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Who are we studying?
Reliance on WEIRD and/or student subjects in cross-cultural, social/personality and evolutionary psychology

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Abstract

This article investigates the distribution of origin and type of samples in cross-cultural, social/personality and evolutionary psychology journals, both on the level of number of investigated samples and number of investigated participants. Results show that the majority of research comes from W.E.I.R.D. (Western, Educated, Industrialized, Rich and Democratic) countries, mostly from Northern America and Europe in all disciplines. The reliance on WEIRD and Northern American samples was greatest in social/personality journals, followed by evolutionary psychology journals and least in cross-cultural journals. Furthermore, an important and promising finding was that the reliance upon student sampling in social/personality research has dramatically decreased in comparison with previous content analyses. The implications of the narrowness of the investigated populations, even in cross-cultural psychology, for the validity and universality of psychological research are discussed and recommendations for future research are made.

Contents

Introduction

As the science of behavior and the mind (Gray, 2011), psychology focuses on drawing conclusions from empirical data that can be universally applied to all humans (Sue, 1999). However, how much do we know about ''humans'' if we predominantly study one specific subgroup of people? In 2010, Henrich, Heine and Norenzayan drew awareness to the fact that the majority of studies into human psychology and behavior relies on samples almost entirely from Western, Educated, Industrialized, Rich and Democratic (WEIRD) countries. WEIRD subjects, and more specifically, Americans, are by far the largest investigated population in psychological research. Arnett (2009) analyzed the flagship journals of six sub disciplines from the American Psychology Association from 2003 to 2007 and found that 96% of the subjects were from Western industrialized countries, specifically those in North America and Europe, as well as Australia and Israel. More precisely, sixty-eight percent of the samples were from the United States, 14% were from the other English-speaking countries, and 13% were from Europe, which leaves the rest of the world represented by a mere 5%.

Researchers generalize the findings in WEIRD samples more than often, although usually implicitly, to the human species. However, by comparing experimental studies in several psychological domains, Henrich et al. show that several psychological phenomena -if they exist at all- play out differently in different populations and conclude that assuming generalizability is therefore in many cases unjust.

A straightforward example Henrich et al mention is the study by Segall et al. (1966), who investigated to what extent the Muller-Lyer illusion influenced subject's perception in 16 different societies. This famous optical illusion consists of a stylized arrow. Viewers are asked to place a mark on the figure at the midpoint, and it turns out that viewers' perception of the midpoint is influenced by direction of the arrows: the illusion causes viewers to perceive the midpoint as more towards the "tail" end. As turns out, the effect is not universal: Segall and his colleagues found major differences between samples, with the San foragers of the Kalahari not being affected by the illusion and American undergraduates being most affected, deviating significantly from all other societies studied. Henrich et al. found WEIRD samples as the frequent outlier on numerous other areas such as moral reasoning, fairness, cooperation, spatial reasoning, self-concepts and the heritability of IQ and therefore note that WEIRD subjects seem to be -quite ironically- truly weird.

Moreover, most participant pools in psychology, are not representative of WEIRD societies, but have been relying massively upon a very narrow and specific subpopulation in them: (mostly undergraduate) students. Christie (1965) was the first to notice this trend when her research showed that 49% of the research participants in the 1959 volume of the Journal of Abnormal and Social Personality were undergraduate students. From the 60 up and until the 00s, content analyses have repeatedly revealed an increasing reliance on American undergraduate student pools, especially in research published in social and

personality psychological journals (Sherman, 1998; Higbee & Wells, 1972; Higbee, Millard & Folkman, 1982; Higbee, Lott & Graves 1976). For instance, Sears (1986) showed that in the 1980 volumes of the Journal of Personality and Social Psychology (JPSP), Personality and Social Psychology Bulletin (PSPB), and the Journal of Experimental Social Psychology (JESP), 82% of the samples used students of one kind or another. Fifteen years later, this trend had not decreased: publications in the 1995 volumes of the JESP and JPSP used undergraduate students as participants in respectively 95.8% and 70.6% of the cases (Wintre, North & Sugar, 2001).

The tendency to study students over other populations is understandable in terms of convenience and cost-effectiveness, as students are readily available to participate in research in exchange for money or course credits. However, the heavy reliance on student pools has continuously raised concerns and criticism over the years, questioning whether it can withstand conditions for validity and generalizability. Moving from adolescence to adulthood, undergraduates are considered a unique population (Schultz, 1969; Smart, 1966) going through a difficult transition period in their lives (Adams, Ryan, & Keating, 2000; Berzonsky & Kuk, 2000). Sears (1986) argued that college students have less-crystallized attitudes, less-formulated senses of self, stronger cognitive skills, stronger tendencies to comply with authority, and more unstable peer group relationships than other adults. Generalizing research outcomes from students to the general population may therefore lead to wrong inferences. Indeed, mounting evidence shows that psychological behavior of undergraduate students differs from adults (Snibbe & Markus, 2005; Kusserow, 1999; Stephens et al., 2007; Henry, 2008; Burke et al., 2010).

For example, by performing a second-order meta-analysis, Peterson (2001) found that nearly half (48%) of the effect sizes respectively observed for college student and nonstudent subjects differed substantially, either in direction or magnitude. Another study by Hanel and Vione (2016) compared students with the general population in 59 countries on 12 personality (Big-5) and attitudinal variables based on the 2015 World Values Survey. They found that students varied from the general population often in substantial and incoherent ways. In both studies, the authors could not find a systematic pattern to explain the differences between students and non-students subjects.

Summarizing, research suggests that generalizing from WEIRD participants, but specifically WEIRD students, to other populations can be problematic and should be performed with caution. Sears (1986) argues that over reliance on this narrow data base may distort our view of human nature, especially since researchers often fail to mention the (limited) generalizability of their findings (Peterson, 2014). In her research, Wintre (2001) noted that only 24 of the 1,065 articles (2.25%) based on data from undergraduates included statements about the restricted generalizability of their results. Henrich et al. (2010) mention that even in publications in top journals such as Nature and Science, researchers generalize from WEIRD undergraduates

to the entire species with great ease. Arnett (2009) noted that the title of the 2007 Journal of Personality and Social Psychology could be changed to ''*Journal of the Personality and Social Psychology of American Undergraduate Introductory Psychology Students*'' to reflect more truth, since 67% of the American samples and 80% of the samples from other countries were composed solely of undergraduates in psychology courses. But even if researchers would do so, perhaps the most important question is whether limiting psychological research to this extremely narrow subgroup of the human race is what we should be aiming for. Many researchers argue differently for the future of psychology and have called upon the need for more broadly construed samples from all over world and less reliance on student samples (Arnett, 2009; Henrich et al., 2010; Higbee & Wells; 1972; Hanel & Vione, 2016; Schultz, 1969; Sears, 1986; Peterson, 2001; Wintre, 2001).

The current research

Nearly a decade after the provoking article of Henrich et al. (2010), this study aims to find out more about the current state of affairs regarding sample diversity in psychology and to see whether these calls for more broadly construed samples from all over the world and less reliance on student samples have been answered. We aim to do so by analyzing disciplines of psychology who are supposedly the ''best'' and the ''worst'' when it comes to sample diversity. First of all, we will analyze the current state of affairs in the field where sample diversity has been raised many times as being a serious issue: social/personality psychology. As previously discussed, research has shown an increasing trend of reliance on student samples in the field of social and personality psychology over the years. Have changes been made, or does the majority of samples in social/personality psychology still rely upon participants from WEIRD societies and students? To my knowledge, in the past decade, no significant changes have been made by editors and reviewers that might change this trend. Therefore, based on previous content analyses of social/personality journals (Sherman, 1998; Higbee & Wells, 1972; Higbee, Millard & Folkman, 1982; Higbee, Lott & Graves 1976; Wintre, North & Sugar, 2001), I expect at least 75% of the studies in social and personality journals to rely upon student samples as compared to other samples. Furthermore, in line with Arnett's findings, I expect at least 90% of the samples of social and personality psychology to be derived from WEIRD countries, and more specifically, 70% of the samples of social and personality psychology to be derived from Northern America.

