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Intellectual and social critique: The role of the *South African Journal of Science*

Over more than a century, since 1905, in various formats and published by different organisations, the content of the *South African Journal of Science (SAJS)* has reflected the state of scientific thinking in South Africa and provided a platform for multiple voices from its scholarly community.

In keeping with standard practice followed by numerous scholarly journals, the *SAJS* has a short 'Front Section' containing a variety of articles that, unlike the main research articles in the journal, are not normally peer reviewed. Their purpose is to provide a space for discussion, debate and critique on topical matters relating to science in South Africa.

In terms of ASSAf policy, every submission is subject to a signed legally binding Publishing Agreement that, inter alia, obliges the author to warrant that the manuscript does not contain any unlawful statements or content; does not contain defamatory material; is not in violation of any rights of privacy or any other rights of third persons; if reporting on research involving human or non-human vertebrates, the research meets the highest reporting standards and has been approved by an institutional ethics committee.

Following international best practice, the *SAJS* encourages robust scholarly debate by accepting and publishing rebuttals and responses from academic peers to published (peer-reviewed) articles as well as to material that is published in the Front Section (currently not formally peer reviewed). The convention is that these are published in the following issue of the Journal together with the original author's response.

One of the Front Section categories is that of 'Commentary': 'Commentaries come in a variety of forms, but they are most often views regarding scientific challenges or opportunities that have arisen out of research experiences. Commentaries can, however, also present the summarised results of research projects, or comments on such research findings, that have direct policy implications and/or immediate social value. Commentaries of a similar or related nature may also be considered.'

The publication of a Commentary in the *South African Journal of Science* (Volume 116 5/6) by UCT Professor Nicoli Nattrass, entitled Why are black South African students less likely to consider studying biological sciences? elicited many fervent responses from readers. In the interest of fair scholarly discourse and the importance of the matter, we are enabling wide participation by publishing this unprecedented special issue. Every formal response to the Commentary received by the *SAJS* has been included together with a reply by Prof. Nattrass. All material in this special issue is subject to the standard publishing policies of the *SAJS* but has not been limited in length.

However, the Editorial Advisory Board of the *SAJS* has noted the critical responses related specifically to the 'Commentary' section of the Journal. We acknowledge that the current guidelines pertaining to the 'Commentary' section need to be reviewed and, if required, be changed, specifically in regard to what necessitates peer review.

Hence, the Editorial Advisory Board has taken the decision to reconsider the existing guidelines for categories of the Front Section. We will make an announcement regarding this matter in the coming months.

We express our continued commitment to publish research of high quality in line with internationally acceptable norms and with particular attention to ensure that published work does not discriminate or cause harm. We also welcome constructive opinion as to how we might improve our endeavours in this regard.

This episode reflects an important moment in the longer history of the *SAJS* at a time of

changing values. Our Statement of 11 June 2020 expressed the hope that this compilation of articles – the original article, the rebuttals and the author's response – will perform an important and useful educational function in universities as well as in our broader society.

Prof. Jane Carruthers, Editor-in-Chief
Prof. Johann Mouton, Chair: Editorial Advisory Board

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Why are black South African students less likely to consider studying biological sciences?

An exploratory survey of University of Cape Town (UCT) students in mid-2019 drew attention to an important, but under-researched, question: why do conservation biology, zoology and the other biological sciences subjects struggle to attract black South African students? A large part of the answer is obviously that persisting inequalities in the schooling system make it less likely that they will meet the entrance requirements for science courses. Yet there are likely to be other reasons too, notably materialist values and aspirations (pertaining to occupation and income) as well as experience with pets and attitudes towards wildlife – all of which are likely also to be shaped by a student's socio-economic background. Given the 'Fallist' protests of 2015/2016, another possibility is that wildlife conservation itself might be regarded as colonial, and students might perceive a trade-off between social justice and conservation. The survey, conducted by researchers from the Institute for Communities and Wildlife in Africa (iCWild) at UCT, explored these possibilities. The key outcome variable was whether students had ever considered studying zoology or the biological sciences, irrespective of whether or not they met the entrance requirements.

The opportunistic survey of 211 students (obtained by approaching students during the lunch break) resulted in an over-sampling of black South Africans (54% of the total compared to their share of 30% of UCT students). The results for the total sample are thus in no way 'representative' of UCT students. However, the data allow for some exploration of attitudinal differences between black South African students and others – and whether this correlates with ever having considered studying biological sciences.

