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COMMENT

The Scientific Revolution of Evolutionary Psychology: Current Status and Future Directions. A Commentary on Zagaria (2024)

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Abstract

Objectives: A bibliometric analysis by Zagaria (2024) claimed that research in Evolutionary Psychology (EP) lags behind research grounded in the Standard Social Science Model (SSSM) in prevalence and growth rate, questioning EP's status as a scientific revolution. This commentary aims to re-evaluate Zagaria's findings and conclusions. We raise two major concerns about his analysis. First, Zagaria's EP syntax excluded key EP terms like fitness, psychological adaptation, and parental investment, while the SSSM syntax included homonyms (e.g., culture) not always relevant to SSSM (e.g., tissue culture in medicine). Second, the analysis included non-scientific journals from fields like gender studies, skewing results since EP is not intended to influence non-scientific fields like dance therapy or tourism studies. Focusing on high-impact psychology journals would better reflect EP's influence. Methods: We revised the SSSM syntax to "cultural" and updated the EP syntax by adding "inclusive fitness," "parental investment," and "psychological adaptation." Our analysis also used year-by-year data and 5- and 10-year rolling averages to assess trends more accurately. Results: Our analysis found that growth in EP and SSSM research is comparable over time, and the ratio of SSSM to EP papers was overstated by at least 23%. Conclusion: We highlight metrics that should be weighted more heavily than publication quantity, such as effect magnitude, universality, and replicability. By these metrics, EP is arguably outperforming the SSSM and embodies elements of the Kuhnian scientific revolution discussed by Zagaria (2024). This commentary offers a more optimistic vision for EP's current status and future direction.

Keywords Evolutionary Psychology · Scientific Revolution · Standard Social Science Model

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It has been argued that Evolutionary Psychology (EP) represents an important scientific revolution in psychology and the social sciences (e.g., Buss, 2020). We commend Zagaria (2024) on his recent study, which we feel aims to answer an important research question about the current state of EP and its role within wider scientific research. Zagaria (2024) performed a bibliometric analysis of the prevalence of EP in psychology and contrasted it with the prevalence of the socio-cultural approach, known as the Standard Social Science Model (SSSM; Tooby & Cosmides, 1992); he concludes that the SSSM enjoys significantly greater prominence than EP and is growing at a swifter pace, which raises doubts about EP's status as a scientific revolution (Buss, 2020).

We have identified some methodological flaws in his analysis. To start with, the journals covered by *APA PsycINFO* used as the database include many non-scientific journals. Some particularly egregious examples include, but are not limited to, *Feminist Inquiry in Social Work, AIDS Patient Care and STDs, Alberta Journal of Educational Research, Annals of Dyslexia, Telemedicine, Art Therapy, Australian Social Work, British Journal of Special Education, British Journal of Visual Impairment*, and *Feminist Theory*. We think this makes the analysis problematic. Judging whether EP constitutes a scientific revolution based on the number of publications in journals such as these is not very informative. It would be more meaningful to focus on empirical papers in scientific psychology journals. It was never the claim of Buss (2020) that EP would revolutionize other disciplines like dance therapy, art therapy, or ideologically-driven fields such as feminist scholarship.

We do, however, note that there are several examples of successful cross-fertilization between EP and other disciplines and sub-disciplines, some of which Zagaria identifies himself, for example personality psychology (e.g., Lukaszewski, 2021; Lukaszewski et al., 2020), as well as clinical psychology/psychotherapy (e.g. Gilbert et al., 2014; Liotti et al., 2017). We add to this also evolutionary medicine (Stearns, 2012), political psychology (Petersen, 2015), occupational psychology (Browne, 2006), and the tremendous potential for collaboration with evolutionary anthropology (Hahnel-Peeters, 2021). There have been excellent examples of feminist EP (Buss & Schmitt, 2011; Campbell, 2006), an EP perspective has informed on the evolution and function of human dance (Fink et al., 2021), and has even on occasion, informed tourism studies (Hahnel Peeters et al., 2021). However, despite these admirable efforts, it is not reasonable to expect that the *American Journal of Dance Therapy, Feminist Theory*, or *Annals of Tourism Research* should be, or ever will be, dominated by an EP perspective.

Critique of Zagaria's (2024) Analysis

In his bibliometric analysis, Zagaria takes a carefully considered approach to designing appropriate search terms for the SSSM, which is a particularly thorny issue given that those who use theories grounded in the SSSM do not use this expression to describe their work. However, a careful review of the results obtained using the search syntax for the SSSM raised several concerns.