Secondly, we aim to analyze the fields of psychology where one might assume most variety among the studied participants: cross-cultural and evolutionary psychology. In the past decades, the rise of cross-cultural and evolutionary psychology has paved the way for more inclusive, generalizable and context-driven theories of human behavior which embrace and explain, rather than ignore, cultural differences between human beings. However, interestingly, until now, virtually no research has examined sample diversity in these fields of psychology. For reasons to be explained in more detail later on, one may hope to

find substantial sample diversity in these fields. Perhaps the expectation to find considerable sample diversity in these fields is the very reason why it has not been investigated, as may be assumed that it is not an issue here. However, exactly for this reason, it is valuable and important to investigate whether this really is the case. If turns out that also in these disciplines, sample diversity is rather low and the majority of participant pools is derived from WEIRD countries, this further narrows down the broadness of the investigated scope of participants in psychology. Taking the field of social/personality psychology as a baseline with a possible a heavy reliance on participants from WEIRD countries, I hope to find that samples in cross-cultural psychology and evolutionary psychology contrast sharply against this background and investigate a more diverse range of participants. All in all, by performing a content analysis of 10 leading journals in the disciplines of social/personality, evolutionary and cross-cultural psychology, I aim to shed light on the use of WEIRD and student samples in those fields in the years 2015 and 2016. Although performing a descriptive analyses and doing partly novel work, based on literature, I expect to find certain patterns in advance.

Sampling tendencies in evolutionary psychology

Evolutionary psychology aims to understand the human mind and behavior from an evolutionary perspective and by doing so, evolutionary psychologists work toward the long-term goal of discovering our universal human nature (Buss, 2015). This evolutionary quest into *human* nature naturally implies that whatever this human nature beholds, accounts for all humans. From this perspective, one may argue that *any* human, regardless of which ''group'' it belongs to, suffices as being investigated to know more about human nature. From this perspective, the heavy reliance on WEIRD samples (or any other homogenized research group, for that matter), would be reimbursed. However, as the work of Henrich et al. (2010) shows, behavioral varieties between different groups of humans are enormous. As Henrich et al. state themselves:

Evolution has equipped humans with ontogentic programs, including cultural learning, that help us adopt our bodies and brains to the local physical and social environment […] *Our thesis is not that humans share few basic psychological properties or processes; rather, we question our current ability to distinguish these reliably developing aspects of human psychology from more developmentally, culturally, or environmentally contingent aspects of our psychology given the disproportionate reliance on WEIRD subjects.* (pp. 20)

Furthermore, they note:

> *More than other researchers in the social sciences, evolutionary researchers have led the way in performing systematic comparative work, drawing data from diverse societies. This is not because they are interested in variation per se (though some are), but because they are compelled, through some combination of their scientific drive and the enthusiasm of their critics, to test their*

> *hypotheses in diverse populations (e.g., Billing & Sherman, 1998; Buss 1989; Daly & Wilson 1988; Fessler et al. 2005; Gangestad et al. 2006; Henrich et al. 2005; Kenrick & Keefe 1992a; 1992b; Low 2000; Medin & Atran 2004; Schaller & Murray 2008; Schmitt 2005; Sugiyama et al. 2002; Tracy & Robins 2008).* (pp. 22)

Nevertheless, since evolutionary psychology is still part of the greater field of general psychology, it is probable that the tendency to study WEIRD samples over non WEIRD samples, and more specifically, a dominance of samples derived from Northern America (Arnett, 2009; Henrich et al., 2010), is also apparent in evolutionary psychology. Comparative content analyses of the 2012 volumes of the journal of Evolution and Human Behavior (E&HB) and Journal of Personality and Social Psychology (JPSP) by Kurzban (2013) indicate that this is indeed the case. He found that 65% of the samples in E&HB were from WEIRD samples, as compared to 96% of the samples in the JPSP. Along these lines, I hypothesize that at least 65% of the samples in evolutionary psychology journals will be derived from WEIRD countries. Furthermore, mirroring the proportion between WEIRD samples coming from Northern America that Arnett found, I hypothesize that of these 65% WEIRD samples in evolutionary psychology, at least 50% will be derived from Northern America.

Sampling tendencies in cross-cultural psychology

Cross-cultural psychology, defined by Shiraev & Levy (2010, p. 2), entails ''the critical and comparative study of cultural effects on human psychology''. Furthermore, Shiraev & Levy (2010, p. 3), define culture as ''a set of attitudes, behaviors, and symbols shared by a large group of people and usually communicated from one generation to the next''. The Cambridge dictionary defines culture as: ''the way of life, especially the general customs and beliefs, of a particular group of people at a particular time''. By definition, one may therefore hope to find cross-cultural researchers studying a culturally diverse range of participants, of which studying participants from a diverse range of countries would be a start. However, as previously discussed, research within the entire field of psychology has mostly focused on studying participants from WEIRD countries, and more specifically, on participants from Northern America (Henrich et al., 2010; Arnett, 2008). Furthermore, the definition of culture is not confined to land borders, meaning that cross-cultural comparisons can also be made by investigating different subcultures within one nation, such as Afro-Americans or Asian-Americans within the United States. Research into such subcultures will still allow for American dominance within the field of cross-cultural psychology. As May (1997) found that between 1981 and 1994, 70% of research in psychology originated from the United States, I believe that this tendency will be reflected in cross-cultural psychology as well. As stated before, no research so far has looked into international sample representation in cross-cultural psychological journals. Combining findings in works of May, (1997), Arnett (2009) and Kurzban (2013), but keeping in mind the nature of cross-cultural psychology and expecting this discipline to investigate the most diverse range of participants, I hypothesize

that at most, 65% of samples in cross-cultural psychology will be derived from WEIRD countries, of which at most, 50% will be derived from Northern America.

Finally, to the best of my knowledge, no study so far has analyzed to what extent participant pools in cross-cultural psychology rely upon samples from student populations. However, regarding the legitimacy of the use of student samples in cross-cultural research, different perspectives and mixed evidence exist. Greenfield (2008) poses that differences between socioeconomic groups are larger than differences between countries. As students have usually high socioeconomic status, this perspective challenges the generalizability of results found in student samples. On the contrary, Diener, Diener and Diener (1995) studied subjective well-being, and found that college student samples gave moderately accurate estimates of the between-country differences that were found with more representative surveys. Student populations, by being in a similar life stage and education level, could be considered more homogenous than other populations, such as a representative sample of the general population, although studies fail to reach consensus over this (Peterson, 2001; Hanel & Vione, 2016). Still, this homogeneity assumption may still lead cross-cultural researchers to favor students over other samples for cross-cultural comparisons. For example, Saucier et al. (2015) choose to study college students over representative samples of countries, to decrease large between-population differences in education level. All of this indicates that students are regarded a feasible option as research participants in the field of cross-cultural research. Furthermore, out of convenience reasons, student samples remain an attractive option for researchers in all research branches, cross-cultural psychology being no exception. Therefore I expect the majority of samples in the field of cross-cultural psychology to be derived from student populations. Wintre, North and Sugar (2001) showed that about 70% of the samples in different fields of psychology were derived from student populations. In line with these findings, I expect 70% of the samples in cross-cultural psychology to be derived from student populations as compared to other samples.

In sum, I expect that, in all disciplines samples will for the majority be derived from WEIRD countries:

Hypothesis 1a: At least 90% of the samples in social/personality psychology journals will be derived from WEIRD countries

Hypothesis 1b: At least 65% of samples in evolutionary psychology journals will be derived from WEIRD countries

Hypothesis 1c: At most 65% of samples in cross-cultural psychology journals will be derived from WEIRD countries

Hypothesis 1d: The reliance on samples derived from WEIRD countries will significantly be greater in social/personality psychology journals, followed by evolutionary psychology and will be least in cross-cultural psychology

Moreover, I expect that great parts of WEIRD samples in all disciplines will be derived from Northern America:

Hypothesis 2a: At least 70% of the samples in social/personality journals will be derived from Northern America
Hypothesis 2b: At least 50% of the samples in evolutionary psychology journals will be derived from Northern America
Hypothesis 2c: At most, 50% of the samples in cross-cultural psychology journals will be derived from Northern America
Hypothesis 2d: The reliance on samples derived from Northern America will significantly be greater in social/personality psychology, followed by evolutionary psychology and will be least in cross-cultural psychology

Finally, I expect that the majority of samples in social/personality psychology and cross-cultural psychology will be derived from student populations:

Hypothesis 3a: At least 75% of the samples in social and personality psychology will be derived from student populations, as compared to other populations
Hypothesis 3b: At least 70% of the samples in cross-cultural psychology will be derived from student populations, as compared to other populations