Table 1 shows that less than one third of black South African students reported having considered studying biological sciences compared to almost half for other students. Very few students had 'Fallist' opinions (agreeing that conservation biology and national parks should be scrapped) – and there was no statistically significant difference between black South Africans and other students on these issues. Rather, the key differences pertained to career aspirations, attitudes towards evolution and experience with, and attitudes to, animals.

Table 1: Selected statistics for comparison of responses from black South African and other students

	Black South Africans	Other students	Total sample	Fisher's exact (Pr)
Considered studying the biological sciences	32.4%	49.5%	40.3%	0.016
Agrees 'Addressing social inequality is more important than wildlife conservation'	43.4%	31.6%	38.0%	0.087
Agrees 'I support wildlife conservation but have no interest in having a career in it'	76.1%	60.0%	68.8%	0.016
Agrees that 'Humans evolved from apes'	19.9%	57.1%	36.3%	0.000
Likes having starlings around at UCT	44.3%	68.0%	55.2%	0.001
Agrees that disciplines like conservation biology are colonial and should be scrapped at UCT	7.1%	3.1%	5.3%	0.199
Agrees that many of South Africa's national parks should be scrapped and the land given to the poor	10.6%	5.3%	8.2%	0.281

Table 2 presents a set of exploratory regressions showing that attitudes were better predictors of having considered studying biological sciences than the crude indicator of being a black South African. Regression 2.1 shows that being a black South African reduced the average marginal probability of having considered biological sciences by 17 percentage points. Regression 2.2 controls also for agreeing that social inequality is more important than wildlife conservation. This reduces the average marginal probability by 14 percentage points and the effect of being a black South African remains substantial. Regression 2.3 includes whether the respondent agreed with the statement 'I support wildlife conservation but have no interest in having a career in it'. This turned out to be the largest single determinant of whether a student considered studying biological sciences or not. Importantly, including it rendered the other variables statistically insignificant. The variable 'black South African' remained statistically insignificant in Regressions 2.3, 2.4 and 2.5, and when dropped (Regression 2.6) the model improves. Regression 2.6 shows that conditional on the other variables, supporting wildlife conservation but having no interest in a career in it, reduced the average marginal probability of considering biological sciences by 39 percentage points. Agreeing that humans evolved from apes increased it by 16 percentage points. Every additional type of pet ever owned increased the probability by 9 percentage points.

Table 3 shows potential attitudinal determinants of supporting wildlife conservation but having no interest in a career in it. As in the earlier analysis, the statistical significance of being a black South African disappears when these values and attitudes are controlled for. Regressions 3.2 to 3.4 include a measure of how respondents scored on the World Values Survey's 'materialist index' – a set of 12 questions probing the extent to which people value economic growth and other materialist objectives over environmental objectives.[1-3]

Regressions 3.3 and 3.4 also include scores on an 'anti-conservation' (or 'Fallist') index which was constructed by adding the scores (taking a value of 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for agree strongly) for responses to: 'Many of South Africa's national parks should be scrapped and the land given to the poor' and 'Disciplines like conservation biology are colonial and should be scrapped at UCT'. Finally, Regression 3.4 adds a proxy variable for enjoyment or valuing of local wildlife by asking students whether they 'like'

Table 2: Exploratory regressions on 'Considered studying zoology or the biological sciences'

Variable	Regression					
	2.1	2.2	2.3	2.4	2.5	2.6
Black South African	-0.17* (0.068) $p=0.012$	-0.16* (0.069) $p=0.020$	-0.10 (0.065) $p=0.117$	-0.04 (0.068) $p=0.584$	-0.00 (0.068) $p=0.986$	
Agrees 'Addressing social inequality is more important than wildlife conservation'		-0.14* (0.069) $p=0.037$	-0.07 (0.066) $p=0.309$	-0.09 (0.065) $p=0.187$	-0.11 (0.065) $p=0.091$	-0.11 (0.064) $p=0.088$
Agrees 'I support wildlife conservation but have no interest in having a career in it'			-0.41*** (0.073) $p=0.000$	-0.43*** (0.071) $p=0.000$	-0.39*** (0.074) $p=0.000$	-0.39*** (0.074) $p=0.000$
Agrees that 'Humans evolved from apes'				0.18* (0.071) $p=0.010$	0.16* (0.071) $p=0.022$	0.16* (0.066) $p=0.013$
Number of different kinds of pets ever owned					0.09** (0.034) $p=0.007$	0.09** (0.037) $p=0.005$
Prob>chi^2 Pseudo-R^2	0.0128 0.0223	0.0048 0.0389	0.000 0.1474	0.000 0.1790	0.000 0.2049	0.000 0.2049
AIC BIC	275.57 282.22	269.21 279.15	238.71 251.94	231.45 247.87	226.42 246.18	224.42 240.88