First, the SSSM model contains the term "cultur*" which returns work containing mention of "cultural", "cultures", "cultured" and so on. Brushing aside concerns as to whether work on culture should be classed as SSSM by default (some of the best

EP work involves examinations of cultural differences and similarities; Buss, 1989; Thomas et al., 2019), the issue here is that culture has different meanings within different scientific sub-disciplines. In biomedical research, it refers to a growth of microorganisms, cells, and tissues in a laboratory setting. Because of its inclusion, the SSSM search query returns papers such as "PI3Kγ/AKT signaling in high molecular weight hyaluronan (HMWH)-induced anti-hyperalgesia and reversal of nociceptor sensitization" and "A purine-sensitive pathway regulates multiple genes involved in axon regeneration in goldfish retinal ganglion cells", which are not papers grounded in the SSSM. Moreover, the term would also erroneously include evolutionary psychological analyses of culture in the SSSM category. Examples are "The Psychological Foundations of Culture" (Tooby & Cosmides, 1992), "Evolution, Culture, and the Human Mind" (Schaller et al., 2011), and "The Evolutionary Foundations of Cultural Variation" (Gangestad et al., 2006). We do appreciate, however, Zagaria's efforts to identify and exclude papers that overlap with both EP and SSSM.

Second, Zagaria's analysis did not include some of the key terms unique to evolutionary approaches and form the bedrock of modern evolutionary psychology including fitness, adaptation, and parental investment. Though we understand that some of these terms do not appear in the APA Thesaurus of Psychological Index Terms, parental investment does and clearly should have been included in the EP syntax. Similarly, the inclusion of terms such as "animal behavior" in the EP syntax poses a problem because some animal behavior research originates from sub-disciplines (such as 'behavioristic' comparative psychology or 'animal learning studies') which are arguably SSSM aligned.

Our Reanalysis

To illustrate our concerns, we conducted our own analysis using the instructions outlined in Zagaria (2024). However, we made the following changes:

(1) The term "cultur*" was replaced with "cultural" in the SSSM search. The logic here is that articles discussing culture in the biomedical sense do not tend to use the word "cultural", whereas any paper genuinely studying culture from an SSSM perspective would likely use the term "cultural" somewhere in the abstract, title, keywords, or subject headings.
(2) We removed "animal behavior" from the EP search and replaced it with "inclusive fitness", "parental investment", and "psychological adaptation". These specific phrases were chosen as their more generic versions (e.g., fitness, adaptation) might have captured articles using these words in a different context (e.g., exercise, homeostasis).
(3) We analyzed the period between 1975 and 2023 on a year-by-year basis to get a full view of variability between years over the last 25 years. We also produced 5- and 10-year rolling averages to examine smoothed trends over time.

While these steps do not address all of our concerns, such as the need to exclude non-scientific journals or the inherent problem with assuming that all cultural work is grounded in SSSM, we felt that they would be sufficient to demonstrate that even modest, sensible