Method

Sample
The present study will use data from another research group who analyzed 1111 articles from 11 journals into health, emotion, social/personality and evolutionary psychology from year 2015. Leading journals in each of these fields were sought through academic search engines as PsycINFO, Web of Science, Google Scholar, and academic publisher's websites and a collection of journals was chosen on the basis of impact factors and relevancy to the field of interest. Six journals were related to social/personality and evolutionary psychology and were included in the present study. Evolution & Human Behavior is the official journal of the Human Behavior and Evolution Society and is by impact factor the leading journal in the field of evolutionary psychology and was also analyzed by Kurzban (2013). The majority of the work published in EH&B falls under the discipline of evolutionary psychology, although, being an interdisciplinary journal, also encompasses research from other allied fields such as anthropology. Therefore, Evolutionary Psychology was added to this analysis, which is the other renowned journal in the field and as the title suggests,

publishes research about human psychology in an evolutionary perspective. Together these two journals represent the field of evolutionary psychology. Furthermore, four of most influential social/psychological journals were selected to represent the discipline of social/personality psychology. The Journal of Experimental Social Psychology aims to publish articles that extend or create conceptual advances in social psychology, and as the title suggests, focusses mainly on experimental psychology. The Journal of Personality and Social Psychology, Personality and Social Psychology Bulletin and Social Psychological and Personality Science publish research in all areas of social and personality psychology. As JESP, JPSP and PSPB have been included multiple times in previous content analyses (e.g. Sears, 1986; Higbee and Wells; 1972) this allows us to make comparisons.

Furthermore, a new set of data was collected, consisting of 872 articles from 9 journals into organizational and cross-cultural psychology from years 2015 and 2016. Leading journals were searched through academic search engines as PsycINFO, Web of Science, Google Scholar, and academic publisher's websites and again, a collection of journals was chosen on the basis of impact factors and relevancy. Closest related to the field of cross-cultural psychology were Cultural Diversity and Ethnic Minority Psychology, which focuses on the psychological science of culture, ethnicity and race, and the Journal of Cross-Cultural Psychology, which publishes about the interrelations between culture and psychological processes. The scope of Cross-Cultural Research is broader, as it publishes cross-cultural and comparative studies from all human sciences. Finally, the International Journal of Intercultural Relations focuses on applied research intercultural relations, such as immigrant acculturation and integration. Together these four journals were deemed most influential and relevant to represent the rather broad discipline of cross-cultural psychology and were included in the present study.

As the present study is about representativeness, generalizability and sampling diversity, only empirical articles with human participants were examined and pilot studies, meta-analyses, animal studies, commentaries, rejoinders and review articles were excluded from analyzing. This led to the exclusion of 170 articles. Finally, the present study covers a total of 2144 separate samples from 880 research articles to be analyzed from 10 journals in the years of 2015-2016. An overview of journal and sample information can be found in Table 1.

Materials

Coding schemes for both part of the data collection are in the broadest sense equal, specific code books can be found in Appendix A. Relevant coding matters for the present study shall now be discussed. After the article was deemed relevant according to the previously mentioned inclusion criteria, each separate sample in an article was coded by sample size, origin of sample and type of sample. In both parts of the data collection, sample size was coded by ''actual N'', which is defined as the number of participants that actually took part in the data analyses, drop-outs and outliers subtracted. In the social/personality and evolutionary

part of the data, information about the origin of the sample was coded by continent, based on the UN49 area division. Also, in the social/personality and evolutionary data, samples were categorized as WEIRD or nonWEIRD: Samples were considered WEIRD when they were derived from the U.S.A, Canada, Australia, New Zealand, Switzerland, the European Union or the European Economic Area (GOV, 2017). This division was based on WEIRD literature in the articles of Henrich (2010) and Arnett (2008). In the cross-cultural part of the data, origins of samples were coded by country, based on the ISO 3166-1 alpha-3 coding system[1]. Samples could be coded up and until eight different countries to retain as much information as possible. Samples were coded for the country of residency of its participants. Furthermore, when a sample consisted of participants from more than eight countries, one of the following options had to be chosen: *Mixed WEIRD,* when the sample consists of people from >8 WEIRD countries, *Mixed nonWEIRD,* when the sample consisted of people from >8 nonWEIRD countries or *Mixed* when sample consists of people from >8 countries. In the cross-cultural part of the data set, WEIRD and nonWEIRD categorization was defined using a tool by Muthukrishna (2017), which is currently still in beta-testing and was not yet available to the researchers of the social/personality and evolutionary psychology database. Therefore, the mixed-WEIRD and nonWEIRD samples in the cross-cultural database were recoded to match the previously discussed WEIRD- non WEIRD division. Samples consisting of a mixture of participants from more than 8 different WEIRD and nonWEIRD countries were categorized as Cross-Cultural for the continent category and Mixed for the WEIRD and nonWEIRD category.

In order to make comparisons between the datasets, all entries for Type of sample were recoded into one of the following categories: Student Sample, Crowd-Sourced Sample, Other Adult Sample or Younger than 18. Country entries in the cross-cultural part of database were recoded to fit the Continent category. Finally, all samples were categorized as WEIRD, nonWEIRD or Mixed on the basis of the previously described criteria.

[1] three-letter country codes published by the International Organization for Standardization (ISO), to represent countries, dependent territories, and special areas of geographical interest.

Table 1.

Journal and sample information

Journal	Year	JCR Impact Factor	Publisher & country	Total number of articles per volume	Number of articles included in present study*	Total number of subsamples	Average number of separate samples within articles
Journal of Cross-Cultural Psychology	2015	1.795	Sage (US-CA)	94	47 (50.0%)	125	2.66
	2016	1.657		80	64 (80.0%)	153	2.39
Cross-Cultural Research	2015	.805	Sage (US-CA)	8	8 (100.0%)	18	2.25
	2016	.851		12	12 (100.0)	37	3.08
International Journal of Intercultural Relations	2015	.963	Elsevier (NL)	83	46 (55.4%)	87	1.89
	2016	1.183		58	58 (100.0%)	64	1.10
Cultural Diversity & Ethnic Minority Psychology	2015	1.790	American Psychology Association	64	57 (89.0%)	78	1.37
	2016	2.040		58	52 (89.7%)	85	1.63
Discipline Cross-Cultural Psychology total				457	344 (75.3%)	647	1.88
Evolution & Human Behavior	2015	3.223	Elsevier (NL)	67	56 (83.4%)	94	1.69
Evolutionary Psychology	2015	1.050	Sage (US-CA)	54	41 (76.0%)	68	1.66
Discipline Evolutionary Psychology total				121	97 (80.2%)	162	1.67
Journal of Experimental Social Psychology	2015	2.159	Elsevier (NL)	115	109 (94.8%)	314	2.88
Journal of Personality and Social Psychology	2015	4.420	American Psychology Association	120	106 (88.3%)	444	4.19
Personality and Social Psychology Bulletin	2015	2.504	Sage (US-CA)	123	115 (93.5%)	400	3.48
Social Psychological and Personality Science	2015	1.883	Sage (US-CA)	116	111 (95.7%)	177	1.05
Discipline Social/Personality Psychology total				474	439 (93.6%)	1335	2.82
Total all disciplines				1052	880 (83.7%)	2144	2.43

Procedure

Both parts of the data collected were according to the previously discussed coding procedures. Articles were divided among the researchers and researchers worked independently. Difficult coding matters were discussed and decided upon collectively. The social/personality and evolutionary psychology part of the data was collected in September 2016 by eight coders who shared a Krippendorf's interrater reliability of α = .854. The cross-cultural part of the data was collected in April 2017, by three coders and yielded a Krippendorf's interrater reliability of α = .946.

Results

Origins of samples across disciplines

Across disciplines, 84.8% (*N* = 2144) of the investigated samples were derived from WEIRD countries, 13.7% from nonWEIRD countries and 1.4% of the samples were derived from a combination of both WEIRD and nonWEIRD countries. More specifically, 60.2% of the samples were derived from Northern America. Hereafter, Europe was the most investigated continent (19.6%), followed by Asia and Eastern Asia (12.8%) and cross-cultural research (3.1%). The remaining 4.3% of the samples were derived from Africa, Australia, New Zealand and America. The underrepresentation of Africa and America[2] is especially remarkable: less than 1% of the samples were derived from these continents. In other words, 82.9% of the total samples were derived from Northern America, Europe, Australia or New Zealand, which leaves the rest of the world represented by 17.1% of the samples. An overview of WEIRDness of samples can be found in Table 2 and 3, while an overview of origin of samples by continent can be found in Table 4. Furthermore, from the cross-cultural part of the data set, it becomes clear that within continents, some countries are investigated more frequently than others. For example, of all samples derived from Eastern Asia, 50% came from China. In Europe, samples were coming mostly from Germany (22.7%) and the Netherlands (19.3%). In Asia, Israel (36.4%), India (19.6%), Russia (12.1%) and the Philippines (9.1%) were investigated most often. Combined, these countries embodied 77.2% of the samples in the entire continent of Asia. A detailed overview of origin of samples by country in the cross-cultural psychology journals can be found in Table 6.

