an abstracted story of what psychology was in the second half of the twentieth century.

Data

The first step in our study was the construction of a representative dataset of the psychological literature. To construct this dataset, we used PsycINFO, a bibliographic database containing the meta-data of more than four million articles from the field of psychology and related disciplines. The dataset we extracted from PsycINFO includes most indexed articles of the document type 'journal article' published between 1950 and 1999. The number of articles in the dataset is 676,393. *Figure 1* provides a breakdown of the number of articles for each of the five decades. It can be seen that over time there has been a rapid increase in the number of articles. The articles appeared in 1,269 different journals. *Table 1* provides an overview of the 20 journals with the largest number of articles in the dataset (for the full list of included journals, see footnote 5).

[7] Digital methods quite literally make us dynamic nominalists because we deal with ephemeral names of things that appear in the summaries and titles of published literature. The psychologists' research "objects", subjects who acted as sources of data, researchers with their idiosyncrasies in their institutional and social contexts; all remain an elusive background to the thousands of names of things we will showcase in the analysis. Our approach does not invalidate all these objects and subjects behind the literature as crucial elements of causal explanations of historical development. On the contrary, the data-mined perspective offers a framework for explicating them through conventional historiography.

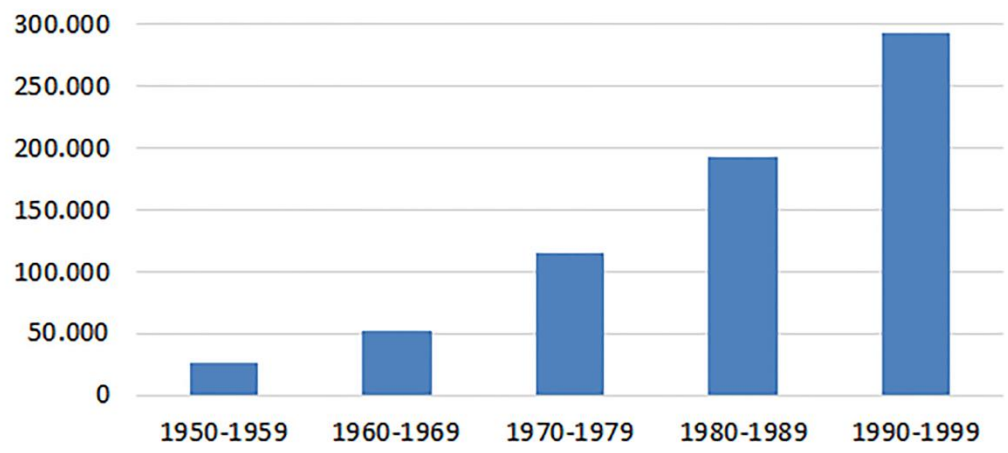

Figure 1. Number of articles per decade in the data set of Psychology articles.

Table 1. Top 20 journals with the largest number of articles in the dataset of psychology articles.

Journal	**No. of pub.**
Psychological Reports	17,761
Perceptual and Motor Skills	16,291
Physiology & Behavior	9,736
Brain Research	7,554
Pharmacology, Biochemistry and Behavior	7,159
Journal of Personality and Social Psychology	6,899
Journal of Clinical Psychology	6,786
American Psychologist	6,400
Psychopharmacology	5,997
Animal Behaviour	5,972
Journal of Experimental Psychology	5,636
Journal of Comparative and Physiological Psychology	5,484
Child Development	5,480
The Journal of Social Psychology	5,000
Educational and Psychological Measurement	4,935
Perception & Psychophysics	4,738
Journal of Applied Psychology	4,726
Journal of Nervous and Mental Disease	4,692
Journal of Consulting and Clinical Psychology	4,368
Vision Research	4,331

Ideally, we would have preferred to work with the full text of articles included in our analysis. Unfortunately, however, we could only use article titles and abstracts because of limited database access. Our data was manually retrieved from PsycINFO with a lot of effort and man-hours, focusing on retrieving article-level metadata from the database (e.g. title, abstract, and years of publication, among other things). Retrieving full texts on the same scale is currently impossible. The newly founded PsycINFO Data Solutions service (http://www.apa.org/pubs/psycinfodatasolutions/) is supposed to provide the kind of access we would need for our research, but the level of access for large-scale discipline-wide literature analysis is still well beyond the capacity of this service (PsycINFO, personal communication, November 8, 2016).

Term identification

After collecting the titles and abstracts of the articles in our analysis, we tried to identify the terms that best capture the intellectual structure of the psychological literature. This was done by following the automatic term identification approach developed by Van Eck & Waltman (2011). This approach automatically identifies relevant terms in the titles and abstracts of the articles in our dataset. More specifically, using natural language processing techniques, we first identified noun phrases in the titles and abstracts of the 676,393 articles in our dataset. A noun phrase was defined as a sequence of words such that the last word in the sequence is a noun and each other word is either a noun or an adjective. We then converted plural noun phrases into singular ones. In this way, noun phrases like "symptom" and "symptoms" were unified. Only noun phrases occurring in the titles and abstracts of at least 300 articles were taken into consideration. Noun phrases occurring in fewer than 300 articles were excluded in order to keep the number of noun phrases included in the analysis manageable. In visual analyses like the one presented in this paper, it is typically not useful to include more than a few

thousand noun phrases. The requirement that a noun phrase needs to occur in 300 articles resulted in a set of 4,913 noun phrases. Of these noun phrases, the 3,000 noun phrases that seemed most relevant were selected. The selection was made based on relevance scores calculated using a computer algorithm (Van Eck & Waltman, 2011). These relevance scores were used to distinguish general noun phrases with a broad meaning (e.g., "method", "result", and "conclusion") from more specific noun phrases (e.g., "depression", "memory function", and "posttraumatic stress disorder"). The latter noun phrases tend to be the more interesting ones, and these noun phrases were therefore selected. In our experience, selecting about 60% of the noun phrases typically works reasonably well. Although our algorithmic approach to select noun phrases does not always give optimal results (some relevant noun phrases may be excluded from the selection and some non-relevant ones may be included), the selected noun phrases generally can be regarded as important and relevant terms in the field of psychology.

Term maps

Based on our set of 3,000 important and relevant terms, the next step was the construction of the so-called term maps. A term map is a two-dimensional visualization in which the terms are located in such a way that the distance between any two terms reflects the relatedness of the terms as accurately as possible. In general, the larger the number of co-occurrences of two terms, the smaller the distance between them. In this way, a term map provides a visual overview of important topics discussed in the literature and how these topics relate to each other. The larger the number of articles in which a term occurs (in the title or abstract), the more prominently the term is displayed in a term map. Frequently occurring terms are for instance presented using a larger font size.

In total, we constructed six term maps. To get a general impression of the subdivision of the field of psychology into topics, and how these topics relate to each other, we constructed an overall term map based on all articles in our data set. To identify changes over time in the topical focus of the field, we also constructed term maps based on the articles published in each of the five decades covered by our data set, that is, 1950–1959, 1960–1969, 1970–1979, 1980–1989, and 1990–1999.

The six term maps were created using a software tool called VOSviewer (Van Eck & Waltman, 2010, 2014; http://www.vosviewer.com), in which VOS stands for visualization of similarities. To construct a term map, we determined for each pair of terms the co-occurrence frequency. The co-occurrence frequency of two terms is obtained by counting the number of articles in the relevant time period in which the two terms both occur (in the title or abstract). We then used the co-occurrence frequencies of the terms as input for the VOSviewer software. Based on these frequencies, the VOSviewer software constructed a term map in which the distance between any pair of terms provides an approximate indication of the relatedness of the terms as measured by co-occurrences. Each term in a term map also has a color. Colors are used to indicate the grouping or clustering of terms into topics. Terms that have the same color belong to the same cluster and tend to be more closely related than terms having different colors. In other words, terms that have the same color tend to co-occur with each other more frequently than terms having different colors.

To obtain the layout and the clustering of the terms in a term map, the VOSviewer software uses a mapping technique and a clustering technique. These techniques jointly provide a unified framework for mapping and clustering (Waltman, Van Eck, & Noyons, 2010). The mapping technique determines the layout of the terms in a term map (i.e., the locations of the terms in the map), while the clustering

technique produces a clustering of the terms in a term map by assigning frequently co-occurring terms to the same cluster. In the example presented in *Figure 2*, the layout of the terms was determined by the mapping technique while the clustering of the terms, indicated by colors, was produced by the clustering technique. The techniques were applied independently for each of the six term maps based on co-occurrence frequencies obtained for the relevant time period. Each map therefore has its own layout and clustering.

The mapping technique used by the VOSviewer software is called VOS. This technique is closely related to the technique of multidimensional scaling (e.g., Borg & Groenen 2005). We refer to Van Eck, Waltman, Dekker, & Van den Berg (2010) for a discussion of the advantages of the VOS mapping technique over approaches based on multidimensional scaling. The VOS mapping technique has the so-called attraction and repulsion parameters that allow for some degree of customization in the way terms are positioned in a term map. We used a value of 1 for the attraction parameter and a value of 0 for the repulsion parameter. These values yielded the most satisfactory layouts.

The clustering technique used by the VOSviewer software is closely related to modularity-based clustering (Newman, 2004; Newman & Girvan, 2004). For a detailed discussion of the clustering technique, we refer to Waltman et al. (2010). The clustering technique has a resolution parameter that determines the level of granularity of the clustering that is obtained. We used the default value of 1 for this parameter.

Term maps are invariant to rotation and reflection because these operations do not affect the distances between the terms in a term map. In order to facilitate easy comparison of the term maps

obtained for the overall period and for the different decades, the locations of the terms in the various maps were aligned as much as possible. This was done using a technique known as Procrustes analysis (Borg & Groenen, 2005). Using this technique, the term maps were rotated and reflected in such a way that terms are located consistently in the different maps as much as possible.

In addition to visualizations in which terms are colored based on the cluster to which they belong, we also used the VOSviewer software to create so-called density and overlay visualizations. In a density visualization, colors are used to indicate the density of terms in the different areas of a term map. In an overlay visualization, colors are used to display the topical focus of the articles published in different sets of journals. Since the overlay visualizations that we use in this paper indicate frequencies of terms occurring in certain journals, we call them journal projections – they project specific journals onto the terms in a term map.

Psychology in term maps (1950-1999)

Our discussion of the term maps is structured in the following way. We first describe a basic pattern that arose out of the term maps. This pattern can be seen in each decade under investigation. We look into its most prominent characteristic - the structure of the two big superclusters - and then continue in analyzing these two superclusters with different sets of map overlays in the each of the decades.[8]

[8] The decade maps can be accessed directly and explored in detail online. This is recommended for a better understanding and using the full functionality of VOSviewer. Exploring each map with the zoom function and the ability to look at smaller groups of terms allows for easier and more intuitive inspection of the visualizations. The decade maps can be found here: 1950s: https://goo.gl/kqD8Ww 1960s: https://goo.gl/R3tKh4 1970s: https://goo.gl/yKNSgc 1980s: https://goo.gl/5TidHO

Basic structure of psychology's term maps

The term maps based on our selection of journals exhibit a robust overall structure. We will explain it for the map of the whole period (*Figure 2* and its density visualization, which is represented by *Figure 3*). Each figure in the article will have the same layout. The terms in these maps were mined from all articles from 1950 to 1999 in our dataset. The bottom large map in the figure represents the whole period under analysis - from 1950 to 1999. The tableau on top of the map is a schematic representation of the occurrence of terms in each decade. In this way, each figure represents the whole period (the big map) and the schematic breakdown per decade (top band of schematic representations of the map).