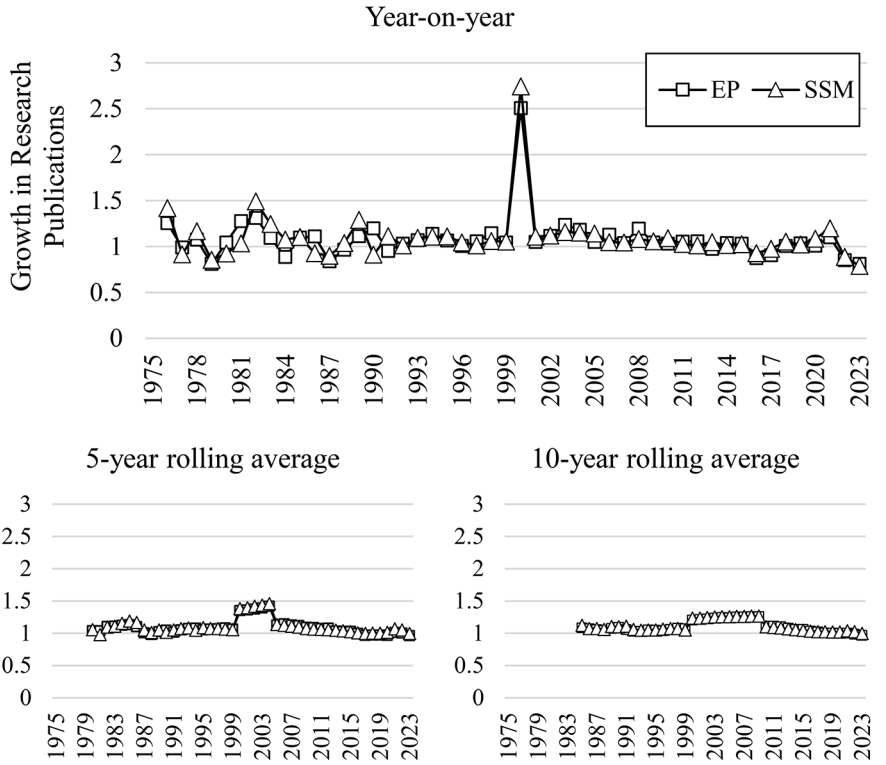

Fig. 1 Growth of standard social science model (SSSM) to evolutionary psychology (EP) papers published each year from 1975 to 2023. Values represent the current year divided by previous year such that 1 indicates no growth while 1.5 would indicate 50% growth over the previous year. Rolling 5-year (bottom-left) and 10-year averages (bottom-right) are also presented

changes to the original syntax may lead to different conclusions about the relationship between SSSM and EP.

Growth in EP and SSSM Research is Comparable Over Time

If SSSM research were gaining momentum relative to EP, then we would expect to see a increasing gap in yearly growth in publications. However, as can be seen in Fig. 1, levels of growth are almost identical, typically fluctuating between 0% and 20%[1]. From 1975 to 2023, the average growth was 9.8% (SD=27.4%) for SSSM research and 8.1% (SD=23.9%), $t(47)$ = -1.105, p=.275, d=0.16. In fact, the correlation between EP and SSM growth is $r(48)$=0.925, p<.001.

[1] Note that in the year 2000 there was a large "jump" in recorded research papers of both kinds. While we are unsure why this occurred, it does support our case that greater temporal acuity is needed with this type of work.

The Ratio of SSSM to EP Papers was Overstated

In the original analysis, an average of 2.31 ($SD = 0.35$) SSSM papers were published per EP paper each year. However, in our reanalysis (see Fig. 2), we estimate this to be about 23% lower, at 1.78 ($SD = 0.26$). To allow for statistical comparisons, we compared the differences between the 5-year rolling average based on Zagaria's (2024) summary dataset to our own, and found this to be a significant and large underestimate, $t(44) = 18.538$, $p < .001$, $d = 2.76$. Overall, while we agree that more research is published using an SSSM lens (when non-scientific publications are included), this ratio is smaller than originally stated, though there may be evidence of a small positive increase over time (about 1.3% per year; $B = 0.013$, $SE = 0.002$, $p < .001$).

In summary, even minor changes to the original syntax from Zagaria's (2024) bibliometric analysis paints quite a different picture. Growth in EP and SSSM research (regardless of whether it is considered "scientific") is comparable over time and the ratio of SSSM to EP papers was overstated by approximately 23%. While there are many further refinements that could be made to search specifications for the bibliometric analysis, none would overcome the weakness of adopting a narrow, univariate, approach to appraising EPs status as a scientific revolution. Throughout the rest of our commentary, we will highlight other metrics that ought to be weighted more heavily than the quantity of publications, such as magnitude of effect, universality