WEIRDness

WEIRDness within disciplines – by number of samples

Confirming hypothesis 1a, studies in social/personality psychology journals sampled from WEIRD over non

[2] Central America, Latin America & the Caribbean and South America were merged into a single category labelled ''America'' because combined, the samples derived from these regions represented less than one percent of the total samples.

WEIRD countries in more than 90% of cases: 94.7% of samples were derived from WEIRD countries (see Table 2). As expected, studies in cross-cultural psychology journals relied upon WEIRD samples least often of the three disciplines, however .4% more than we hypothesized: 65.4% of the samples within the cross-cultural journals were derived from WEIRD countries, rejecting hypothesis 1c. Levelling between the other two disciplines, studies in evolutionary psychology journals sampled from WEIRD countries in 81.5% of the cases, confirming hypothesis 1c. There was a significant, although weak (Cramér's V = .264, p < .001) association between discipline and WEIRDness by number of WEIRD/nonWEIRD/mixed samples; χ^2 (4) = 297.961, p < .001. Three separate Chi square tests were run to compare each combination of disciplines separately and all three were significant: comparing evolutionary psychology to social/personality psychology (χ^2 (2) = 45.842, p < .001, Cramér's V = .175, p < .001), evolutionary psychology to cross-cultural psychology (χ^2 (2) = 18.013, p < .001, Cramér's V = .149, p < .001) and cross-cultural psychology to social/personality psychology (χ^2 (2) = 295.726, p < .001, Cramér's V = .386, p < .001). Taking into account the previously discussed differences in reliance on WEIRD over nonWEIRD samples between disciplines, the results of the separate Chi square tests support hypothesis 1d, confirming that the reliance on samples derived from WEIRD countries is greatest in social/personality psychology journals, followed by evolutionary psychology and the least in cross-cultural psychology. Based on the odds ratio, a sample in social/personality psychology is 8.11 times more like to be derived from a WEIRD country than a sample in cross cultural psychology.

WEIRDness within disciplines – by number of participants

When looking at the number of studied WEIRD/nonWEIRD/mixed *participants* instead of looking at the number of WEIRD/nonWEIRD/mixed *samples*, the balance of WEIRD/nonweird/mixed samples changes; both across and within the different psychological disciplines. Noteworthy is the large number of participants in the study groups of mixed studies: even though mixed samples only amount to 1.4% of the total samples, they represent 42.3% of the total participants. In social/personality psychology journals, the 6 (0.4%) mixed samples amount to more participants than the 1264 (94.7%) WEIRD samples combined. Similarly, in cross-cultural psychology journals, the 3.9% mixed samples amount to 33.0% of the total number of participants. Moreover, in all disciplines, the proportion of nonWEIRD samples is greater than the proportion of nonWEIRD participants: fully nonWEIRD samples (13.7%) consist of less than 1% of the total body of participants. The discrepancies between nonWEIRD samples/participant proportions were most apparent in cross-cultural psychology and evolutionary psychology. In cross cultural psychology, nonWEIRD samples (30.8%) consisted of 1.7% of the total number of participants. In evolutionary psychology, nonWEIRD samples (18.5%) consisted of .4% of the total number of participants. There was a significant, moderately strong (Cramér's V = .350, $p < .001$) association between discipline and WEIRDness:

Table 2.
Contingency table WEIRDness of samples in cross-cultural, evolutionary and cross-cultural psychology

		WEIRDness		
Discipline	WEIRD	NonWEIRD	Mixed[e]	Total (100%)
Cross Cultural Psychology				
Samples [a]	423 (65.4%)	199 (30.8%)	25 (3.9%)	647
N_a	2 110 115 (65.3%)	57 244 (1.7%)	1 065 652 (33.0%)	3 233 011
Minimum	1	2	21	1
Maximum	1 772 133	8178	7 26 977	1 772 133
Median	173.00	130.00	2561.00	165.50
Evolutionary Psychology				
Samples [a]	132 (81.5%)	30 (18.5%)	0 (0.0%)	162
N_a	1 202 507 (99.5%)	6181 (.5%)	0	1 208 688
Minimum	11	63	0	11
Maximum	927 134	1069	0	927 135
Median	236.50	130.50	0.00	211.00
Social/Personality Psychology				
Samples	1264 (94.7%)	65 (4.9%)	6 (0.4%)	1335
N_a	3 245 874 (45.6%)	48 925 (.7%)	3 824 548 (53.7%)	7 119 347
Minimum	16	6	3058	6
Maximum	1 129 991	36 845	2 718 838	2 718 838
Median	141.50	119.00	129944.00	141.00
Total				
Samples	1819 (84.8%)	294 (13.7%)	31 (1.4%)	2144
N_a	6 558 496 (56.7%)	112 350 (1.0%)	4 890 200 (42.3%)	11 561 046
Minimum	1	2	21	1
Maximum	1 772 113	36 845	2 718 838	2 718 838
Median	186.00	126.50	2561.00	141.00

[a]Percentage of total within discipline between parentheses
[e]Mixed category also consists of 1 study (N = 21) in which the origin of participants was unknown

by number of WEIRD/nonWEIRD/mixed participants; χ^2 (4) = 1414024.08, $p < .001$. Three separate Chi square tests were run to compare each combination of disciplines separately and all three were significant comparing evolutionary psychology to social/personality psychology (χ^2 (2) = 1211710.86,$p < .001$, Cramér's V = .351, $p < .001$), evolutionary psychology to cross-cultural psychology (χ^2 (2) = 546315.787, $p < .001$, Cramér's V = .149, $p < .001$) and cross-cultural psychology to social/personality psychology (χ^2 (2) = 394638.788, $p < .001$, Cramér's V = .195, $p < .001$. The distribution of WEIRD/nonWEIRD/mixed participants is significantly different in each discipline. Consistent with the effect size, this difference is greatest between social/personality and evolutionary psychology. 45.6% of the participants in social and personality psychology studies came from WEIRD countries. Evolutionary psychology journals investigated by far the greatest proportion of WEIRD participants: 99.5% of the investigated participants came from WEIRD countries. Studies in cross-cultural psychology levelled between the two: 65.3% of the participants came from WEIRD countries.

WEIRDness within disciplines – without mixed samples

Because the large sample sizes of the relatively few mixed samples influenced the previously discussed

Table 3. *Distribution of WEIRDness of Samples without Mixed Samples*

	WEIRD	nonWEIRD	total
Cross Cultural Psychology			
Samples	423 (68%)	199 (32%)	622
N_a	2110115 (97.4%)	57244 (2.6%)	2167359
Evolutionary Psychology			
Samples	132 (81.5%)	30 (18.5%)	162
N_a	1202507 (99.5%)	6181 (.5%)	1208688
Social/Personality Psychology			
Samples	1264 (95.1%)	65 (4.9%)	1329
N_a	3245874 (98.5%)	48925 (1.5%)	3294799
Total			
Samples	1819 (86.1%)	294 (13.9%)	2113
N_a	6558496 (98.3%)	112350(1.7%)	6670846

$_a$Percentage of total within discipline between parentheses

WEIRDness distributions considerably, I also ran the analyses without the mixed samples (see Table 3).