1990s: https://goo.gl/53SXFA. The overview map (1950-1999) can be found here: https://goo.gl/vPSAHC. For extra instructions on using the maps, see https://figshare.com/articles/Framing_Psychology_Map_Opening_Instructions/4043772

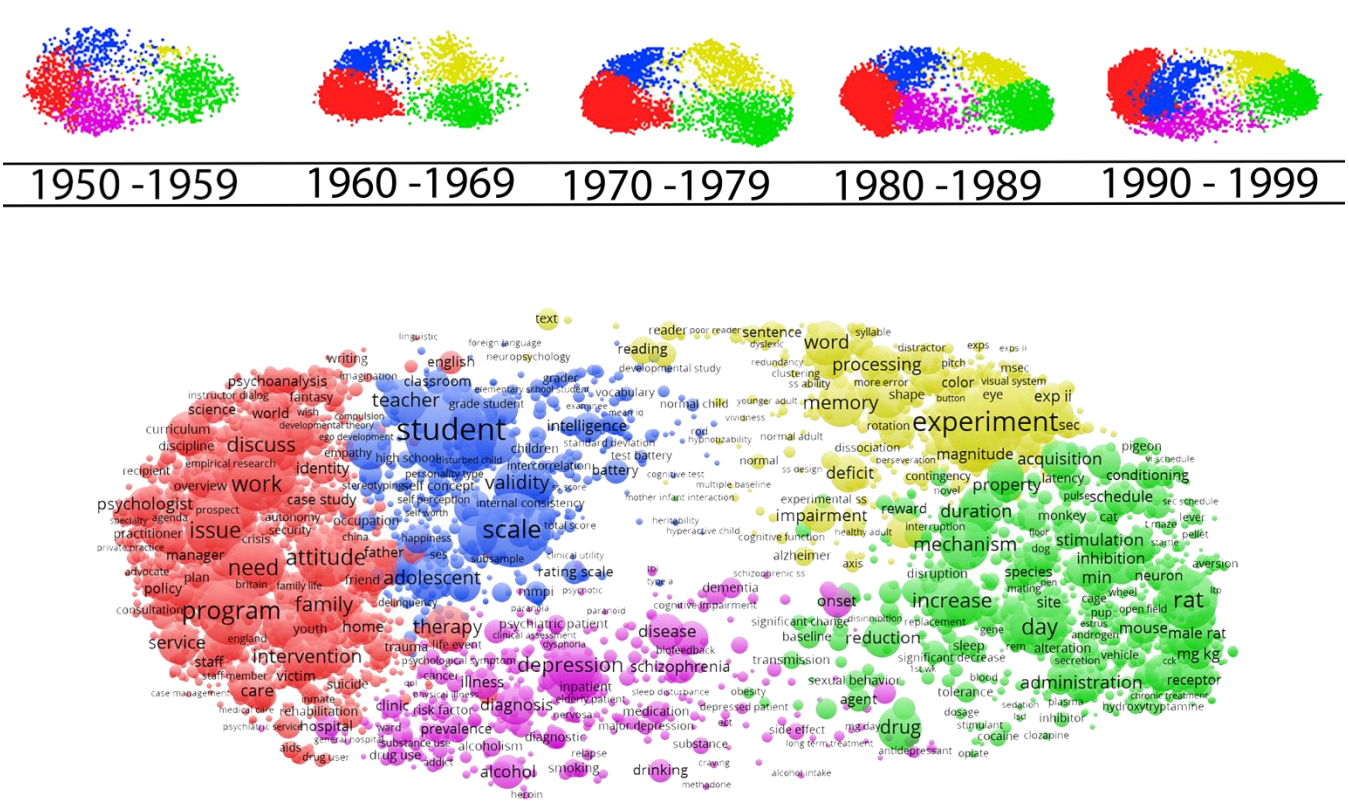

Figure 2. VOSviewer maps with the default clustering resolution (1.0)

To begin with, we interpret the most robust feature of the maps. By robust, we mean the one that each of the maps exhibits. The field as a whole is structured into two superclusters - in *Figure 2* this can't be seen at first glance because we are using the clustering algorithm of VOSviewer. The interpretation of these clusters is slightly ambiguous, especially when we try to do it for different decades e.g. are the boundaries of the yellow clusters stable, and why does the purple cluster disappear in the 1960s and the 1970s?

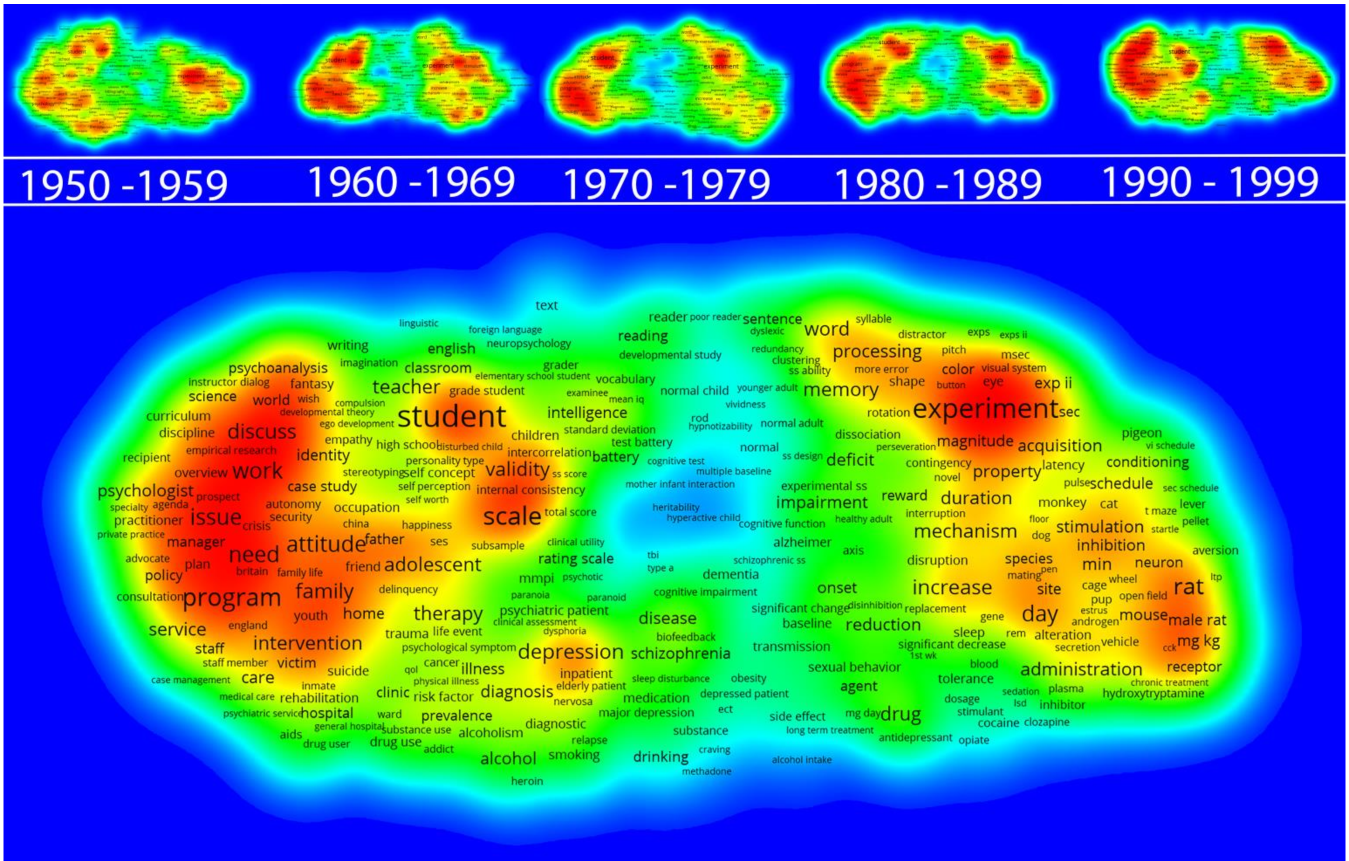

Figure 3. Density visualizations of VOSviewer maps

But if we look at the density visualization in *Figure 3*, we see the pattern that the terms exhibit when they form more dense areas of the map. The 'warmer' the section, the more terms group in that area.[9] In the density visualization we can see that the terms group themselves in the western area and an eastern area, with an area of lower density in between. Here, the take home message is about the superstructure:

[9] Each point in the density visualization has a color that depends on the density of terms at that point. The larger the number of terms in the neighborhood of a point and the higher the weights of the neighboring terms, the closer the color of the point is to red. The kernel width (how far the 'redness' in the density visualization extends from a group of terms) is one of the manipulable parameters in making VOSviewer density visualizations. In this case, we have made it lower than the default to sharpen the distinctions between the smaller term clusters.

1. The map is divided into a western and eastern collection of denser clusters of terms. We call these denser clusters the eastern supercluster and the western supercluster. Supercluster is not a mathematical term; it just means that it encompasses different hotspots of terms that are close to each other but divided from the other half by the area of lower density in the middle of the map. Superclusters can be visually identified through the density visualization, or a low clustering resolution (the default in *Figure 2* being 1.0; if we lowered the resolution to 0.5,[10] it would clearly show the two superclusters). As the interpretation of these superclusters will show, they correspond to the various kinds of experimental psychology in the eastern supercluster and all the 'other' kinds of psychology in the western supercluster.[11]

2. In the center of the map, northern and southern bridges of lower density connect the two superclusters. For ease of identification, these are some of the terms in the northern bridge: "reading", "reader", "developmental study", "vocabulary". These appear in the southern bridge: "disease", "schizophrenia", "medication", "drinking".

---

[10] A map with a lowered clustering resolution can be found here: https://figshare.com/account/projects/16467/articles/4015695.You can manipulate the representations produced by different clustering resolutions yourself by opening the maps as linked in footnote 8. The clustering parameters in VOSviewer can be accessed in the left-hand tab under the label 'Analysis'.

[11] The interpretation of the meaning of the two superclusters will take the rest of this article. 'Experimental' and 'other' are placeholders for the discussion to come, aimed to help orient the reader. By placeholder, we mean a sort of promissory note (Manicas, 2006, p. 88): "a quasi or suggestive explanation" which still demands a further explanation of the underlying mechanisms producing it. By the end of the article, we will fill in the promissory note with an analysis of methodologies in psychology as the explanation of the stable structure.

Depending on the way terms were generated, the different values of the relevancy algorithm and occurrence thresholds, and the decade from which the titles and abstracts were selected, we get different terms in the maps. Thus, the structure of the terms' layout can be influenced by the parameters set for mapping and clustering. We varied all of these parameters and different approaches to the data, but all of them keep the superstructure of two distinct superclusters of terms: one on the west and one on the east, with a lower term density chasm between them. This consistent pattern allows us confidently to proclaim that we have identified a robust configuration that should be analyzed as a representation of the structure of psychology, at least as the underlying structure of terms appearing in titles and abstracts of psychological literature in English from 1950 to 1999. The caveat is that this analysis covers the psychology that is published in journals and somehow related to the mainstream traditions - and complementary traditions that flow alongside the mainstream - in English-language psychology. We include a small number of non-English language journals (e.g. French, German, Spanish, Italian) that are indexed with translated titles/abstracts, but their number is too small to draw reasonable conclusions about psychologies in those languages. [12]

An important note is in order on the way visualizations are generated from our dataset. The York group of digital historians designates the visualization parameters under the researcher's control as less

[12] For a true international account of large-scale literature trends in psychology, the analysis cannot be done just in English despite its prestige and the amount of literature published in the language. Comparative studies should be conducted in other languages, or even better, in multiple languages at the same time. Comparative implies parallel development, while the case is probably extensive cross-pollination, especially for Anglophone psychology's impact on other national contexts in the late 20th century, e.g. Jevremov, Pajić and Šipka's (2007) study of the impact of Anglophone psychology on Serbian research in personality. There are examples of psychology literature analysis in other languages, e.g. Albani, Lombardo and Proietto (2014). Drawing substantive comparisons between traditions in different languages is a productive future direction for digital scholarship of the history of psychology.

"objective" (see Green, Feinrer, & Burman, 2015a; p. 18-19) when they use Gephi (another software used for network and graph visualizations, www.gephi.org). In this, Gephi and VOSviewer are comparable, but we wouldn't agree that it makes the method less objective. It just makes it evident that we need to be aware of all the degrees of freedom we take in generating the maps, and being open about the choices we make, especially if they could have been different. Would taking different steps generate a different analysis? As far as we can tell: No. But this is an open question leading to a debate about large historical trends in literature. Differing interpretations are not only welcome, they are also necessary for digital humanities to become a robust and useful perspective among historians of psychology. Being able to vary these parameters would be less objective only if the algorithms and datasets we use are black boxes. If they are openly debated and examined, they represent the crux of digital historical scholarship. In our opinion, varying parameters is what makes tools like this interesting for generating historical interpretations. The distinction objective/subjective applied to methods is too unstable and might hide more than it explains. Because of this, we would strongly discourage the reader from viewing our approach as objective *or* subjective. We would rather call it data-driven and interpretive.[13] In using digital tools in history, we agree with Green's perspective that our aim is a well-designed visualization generating interesting questions and potential answers; not "complicated statistical models based on controversial assumptions" (2016; p. 215).

[13] It would even be more appropriate to use Johanna Drucker's (2011) view of "data as capta" throughout our article. Reconceiving data as capta has some important consequences for research in digital humanities. As Drucker puts it: "Differences in the etymological roots of the terms data and capta make the distinction between constructivist and realist approaches clear. Capta is "taken" actively while data is assumed to be a "given" able to be recorded and observed. From this distinction, a world of differences arises. Humanistic inquiry acknowledges the situated, partial, and constitutive character of knowledge production, the recognition that knowledge is constructed, taken, not simply given as a natural representation of pre-existing fact" (2011; para. 3).