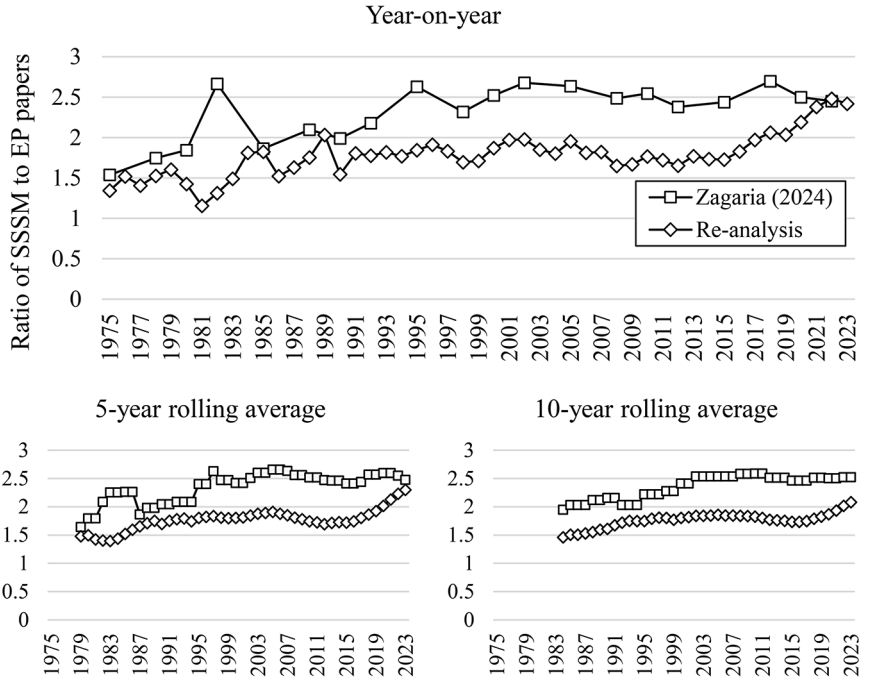

Fig. 2 The ratio of Standard Social Science Model (SSSM) to Evolutionary Psychology (EP) papers published each year from 1975 to 2023 based on Zagaria's (2024) original analysis and our re-analysis. Rolling 5-year (bottom-left) and 10-year averages (bottom-right) are also presented

across cultures, replicability of findings, and cumulation of findings that are either anomalous on the SSSM account or appear to require an evolutionary psychological framework to understand them. By these metrics, we suggest that EP is outperforming the SSSM; therefore, we offer a more optimistic vision for the current status, and future directions, for the EP discipline.

The Direction of Travel for Evolutionary Psychology

Since its inception in the early 1990s, there are now thousands of EP researchers around the world. Some of these scholars were raised in postgraduate programs dedicated to evolutionary perspectives on human behavior (like the MSc in Psychology, Culture and Evolution at Brunel University, or the MSc in Comparative, Evolutionary and Developmental Psychology: Origins of Mind at University of St. Andrews) and many join societies and attend conferences all around the world, including FEPS (Feminist Evolutionary Psychology Society) and AEPS (Applied Evolutionary Psychology Society).

In the 1990s there was just one academic journal devoted to EP (*Ethology and Sociobiology*); now we have roughly eight evolutionary journals. The EP flagship journal, *Evolution and Human Behavior*, is enjoying an upward trajectory in terms of impact factor (see Fig. 3). Considering the *Handbook of Evolutionary Psychology*, the 32 chapters of the 2005 first edition (Buss, 2005) expanded to 52 in the 2016 s edition (Buss, 2016) – an increase of 62% in just over a decade. There are now multiple EP handbooks either already published or in the works, and we even have a growing periodic table of evolved psychological adaptations (Balachandran & Glass, 2012).

Buss (1988) published his first empirical EP article in the *Journal of Personality and Social Psychology* in 1988, but it may have been the only one that year or the year after that. Now, EP research is routinely published in the highest impact journals in Psychology (e.g., *Psychological Science*). Between the years 2001 and 2004, more than 1/3 of the publications in the journal *Behavioral and Brain Sciences* were informed by evolutionary themes (Glass et al., 2012). This same trend has been found in other important journals as well (e.g., the *Journal of Personality and Social Psychology*; see Webster, 2007). A recent analysis found that the psychology journals publishing the most replicable research often publish EP papers, including the top ranked *Journal of Individual Differences*, with *Archives of Sexual Behavior* and *Evolutionary Psychology* all counted in the top 10 (Schimmack, 2022). Beyond this, several EP scholars were recently counted among Stanford/Elsevier's Top 2% most cited scientists (not just psychologists) in the world (Ioannidis, 2023).

Zagaria (2024) aimed to analyze broad trends in the entire field of psychology and claimed that focusing mainly on highly influential journals would have been misleading. We argue, instead, that by including too many journals, Zagaria cast too wide a net and ended up obscuring the trends he wished to identify. We wager that if the analysis had focused only on high impact journals, or even just scientific, empirical, psychology journals, and excluded humanities and gender studies journals, EP would have looked a lot better than Zagaria's (2024) results depicted. To avoid having to manually sort through hundreds of thousands of records, such an undertak-