After omitting the mixed samples, a significant, moderately strong (Cramér's V = .353, $p < .001$) association between discipline and WEIRDness by number of WEIRD/nonWEIRD samples remained, χ^2 (2) = 262.943, $p < .001$. The association between discipline and WEIRDness by number of WEIRD/nonWEIRD participants is significant as well: χ^2 (2) = 22818.325, $p < .001$, although the effect is much weaker (Cramér's V = .058). Notably, when omitting the mixed samples, the percentage of studied WEIRD over nonWEIRD participants reaches nearly 100% in all disciplines

Origins of Samples

Origin of samples - by number of samples

Participants from Northern America were by far the most studied population in the investigated psychological journals. Across disciplines, 60.2% of the samples were derived from Northern America (Table 4). Confirming hypothesis 2a, studies in social/personality psychology journals studied Northern American samples in more than 70% of the cases: 72.3% of the samples in social/personality journals were derived from Northern America. Confirming hypothesis 2b, more than half (51.2%) of the samples in evolutionary psychology were derived from Northern America. Confirming hypothesis 2c, studies in cross-cultural journals sampled from Northern America in no more than 50% of the cases: 37.4% of the samples were derived from Northern America. There was a significant, moderately strong (Cramér's V = .325, p < .001), association between discipline and origin of samples (Northern America vs other continents), χ^2 (2) = 227.108, $p < .001$. Three separate Chi square tests were run to compare each combination of disciplines separately and all were all significant: comparing cross-cultural to social/personality psychology (χ^2 (1) = 222.671, $p < .001$, Cramérs V = .335, p < .001), evolutionary psychology to cross-cultural psychology (χ^2 (1) = 10.312, p < .001, Cramér's V = .113, p < .001) and evolutionary psychology to social/personality psychology (χ^2 (1) = 30.487, p < .001, Cramér's V = .143, p < .001). Taking into account the previously discussed differences in proportions of reliance on Northern American over other samples between disciplines, the results of the separate Chi square tests support hypothesis 2d, that states that the reliance on samples derived from WEIRD countries is significantly greatest in social/personality psychology journals, followed by evolutionary psychology and least in cross-cultural psychology. Based on the odds ratio, a sample in social/personality psychology is 4.35 times more like to be derived from Northern America than a sample in cross-cultural psychology. A detailed overview of Northern American samples vs other samples can be found in Table 5.

Origin of samples – by number of participants

The reliance on samples from Northern America over other continents decreases when viewed from the perspective of number of studied participants instead of number of studied samples. 60.2% of the total body of Northern American samples is made up out of 33.3% of participants. A similar shift is seen in evolutionary and social/personality psychology, where respectively 51.2% and 72.3% of Northern American samples consist of 7.6% and 26.5% of the participants. In cross-cultural psychology, this effect is reversed: the percentage of Northern American samples is lower (37.4%) than the percentage of Northern American participants (57.8%). Furthermore, it is notable that the relatively low number of cross-cultural samples in social/personality and cross-cultural psychology (1.9% and 5.3%) consist of respectively 38.0% and 55.0% of the participants. A similar effect is found in European samples in evolutionary psychology, where the 21.0% of European samples consist of 85.9% of the participants.

Origin of samples – without cross-cultural samples

Again, the large sample sizes of the relatively few cross-cultural samples have a great influence on these results. Therefore, we ran the analyses again without the cross-cultural samples, as can be seen on the right side of Table 6. Without the cross-cultural samples, there is still a significant, moderately strong (Cramér's V = .321, $p < .001$) association between discipline and origin of sample (Northern America vs other) samples, χ^2 (2) = 213.588, $p < .001$. The association between discipline and origin of sample by number of Northern American participants is also significant, χ^2 (2) = 2303041.04, $p < .001$, although the effect is much stronger (Cramér's V = .599). This effect is mainly caused by the difference in the distribution of sampling from Northern America vs other continents between evolutionary and cross-cultural psychology. Without the cross-cultural samples, the distribution is nearly reversed for these disciplines: in cross-cultural psychology, 93.3% of the participants were sampled from Northern America, whereas in evolutionary psychology, 7.7% of participants were sampled from Northern America.

Table 4.

Distribution of origin and sample size in cross-cultural, evolutionary and social/personality journals in 2015/2016

	Continent										
Discipline	Africa	Asia	Australia	Cross-Cultural	Eastern Asia	Europe	New Zealand	Northern America	America	Unknown	Total
Cross Cultural											
Samples [a]	12 (1.9%)	66 (10.2%)	15 (2.3%)	34 (5.3%)	102 (15.8%)	150 (23.2%)	10 (1.5%)	242 (37.4%)	15 (2.3%)	1 (.2%)	647 (100%)
N_a	3842 (.1%)	12 550 (.4%)	1676 (<.1%)	1 229860 (38.0%)	36 143 (1.1%)	50 107 (1.5%)	25 404 (.8%)	1 869 224 (57.8%)	4184 (.1%)	21 (<.1%)	3 233 011 (100%)
Evolutionary Psychology											
$Samples_a$	7 (4.3%)	16 (9.9%)	6 (3.7%)	6 (3.7%)	8 (4.9%)	34 (21.0%)	0 (0.0%)	83 (51.2%)	2 (1.2%)	0 (0.0%)	162
N_a	788 (.1%)	3 600 (.3%)	67 765 (5.6%)	4917 (.4%)	965 (<.1%)	1 038 159 (85.9%)	0	92 156 (7.6%)	338 (<.1%)	0	1 208 688
Social/Personality											
$Samples_a$	0 (0.0%)	54 (4.0%)	27 (2.0%)	26 (1.9%)	14 (1.0%)	237 (17.8%)	10 (.7%)	966 (72.4%)	1 (.1%)	0 (0.0%)	1335
N_a	0	8 348 (<.1%)	4133 (<.1%)	3 916 787 (55.0%)	2174 (<.1%)	126 026 (1.8%)	7589 (<.1%)	3 017 445 (42.4%)	36 845 (0.5%)	0	7 119 347
Total											
$Samples_a$	19 (.9%)	136 (6.3%)	48 (2.2%)	66 (3.1%)	124 (5.8%)	421 (19.6%)	20 (.9%)	1291 (60.2%)	18 (.8%)	0.0%	2144
N_a	4630 (<.1%)	24 498 (.2%)	73 574 (.6%)	5 151 564 (44.6%)	39 282 (.3%)	1 214 292 (10.5%)	32 993 (.3%)	4978825 (43.1%)	41 367 (.4%)	0	11 561 046

[a] Percentage of total within discipline between parentheses

Table 5.
Contingency table of origin of sample with/without cross-cultural samples across disciplines

	Origin of sample					
Discipline	Northern America	Other – Including Cross-Cultural Samples	Total (100%)	Northern America	Other – Excluding Cross-Cultural Samples	Total (100%)
Cross Cultural Psychology						
Samples	242 (37.4%)	405 (62.6%)	647	242 (39.5%)	371 (60.5%)	613
N_a	1 869 224 (57.8%)	1 363 787 (42.2%)	3 233 011	1 869 224 (93.3%)	133 927 (6.7%)	2 003 151
Evolutionary Psychology						
Samples	83 (51.2%)	79 (48.8%)	162	83 (53.2%)	73 (46.8%)	156
N_a	92 156 (7.6%)	1 116 532 (92.4%)	1 208 688	92 156 (7.7%)	1 111 615 (92.3%)	1 203 771
Social/Personality Psychology						
Samples	965 (72.3%)	370 (27.7%)	1335	965 (73.7%)	344 (26.3%)	
N_a	1 887 454 (26.5%)	5 231 893 (73.5%)	7 119 347	1 887 454 (58.9%)	1 315 106 (41.1%)	3 202 560
Total						
Samples	1290 (60.2%)	854 (39.8%)	2144	1290 (62.1%)	788 (37.9%)	2078
N_a	3 848 834 (33.3%)	7 712 212 (66.7%)	11561046	3 848 834 (60%)	2 560 648 (40%)	6 409 482

$_a$ Percentage of total within discipline between parentheses

Table 6.

