

On the WEIRD Nature of ITS/AIED Conferences

A 10 Year Longitudinal Study Analyzing Potential Cultural Biases

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Abstract. Arnett (2008) confirmed that research production (authorship, samples) in major psychology journals is strongly dominated by Western societies that are not cognitively representative of the whole mankind (Henrich et al., 2010). In this paper, results from a ten-year analysis of paper production in ITS/AIED conferences suggest a similar bias in the AIED research field.

Keywords: Research production, cultural bias, AIED design and strategies.

1 Introduction

In an analysis of publications of six major journals of the American Psychology Association (APA), Arnett [1] shows that a huge majority of first authors are affiliated with academic institutions from *Western, Educated, Industrialized, Rich, and Democratic* (WEIRD) societies [2] that represent just 12% of the world population. This analysis further reveals that samples in considered journals are almost exclusively WEIRD ones, and that authors tend to easily broaden the applicability of their results to the whole of mankind. However, Henrich et al. [2] showed that WEIRD and non-WEIRD people cognitively differ to a great extent. This paper discusses if and how this WEIRD bias observed in psychology may be influencing AIED¹ research. First, Arnett [1] is presented. Henrich et al. [2] is then summarized and considered in the AIED context. Results of an analysis of full papers published in the AIED/ITS conferences are eventually reported and discussed by AIED senior members.

2 WEIRD Dominance on Psychology and Implications for ITS

The WEIRD dominance on psychology. The main contribution of Arnett [1] is an analysis of national affiliations of content of papers published in six premier APA journals between 2003 and 2007. Results for first authors and samples are summarized in Table 1, and show a very strong dominance of WEIRD first authors and a similarly large tendency to draw conclusions based only on WEIRD samples.

¹ In this paper, the AIED acronym refers to the field for which Intelligent Tutoring Systems (ITS) and Artificial Intelligence in Education (AIED) conferences are frequently acknowledged as premier events.

Table 1. National affiliations of first authors and of samples in six APA journals (see [1])

	DP	JPSP	JAP	JFP	HP	JEP	Total	DP	JPSP	JAP	JFP	HP	JEP	Total
Nb.	461	698	354	313	408	297	2531	466	721	334	273	371	287	2452
	1st Author (% per national affiliation)							Samples (% per national affiliation)						
USA	72%	65%	78%	85%	78%	66%	73%	64%	62%	73%	81%	76%	64%	68%
Eng.	17%	13%	12%	8%	16%	15%	14%	19%	12%	13%	8%	15%	14%	14%
Europe	9%	18%	9%	6%	6%	12%	11%	11%	19%	11%	8%	8%	13%	13%
Asia	1%	1%	1%	1%		4%	1%	4%	4%	2%	1%	1%	7%	3%
Latin A.								1%	1%					1%
Africa									1%					
Israel	2%	2%		1%	1%		1%	1%	2%		2%		2%	1%

Notes: The journals considered are *Developmental Psychology* (DP), *Journal of Personality and Social Psychology* (JPSP), *Journal of Abnormal Psychology* (JAP), *Journal of Family Psychology* (JFP), *Health Psychology* (HP), and *Journal of Educational Psychology* (JEP). In tables 1 and 2, ‘Latin A.’ refers to Latin America, and ‘Eng.’ to English-speaking countries i.e. the United Kingdom, Canada, Australia and New Zealand. Finally, according to [2], WEIRD societies refer to the ‘USA’, ‘Eng.’, ‘Europe’, and ‘Israel’ rows.

Arnett sees two main reasons for the dominance of WEIRD countries on psychology. The first one is economic, with governments of developing countries likely to dedicate their funds to more crucial expenses than research on psychology. However, this does not explain the low presence of research originating in non-WEIRD developed countries (e.g. Japan). Arnett thus suggests that the dominant philosophy of science in psychology remains “*on investigating fundamental processes, resting on the assumption – rarely stated, and rarely actually tested – that people anywhere can be taken to represent people everywhere, and that the cultural context of their lives can be safely ignored*”. This philosophy strongly favors the production of WEIRD-flavored content when considering that most psychology scholars are located in WEIRD societies and consequently have an easy access to WEIRD samples, and that they “*have extremely limited knowledge concerning the work of their international counterparts*” [3].

WEIRD People as Outliers in the World Population. Henrich et al. [2] extended [1] by investigating potential WEIRD cognitive biases through a four-level review: (i) Industrialized societies versus small scale societies. Variations in *visual perception*, *economic decision-making* (e.g. social motivation, fairness), *folk-biological reasoning*, and *spatial cognition* are reported between member of industrialized societies (frequent outliers) to members of various small-scale societies. Other variations in *decision-making* are also likely to exist. (ii) Western versus non-Western societies. Variations are reported with regards to *social-decision making* (e.g. fairness, cooperation, punishment), *reasoning strategies* (tendency of Westerners to be more analytic, and of others to be more holistic), *moral reasoning*, and *independent/interdependent self-concepts* (tendency of Westerners to be more individualistic, which has implications for features such as motivation or emotions). (iii) Contemporary US peoples versus the rest of the West. Reliance on US content is huge in contemporary psychology even when compared to other WEIRD societies (see Table 1). According to [2], US people have a higher tendency for *expressing strong individualism*, which may be the illustration of an ideology that “*particularly stresses the importance of freedom and self-sufficiency*”, and of “*various practices in education and childrearing*” that