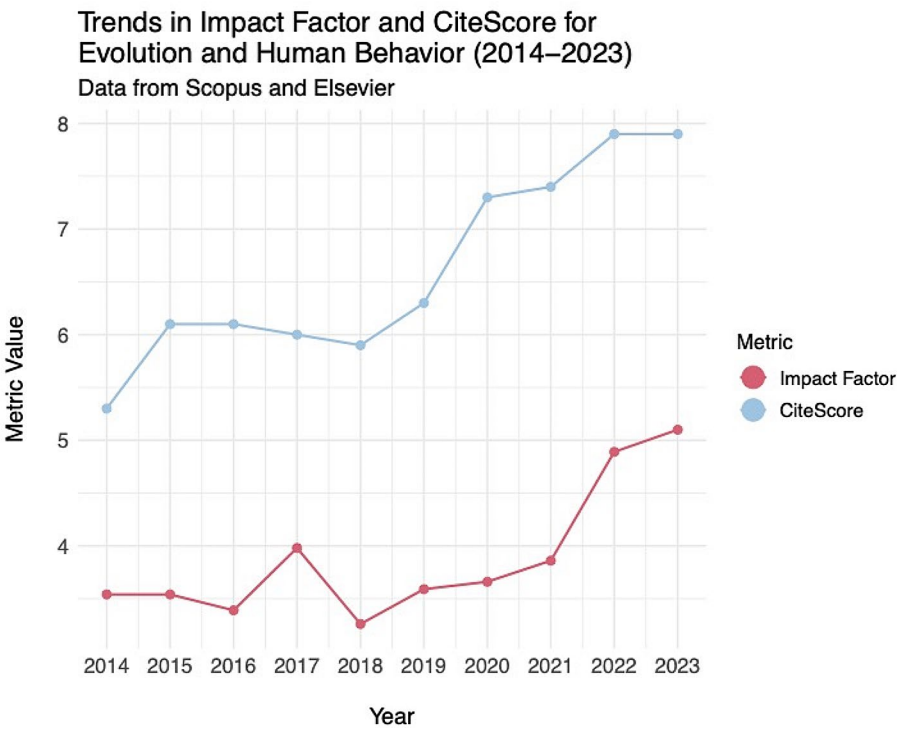

Fig. 3 Trends in impact factor and citescore for evolution and human behavior (2014–2023). Graph produced by Garfield (2024)

ing would likely require more sophisticated software, perhaps utilizing AI (artificial intelligence), than that afforded by APA PsycINFO database search tools.

Ultimately, evidence for the EP scientific revolution proposed by Buss (2020) will not be found in obscure journals that are arguably not even tangentially related to the field of psychology. It will instead be found in high impact psychology journals, and in published articles with highly replicable findings predicted by mid-level evolutionary theories such as sexual conflict theory (Buss, 2017), error management theory (Haselton & Buss, 2000), parental investment theory (Trivers, 1972), sexual strategies theory (Buss & Schmitt, 1993), and many others. We believe that these contributions have truly revolutionized entire domains of behavioral research that remain otherwise entirely inexplicable on the SSSM accounts. This achievement is correctly identified by Zagaria (2024) as a necessary component of a Kuhnian paradigm shift in science to warrant the label of "scientific revolution."

Evolutionary Psychology as a Solution to the Kuhnian Stage Four (Replication) Crisis in Psychology

Zagaria (2024) stated, as per Kuhn's (1996) framework of paradigm shifts in science, that in Stage 4: "normal science continues in its 'puzzle-solving' activities up to the point when the growing accumulation of anomalies (facts that cannot be explained through the paradigm's usual ontology and methodology) leads science to enter a stage of crisis (fourth stage)". Relatedly, psychological science now finds itself mired in what has colloquially become known as the "replication crisis", which arises from the inability to replicate many well-known "classic" findings in the field (Open Science Collaboration, 2015). The replication crisis likely has many causes, such as statistically under-powered research designs, questionable analytic decisions, *p*-hacking, and the biases of journals toward publishing positive rather than null findings and surprising counter-intuitive findings (which Smaldino & McElreath, 2016, describe as the 'natural selection of bad science'); some scholars also point to the lack of a good overarching meta-theory as a major cause of the replication crisis in psychology (e.g., Muthukrishna & Henrich, 2019). EP, however, has remained relatively unaffected by this replication crisis. EP differs from the SSSM in providing a consilient meta-theory, which links a wide range of concepts, including, but not limited to, universal criteria for social status (Buss et al., 2020) and morality (Curry et al., 2019) and the adaptive nature of depression (Nesse, 2000) and anxiety (Marks & Nesse, 1994). We argue that some metrics ought to be weighted more heavily than the quantity of publications, for example, magnitude, universality, and replicability of findings. Ultimately, the replication crisis is no surprise when Zagaria's (2024) data show that most papers now pursue the explicitly non-EP route. We encourage more scholars to embrace the EP framework in their future work to help combat the replication crisis.