Specified origin of samples by country from Cross-Cultural journals sorted by continent

	Count	%
Africa	12	1.9
Cameroon	1	.2
Egypt	1	.2
Ethiopia	2	.3
Ghana	2	.3
Kenia	1	.2
Liberia	1	.2
South Africa	2	.3
Zambia	1	.2
Zimbabwe	1	.2
Asia	66	10.2
Indonesia	1	.2
India	13	2.0
Iran	1	.2
Israel	24	3.7
Kuwait	1	.2
Malaysia	4	.6
Pakistan	2	.3
Philippines	6	.9
Qatar	1	.2
Russia	8	1.2
Saudi Arabia	2	.3
Sudan	1	.2
Singapore	1	.2
Thailand	1	.2
Australia		
Australia	15	2.3
Eastern Asia	102	15.8
China	51	7.9
Hong Kong	18	2.8
Japan	8	1.2
Korea	16	2.5
Macao	1	.2
Taiwan	8	1.2
Europe	150	23.2
Albania	1	.2
Austria	2	.3
Belgium	9	1.4
Bulgaria	3	.5
Bosnia and Herzegovina	1	.2
Cyprus	1	.2
Germany	34	5.3
Spain	8	1.2
Finland	9	1.4
France	5	.8
Great Britain	9	1.4
Georgia	1	.2
Croatia	2	.3
Hungary	2	.3
Italy	10	1.5
the Netherlands	29	4.5
Norway	2	.3
Poland	2	.3
Portugal	1	.2
Romania	1	.2
Serbia	2	.3
Sweden	2	.3
Switzerland	2	.3
Turkey	11	1.7
Northern America	242	37.4
Canada	28	4.3
USA	214	33.1
America	15	2.3
Argentina	1	.2
Brazil	5	.8
Chile	2	.3
Colombia	1	.2
Ecuador	1	.2
Guatemala	1	.2
Jamaica	1	.2
Mexico	4	.6
New Zealand		
New Zealand	10	1.5
Cross Cultural	34	5.3
Mixed WEIRD	7	1.1
Mixed nonWEIRD	3	.5
Mixed WEIRD/nonWEIRD	23	3.6
Unknown	2	.3
Total	647	100

Types of Samples

Types of samples - by number of samples

Across disciplines, Students were the most investigated population by number of samples (43.9%), followed by Crowdsourced Samples (32.6%), Other adults (17.8%) and participants Younger than 18 (5.6%).

Reliance on a certain type of sample was most equally distributed in evolutionary psychology, where the percentage of Student Samples and Crowdsourced Samples were both 29.0%, Other adults 25.9% and Younger than 18 the remaining 10%. In both social/personality and in cross-cultural psychology journals, Student samples were the most investigated type of sample.

Table 7.
Contingency table of Discipline x Type of Sample

	Type of Sample				
Discipline	Student	Crowdsourced	Other Adult	Younger than 18	Unspecified
Cross Cultural Psychology					
Samples	245 (37.9%)	149 (23.0%)	176 (27.2%)	75 (11.6%)	2 (.3%)
N_a	1 859 005 (57.5%)	980076 (30.3%)	258 477 (8.0%)	135230 (4.2%)	223 (<.1%)
Evolutionary Psychology					
Samples	56 (29.0%)	47 (29.0%)	42 (25.9%)	17 (10.5%)	0 (.0%)
N_a	12078 (1%)	148049 (12.2%)	1036573 (85.8%)	11988 (1%)	0 (.0%)
Social/Personality Psychology					
Samples	641 (48.0%)	502 (37.6%)	163 (12.2%)	29 (2.2%)	0 (.0%)
N_a	199769 (2.8%)	5101682 (71.7%)	1321396 (18.6%)	496500 (7.0%)	0 (.0%)
Total					
Samples	942 (43.9%)	698 (32.6%)	381 (17.8%)	121 (5.6%)	2 (.1%)
N_a	2070852 (17.9%)	6229807 (53.9%)	2616446 (22.6%)	643718 (5.6%)	223 223 (<.1%)

$_a$ Percentage of total within discipline between parentheses

However, the reliance on student samples does not come close to what I expected. In social/personality psychology, I expected 75% of the samples to be derived from student populations, however, this turned out to be only 48.0%. In cross-cultural psychology, I hypothesized a reliance of 70% student samples, and this turned out to be only 37.9%. Therefore, both hypotheses 3a and 3b were rejected. Furthermore, social/personality psychology, there was more reliance upon Crowdsourced samples (37.6%) and less on samples from Other adults (12.2%) and participants Younger than 18 (2.2%). In cross-cultural psychology, there was a more even distribution, with other adults, Crowdsourced, and Younger than 18 consisting of respectively of 23.0%, 27.2% and 11.6% of the samples.

Types of samples – by number of participants

Across disciplines, crowdsourced samples proportionally study the most participants (53.9%), followed by Student samples (17.9%), Other adults (22.6%) and Younger than 18 (5.6%).

In cross-cultural psychology, students represented the majority of participants by 57.5%, followed by Crowdsourced samples (30.3%), Oher adults (8.0%) and Younger than 18 (4.2%). In social/personality psychology, Crowdsourced samples constituted by far the largest percentage of participants with 71.7%, followed by Other adults (18.6%), younger than 18 (7.0%) and students (2.8%). Note that in social/personality psychology, students were most often studied, (48.0%), but they amounted to the smallest proportion of participants (2.8%). In evolutionary psychology, with 85.5%, Other adults were the most heavily investigated population by number of participants, followed by Crowdsourced samples (12.2%), Younger than 18 and Students (both 1%).

Comparison with previous content analyses

Especially in social/personality psychology, the investigated percentage of student samples was much lower than anticipated. To see if this was due to a decrease of the use of student participants in all journals, or perhaps in some more than others, I compared the results from the present study with results from previous content analyses. Until 1995, there was an increasing reliance upon student populations in studies published in renowned social/personality psychological journals, such as JESP, JPSP and PSPB. As can be seen in Table 8, the numbers indicate that this trend changed in the past decade: percentages of student samples over other samples have dropped dramatically, with at least 30%. In twenty years, the reliance upon student samples in the JESP has nearly halved. The most recent content analysis was done by Arnett in 2007, who showed that 74% of the samples in SPPS were student populations. Twelve years later, this percentage has dropped to 42.4%.

Table 8.

Use of student samples over other samples in social/psychological journals over the years

Journal	1975	1980	1985	1995	2007	2015
Journal of Experimental & Social Psychology	78.3%	-	88.2%	95.8%	-	56.7%
Journal of Personality and Social Psychology	70.1%	-	65.6%	70.6%	-	44.6%
Personality and Social Psychology Bulletin	-	81%	-	-	-	47.5%
Social Psychological and Personality Science	-	-	-	-	74%	42.4%

Source: Sears, 1986; Wintre, Sugar, North; 2001, Arnett; 2008

Outliers

The above presented data includes all study samples in the journals under investigation in the present study and is therefore the most truthful reflection of the reality of the WEIRDness and origin of sampling of research published in the corresponding disciplines of those journals. However, in each discipline, there were a handful of samples that were so large that they significantly affected the distribution of WEIRDness, origin and type of samples when viewed from the perspective of investigated number of participants. Taking a closer look at the data, I found that these samples were all WEIRD samples, mostly from Northern America, causing a bias toward WEIRD and Northern American participants. Therefore, I also examined the distribution of investigated number of participants without these outliers to investigate if the studied population would still be biased towards WEIRD and/or Northern American participants if the outliers were not considered In Table 9, an overview of the studies involving these WEIRD outliers can be found. After excluding these studies, only samples with less than 40 000 participants remained and the biggest WEIRD sample (N = 39 204) and the biggest nonWEIRD sample (N = 36 845) left in the database were nearly equal in size. Previously, I found that the relatively few mixed and cross-cultural studies consisted of large numbers of participants, of which the exact distribution of origin is in many cases unknown. Therefore, I examined the data without the mixed and cross-cultural studies, to see how much participants from WEIRD and nonWEIRD countries were investigated and to what extent Northern American dominance is still present without the WEIRD outliers, resembling Table 4 and the right side of Table 6 in the analyses with the full sample. The results of these analyses can be found in Table 11 and the most important findings shall now be discussed.

WEIRDness

Previously, nearly 100% of the investigated participants were coming from WEIRD countries across disciplines (see Table 3). Excluding the WEIRD outliers, the percentage of WEIRD to nonWEIRD participants decreases to an average of 86.4% across disciplines. In other words, whereas in the full sample, no more than 3% of the total participants was from nonWEIRD countries, this is now nearly 14%. More specifically, the percentage of WEIRD over non WEIRD participants without WEIRD outliers is 75.4% in cross-cultural psychology, 93.7% in evolutionary psychology and 90.1% in social/personality psychology.

Northern American dominance

In a similar vein, the overreliance on investigated participants from Northern America decreases with omission of outliers. When considering the total sample across disciplines (with outliers), 60% of the investigated participants were from Northern America. When the outliers were omitted, this percentage reduced to 53.2%. Between the different disciplines, excluding these outliers was most substantial for cross-cultural psychology. When a study with 1.7 million American students is removed from the analysis, the percentage of investigated participants from Northern America in cross-cultural psychology drops from 93.3% to 41.8%. This resembles the percentage of samples derived from Northern America in cross cultural psychology, which is 39.1%. Although this decreases the reliance on Northern American participants substantially, a considerably large proportion of research in cross cultural psychology is conducted with Northern American participants. Conversely, in evolutionary psychology, the percentage of investigated participants from Northern America rises to from 7.7% to 34.4% when outliers are omitted. In social/personality psychology, the numbers remain fairly equal, with around 60% of the participants coming from Northern America both in analyses with and without outliers.