Chronologically projecting subdisciplines into term maps

Hundreds of thousands of abstracts/titles were included in our dataset. The mass of words used in them is the pool from which our terms spring, and then these terms are structured in a certain way. The structure arises from the terms' co-occurrence. How can we tell where particular groups of terms come from? In the example of *Figure 2* and *Figure 3* shown in the previous section, how can we tell where the terms in the eastern versus the western half of the map come from? For example, do they talk about mental testing or animal psychology? Where does one begin and the other end, and how do they change through time? The clusters we see in *Figure 2* are interesting and meaningful, but very difficult to interpret in maps based on hundreds of journals.

If the structure has any meaning, clusters of terms will tend to appear more often in the abstracts and titles of particular groups of journals. In order to scale it to the level where we can meaningfully analyze it, we need to make a selection of relevant journals that represent certain subdisciplines in psychology. To this end, we used Daniel Burgard's (2001) selection of journals of the century in psychology. Burgard, as a Psychology Subject specialist librarian, compiled a list of the "best psychology journals of the century" (p. 42). We are not sure if these journals are the best, but since Burgard used multiple criteria to make a selection of a very small number of journals, we found his selection very useful.

If we made a 'heat indicator' in our term maps based on small groups of what are perceived as excellent journals in particular subdisciplines, we would get some much needed information about the structure of the whole map. This is what we did. In the following selection of visualizations, the redder the color of a term is, the more frequently it appears in the abstracts and titles of articles in that group of

journals. Doing this, we visually identify hotspots in the whole term map - and by doing it for a number of groups of journals, we glimpse an overall structure. Other than the journal projections, the figures are organized in the same way as the first map and its density visualization in *Figure 2* and *Figure 3*. We note that in the density visualization, the 'redness' of an area in a map, indicates the presence of a large number of terms in that area. In the journal projections the 'redness' of a term indicates that the term occurs relatively often in a group of journals.

To project the journals through overlays, we grouped them following Burgard's scheme, although we selected just a few of the journals listed by him for ease of coding and analysis. To Burgard's categories, we also added educational psychology as a category drawing on a complementary publication, *Journals of the Century in Education* (which covers educational psychology) by Nancy Patricia O'Brien (2001). The groups and the journals that represent them can be found in *Table 2*.

Table 2. Journal groups according to Burgard (2001) and O'Brien (2001).

Group name	**Journal**
General	American Psychologist
Applied	Journal of Applied Psychology
	Journal of Counseling Psychology
	Personnel Psychology
Biological/Physiological	Journal of Comparative Psychology
	Comparative Neuroscience
Clinical/abnormal	Journal of Abnormal Psychology
	Journal of Consulting and Clinical Psychology
Developmental	Child Development
	Developmental Psychology
Experimental	Cognition
	Journal of Experimental Psychology*
	Perception & Psychophysics
Personality/social	Journal of Personality
	Journal of Experimental Social Psychology
	Journal of Personality and Social Psychology
Educational	Journal of Educational Psychology
	Educational and Psychological Measurement

*In the time period from 1950-1999 the *Journal of Experimental Psychology* fractured into multiple subfield specific journals. All are included in our dataset.

Some journals changed names in the period: *Journal of Abnormal Psychology* used to be called *Journal of Abnormal and Social Psychology*; *Journal of Consulting and Clinical Psychology* used to be called *Journal of Consulting Psychology*. *Journal of Comparative Psychology* and *Comparative Neuroscience* used to be a single journal called *Journal of Comparative and Physiological Psychology*. The journals were included under the different names in their respective time periods.

We projected[14] each of the above groupings of journals into separate decade maps. These maps will be analyzed from *Figure 4* to *Figure 11*.

Experimental: *Cognition, Journal of Experimental Psychology* and *Perception and Psychophysics*

The three abovementioned journals project into the maps to generate *Figure 4*. As before, the big map represents the terms for the whole period of five decades while the smaller schematic images are journal projections per decade.

[14] The scale in the bottom right of every figure is not fixed in the decade maps represented in the schematic per decade visualizations on top of every figure. This was done to ease interpretability, but the reader should be cautioned against interpreting the 'presence' of each journal as being more or less constant in every decade. The later decades include many more journals and the term frequencies for each term are much larger, so the relative proportion of each journal containing the terms in their abstracts/titles is smaller. In other words, single journals have lower relative frequencies for particular terms in each of the decades following the 1950s. In the actual maps accessible through the links in footnote 8, the range can be manipulated by double clicking on the scale, and the different overlays thus generated can be inspected by the reader.

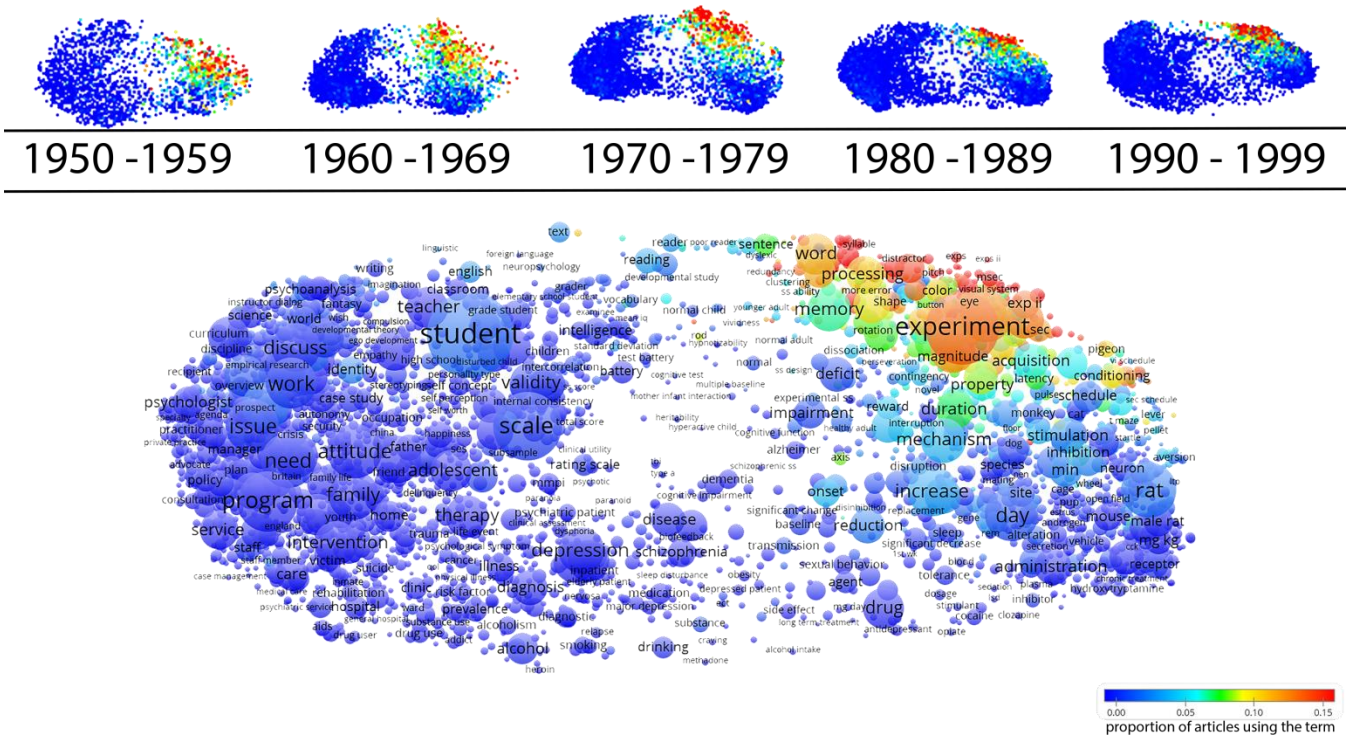

Figure 4. VOSviewer projections of experimental psychology

Looking at *Figure 4*, we can see that *Cognition*, *Journal of Experimental Psychology*, and *Perception and Psychophysics* grouped in the northeast quadrant of the map. Not surprisingly, they seem to have gathered around the term experiment. The further we go west and north in their grouping, the more cognitive the vocabulary becomes (with terms like “processing”, “memory”, and “syllable”). What we see in the top tableau is the shrinkage of coverage of these three journals. In the 1950s, they projected into the terminological territory of the whole northern part of the eastern supercluster. As we go further through the second half of the twentieth century, these three journals become less representative of the eastern half of the map. The shrinkage of the projections of particular journals through time happens with almost all of the projections we analyze. This would be even more evident if we fixed the same scale for every decade – so much so that sometimes it would make interpretation difficult. This is probably due to doubling of literature in each decade. The expansion of the literature

goes hand in hand with the specialization of particular journals for smaller subfields or developing research fronts.

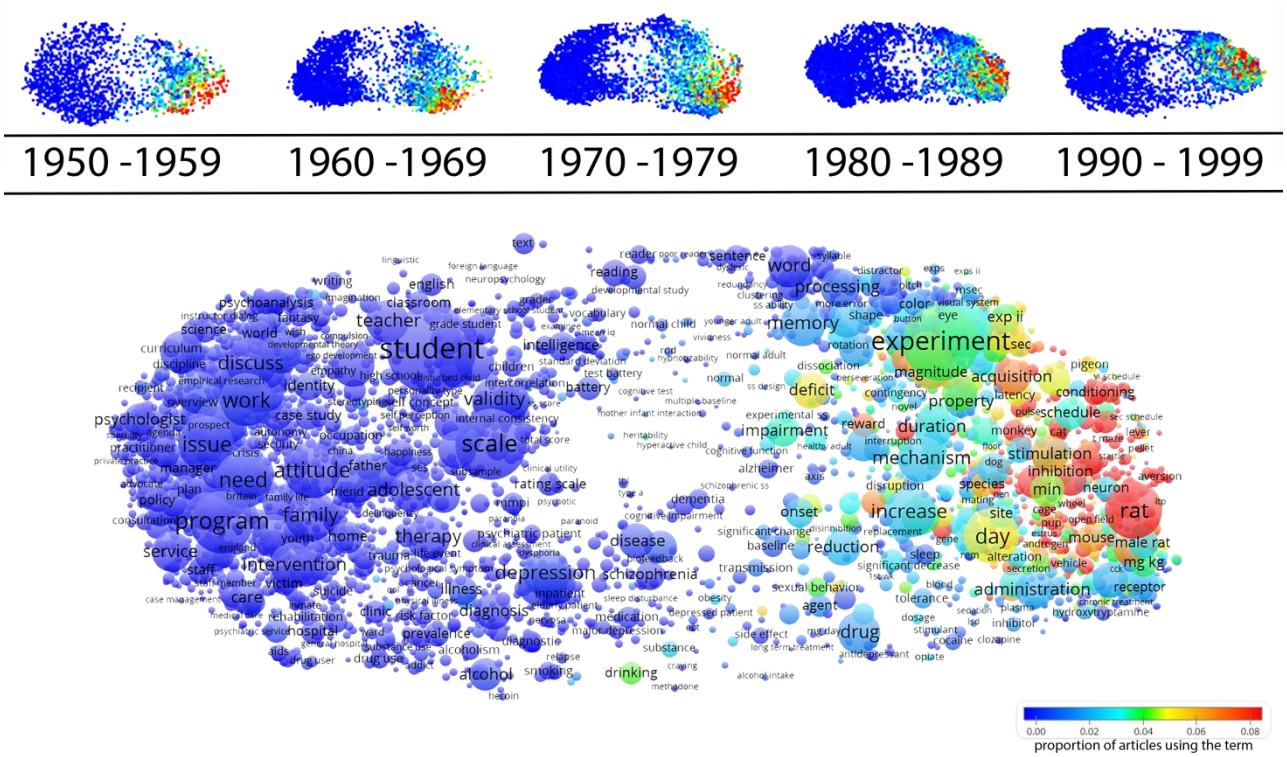

Figure 5. VOSviewer projections of biological/physiological psychology

Saying that the journal projection "moves" or becomes more "central" is a geographic metaphor, which means that the projection position has changed in relation to the other projections in the map, or to its position in the previous decades. Centrality is not a measure of importance for the field of psychology intellectually, or as a value judgment; it is just a comment on the relative position in the term map.