The (not so) Distant Open Fields of Darwin's Vision for Psychology

At the end of Darwin's classic (1859) book on the natural selection and the origin of species, he prophesied that the theory of evolution would one day be applied to the human mind, "In the distant future, I see open fields for far more important researches. Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation" (p. 488). Relatedly, Nettle and Scott-Phillips (2023) recently concluded that non-evolutionary psychology is not possible, and that the EP/non-EP dichotomy should be retired. However, we suggest that the social sciences are a long way away from that point. While we agree that just as biology is often said to be a discipline unified by the theory of evolution (Dobzhansky, 1973), so too should psychology, there is still a sharp divide between psychological studies that explicitly use evolutionary principles to derive hypotheses and predictions, and those for which evolutionary assumptions are implicit and never stated. The latter are often actually still 'blank slate' assumptions; that selection has created just a few domain general learning mechanisms, and that society writes on the "blank slate" (Tooby & Cosmides, 1992). Although many psychologists, when pushed, deny

that they are blank-slaters, the lenses they use to guide their research and interpret their findings tell a different story. We suggest that good science requires that evolutionary assumptions be made explicit and agree with Zagaria (2024) that the EP/SSSM distinction is still a useful heuristic.

Another metric by which EP is surpassing the SSSM is in the cross-cultural nature of findings. While Henrich et al. (2010) highlight that 96% of subjects in psychological studies are from WEIRD (Western Educated Industrialized Rich and Democratic) countries, housing just 12% of the world's population, EP scholars are much less egregious than SSSM researchers in this pursuit. For example, many EP studies represent between 20 and 50 cultures (e.g., Lippa, 2009; Schmitt, 2005). There is, however, much room for improvement even within EP. For example, 81% of samples used in the 2015–2016 volumes of '*Evolution & Human Behavior'* and '*Evolutionary Psychology*', were classified as 'Western' (Pollet & Saxton, 2019).

Zagaria (2024) concludes with a recommendation for EP to continue engaging in interdisciplinary research to enhance the prominence of EP in the broader scientific community. We agree with this and hope that the recent sex/gender differences debate held in Santa Fe (Santa Fe Boys Educational Foundation, 2023) can be a watershed moment in the ideological culture war around sex and gender (Del Giudice, 2023). We urge our fellow evolutionary scholars to continue in this spirit. We also point to adversarial collaborations (a methodological procedure in which disagreeing scholars work together to resolve their empirical disputes) as a potentially fruitful enterprise on this front (Clark & Tetlock, 2023).

Zagaria (2024) appropriately attempted to contextualize his findings, noting, for example, that one sign that EP has not yet become popular in psychology is that the authors of EP papers still go to great lengths in explaining the basic tenets of evolution, justifying their methods, and countering accusations of prejudice (see Del Giudice, 2018; Lukaszewski, 2021; Lukaszewski et al., 2020; Simpson & Belsky, 2016). Zagaria (2024) is also right to point out that scientific revolutions are often nonlinear and sometimes take a lot of time to complete. Many scientific revolutions are also ferociously resisted in their time (e.g., Galileo's Heliocentric Revolution, Mendelian genetics, and even the gene's eye view of selection). The same may be true of EP.

Given that the explanatory power of the evolutionary framework is unquestionable, we suggest that other factors are causing the scientific community to remain in oscillation between crisis (i.e., Stage 4) and embracing the new, more powerful evolutionary paradigm (i.e., EP Stage 5). For example, it is true that EP has not yet sufficiently overcome the ideological resistance (Buss & von Hippel, 2018) or the poor training of some of the social scientists (Bleske-Recheck & Donovan, 2015; Glass et al., 2012). Nor has the field yet overcome the many misconceptions that still pervade the social sciences (Schmitt, 2023). While it is beyond the scope of this commentary to go into greater detail about the reasons why there is still resistance to the EP paradigm, we will do so in future work.

Conclusion

It may take some time for the EP scientific revolution to be widely recognized as such (Buss, 2020), but we have no doubt about what the history books will reveal about the myopia of a pre-Darwinian view of the human mind. Darwin's vision of a distant future may not have materialized just yet, but evolutionary psychology has a strong foothold in psychological research, is growing at a rapid pace, and is producing highly replicable findings that would appear anomalous or inexplicable on standard SSSM accounts. In the words of William Hamilton "The tabula of human nature was never rasa, and it is now being read". We in EP will continue to read the tabula and illuminate our fundamental human nature.

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Declarations

Ethical Approval Not applicable.

Competing Interests The authors declare no competing interests.

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