Table 9.

WEIRD outliers with over 60 000 participants per sample

Discipline	N	Origin of Sample	Type of Sample	Title
Cross-Cultural	1 772 133	Northern America	Student	Ethnic Variation in Gender-STEM Stereotypes and STEM Participation: An Intersectional Approach
	701 144	Cross-Cultural	Younger than 18	Parental Resources, Sibship Size, and Educational Performance in 20 Countries: Evidence for the Compensation Model
Evolutionary Psychology	927 134	Europe	Other Adult	Someone to live for: effects of partner and dependent children on preventable death in a population wide sample from Northern Ireland
	64 000	Europe	Other Adult	Did sexual selection shape human music? Testing predictions from the sexual selection hypothesis of music evolution using a large genetically informative sample of over 10,000 twins
	60 058	Northern America	Crowdsourced	Height and Body Mass on the Mating Market: Associations With Number of Sex Partners and Extra-Pair Sex Among Heterosexual Men and Women Aged 18-65
	59268	Australia	Crowdsourced	The multivariate evolution of female body shape in an artificial digital ecosystem
Social/ Personality Psychology	1 129 991	Northern America	Crowdsourced	Caught in the Middle: Defensive Responses to IAT Feedback Among Whites, Blacks, and Biracial Black/Whites
	1 104 428	Northern America	Other Adult	Exposure to Racial Out-Groups and Implicit Race Bias in the United States
	398 194	Northern America	Younger than 18	Declining Loneliness Over Time: Evidence From American Colleges and High Schools
	81 000	Northern America	Younger than 18	Can Personality Traits and Intelligence Compensate for Background Disadvantage? Predicting Status Attainment in Adulthood
	85748	Cross Cultural	Student	Religion, Self-Rated Health, and Mortality: Whether Religiosity Delays Death Depends on the Cultural Context
	54 540	Cross Cultural	Crowdsourced	Life Satisfaction Among Ethnic Minorities in Europe

Table 10.

Contingency table of origin of sample with/without cross-cultural samples across disciplines without WEIRD outliers

WEIRDness (without mixed samples) and Origin of sample (without cross-cultural samples)						
Discipline	WEIRD	nonweird	Total	Northern America	Other	Total (100%)
Cross Cultural Psychology						
Samples	416 (67.7%)	199 (32.4%)	615	238 (39.1%)	370 (60.9%)	608
N_a	175 083 (75.4%)	57 244 (24.6%)	232 327	95 977 (41.8%)	133 826 (58.2%)	229 803
Evolutionary Psychology						
Samples	128 (81.0%)	30 (19.0%)	158	82 (53.9%)	70 (46.1%)	152
N_a	92 407 (93.7%)	6181 (6.3%)	98 228	32 098 (34.4%)	61 213 (65.6%)	93 311
Social/Personality Psychology						
Samples	1258 (95.1%)	65 (4.9%)	1323	961 (73.7%)	343 (26.3%)	1304
N_a	446 513 (90.1%)	48 925 (9.9%)	495 438	303832 (62.1%)	185 115 (37.9%)	488 947
Total						
Samples	1802 (86.0%)	294 (14.0%)	2096	1281 (62.1%)	783 (37.9%)	2064
N_a	713 643 (86.4%)	112 350 (13.6%)	825 993	431 907 (53.2%)	380 133 (46.8%)	812 040

$_a$ Percentage of total within discipline between parentheses

Types of samples

Lastly, omitting the outliers also had a substantial effect on the distribution of types of samples (see Table 11). Overall, crowdsourced samples remain the most investigated type of sample by number of participants, with on average 86.6% of the participants coming from crowdsourced populations. When outliers are omitted, the greatest drop in investigated student participants can be seen in cross-cultural psychology: from 57.5% to 6.3%. This is due to the exclusion of the sample with 1.7 million American students. Because of this, crowdsourced samples are now the most prevalent type of sample participants (72.5%) in cross-cultural psychology. In social/personality journals, the percentage of crowdsourced participants increases from about 70 to 90%. In evolutionary psychology, crowdsourced samples increase from 12.2 to 55.9%. The big increase in cross-cultural psychology (from 23.2% to 72.5% is most likely due to to the large number of crowdsourced participants in mixed and cross-cultural studies.

Table 11.
Contingency table of Discipline x Type of Sample without WEIRD Outliers

	Type of Sample					
Discipline	Student	Crowdsourced	Other Adult	Younger than 18	Unspecified	Total
Cross Cultural Psychology						
Samples	241 (37.5%)	149 (23.2%)	176 (27.4%)	74 (11.5%)	2 (.3%)	642
N_a	85 758 (6.3%)	980 878 (72.5%)	25 8477 (19.1%)	28086 (2.1%)	223 (<.1%)	1 353 422
Evolutionary Psychology						
Samples	56 (35.2%)	46 (28.9%)	40 (25.2%)	17 (10.7%)	0 (.0%)	159
N_a	12 078 (7.7%)	87 991 (55.9%)	45 439 (28.9%)	11988 (7.6%)	0 (.0%)	157 496
Social/Personality Psychology						
Samples	641 (48.2%)	503 (37.8%)	161 (12.1%)	26 (2.0%)	0 (.0%)	1331
N_a	114 090 (2.6%)	4 033 540 (92.1%)	215 738 (4.9%)	17306 (<1%)	0 (.0%)	4 380 674
Total						
Samples	938 (44.0%)	698 (32.7%)	377 (17.7%)	117 (5.5%)	2 (.1%)	2132
N_a	211 926 (3.6%)	510 2409 (86.6%)	519 654 (8.8%)	57 380 (1.0%)	223 (<.1%)	5 891 592

$_a$ Percentage of total within discipline between parentheses

Therefore, we analyzed the distribution one final time without outliers and without mixed and cross-cultural samples, leaving a total of 2063 samples (see Table 12). This results in a more even distribution of sample type. Crowdsourced samples are still the most investigated type of sample (38.3%), followed by Other adults (31.2%), Student samples (24.4%) and participants Younger than 18 (6.0%).

Table 12.
Contingency table of Discipline x Type of Sample without WEIRD Outliers, mixed and cross-cultural studies

	Type of Sample					
Discipline	Student	Crowdsourced	Other Adult	Younger than 18	Unspecified	Total
Cross Cultural Psychology						
Samples	233 (38.4%)	139 (22.9%)	159 (26.2%)	74 (12.2%)	2 (.3%)	607
N_a	73 691 (32.1%)	68 863 (30.0%)	58 919 (25.6%)	28 086 (12.2%)	223 (<1%)	229 782
Evolutionary Psychology						
Samples	56 (36.8%)	42 (27.6%)	38 (25.0%)	16 (10.5%)	0 (.0%)	152
N_a	12 078 (7.7%)	27 956 (30.0%)	41 534 (44.5%)	11 743 (12.6%)	0 (.0%)	93311
Social/Personality Psychology						
Samples	638 (48.9%)	489 (37.5%)	153 (11.7%)	24 (1.8%)	0 (.0%)	1304
N_a	112 277 (23.0%)	214 366 (43.8%)	153 165 (31.3%)	9139 (1.9%)	0 (.0%)	488947
Total						
Samples	927 (44.9%)	670 (32.5%)	350 (17.0%)	114 (5.5%)	2 (.1%)	2063
N_a	198046 (24.4%)	311 185 (38.3%)	253 618 (31.2%)	48968 (6.0%)	223 (<.1%)	812040

$_a$Percentage of total within discipline between parentheses

Discussion

My research builds upon the work of Henrich et al. (2010), who showed that implicit generalizations from WEIRD participants to human beings in general are often unjustifiable. Around the same time, Arnett (2009) showed that the majority of psychological research originated from WEIRD, and mostly American, samples. Combined, these two conclusions raise concerns regarding the validity and universality of psychological research. Previous studies have shown that the field of social/personality psychology was heavily biased toward Northern American (student) samples. Research on sample diversity in evolutionary and cross-cultural psychology was virtually non-existent, and therefore the present study aimed to fill the gap in the literature by reviewing research in those fields on sample diversity. If sample diversity would be lacking even in those branches of psychology, this could further question the validity of psychological research. Therefore, the present study aimed to shed light on the current state of affairs of sample diversity in social/personality, evolutionary and cross-cultural psychology.