Biological/Physiological: *Journal of Comparative and Physiological Psychology/Journal of Comparative Psychology* and *Comparative Neuroscience*

The Journal of Comparative and Physiological Psychology is projected in the *Figure 5*. It is situated in the eastern supercluster, and defines the east-central quadrant of the maps. In the 1950s, it

projects all over the quadrant, and exhibits a similar trend of shrinkage in the coming decades. It moves from the southern position occupied from 1950s to 1970s, taking a more central position in the eastern supercluster in the 1990s. This move is due to the expansion of the terminology related to drugs in specialized journals on psychopharmacology, which start occupying the south-west part of the eastern supercluster. Furthermore, the easternmost edge moving slightly to the north in 1990s signals the rise of neuroscience - with a cluster of words like “neuron”, “electrical stimulation”, and “prefrontal cortex” – this is the part of projection dominated by *Comparative Neuroscience*.

Applied: *Journal of Applied Psychology, Journal of Counseling Psychology,* and *Personnel Psychology*

These three journals project into the western supercluster in *Figure 6*. In 1950s, they are situated in the northwestern quadrant. In the next three decades, they shift to the southwest, occupying a central

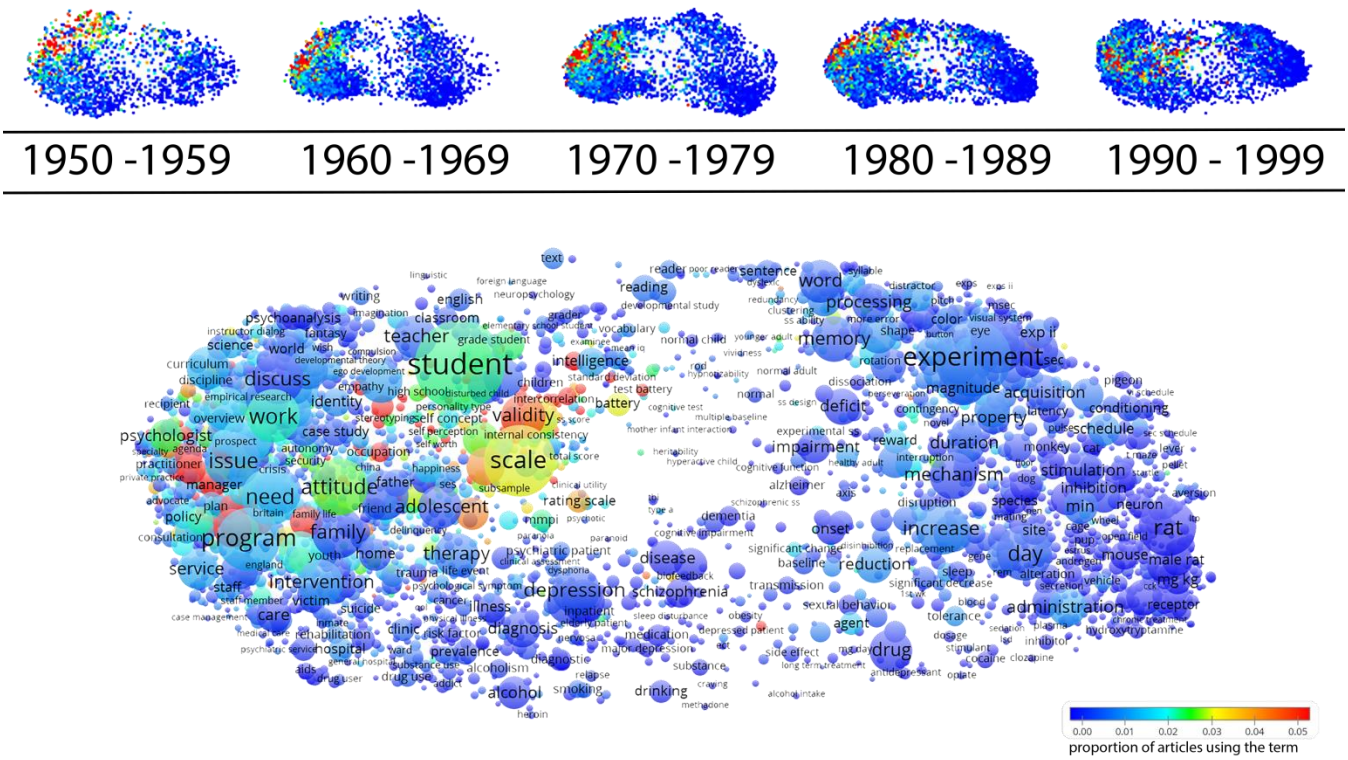

Figure 6. VOSviewer projections of applied psychology

part of the western cluster. In the 1990s, they lose coherence and dissipate more. They roughly occupy the same space in the western cluster, expanding throughout its central part. In the schema for 1990s, the projection is completely absent from the northernmost part of the western supercluster - psychoanalysis shifted to occupy this space in the 1990s, which will be analyzed later.

Developmental: *Child Development* and *Developmental Psychology*

The projections for developmental psychology can be found in *Figure 7.* Note that *Developmental Psychology* started publishing in 1969, so the first two schemas (1950s and 1960s) are only representative for *Child Development*. In 1950s, *Child Development* projected into the western supercluster. Except for the main area in the western supercluster, there are smaller areas in the eastern supercluster that use similar vocabularies. In the following three decades - from the 1960s to the 1980s - the two developmental journals indeed straddle the northern bridge between the two superclusters. They

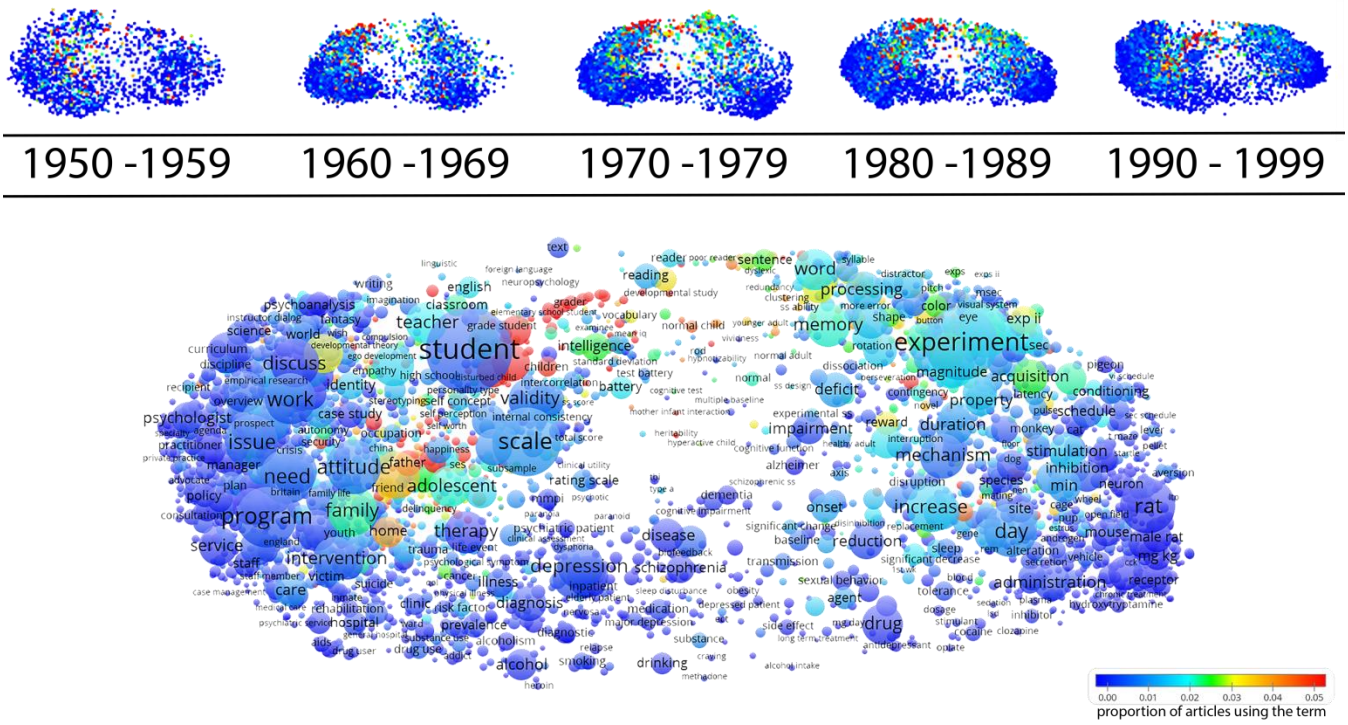

Figure 7. VOSviewer projections of developmental psychology

occupy a position in the very middle of the map, jumping across the low density chasm.

We can also see how adding *Developmental Psychology* in the following decades focused the projection more and anchored it in its relatively fixed position. In the 1990s, the presence of the terms from the eastern supercluster ceases to be so prominent, and a focal axis (the red line projecting toward northeast from the term ‘student’ in the big overview map) can be clearly identified. The axis is actually formed by the words describing the subjects and institutions which house participants in developmental research: “elementary school child”, “nursery school”, “grade level”, “6th grader”, “kindergarten”, numbered grades (from 1 to 5) and numbered graders; and the easternmost pinnacle finally bringing theoretically relevant terms: “language development” and “developmental difference”. No wonder that the axis projects toward the low density chasm and the northernmost quadrant of the eastern half dominated by cognitivist experimental psychology. All in all, developmental psychology seems to be well defined in each period except the 1950s.

General: *American Psychologist*

Figure 8 tells the most straightforward story. *American Psychologist* consistently projects into the same area of the map - the westernmost area of the western half of the map. This pattern does not change through the decades. Since the journal is the official organ of the American Psychological Association, this should give a clear sign that is very much in-line with the development of the APA in the 20th century and its shift from being an association of academics to an association of professionals. This shift is already in full swing by the 1950s, and its effect is consistent with the structure of our maps.

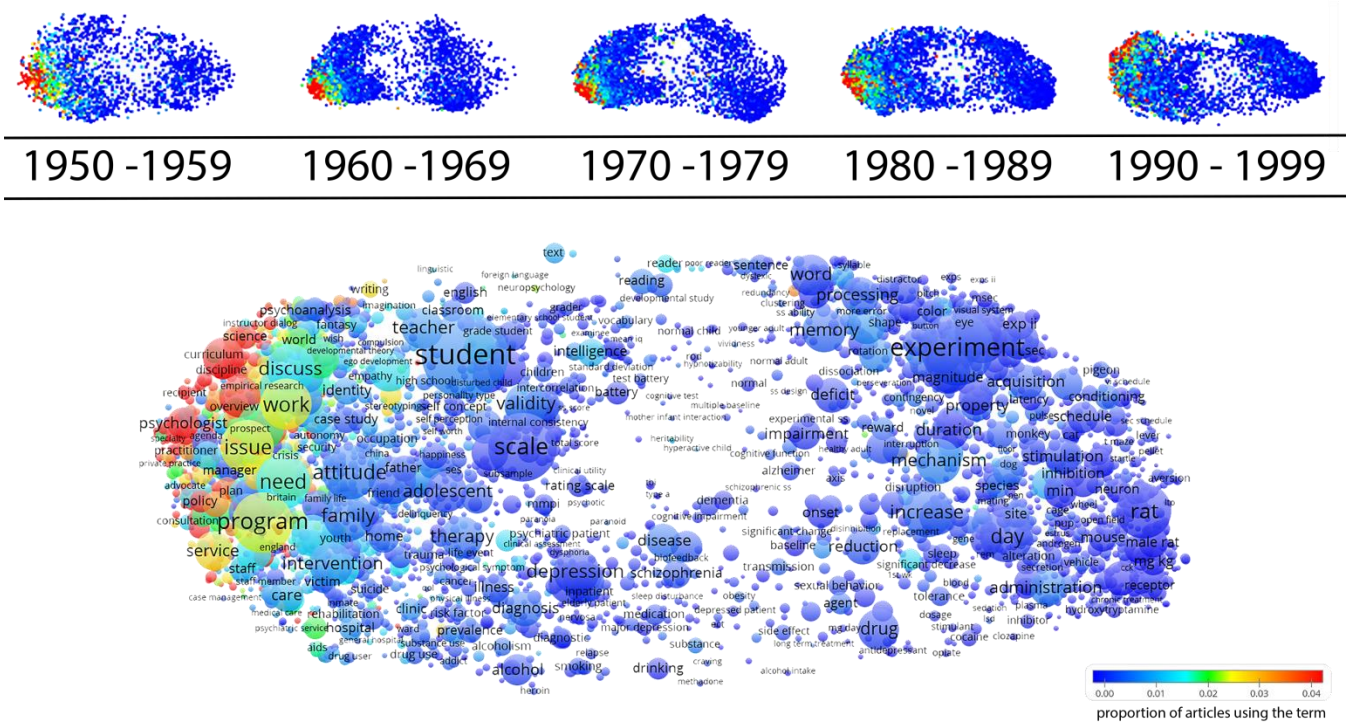

Figure 8. VOSviewer projections of general psychology

Personality/social: *Journal of Experimental Social Psychology, Journal of Personality and Social Psychology,* and *Journal of Personality*

Social and personality psychology were projected with three journals in *Figure 9*. Note that both the *Journal of Experimental Social Psychology* and *Journal of Personality and Social Psychology* started publishing in the 1960s, so they have no projections in the schematic map 1950-1959. Considering this, it is difficult to say how that schema compares to the other four decades, and the large overview map. Otherwise, personality and social psychology project in such a way that straddles the divide between the eastern and western supercluster, with the main concentration of terms located in the western supercluster. This concentration gains more definition with each coming decade, locating the center of the projection in the central part of the western supercluster, gravitating toward north and east. Most of the presence in the eastern supercluster is in the north-west part of the supercluster, reinforcing the idea that social and personality psychology straddle the low density gap in the middle. The map in

the 1990s supports this interpretation, with scant presence of terms in the eastern supercluster and a hotbed in the west.