Reporting average marginal effects for the coefficients (dy/dx) *p<*0.05,* **p<*0.01,* ***p<*0.000*

having starlings at UCT. Redwing starlings are common on the campus and bolder individuals have been known to 'raid' people's lunches. Regression 3.4 (the strongest model) shows that, conditional on the other variables, a one unit increase in the materialism scale and a one unit increase in the anti-conservation scale, both increased the average marginal probability of having no interest in a career in conservation by 5 percentage points and that liking UCT's starlings reduced it by 28 percentage points.

Table 3: Exploratory regressions on 'Supports wildlife conservation but have no interest in pursuing a career in it'

Variable	Regression			
	3.1	3.2	3.3	3.4
Black South African	0.16* (0.064) $p=0.012$	0.13 (0.068) $p=0.055$	0.11 (0.068) $p=0.105$	0.03 (0.067) $p=0.656$
Score on the World Values Survey 'materialist index'		0.06* (0.026) $p=0.028$	0.05* (0.026) $p=0.042$	0.05* (0.024) $p=0.031$
Score on the 'anti-conservation stance' index			0.05** (0.021) $p=0.015$	0.05* (0.020) $p=0.010$
Likes having starlings around at UCT				-0.28*** (0.064) $p=0.000$
Prob>chi^2 Pseudo-R^2	0.0125 0.0241	0.0064 0.0428	0.001 0.0682	0.000 0.1560
AIC BIC	256.14 262.81	232.04 241.80	227.36 240.35	210.68 230.16

Reporting average marginal effects for the coefficients (dy/dx) *p<*0.05,* **p<*0.01,* ***p<*0.00*

In short, the survey results suggest that black South African students are less likely to consider studying biological sciences than other students, and that this stance was linked primarily with career aspirations (supporting conservation but not wanting a career in it) – and these were associated with materialist values and attitudes to local wildlife. Agreeing that 'humans evolved from apes' was the second biggest predictor of considering studying biological sciences, and the relatively high proportion of black South Africans who disagreed with this probably speaks to failures at school level with regard to the teaching of biological sciences and to the strength of religiosity in South Africa. We also found a strong relationship between the number of different pets owned by students and whether they had considered studying biological sciences. This variable is probably picking up attitudes towards and experience of companion animals as well as socio-economic status (pet ownership is more affordable for middle- and upper-income groups).

Materialist values (a key determinant of not desiring a career in conservation) are probably another indicator of socio-economic status as cross-national research shows that dominant social values shift from materialist to postmaterialist with economic development.[2,3] This suggests that black South Africans may be interested in careers other than in conservation in part because of their relatively disadvantaged backgrounds which could prime them towards considering primarily the higher-paying occupations (accountancy, law). This, together with the fact that very few students were hostile to conservation, suggests that interest in conservation as a career and in studying biological sciences might increase as the black middle-class grows.

It is worth emphasising, however, that these findings are tentative and that all the regression models left a great deal of the variation unexplained. More research is needed on potential socio-economic and cultural correlates of having considered studying biological sciences or a career in conservation biology.

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The Anatomy of a Bad Science: Reflections on Nattrass' 'commentary'

In its May/June 2020 issue, the *South African Journal of Science* (*S Afr J Sci*) published a two-page 'commentary' by Nicoli Nattrass, a professor of economics and co-Director of the Institute for Communities and Wildlife in Africa at the University of Cape Town (UCT). The 'commentary' is titled 'Why are black South African students less likely to consider studying biological sciences?'[1] The piece reported 'the findings' of a survey of students at the University of Cape Town that was conducted in mid-2019. This was supposed to be an exploratory study, intended to offer insights into why Black South African students do not study biological sciences. In this article, I explore three dimensions of the research and the results reported in Nattrass' commentary.

First, I assess the methodological framing of the 'exploratory' survey and argue that the study design is gravely deficient. Second, I examine the descriptive and inferential statistics that Nattrass reports. I argue that there is significant dissonance between the results of the regression models reported and the conclusions that Nattrass draws. Third, I examine a set of highly problematic claims that shape the survey and offer insights into the presuppositions that explain the conclusions Nattrass draws from the study. These presuppositions involve a set of racially charged tropes about 'black South African' students. The summative conclusion is that what we have is bad science hanging on the horns of prejudice.