enforce individualism. (iv) Typical contemporary American subjects versus other Americans. Much of American psychology relies on samples of college students. Variations are reported between them and other American with regards to *rationality of choices, individualism, conformity motivation, perception of racial diversity, structure of social networks, interdependence, pro-social behaviors*, etc. As test subjects, children are likely to have parents with a high socio-economic status (SES), while poor-SES and high-SES children show differences in processes such as *spatial reasoning*. Existing and reported similarities do not restrain Henrich et al. to state that WEIRD subjects “*are some of the most psychologically unusual people on Earth*”, and consequently “*may often be the worst population from which to make generalizations*”. The authors also warn that the demonstrated extreme reliance on WEIRD samples “*may cause researchers to miss important dimensions of variation, and devote undue attention to behavioral tendencies that are unusual in a global context*”.

[2] has been overwhelmingly supported by many researchers in [4]. These comments also bring additional elements to consider such as extending the suspicion of WEIRD biases to research on cognitive development, children’s social behavior, and parent-child interaction (p. 99-100), to philosophical production and intuitions (p. 110), and to experimental designs (p.84-85). Evidences of socio-cultural variations in brain functioning are also reported (p. 88-90), distortions on research resulting from the use of English and other WEIRD languages (p. 103) are also mentioned, and “*the promise of Internet in reaching more diverse samples*” (p.94-95) is also noticed.

WEIRD Biases Spreading to the ITS Research Field. The work of Arnett [1] convincingly demonstrates that contemporary psychology is WEIRD-dominated to a great extent. Furthermore, according to Henrich et al. [2], this situation is likely to produce ethnocentric biases in research since WEIRD societies are not cognitively representative of the world population, though there is a tendency among scholars to present results obtained on WEIRD samples incautiously as universalisms.

An initial conclusion can be drawn from this situation. Since AIED historically relies on research in psychology, the reported ethnocentric biases have most probably spread to this domain. Indeed, several features with reported variability between WEIRD and non-WEIRD societies (see [2, 4]) are genuine ITS topics of interest e.g. self-concepts, emotions (see [5] for an overview of cultural influences on the affective domain), reasoning strategies, decision making, cooperation, etc. However, concerns on potential WEIRD biases in AIED are not necessarily relevant if a tutoring system is tailored for a WEIRD audience, although even within WEIRD societies there may be large variations. Still, one has to be cautious when relying on theories established in a different socio-cultural context than the one of the targeted learners, and with growing educational needs of demographic giants such as China, India, Brazil, or Nigeria (all showing great market opportunities for AIED), alternative approaches could be envisioned for ITS to become more culturally-aware [6].

3 A Ten Year Analysis of Full Papers in ITS/AIED Conferences

While the influence of psychology-originated WEIRD biases on AIED is not really questionable, another point needs to be discussed: does AIED similarly produce

WEIRD-biased research results? To address this question, the full paper production of the ten last AIED/ITS conferences was analyzed. Similar to APA journals in psychology, both these conferences are seen as premier references by many members of the ITS community, especially when considering the limited number of long-term established journals dedicated to the discipline. Using the same regional categories as [1], the top part of Table 2 presents the distribution of first authors' national affiliations per conference. Results indicate nearly similar proportions of WEIRD first authors in ITS/AIED conferences as in results reported by Arnett (see Table 1).

Table 2. National affiliations of first authors and of samples in ITS and AIED conferences²

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Nb.	93	40	73	89	67	60	62	68	61	49	662
1st Author (% per origin)											
USA	26%	40%	41%	46%	37%	70%	56%	49%	74%	63%	49%
Eng.	26%	20%	22%	26%	28%	17%	19%	30%	15%	18%	23%
Europe	40%	25%	21%	16%	16%	8%	13%	13%	5%	12%	19%
Asia	4%	10%	5%	10%	15%	3%	11%	9%	7%	4%	8%
Latin A.	4%	5%	11%	1%	3%	2%		1%			3%
Nb.	41	20	28	48	29	47	40	50	47	36	386
Considered Samples (% per origin)											
USA	34%	50%	61%	54%	55%	79%	75%	52%	81%	61%	61%
Eng.	37%	35%	29%	27%	28%	9%	13%	24%	6%	17%	21%
Europe	27%	10%	11%	13%	3%	9%	5%	10%	4%	14%	11%
Asia				4%	10%	4%	8%	10%	6%	8%	5%
Latin A.	2%	5%		2%	3%			4%	2%		2%