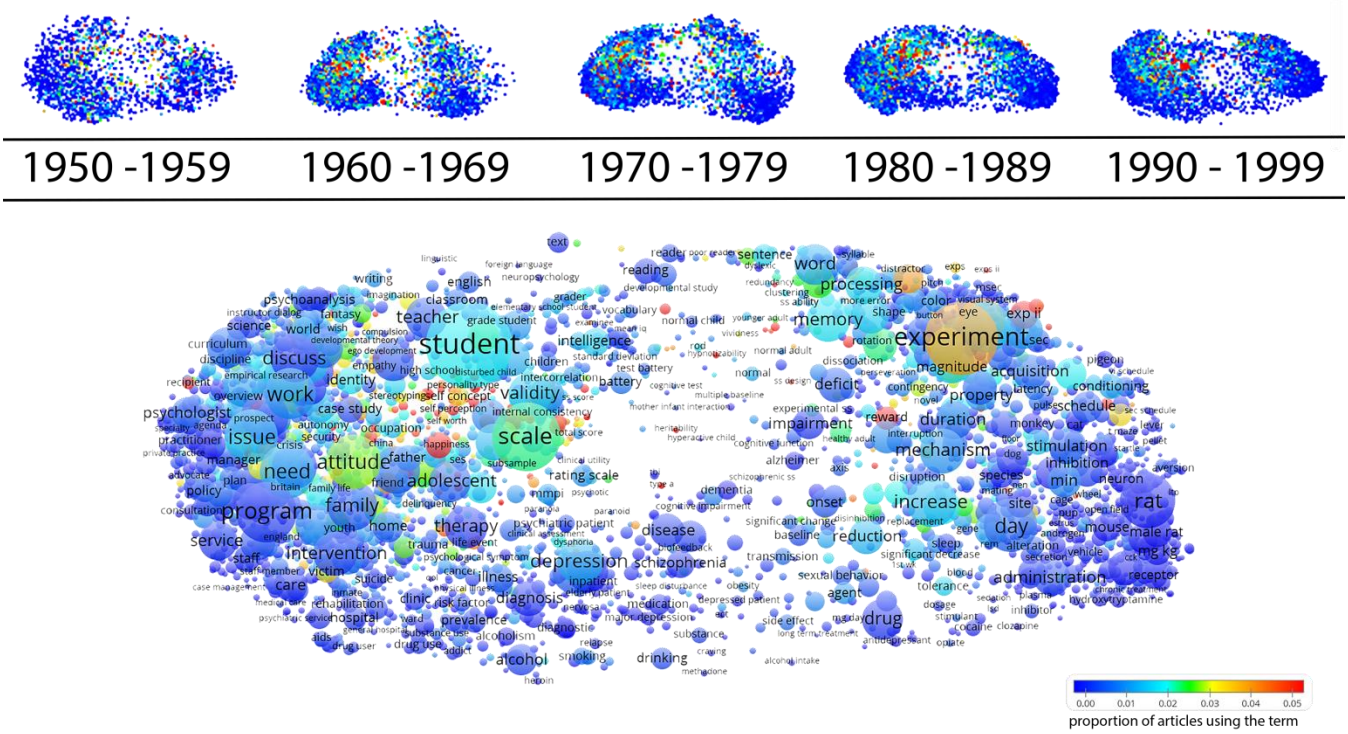

Figure 9. VOSviewer projections of personality/social psychology

Educational: *Educational Psychology* and *Educational and Psychological Measurement*

In *Figure 10*, we analyze the projections of educational psychology. Educational psychology roughly projects in the same space developmental psychology occupied in *Figure 7*. This is expected and commonsensical for the whole period, providing evidence for the robustness of the map structure. Terms related to educational psychology form a cohesive unity in the northern part of the western supercluster. From the 1970s onwards, they also start to move slightly toward the eastern supercluster, but the biggest concentration of the subfield remains in the northern part of the western supercluster. The dominance of educational psychology over the whole northern quadrant of the western supercluster in the 1950s is telling of the centrality and importance of psychologists' research in the educational

setting. If we link the western supercluster with Cronbach's 'correlational psychology', educational psychology, at least terminologically, encompasses a large part of psychologists' research interests among the correlationalists. There is also something to be said about the term that appears in most abstract/titles in the whole half century: 'student'. The term is used in 10,8% or 73,110 articles across the decades.[15]

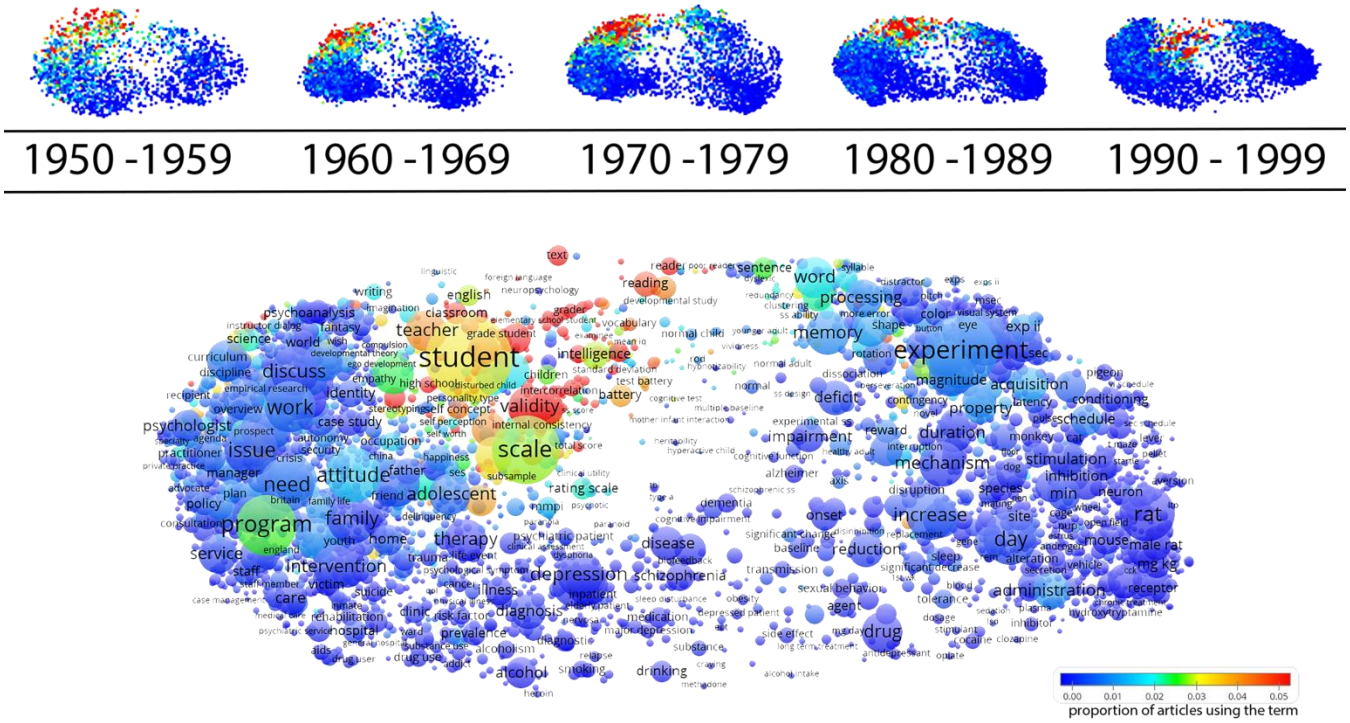

Figure 10. VOSviewer projections of educational psychology

[15] This is a conservative estimate, because VOSviewer separately identifies frequent collocations which include the term 'student' (e.g. "grade student," "secondary school student," but also "student's perception," or "student performance."). With a more inclusive but less accurate query in our dataset, searching for "*student*", we arrive at a bigger estimate of 82,286 entries using the term *student*.

Clinical/abnormal: ***Journal of Abnormal and Social Psychology/Journal of Abnormal Psychology,*** **and** ***Journal of Consulting Psychology/Journal of Consulting and Clinical Psychology***

In *Figure 11*, we see the projections of the two journals publishing on clinical work and psychopathology. They occupy the easternmost part of the western supercluster (the one closest to the area of low density separating the west supercluster from the eastern one). In the fifty years, the focus has shifted slowly from the north to south. Note that these two journals also straddle the chasm of low density. Their position, as in the middle of the two superclusters, becomes more predominant later. This is also related to the pharmacological perspective which slowly displaces the projection of *Journal of Comparative Psychology* - from its dominant position in the southeastern quadrant from the 1950s through the 1980s, and then its shrinkage in the 1990s. Seen in this way, the projection's shift from north to south is a shift from the terminology of psychometrics and tests toward psychopharmacology.

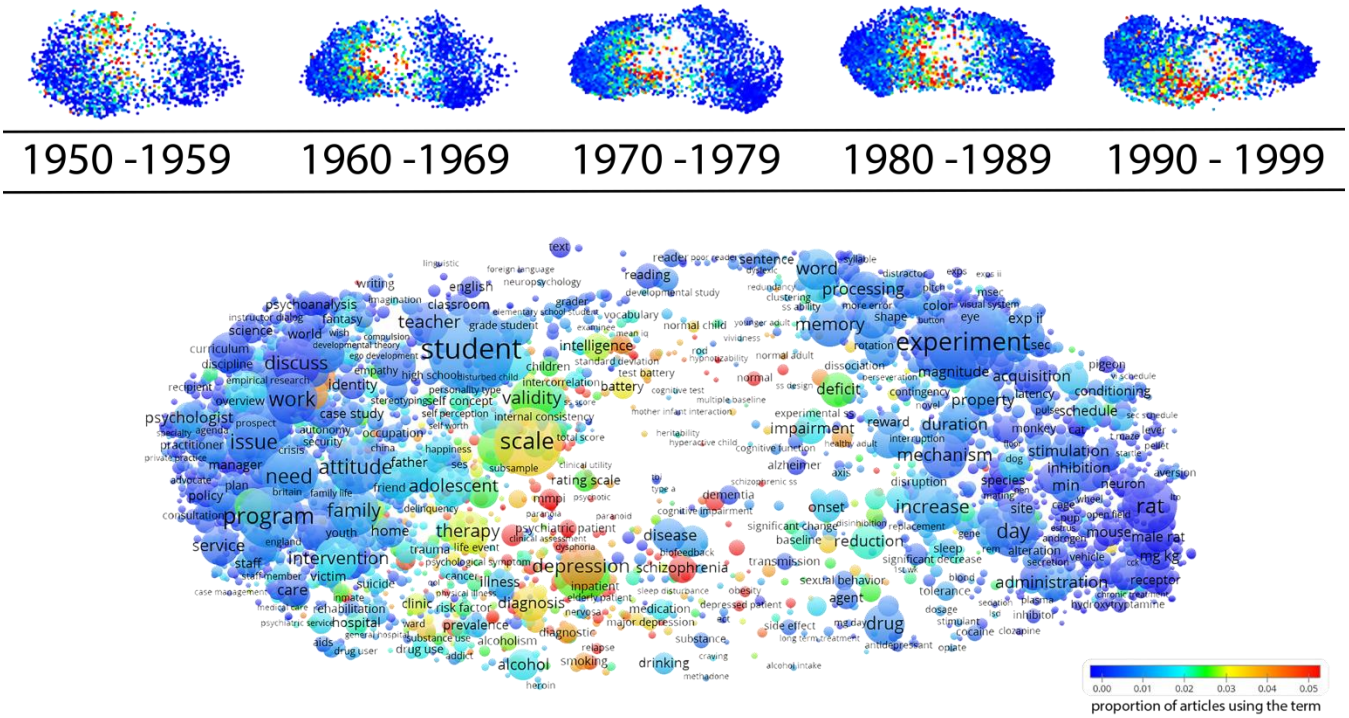

Figure 11. VOSviewer projections of clinical/abnormal psychology

The peculiar case of psychoanalysis and psychotherapy

Even though we do not have much space to devote to psychoanalysis, its erratic behavior in the maps needs to be mentioned. In the overview map covering the whole period psychoanalysis occupies the north-western top of the western supercluster (around the prominent term 'psychoanalysis'). Around psychoanalysis, the terms form an indicative collection of psychoanalytic vocabulary: "Jung", "psyche", "countertransference", "Freud", "psychoanalytic process", "unconscious", "dream", "superego", "object relation", "narcissism", "defense mechanism", etc. Even with this short list, it is evident the terminological space is highly specified and identifies various branches of psychoanalytic schools of thought. What is peculiar is that the position of this collection of terms shifts in the period under investigation. Its shift isn't gradual like in the other cases, but drastic and it changes the spatial structure of the map.