Methodological problems in the study design

The first issue of concern in engaging with the commentary concerns the study design. The study participants were recruited 'by approaching students during the lunch break.'[1] Nattrass referred to this as 'opportunistic survey.'[1] The choice of sampling technique is puzzling, instead of more robust probability sampling methods. The claim that the study is 'exploratory' is not credible. An exploratory study seeks to address, in tentative ways, issues that might not have been previously studied. Using the students at UCT may be permissible for such study—as a prelude to a more national survey—but this would not justify the use of non-probability sampling. The reason for this is simple. The study seeks to answer a 'why' question not a 'how' question. Even in its 'exploratory' nature, the (tentative, preliminary) answers that the researchers sought involve making claims *beyond the study sample.* Generalisability is at the heart of the question the researcher sought to answer.

The choice of non-probability sampling is all the more puzzling because, as staff of the university, the researchers had access to a reliable sampling frame from which they could develop the probability sampling. The sampling frame would involve a complete record of

all the students at the university. As researchers at the university, they could easily access such sampling frame, from the Office of the Registrar. The frame would have provided the relevant socio-demographic distribution of the student population, their degree options, and other characteristics needed for generating a credible sample.

With the sampling frame, the researchers could have employed an appropriate stratified, random sampling procedure. Race-categories, fields of study (as a proxy for career trajectory), and socio-economic status of the study participants are all critical for the research questions that underpin this study. The sampling frame would have provided the basis for a robust stratification of the population from which they can draw the study sample. Further, the researchers would have indicated, beforehand, the margin of error used in arriving at the sample size. The error margin would have helped in interpreting even the descriptive statistics since we would know the confidence interval for the reported percentile distribution of the sample.

It is unclear if a scientific committee ever considered the study proposal at the university. If this was the case, the study should have been flagged. A research ethics committee would be concerned with issues of whether the research process could open the students to harm. Still, an approval that the study is scientifically robust should have come before the ethics clearance application.

The effects of the methodological deficiencies highlighted above are that the researchers stumbled blindly into the field. While 'black South African' students'(BSA) share of the total population of UCT students was 30 per cent, they are 54 per cent of the study sample. The sample size derived with convenience sampling was 211 students. Properly designed, with a 3 per cent margin of error, we would have expected a sample size of at least 1 030 students. The use of the sampling frame would have offered the researcher access to the e-mail addresses of the potential respondents. They could have used this to invite them to complete an online questionnaire rather than the face-to-face interviews approach they employed. With this, they could have avoided methodological problems with the race or gender of the enumerators, for instance, that are widely known in social research.

Even for a study based on non-probability sampling, there is a curious homogenisation of the BSA students at UCT—that they are all from impoverished backgrounds. A background claim to the study is that 'obviously... persisting inequalities in the school system make it less likely that they [BSA students] will meet the entrance requirements for science courses.' This clearly shows a shocking lack of appreciation for the diversity of the UCT BSA students and their school backgrounds.

The issues raised above immediately undermine the author's capacity to make any credible inferences about the study population, much less the study universe. Similarly, the study cannot make any inferences about BSA students at UCT (beyond those in the study sample), much less BSA students in the country. The title and conclusion of the 'commentary' make claims that cannot be supported by the study design—even the ones that supposedly repudiate race as a critical variable with predictive power (see further discussion below).

A study on why BSA students 'are less likely' to consider studying biological sciences is not the same as 'no BSA student' considered studying biological sciences. If the population of BSA students in UCT is 30 per cent but the share of BSA among those studying Biological Sciences was 35 per cent, the share of BSA students studying Biological Sciences would still be low relative to the other categories of students but would be higher than their overall share of the university student population. The author makes no effort to engage with this scenario.

For a study concerned with explaining why BSA students are less likely to study the Biological Sciences, a researcher would want to consider a sample stratified, at least, along the lines of those studying the Natural Sciences and those

who are not. Since an organising assumption is the economic status of the students at the university, one would also have expected a sample stratified by such status. Why would 'materialist values' enter the equation, and be a hypothesised reason for not choosing a career in conservation biology other than they choose well-paying professions because 'they are trying to escape poverty.' Financial aid could have been used as a proxy (a dummy variable) for the students' economic status.