In general, the results of this study show that there is a remarkable imbalance in sampling from WEIRD to nonWEIRD nations in all disciplines. It became clear that some parts of the world are heavily underrepresented, to the extent that they are nearly not investigated at all. Especially the underrepresentation of Africa and America[3] was remarkable: less than 1% of the samples were derived from these continents. Furthermore, the majority of research in Asia or Eastern Asia is based upon investigation of only a handful of countries in those continents. The majority of research in all disciplines is based upon research with participants from Northern America, followed by research with participants from Europe. Since Northern America constitutes only 5% of the world population (Arnett, 2000), psychology cannot lay claim to be a universal science applicable to all nations, both WEIRD and nonWEIRD, and this bias towards WEIRD nations may have implications for generalizability and validity.

The present study has made clear that although all disciplines are biased toward WEIRD and Northern American over nonWEIRD and other populations, not all disciplines are biased in the same ways and to the same extent. The field of social/personality psychology was most heavily biased toward WEIRD and Northern American participants, with nearly 90% of the samples being derived from WEIRD countries, 70% of which came from Northern America. Cross-cultural psychology studied the most diverse range of samples, with more than 60% of samples and participants derived from countries other than Northern

[3] Central America, Latin America & the Caribbean and South America were merged into one category ''America'' because of the percentage of samples derived from these areas together compromised less than 1% of the samples

America. And, as expected, evolutionary psychology levelled between these two disciplines with regards to sample diversity, however, the results of the present study revealed a heavier bias towards WEIRD samples than we expected to find, based on the analyses of Kurzban in 2013.

Whether one finds these conclusions of narrow focus in psychological research to be problematic depends on what one expects or finds the science of psychology to be. Historically, psychology started off mirroring the natural sciences, using experimental methods to examine human behavior in the laboratory. The rise of behaviorism is the most straightforward example of this. Phenomena such as reaction times could be reliably investigated and characteristics of the participants were deemed irrelevant: any participant would suffice. Throughout the years, psychological research became broader and different investigational methods became accepted, such as observations and questionnaires. However, the natural scientific method remained to underlie psychology, focusing on fundamental processes and principles. This approach neglected the cultural context of people being studied to a certain extent (Norenzayan & Heine, 2005). The rise of cross-cultural psychology and evolutionary psychology as separate disciplines in the last decades have emphasized and acknowledged the role of context and culture and have introduced a new way of thinking.

A promising finding was the decrease of reliance on student sampling in social/personality psychological journals. Until 1995, there was an increasing reliance upon student populations in studies published in renowned social/personality psychological journals, such as JESP, JPSP and PSPB. In the past decade, use of student samples in these journals has decreasing with at least 30%. In twenty years, the reliance upon student samples in the JESP has nearly halved. The most recent content analysis was done by Arnett in 2007, who showed that 74% of the samples in SPPS were student populations. Ten years later, my research shows that the percentage of student populations in SPPS has dropped to 42.4%. An explanation for this might be found in the increase in crowdsourced study samples. I found crowdsourced samples were the second most investigated samples in social/personality psychology journals (37.6% crowdsourced samples, 48% student samples). In all research fields (social/personality, cross-cultural and evolutionary), crowdsourced study samples were the most common sample type by number of participants. The increasing availability and use of the internet, for both researchers and study populations alike, has enabled researchers to reach out more easily to populations outside the university walls. Studies that can be executed in digital environments, could possibly allow for broader sections of the population to be reached through platforms such as Amazon and M-Turk. However, I found no data on how many, if any, of the samples were based on crowdsourcing in the research of Arnett in 2007. Therefore, this remains an assumption. Other future research could focus on the American dominance within these three disciplines and review on a deeper level whether or not this is problematic.

A remarkable fact was that although there were few with mixed and cross-cultural samples, they still accounted for the greatest number of participants in some study groups. I did not investigate the distribution of these mixed and cross-cultural samples: this could be considered as a limitation of this study. Follow-up research could investigate the distribution of the origins of samples in these studies. Despite this, it is obvious that fully nonWEIRD samples are investigated to a much lesser extent than fully WEIRD samples and that great parts of the world are not represented in psychological research at all.

A limitation of the current study is that the selection of our journals is biased towards Western (APA) journals. This is to some degree a consequence of selection on the basis of impact factor – one of the criteria that we used to select the journals for our research as described in the Methods section. These journals might be more geared towards a readership from WEIRD countries, with their home base in a WEIRD country or continent. However, despite this, Western journals can therefore also be expected to have more means to ensure a diverse study population, fairly distributed over WEIRD and nonWEIRD participants. Without disregarding the efforts and results of psychological research in nonWEIRD countries, it is just as much the responsibility of WEIRD countries to do their share of research in these parts of the world. NonWEIRD countries are the majority of the population of the earth and our research efforts should represent this distribution.

Future research could investigate a broader sample. Also, in future research, more sub disciplines within psychology could be investigated into their employment of sample diversity. For instance, fields as neuropsychology and cognitive psychology are also primarily geared towards the workings of human nature. It would be valuable to investigate to what extent studies in these fields rely upon WEIRD participants and whether or not researchers generalize from this population to other populations.

In summary, the present study has made clear that there is an oversampling of WEIRD populations, and in this population research is based most heavily on Northern American samples, even in the field of cross-cultural psychology. If WEIRD populations are not representative for the entirety of humanity, as the work of Henrich et al. suggests, the call for more replicability work in other populations should be answered.

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Appendix A. Description of coding

Category	Options/Range	Additional information
Relevant	Yes No	Only empirical articles with human participants were examined and pilot studies, meta-analyses, animal studies, commentaries, rejoinders or review articles were excluded from analyzing
Discipline	Cross Cultural Evolutionary Social/Personality	Type of discipline was categorized by journal, see materials.
Complex sample	X	If a study consisted of one or more samples from multiple specified nationalities, these were coded as separate samples, with the possibility of coding up and until 8 different countries. An X in this column indicates this was the case.
Initial N	Number of participants	Targeted sample size, or size of the sample before some results appeared unusable. In case of an X in the previous column, the initial N indicates the size of the actual sample.
Actual N	Number of participants	Used sample size, or size of the subsample in case of an X in the 'complex sample' column.
Type of sample	Student Sample	If the authors stated participants were university students
	Inbound Crowdsourced sample (e.g., M-Turk)	If sample was derived from an online database, such as M-Turk and Amazon
	Outbound Crowdsourced representative of population	If the sample was extracted from a database aiming to give a complete representation of a population
	Working adults	If the participants were specified as working people
	Other Adult	If there was no other specification of how the sample was derived and all participants were adults

	Younger than 18	If participants were not adults.
	Ethnic minority	If the sample was specified as being an ethnic minority living in another country (e.g. Japanese students living in the USA). In this case both 'Country' and 'Nationality' were coded
	Unspecified	If no information about the sample was provided.
	Other (please specify)	If it concerned a specific target group, this was followed by a note to specify.
Country - Cross Cultural Part of Data Set	Countries could be chosen on the basis of the ISO-336 coding system, or one out of the following options:	
	Mixed Western	If the study exceeded 8 (sub)samples, the country of a sample was coded as Mixed Western if all countries involved were Western.
	Mixed Non-Western	If the study exceeded 8 (sub)samples, the country of a sample was coded as Mixed Non-Western if all countries involved were non-Western
	Mixed	If the study exceeded 8 (sub)samples, the country of a sample was coded as Mixed if the countries involved were both Western and non-Western
	Unknown	If no information was provided.
Continents – Evolutionary and Social/Personality part of Data Set	Continents could be chosen on the basis of the UN49 coding system, out of one of the following options: Africa, Europe, Asia, Eastern Asia, Oceania, Australia, New Zealand, Northern America, Central America, Latin America & the Caribbean and South America or Cross-Cultural	
Nationality	Same as Country, with the addition of two codes:	
	Subculture	If the authors specifically mentioned targeting a subculture within the country.

	Tribe	If the sample consisted of a tribe.
Proportion female	0 to 1	
Mean age	0 to 100	
Standard deviation age	0 to 100	
Age lower limit	0 to 100	
Age upper limit	0 to 100	

In both parts of the data collection, missing values were coded as ''999''.