In the overview map the psychoanalytic terms occupy the previously mentioned northern spot in the western supercluster. But in all the decade maps from 1950 to 1989, psychoanalysis can consistently be found in the south-eastern edge of the western supercluster.[16] In other words, for forty years this collection of psychoanalytic terms project in close proximity to the terms that are often used in the journals related to clinical and abnormal psychology. Then psychoanalysis separates from its consistent position and shifts to a place where it is not evident how it relates to the larger structure of the map.[17]

[16] If psychoanalysis is in the southern part of the western cluster for four out of five decades in our analysis, why does the overview map for the whole five decades represent it in its location from the 1990s? This has to do with literature sizes - the largest amount of literature is from the 1990s because the size of the literature doubles every decade, thus the term structure of the whole period has the closest similarity to the term structure of the 1990s.

[17] You can see this odd shift in the decade schema maps for the projection of educational psychology in *Figure 10*. There, in the 1990s, educational psychology does not occupy that much of the northern edge of the western supercluster as in the

This might be a terminological shift that recognizes the general decline of psychoanalysis (Hale, 2000) during the second part of the twentieth century. The demise of psychoanalytic language and categories as a framework for psychological research was probably catalyzed by the publication of DSM-III in 1980, and the subsequent move toward the symptom-based categorical disease model of mental illness and rise of psychopharmacology (Mayes and Horwitz, 2005).[18] This interpretation seems plausible, especially since terms like "cognitive-behavioral therapy" and "cognitive behavioral treatment" do not follow the psychotherapy and psychoanalysis exodus from the southern edge, while terminology used in psychopharmacology expands drastically. This shift in the position of psychoanalytic terms is interesting in itself, and would require an investigation of its own.

The two disciplines of scientific psychology: Lee Cronbach in 1957 and 1975

We opened our introduction with the first sentence of Lee Cronbach's 1957 presidential address, in which he likens psychology to a diverse circus. Cronbach's opinion was not only a vivid metaphor aimed at provoking knowledgeable chuckles among his colleagues in the audience. His was an incisive diagnosis of the state of the art in the discipline – a State of the (dis)Union given by its luminary. The crux of his argument was that psychology in the 1950s had been a divided discipline. There was a schism between "the Tight Little Island of the experimental discipline" and the "Holy Roman Empire"

---

previous decades. This contraction of the projection of educational psychology from the north-west part of the western supercluster roughly corresponds to the place taken over by psychoanalysis and psychotherapy. A similar thing can be seen in the northern projection of the applied journals in the 1990s in *Figure 6* and in the slight shift of *American Psychologist's* projection from south to north in the 1990s map in *Figure 8*.

[18] We would like to thank the anonymous reviewer for pointing us toward the changes in the classifications of mental illness that were centered on the publication of DSM-III in the 1980s.

of correlational psychology "whose citizens identify mainly with their own principalities." He saw these two disciplines as "streams of thought" that have a few markers: "philosophical underpinnings, methods of inquiry, topical interests, and loci of application." He viewed the two traditions as disciplines of scientific thought, and that the "job of science" is asking "questions of Nature" (p. 671).

Our visualizations start in the decade when Cronbach identified the schism, and go on through the period when he made his second re-evaluation in 1975. Given the timeline overlap between our maps and Cronbach's diagnosis of disciplinary disunity his description provides one possible interpretation for our maps. The Holy Roman Empire is the western half - where clinical, abnormal, personnel, consulting, developmental, educational psychologies project. Then, we have the low density divide in the middle signifying the schism, and the eastern half where physiological and experimental psychologies find their location in the self-organizing pattern of co-occurring terms. Even his language fits with our geographical terminology, when he says: "The personality, social, and child psychologists went one way; the perception and learning psychologists went the other; and the country between turned into desert" (p. 673). The metaphor suddenly becomes visual, the desert being the low density area in the middle of our maps.

In 1957, Cronbach used the methodological language of psychologists, mapping the polar opposites of the two disciplines of psychology to historical predecessors: Wundt's "'experimental psychology' versus 'ethnic psychology'", Stern and Binet's "'general psychology' versus "individual psychology'", the turn of the century "'experimental' versus 'genetic' psychology", and his contemporaries' "'experimental' versus 'psychometric' psychology" (p. 672). For him, the point of the difference between the two streams of scientific psychology is an interest in two kinds of mutually

exclusive conceptions of statistical variance. Correlational psychologists look at the variance arising out of individual differences; experimental psychologists at the variance arising out of two different treatments. By treatment, he means the particular kind of manipulation by the experimenter. The kind of variance that is the object of research for one group is the source of error for the other.[19]

In Cronbach's terminology, the goal of scientific research in psychology is developing better ways to control, isolate, inspect, and manipulate variance. This goal drives psychologists to develop more sophisticated methods, which often directly translates into more sophisticated statistics. In other words, better methods rigorously applied, extend psychology to different topics it can tackle and circumscribe.

Sophisticated methodology ≠ developed theory

Methodological sophistication translates into more topics of research, but more topics of research do not translate to theoretical sophistication, at least according to Cronbach. When evaluating how psychology was fitted to these methodological boundary conditions in 1975, Cronbach (p.116) voices his disillusionment: "Model building and hypothesis testing became the ruling ideal, and research problems were increasingly chosen to fit that mode. Taking stock today, I think many of us judge

[19] Note how totalizing the methodological language is for Cronbach. Is he really saying that Wundt's *Völkerpsychologie* investigated individual variance? No, but the talk of variance is the terminological space in which Cronbach can develop his theses - even if that wasn't the case for Wundt or the other predecessors he lists. Relating Wundt's *Völkerpsychologie* to the Darwinist and functionalist research traditions in American and British psychology, which focus on individual variance, does not do justice to the historical record, but it does act as rhetorical leverage for Cronbach's argument about correlational psychology being one big tradition within psychology.

theoretical progress to have been disappointing." Moreover, he acknowledged active discontent within the ranks: "Many are uneasy with the intellectual style of psychological research […]." The research agenda of the two streams of scientific psychology have not been as rewarding as Cronbach, and many other psychologists, had hoped.

Cronbach's declining optimism

After his hopeful invocation of the merging of perspectives on how to conduct research in 1957, Cronbach was less optimistic two decades later. He described his view of psychological research again in the words of the reigning method - what he called the Aptitude x Treatment Interactions (ATIs). ATIs are a way of statistically analyzing the role of both treatment and individual differences variance, and how their interaction potentially produced effects different from those produced from the single source of variance. The problem, which he called his shortsightedness in 1957 (p. 119), was not only that a general statement based on treatment was misleading without taking into account relevant individual aptitudes (and vice-versa), but that the same argument could be made for the interaction effects themselves: "If Aptitude x Treatment x Sex interact, for example, then the Aptitude x Treatment effects does not tell the story." His perspective became quite bleak when he admitted: "When we attend to interactions, we enter a hall of mirrors that extends to infinity" (p. 119).

Cronbach offered a humble conclusion for the science of psychology in the 1970s (p. 126):

> Social scientists are rightly proud of the discipline we draw from the natural-science side of our ancestry. Scientific discipline is what we uniquely add to the time-honored ways of studying man. Too narrow an identification with science, however, has fixed our eyes on an inappropriate

> goal. The goal of our work, I have argued here, is not to amass generalizations atop which a theoretical tower can someday be erected (cf. Scriven, 1959b, p.471). The special task of the social scientist in each generation is to pin down the contemporary facts. Beyond that, he shares with the humanistic scholar and the artist in the effort to gain insight into contemporary relationships, and to realign the culture's view of man with present realities. To know man as he is is no mean aspiration.

Who are the correlational psychologists?

We should also note that Cronbach's naming convention for the schism – experimental and correlational – shows a certain bias. As one of the people pushing for a correlational scientific psychology in educational but also other "applied" settings, Cronbach found much to gain by gathering all the disparate non-experimental psychologies under the banner of the correlationists. Keeping with his metaphor, the Holy Roman Empire might have been disunified, but at least it had an emperor. The possibility that the professionals and scientists working in the disparate educational, clinical, organizational, counseling, etc. psychologies might have disagreed with such a designation became invisible – they were all gathered around a single (statistical) conception of their research object. We don't have to think hard to provide historical examples that correlational psychology wasn't a wholly uncontroversial description of non-experimental psychology for some psychologists in the second part of the twentieth century. One of the well-researched examples is humanistic psychology as the "third way" and its different conception of what a science of psychology should be. A good example of such a different conception of science is Abraham Maslow's, which he described in his *Psychology of Science* and other publications (Maslow, 1966; Kožnjak, 2016).

Whether we call it correlational or some other name, the integration of the east and west, according to Cronbach, had failed. Early 21st century evaluations agreed with him (Borsboom et al. 2009). But what role has this failure played in how psychology developed into a discipline in the second part of the 20th century? Our thesis is that the failure to integrate structured scientific psychology around purely methodological lines. The mass of theories and models – the substantive content of the discipline – just followed suit and kept expanding alongside the lines laid out by the sanctioned ways of doing research. In a nutshell, the theories a psychologist wanted to test were never in the front seat – they came and went as they conformed to the ways she could research them. The names of what psychologists call "constructs" could multiply indefinitely, allowing for more and more research that never fed back into larger developed theories, as long as the constructs fulfilled the methodological criteria put before them.

Psychology's methodological infrastructure

Borsboom and colleagues (2009) gave an expanded analysis of the problem of approaching variance in different ways. Their conclusion was even less optimistic than Cronbach's in 1975. They concluded that the integration of these two strands of research in psychology "is a dreamed route of progress that is really a dead end street" (p. 94). We are not primarily interested in how to solve this lack of integration, but to explain how it was sustained for so long despite vocal criticism from prominent psychologists and historians. Borsboom and colleagues' have an idea of what kept it vital (p. 82):

> Theoretical camps professionalize in such a way that a given method is sanctioned, findings that employ the method are publishable when review by the professional in-group, and the body of published findings sustains the theoretical approach, including the careers of those who espouse it.

In other words, methodologies are the collective choices of communities and those choices act in sustaining differences between various approaches. Choice of methodology is a more charitable name for what Kurt Danziger (1985) calls methodological imperative, or in an even more negatively charged tone, methodolatry (e.g. Bakan, 1966). In Danziger's (1990; 1997) and Winston's (2005) view, the role of the meta-language and the methodological discourse is to frame the institutional and substantive boundaries of psychology. By meta-language we mean the basic vocabulary of psychologists in the second part of the 20th century, in which disparate communities of psychologists have been educated in graduate schools, and which appears in textbooks and APA manuals. It includes the vocabulary of variables (independent, dependent, mediating, intervening), operational definitions (constructs, measures), and research designs (randomized experimental trials, longitudinal and transversal correlational studies, quasi-experiments). According to Danziger (1985, p. 10), this "widely accepted methodology"[20] in fact involves theoretical commitments and "this shared commitment … provides the basis for effective intra-disciplinary communication." The supposed theoretical disunity is manifest, but underlying it is a methodological common language suffused with the minimal theoretical commitments of the psychological sciences as a whole. To put it straightforwardly, doing "correlational," "experimental" or some hybrid of the two is already circumscribed by a tradition of thinking that presupposes that the object of research can be found in aggregate statistics and the variables describing them. Cronbach's gathering of the patchwork of non-experimental psychologies under correlational psychology becomes an example of how totalizing the methodological language can be. The psychometricians, in their conclusion, state that integration is impossible in principle (Borsboom et al,

[20] The methodology, alongside the signposts of the meta-language we have included above, also includes inferential statistics and internalized philosophies of science of various psychologists (namely, operationism, see Green, 1992b; Feest, 2005).