Further, what share of the surveyed BSA students (114 out of 211) is in the Humanities or the Natural Sciences, for instance, relative to the category 'Other students' would matter for the question that the author claims she sought to answer? Would a student's degree focus have some bearing on what they think of a question such as whether humans evolved from apes? Suppose a large share of the BSA students in the sample is registered in Theology, and such students consider the idea that humans evolved from apes absurd. Would that reflect their race classification or their disciplinary orientation? Would a BSA student studying Medicine or Zoology hold the same position?

For a sample that the author admits has a higher share of BSA students than the population, it is interesting that there is no attempt to allocate weight to the sub-categories of the sample (BSA students and 'Other students') when reporting the findings. Even in the most rigorously designed probability sampling, sub-categories of the sample may be over-represented due to high non-response rates from other sub-categories of the sample. Researchers need not be held responsible for the non-response rate. What would be expected, however, is that the sample is properly weighted. In this case, the weight for BSA students would be 0.555 (30.0/54.0)—30 per cent being their share in the student population and 54 per cent, their share of the sample. Correspondingly, the weight for 'Other Students' would be 1.521. Even for the descriptive statistics, such weights matter.

Dissonance: The conclusion misreports the study result

While a poorly designed study may reflect limited methodological proficiency on the part of the researchers, misrepresenting the results of the survey is less easily dismissed. Nattrass acknowledges that the result of her 'exploratory regressions' is that attitudes are more important as predictors of the decision to study biological sciences, rather than 'the crude indicator of being a black South African' (cf. Table 2 and p.12 of the 'commentary'). Yet, Nattrass concludes with the exact opposite of this. The regression model shows, *very clearly,* that the predictive power BSA (a race-category) diminished as the attitudinal variables entered the regression model. By the time the fourth attitudinal variable was introduced into the model, the predictive power of BSA race-category had declined from a minus 17 per cent to a minus zero per cent. When the race category variable was dropped entirely from the model, the attitudinal variables retained their predictive power: no change was registered in their coefficients.

The pressing question to ask the author is this: if being a BSA student is less or not a predictor of whether one considered studying (zoology or) biological sciences, what is the purpose of the title of the paper? Given the low or no predictive power of race-category in the model, 'Are black South African students likely to consider studying biological sciences?' would have been a more appropriate title. In such a case, the answer would then have been in the negative: a definite 'No'.

The same diminished predictive power of the race-category of 'black South Africans' is evident in the regression model reported in Table 3 of the commentary: to explain the probability of supporting 'wildlife conservation but hav[ing] no interest in pursuing a career in it.' By the time the three attitudinal variables (including the so-called 'anti-conservation index') were added to the regression, the predictive power of the BSA race-category declined from 16 per cent to 3 per cent; even the 16 per cent was only significant at 5 per

cent probability. Interestingly, the regression model suggests that if you like having the starlings around at UCT, you are 28 per cent *less likely* to say that you support 'wildlife conservation but have no interest in pursuing a career in it.' Either way, attitudinal dispositions not race-category rule the day!

Race-based explanations by any means

Even with the low predictive power of race-category in the model, lurking under the cover are race-based explanations. This plays out in two ways. The first concerns the pattern of attitudinal disposition ascribed to the BSA variable. The variable may not be a good predictor, but the attitudes that are the predictors are racially ascribed. The black South African students in the sample are presented as less likely to agree that humans evolved from apes than the 'Other students.' The BSA students are less likely to like having the redwing 'starlings around at UCT.' They are more likely to agree to the statement that 'I support wildlife conservation but have no interest in having a career in it.' All these are statistically significant in the Fisher's Exact Test results that the author presents. Race explanation remains; only that they are disguised as attitudes.

Despite the diminished (or non-existing) explanatory power of race-category in the model, which Nattrass conceded, nonetheless, she insists that:

> *In short, the survey results suggest that black South African students are less likely to consider studying biological sciences than other students, and that this stance was linked primarily with career aspirations... and these were associated with materialist values and attitudes to local wildlife* (p.13).

No, they do not. Such 'result' is a thumb-suck. She suggests that BSA students are more likely to opt for degrees in accountancy and law because these are better paying. This is intended to underpin the claim of a materialist disposition among black South Africans. No evidence exists in the study to support this claim; no authority offered, and the study offers no such insight.