In order to make the analysis of AIED/ITS samples comparable to Arnett's results, further paper refinements were required. (i) Some ITS/AIED papers do not present any evaluations involving humans and had to be discarded. An analysis of this criterion revealed a strongly increasing tendency of ITS/AIED conferences content to include more and more human-related evaluations: in ITS2002 and AIED2003, papers with such content represented 50.5% and 57.5% respectively (lowest scores in the whole decade), whereas in ITS2010 and AIED2011, they represented 90.2% and 93.9% respectively (highest scores in the whole decade). (ii) Other papers use human-related data only to validate technical aspects³, and similarly had to be discarded. This further categorization showed that the rate of papers with (sometimes lousy) psychology-related features has also strongly increased, especially since AIED2007: in the second half of the decade, it lays between 64.5% and 79.6%, whereas it was between 38.5% and 54.1% in the first half. Various explanations can be envisioned to explain

² ITS2002 occurred in France/Spain, AIED2003 in Australia, ITS2004 in Brazil, AIED2005 in the Netherlands, ITS2006 in Taiwan, AIED2007 in USA, ITS2008 in French Canada, AIED2009 in the UK, ITS2010 in USA and AIED2011 in New Zealand.

³ Human-based evaluations were rated as purely technical only when there was a unique focus on validating the system/technique rather than on assessing the students, their behavioral or cognitive processes, or their appraisal of the system (in which cases they were perceived as including psychological features).

this evolution. Still, this evolution towards more systematic inclusions of psychology-related features makes AIED more sensible to WEIRD-biases affecting psychology.

Following this refinement, the national origins of samples from remaining papers (that include psychology-related features) were investigated. They are presented in the bottom part of Table 2. A significant proportion of samples were not clearly described, but it was possible most of the time to infer their origins by cross-checking indirect clues. Nevertheless, a few samples were discarded because of the impossibility of determining their origin with sufficient confidence. Results indicate a dominance of WEIRD samples that is comparable to Arnett's results. These results suggest that the AIED community may be producing similarly WEIRD-flavored research.

4 Discussion and Conclusion

In order to assess these results in a non-dogmatic way, seven AIED senior members, three of who are female, accepted to comment on them. Regarding their origin, one is from the USA, three are from English-speaking countries (one is a French-speaking Canadian), two are from Europe, and one is from Asia. Despite several attempts, no Latin American expert answered positively to the invitation. Regarding their academic background, two of the panel members have a PhD (or equivalent) in psychology, one in educational technology, and four in computer sciences and related disciplines. Due to space constraints, the following paragraphs only summarize some expert views and comments. Readers have to be aware that comments were collected individually. Hence, each expert may disagree with thoughts expressed by others.

All experts agreed to the existence of a WEIRD bias in AIED research with one expert even noticing a worrying “*strong tendency to blindness to that bias*” in some societies. However, for most of the experts (and for the author as well), it is important to insist that the bias is unintentional, that the selection of papers is only based on scientific criteria, and that the discussed bias can only be understood currently as an imbalance in author and sample origins since no results are actually provided on how it may be influencing the AIED research. Four experts insisted that the AIED field has several important differences with psychology that would lead this bias to have different incidences and implications on AIED production, which has to be thoroughly investigated in future work. One expert rightfully insisted on differentiating the fact that AIED research is mainly performed by WEIRD scholars, from the one that it is mainly grounded on WEIRD samples. These issues are not equally problematic and have to be considered separately. Another expert noted that other potential sampling biases should be investigated as well. Two experts insisted on the English language dominance in the academic world to partly explain the situation. Another expert stated that this imbalance would not be an issue if the AIED community correctly followed the ‘scientific paradigm’, which (s)he claims is not currently the case.

The author submitted several suggestions to the panel. Five experts agreed with the author that the main way to address the issue raised in this paper is to make the AIED community aware of it, which the current paper intends to achieve. Scholars could then self-regulate their work and the way they present their results. Six experts agreed with the author that papers including intercultural evaluations and collaborations should be encouraged, and more events should be dedicated to better understand

issues that may be culturally-variable and relevant for AIED development. Two experts further mentioned that the influence of culture on AIED should also be investigated in more master and doctoral projects. Five experts agreed with the author that conference reviewers should ensure that samples are correctly described and, consequently, sample description guidelines should be available on conference websites. The seventh expert did not see this point as a crucial solution.

Finally, two panel members suggest the AIED community to question itself about the current importance of human-based evaluations on paper acceptance/rejection decisions. Even when loosely done, they claim it has more impact on the acceptance decision than detailing a clever technical solution, which they consider a problematic situation.

As a conclusion, this paper attempts to make the community aware of an identified and quantified WEIRD bias in psychology research that is likely to have an indirect impact on the AIED research field. A ten years analysis of conference full papers production reveals similar WEIRD imbalances in the AIED research field, which suggests that it may be producing WEIRD-flavored research as well. Several AIED experts, while acknowledging the situation, have produced different interpretations and suggestions on how to address it in the future, and many other options could be investigated as well. Indeed, considering culture into AIED is not more of an ‘intractable problem’ than other ones our community has faced in the past. The true question is whether or not we want to embrace this challenge.

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