2009). We would add that the correlational/experimental distinction is not even an issue being addressed in research practice, considering that psychology expands (progresses) as usual *because* this methodological consensus exists.

Hank Stam puts it bluntly (2004, p. 1262): “Calls for unification, no matter how well articulated, will likely fall on deaf ears since there are already deeply entrenched positions in the discipline that are supported by the implicit unity of method and framework.” Coming back to our analysis of the term maps - we show that psychological literature exhibits a stable unchanging structure in five decades - despite the internal squabbles in many of its subdisciplines. Chris Green (2015, p. 210) briefly sketches these changes in psychology: “the integration of the American Association for Applied Psychology with the APA in the 1940s; the simultaneous emergence of the Boulder Model; the rise and fall of “third wave” humanism; the partial retreat of behaviorism as a theoretical basis for psychology and its reformulation as a leading basis for various therapies; the splintering off from the APA, first, of the Psychonomic Society and, later, of the American Psychological Society; the appearance of the Psy. D.; the rises of cognitivism, computationalism, evolutionism, neuroscience, and so forth.” All these supposedly tectonic changes (or at least earthquakes) have happened, alongside the massive expansion of the number of researchers, practitioners, and subdisciplines; yet the field exhibits a stable structure if analyzed as a whole.

We argue that the minimal methodological commitment with its theoretical baggage (whether we call it methodological imperative, meta-language of variables, or just methodology) is the robust structure of the superclusters. The psychological sciences, then, are a “collection of generalizations that describe relations among classes of variables, the kinds of relations and the kinds of variables being

predetermined by the methodology" (Danziger, 1985, p. 11). Growth and expansion in the period from the 1950s is just in magnitude (of data being analyzed and generalizations being made); the structure of the knowledge stays the same. Or in the pessimistic tone of both Cronbach's 1957 article and Danziger's writing on the state of research in the second part of the twentieth century: Generalizations have been amassed, data gathering and manipulation has grown in sophistication, but theoretical progress is almost non-existent.[21] As Stam puts it (2004; p.1261): "[P]sychology proceeds through the multiplication of entities without ever committing itself to the reality (or lack thereof) of the objects it so constitutes."

Another way of asking why the structure of the literature is so stable is to stop equating the literature with the discipline, as we have done up to now. If we follow Green's (2015, p. 210) incisive observation that "[p]sychology has been a hodge-podge from its very creation, and none of the various efforts to create a theoretically unitary discipline out of that miscellany has ever been remotely successful," psychology throughout the 20th century has been a discipline assembled out of incompatible parts. These incompatible parts, however, at least from the 1950s onwards, produced a literature with a stable structure. Then the question is: why haven't these incompatible parts of the discipline balkanized its literature?

The answer, we argue based on the stable and interpretable patterns in our maps, is because the respective methodologies *in* each of the incompatible parts *did* remain stable throughout the second half of the 20th century. On one end, the east of our maps, the conglomerated methodology provides an "objectification of subjectivity", a set of mechanical rules for scientific thinking (Gigerenzer et al, 1989,

[21] The charge for the lack of theoretical progress in psychology is often made by falsificationists. A good example is a discussion of publication bias in which Christopher Ferguson and Moritz Heene (2012) call theories in psychology "undead" – even when they're disproven, they remain in the psychologists' canon.

p. 84). The widespread use of descriptive quantification accompanied by appropriate inferential statistics, and the research designs this usage presupposes, provide the scientific backbone "experimentalists" feel they can rely on. On the other hand, the western side fills its lack of systematics and theoretical justification by placing its bets on the scientific rigor of its shared methodology. Psychoanalysis - and other large theoretical and metaphysical systems - can be left in the dustbin of history because the scientific rigor of psychology's methodology has taken their place; and that scientific rigor is not only applicable in the clinics, schools, and hospitals where psychologists ply their trade. The rigor shares a family resemblance to the laboratories that produce psychological knowledge. And we arrive at the true promise of the Boulder model: The scientist-practitioner has a discipline to call home.

Our argument that methodological uniformity kept the centrifugal forces at bay runs the risk of being read as a simplification, the kind of simplification to which intellectual historians are prone when trying to describe historical change. Methodology becomes an abstraction – a hidden cause – that kept experimentalists and correlationists (and all those others made invisible by Cronbach's two designations) within the same discipline. We *do not endorse* such a view. Methodology and the rules of "good" research become what they are through institutionalization – in journal policies, funding structures, graduate education, writing manuals, textbooks, and handbooks. There is no decoupling of the intellectual from the social. All this forms a rich tapestry of historical change (or continuity), usually described by detailed microhistories. Our aim was to look at that coalesced institutional inertia from the bird's-eye view as represented by the patterns in literature. Our bibliometric analysis was not done with the intent of invalidating social and extra-intellectual explanations of historical change, but to frame them and articulate them on the macro level. As we said at the outset, we take psychology's literature as

a proxy for the discipline – but the relationship between the literature and the discipline producing it is much more complicated than that, and requires further explication.

Conclusion

Our conclusion might seem contradictory. If the two disciplines of scientific psychology cannot build on each other in practice and in principle, why is their collective structure in the period of fifty years stable? Let's shortly go through the argument in the article to see where the contradiction comes from, and how to resolve it.

We have collected a large set of abstracts and titles of published literature in psychology. Then, we have extracted a set of terms out of those abstracts/titles, calculated their co-occurrences, and visualized the co-occurrence relationships between terms, creating the term maps. We have made comparable maps for every decade in the period under investigation. After that, we have projected sets of journals that are the flagships of their subdisciplines into the term maps, and described the structure of the terms in light of how these different journals occupy space. This procedure identified a stable structure of the literature in the psychology from 1950 to 1999. The only large structural deviation that remains conspicuous is psychoanalysis. The structure included two large superclusters, the eastern and the western one. The eastern one included experimental and physiological psychology. The western included various subclusters of educational, social/personality, clinical, and what are traditionally called applied psychologies.

We have connected this structure to a description of psychology made by Cronbach in 1957, of the science being constituted by two historically distinct streams of method. Cronbach, in the 1950s, hoped for a unification of these two streams. That such a thing never happened is confirmed by Cronbach's reevaluation in 1975, a psychometric analysis of the state of the art in 2009 (Borsboom et al, 2009), and the structure of our maps.

How do we answer the contradiction between the stability of the term maps' structure through time and the inability for the two separated superclusters to integrate? Our thesis is that the structure represents the methodological metalanguage of psychology. In Danziger's words, the degree of coherence is caused by the methodologically embedded principles that define the limits of acceptable research and theorizing (1985, p. 10). These principles are the methodological standardization that led to viewing the object of research of psychologists as the manipulation, analysis, and prediction of variables. The method not only defines the universe of potential answers to the questions psychologists are interested in, but more importantly, it defines the boundaries of what questions one can ask to begin with.

In this way, we provide bibliometric evidence for the theses of Danziger, Stam, and Winston. Methodological standards have facilitated the massive expansion, both in size and number, of journals in which psychologists publish in. This has allowed for growth of the discipline. That growth, however, has been checked in the last few years by the looming replication crisis (see Open Science Collaboration, 2015). Maybe instead of a fragmentation into different research superclusters which is suggested as one possible scenario by Green (2015), or unification, as announced by so many others, we will actually see a great culling of viable research areas in psychology. With that thought, our historical

bibliometric analysis is a call for recognizing that psychology's theoretical and metaphysical content has been reduced to a barren methodology. In an extreme conclusion that could be drawn from our analysis, there are no theoretical systems to discuss in scientific psychology in the 21st century. There is just methodology.

Our conclusion is somewhat familiar even if we garb it in digital humanities and data-mining of literature. The terms in our maps become a proxy for the content of psychology - with its few theories, many models, descriptions of participants of research as students or various animals or children, names of particular methods and research designs, and professional discussions and negotiations of psychologists about their fields on the meta-level. The structure of those terms - the thing behind their stable spatial orientation to each other - is a methodological consensus among psychologists about the kind of research that produces psychological knowledge. The consensus allowed for an extremely efficient expansion of psychology in the second part of 20th century to everything from rats in mazes to moral behavior. All these topics remain nominally disunified under the name psychology, while they are actually serviced and sanctioned by a uniform methodology and underlying philosophy of science. The real problem is not disunity or disintegration; rather, it is the lack of a framework for discussing the way psychologists do research that goes beyond the idea that if psychology is to be scientific, it must be based on our currently accepted methodological standards. The methodological straightjacket contained the disintegration of psychology, but it is debatable whether it permits the development of a science that can ask new questions and provide interesting answers. The increasingly vocal jury of replicationists and crusaders for 'robust' psychological science in the 21st century is still out,[22] and we can't tell what the

[22] The discussion is still fresh in the psychologists' blogosphere, and the last large chapter in the vitriolic online debate at the time of writing of this article was a surge of comments to Susan Fiske's (2016; the draft can be found in Gelman, 2016)

verdict will be for the flood of psychological knowledge gathered over the course of the 20th century – hot air or a progressing and branching empirical science of psychology? And if the latter: Per whose standards?

References

Abma, R. (2013). *De publicatiefabriek: Over de betekenis van de affaire-Stapel.* Nijmegen, The Netherlands: Uitgeverij Vantilt.

Albani, A., Lombardo, G. P., & Proietto, M. (2014). Storia e "crisi" della Psicologia scientifica in Italia. In G. P. Lombardo (Ed.), *Storia e indirizzi nell'Istituto di psicologia Sperimentale dell'Universitá di Roma da Sante De Sanctis a Mario Ponzo* (pp. 89–171). Milano: LED.

Bakan, D. (1966). Comments on D. Fiske's "On the Coordination of Personality Concepts and their Measurement." *Human Development, 9*(1–2), 84–88.

Barclay, A. M. (1973). Death and Rebirth in Psychology. *Contemporary Psychology*, *18*(7), 333–334. https://doi.org/10.1037/0012122

Benjafield, J. G. (2012). The long past and short history of the vocabulary of anglophone psychology. *History of Psychology, 15*(1), 50–71. https://doi.org/10.1037/a0023386

Benjafield, J. G. (2013). The vocabulary of anglophone psychology in the context of other subjects. *History of Psychology, 16*(1), 36–56. https://doi.org/10.1037/a0030532

Borg, I., & Groenen, P. J. F. (2005). *Modern Multidimensional Scaling: Theory and Applications*. New York: Springer.

---

leaked early draft of a column accusing some psychologists of "methodological terrorism" in the APS Observer. For a polemical answer, see Andrew Gelman's (2016) blog post. For an insightful journalistic piece covering the debate, see Jesse Singal's text (2016).

Borsboom, D., Kievit, R. A., Cervone, D., & Hood, S. B. (2009). The Two Disciplines of Scientific Psychology, or: The Disunity of Psychology as a Working Hypothesis. In J. Valsiner, P. C. M. Molenaar, M. C. D. P. Lyra, & N. Chaudhary (Eds.), *Dynamic Process Methodology in the Social and Developmental Sciences* (pp. 67–97). New York: Springer.

Burgard, D. E. (2001). Journals of the Century in Psychology. *The Serials Librarian, 39*(3), 41–56. https://doi.org/10.1300/J123v39n03_06

Burman, J. T., Green, C. D., & Shanker, S. (2015). On the meanings of self-regulation: Digital humanities in service of conceptual clarity. *Child Development, 86*(5), 1207–1221.

Cohen-Cole, J. (2007). Instituting the science of mind: intellectual economies and disciplinary exchange at Harvard's Center for Cognitive Studies. *The British Journal for the History of Science, 40*(4), 567–597. https://doi.org/10.1017/S0007087407000283

Cronbach, L. J. (1957). The two disciplines of scientific psychology. *American Psychologist, 12*(11), 671–684.

Cronbach, L. J. (1975). Beyond the two disciplines of scientific psychology. *American Psychologist, 30*(2), 116–127.

Danziger, K. (1985). The Methodological Imperative in Psychology. *Philosophy of the Social Sciences/Philosophie Des Sciences Sociales, 15*(1), 1–13.

Danziger, K. (1990). *Constructing the Subject: Historical Origins of Psychological Research.* Cambridge, UK: Cambridge University Press.

Danziger, K. (1996). The practice of psychological discourse. In C. F. Graumann & K. J. Gergen (Eds.), *Historical dimensions of psychological discourse* (pp. 17–35). New York: Cambridge University Press.

Danziger, K., & Dzinas, K. (1997). How psychology got its variables. *Canadian Psychology-Psychologie Canadienne, 38*(1), 43–48. https://doi.org/10.1037/0708-5591.38.1.43

De Solla Price, D. (1986). *Little Science, Big Science...and Beyond*. New York: Columbia University Press.

Drucker, J. (2011). Humanities Approaches to Graphical Display. *Digital Humanities Quarterly, 5*(1). Retrieved from http://www.digitalhumanities.org/dhq/vol/5/1/000091/000091.html

Erickson, P., Klein, J. L., Daston, L., Lemov, R., Sturm, T., & Gordin, M. D. (2013). *How Reason Almost Lost Its Mind: The Strange Career of Cold War Rationality*. Chicago: University of Chicago Press.

Feest, U. (2005). Operationism in psychology: What the debate is about, what the debate should be about. *Journal of the History of the Behavioral Sciences, 41*(2), 131–149. https://doi.org/10.1002/jhbs.20079

Ferguson, C. J., & Heene, M. (2012). A Vast Graveyard of Undead Theories Publication Bias and Psychological Science's Aversion to the Null. *Perspectives on Psychological Science, 7*(6), 555–561. https://doi.org/10.1177/1745691612459059

Flis, I. (2016). Instructional Manuals of Boundary-Work: Psychology Textbooks, Student Subjectivities, and Disciplinary Historiographies. *Journal of the History of the Behavioral Sciences, 52*(3), 258–278. https://doi.org/10.1002/jhbs.21791

Furumoto, L. (1989). The new history of psychology. In *The G. Stanley Hall lecture series, Vol. 9* (pp. 9–34). Washington, DC: American Psychological Association.

Gelman, A. (2016, September 21). What has happened down here is the winds have changed [Blog]. Retrieved from http://andrewgelman.com/2016/09/21/what-has-happened-down-here-is-the-winds-have-changed/

Gieryn, T. F. (1999). *Cultural Boundaries of Science: Credibility on the Line*. Chicago: University of Chicago Press.

Gigerenzer, G., Swijtink, Z., Porter, T., Daston, L., Beatty, J., & Krüger, L. (1990). *The Empire of Chance: How Probability Changed Science and Everyday Life*. Cambridge: Cambridge University Press.

Goertzen, J. R. (2008). On the Possibility of Unification The Reality and Nature of the Crisis in Psychology. *Theory & Psychology*, *18*(6), 829–852. https://doi.org/10.1177/0959354308097260

Green, C. D. (1992a). Is unified positivism the answer to psychology's disunity? *American Psychologist*, *47*(8), 1057–1058. https://doi.org/10.1037/0003-066X.47.8.1057

Green, C. D. (1992b). Of Immortal Mythological Beasts Operationism in Psychology. *Theory & Psychology*, *2*(3), 291–320. https://doi.org/10.1177/0959354392023003

Green, C. D. (2015). Why psychology isn't unified, and probably never will be. *Review of General Psychology*, *19*(3), 207–214. https://doi.org/10.1037/gpr0000051

Green, C. D. (2016). A digital future for the history of psychology? *History of Psychology*, *19*(3), 209–219. https://doi.org/10.1037/hop0000012

Green, C. D. (2017). Publish and Perish: Psychology's Most Prolific Authors Are Not Always the Ones We Remember. *The American Journal of Psychology*, *130*(1), 105–119. https://doi.org/10.5406/amerjpsyc.130.1.0105

Green, C. D., & Feinerer, I. (2015). The Evolution of The American Journal of Psychology 1, 1887–1903: A Network Investigation. *The American Journal of Psychology*, *128*(3), 387–401.

Green, C. D., Feinerer, I., & Burman, J. T. (2013). Beyond the schools of psychology 1: A digital analysis of Psychological Review, 1894–1903. *Journal of the History of the Behavioral Sciences*, *49*(2), 167–189.

Green, C. D., Feinerer, I., & Burman, J. T. (2014). Beyond the schools of psychology 2: A digital analysis of Psychological Review, 1904–1923. *Journal of the History of the Behavioral Sciences, 50*(3), 249–279.

Green, C. D., Feinerer, I., & Burman, J. T. (2015a). Searching for the structure of early American psychology: Networking Psychological Review, 1894–1908. *History of Psychology, 18*(1), 15–31. https://doi.org/10.1037/a0038406

Green, C. D., Feinerer, I., & Burman, J. T. (2015b). Searching for the structure of early American psychology: Networking Psychological Review, 1909–1923. *History of Psychology, 18*(2), 196–204. https://doi.org/10.1037/a0039013

Hacking, I. (2006, August 17). Making Up People. *London Review of Books*, pp. 23–26. Retrieved from http://www.lrb.co.uk/v28/n16/ian-hacking/making-up-people

Hale, N. G. (2000). *The Rise and Crisis of Psychoanalysis in the United States: Freud and the Americans, 1917-1985*. New York: Oxford University Press.

Henriques, G. (2003). The tree of knowledge system and the theoretical unification of psychology. *Review of General Psychology, 7*(2), 150–182. https://doi.org/10.1037/1089-2680.7.2.150

Henriques, G. R. (2008). Special Section: The Problem of Psychology and the Integration of Human Knowledge Contrasting Wilson's Consilience with the Tree of Knowledge System. *Theory & Psychology, 18*(6), 731–755. https://doi.org/10.1177/0959354308097255

Jevremov, T., Pajić, D., & Šipka, P. (2007). Structure of personality psychology based on cocitation analysis of prominent authors. *Psihologija, 40*(2), 329–343.

Koch, S. (1993). "Psychology" or "the psychological studies"? *American Psychologist, 48*(8), 902–904. https://doi.org/10.1037/0003-066X.48.8.902

Koch, S., & Leary, D. E. (Eds.). (1992). *A Century of Psychology as Science*. Washington, D.C.: American Psychological Association.

Kožnjak, B. (2016). Kuhn Meets Maslow: The Psychology Behind Scientific Revolutions. *Journal for General Philosophy of Science*, 1–31. https://doi.org/10.1007/s10838-016-9352-x

Lovett, B. J. (2006). The new history of psychology: A review and critique. *History of Psychology, 9*(1), 17–37. https://doi.org/10.1037/1093-4510.9.1.17

MacMartin, C., & Winston, A. S. (2000). The rhetoric of experimental social psychology, 1930–1960: From caution to enthusiasm. *Journal of the History of the Behavioral Sciences*, *36*(4), 349–364. https://doi.org/10.1002/1520-6696(200023)36:4<349::AID-JHBS4>3.0.CO;2-X

Maslow, A. H. (1966). *The Psychology of Science: A Reconnaissance.* New York: Harper & Row.

Manicas, P. T. (2006). *A Realist Philosophy of Social Science: Explanation and Understanding.* Cambridge: Cambridge University Press.

Mayes, R., & Horwitz, A. V. (2005). DSM-III and the revolution in the classification of mental illness. *Journal of the History of the Behavioral Sciences, 41*(3), 249–267.

Newman, M.E.J. (2004). Fast algorithm for detecting community structure in networks. *Physical Review E, 69*(6), 066133. https://doi.org/10.1103/PhysRevE.69.066133

Newman, M.E.J., & Girvan, M. (2004). Finding and evaluating community structure in networks. *Physical Review E*, *69*(2), 026113. https://doi.org/10.1103/PhysRevE.69.026113

O'Brien, N. P. (2001). Journals of the Century in Education. *The Serials Librarian*, *39*(3), 95–102. https://doi.org/10.1300/J123v39n03_10

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science, 349*(6251), aac4716. https://doi.org/10.1126/science.aac4716

Pettit, M., Serykh, D., & Green, C. D. (2015). Multispecies Networks: Visualizing the Psychological Research of the Committee for Research in Problems of Sex. *Isis, 106*(1), 121–149. https://doi.org/10.1086/681039

Pooley, J. D. (2016). A "Not Particularly Felicitous" Phrase: A History of the "Behavioral Sciences" Label. Serendipities: *Journal for the Sociology and History of the Social Sciences, 1*, 38–81.

Pooley, J., & Solovey, M. (2010). Marginal to the Revolution: The Curious Relationship between Economics and the Behavioral Sciences Movement in Mid-Twentieth-Century America. *History of Political Economy, 42*(Suppl 1), 199–233. https://doi.org/10.1215/00182702-2009-077

Rose, N. (1996). *Inventing Our Selves: Psychology, Power, and Personhood*. Cambridge: Cambridge University Press.

Rose, N. S. (1990). *Governing the Soul: The Shaping of the Private Self*. London: Routledge.

Singal, J. (2016, October 12). Inside Psychology's "Methodological Terrorism" Debate. *New York Magazine: Science of Us*. Retrieved from http://nymag.com/scienceofus/2016/10/inside-psychologys-methodological-terrorism-debate.html

Smyth, M. M. (2001a). Certainty and Uncertainty Sciences Marking the Boundaries of Psychology in Introductory Textbooks. *Social Studies of Science, 31*(3), 389–416. https://doi.org/10.1177/030631201031003003

Smyth, M. M. (2001b). Fact Making in Psychology The Voice of the Introductory Textbook. *Theory & Psychology, 11*(5), 609–636. https://doi.org/10.1177/0959354301115002

Smyth, M. M. (2004). Exploring Psychology's Low Epistemological Profile in Psychology Textbooks Are Stress and Stress Disorders Made within Disciplinary Boundaries? *Theory & Psychology, 14*(4), 527–553. https://doi.org/10.1177/0959354304044923

Staats, A. W. (1983). *Psychology's Crisis of Disunity: Philosophy and Method for a Unified Science*. Westport, CT: Praeger.

Staats, A. W. (1991). Unified positivism and unification psychology: Fad or new field? *American Psychologist, 46*(9), 899–912. https://doi.org/10.1037/0003-066X.46.9.899

Stam, H. J. (1992). The Demise of Logical Positivism: Implications of the Duhem-Quine Thesis for Psychology. In C. W. Tolman (Ed.), *Positivism in Psychology* (pp. 17–24). New York, NY: Springer.

Stam, H. J. (2000). Theorizing Health and Illness: Functionalism, Subjectivity and Reflexivity. *Journal of Health Psychology, 5*(3), 273–283. https://doi.org/10.1177/135910530000500309

Stam, H. J. (2004). Unifying psychology: epistemological act or disciplinary maneuver? *Journal of Clinical Psychology, 60*(12), 1259–1262. https://doi.org/10.1002/jclp.20069

Sternberg, R. J. (Ed.) (2005). *Unity in psychology: Possibility or pipedream?* Washington, DC: American Psychological Association.

Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics, 84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Van Eck, N. J., & Waltman, L. (2011). Text mining and visualization using VOSviewer. *ISSI Newsletter, 7*(3). Retrieved from http://arxiv.org/abs/1109.2058

Van Eck, N. J., & Waltman, L. (2014). Visualizing Bibliometric Networks. In Y. Ding, R. Rousseau, & D. Wolfram (Eds.), *Measuring Scholarly Impact* (pp. 285–320). New York: Springer. https://doi.org/10.1007/978-3-319-10377-8_13

Van Eck, N. J., Waltman, L., Dekker, R., & van den Berg, J. (2010). A comparison of two techniques for bibliometric mapping: Multidimensional scaling and VOS. *Journal of the American Society for Information Science and Technology, 61*(12), 2405–2416. https://doi.org/10.1002/asi.21421

Walsh, R. T. G., Teo, T., & Baydala, A. (2014). *A Critical History and Philosophy of Psychology: Diversity of Context, Thought, and Practice.* New York: Cambridge University Press.

Waltman, L., van Eck, N. J., & Noyons, E. C. M. (2010). A unified approach to mapping and clustering of bibliometric networks. *Journal of Informetrics, 4*(4), 629–635. https://doi.org/10.1016/j.joi.2010.07.002

Weidman, N. (2016). Overcoming our mutual isolation: How historians and psychologists can work together. *History of Psychology, 19*(3), 248–253. https://doi.org/10.1037/hop0000042

Winston, A. S. (1988). Cause and Experiment in Introductory Psychology: An Analysis of R.S. Woodworth's Textbooks. *Teaching of Psychology, 15*(2), 79–83. https://doi.org/10.1207/s15328023top1502_3

Winston, A. S. (1990). Robert Sessions Woodworth and the "Columbia Bible": How the Psychological Experiment Was Redefined. *The American Journal of Psychology, 103*(3), 391–401. https://doi.org/10.2307/1423217

Winston, A. S. (2005). Controlling the Metalanguage. In A. C. Brock, J. Louw, & W. van Hoorn (Eds.), *Rediscovering the History of Psychology* (pp. 53–73). New York: Springer.

Young, J. L., & Green, C. D. (2013). An exploratory digital analysis of the early years of G. Stanley Hall's American Journal of Psychology and Pedagogical Seminary. *History of Psychology, 16*(4), 249–268.