The correct, and ethically sound, interpretation of the regression statistics that Nattrass presents in Tables 2 and 3 is that ***regardless of the race categories of the respondents,*** the attitudinal variables are better predictors of whether a student considered studying conservation biology. But even with the descriptive statistics presented in Table 1, Nattrass ought to have known that Fisher's Exact Test results are for *descriptive* statistics. The results of the regression model that render the author's conclusions absurd are *inferential statistics.* Descriptive statistics merely describe the distribution of the sample (within a given confidence interval). Predictions and inferences are better, based on inferential statistics.

For a non-probability survey, Nattrass goes ahead to make generalisations that ignore the non-probability design of the study. A simple rule of quantitative research is this: never make claims about your research that it was never designed to carry. Nattrass' 'commentary' breached these simple rules of sample survey studies. She generalised from the sample not only to the study population (about BSA students at UCT) but to the study universe (about BSAs in South Africa beyond UCT).

Even so, these are all moot points. A poorly designed study will, in all probability, produce bad data. No amount of regression or other inferential statistics can fix that foundational problem. The aphorism, in statistical analysis, of 'garbage in, garbage out' would apply.

There are more minor issues to raise with the study. First, the study reduced 'biological sciences' to conservation biology. 'Biological sciences is the study of life and living organisms, their life cycles, adaptations and environment. There are many different areas of study under the umbrella of biological sciences, including biochemistry, microbiology and evolutionary biology.'[2] How many BSA

students at the university and other universities in South Africa are studying other biological sciences, other than conservation biology and wildlife?

The second issue concerns data aggregation. From the reporting of the regressions for the composite index used in Table 3 of the 'commentary', one gets the impression that the questions in the survey instrument were in the form of a Likert scale. However, the reporting on Table 1 involves a binary or categorical 'Agree' or 'Disagree' rather than the fuzzy set disposition of a Likert scale. Otherwise, it is difficult to see why Nattrass reports Fisher's Exact Test results. This is not a pedantic concern since what it does is to elide the more nuanced differences between someone who indicates a preference for 'disagree' as against 'agree', compared to others who expressed a preference for 'strongly disagree' against those who chose 'strongly agree.' The 'distance' between the former respondents is much less than the distance between the latter respondents. That precisely is the value of a Likert scale. Further, what happened to the respondents who selected 'Neutral' as their preferred answer? Keeping the data in the original Likert scale form in which it was collected would not prevent getting a robust descriptive statistics result; that is what Exact Tests modules are intended to do, beyond the Fisher's Exact Test. The Exact Tests modules are available in the major statistical packages: SAS, Stata or SPSS.

Presuppositions, Prejudice, and *Ontological Disconnect*

A scientific study cannot (and should not) be rejected purely on the ground that the result offends a segment of the population, even one with a population share of 80 per cent. A predictable response to such rejection (on the ground that it offends) is 'Don't shoot the messenger.' *But what if the messenger is the message?* A study may be rejected based on the prejudiced presuppositions that underpin it, especially the deployment of racially charged tropes. As Chinua Achebe notes concerning Joseph Conrad's *The Heart of Darkness*, 'travellers with closed minds can tell us little except about themselves.'[3] The Nattrass paper is shot through with presuppositions that are products of prejudice rather than science.

Beyond the disadvantage imposed by relatively weak schools, Nattrass suggests that BSA students' choice of degree subjects is 'likely to be [for] other reasons too, notably materialist values and aspirations.' This underlining assumption is made without any evidence, and no authority cited. The presupposition—something previously enunciated by Nattrass[4]—is that 'crass materialism' characterises black South Africans in the post-apartheid South Africa. By Black South Africans, Nattrass means '(Black) Africans' in contemporary South African population categorisation or the 'Bantu' in the apartheid classification. It is worth noting that Nattrass homogenises all BSA students, as coming from a poor socio-economic background. Choosing to follow a profession in law or accountancy, Nattrass suggests, is indicative of such materialist disposition.

As of January 2019, there were 27 223 attorneys in South Africa. Fifty-six per cent are 'White attorneys', and 44 per cent are 'Black attorneys (African, Coloured and Indian).'[5] That is against a national population share of 7.9 per cent White, and 92.1 per cent Blacks (Black African: 80.7, Coloured: 8.8 per cent, Indian/Asian: 2.6 per cent).[6] The distribution of Chartered Accountants in South Africa is even more skewed. As of May 2020, 46 841 Chartered Accountants were on the register of the South African Institute of Chartered Accountants. Of these, 68.63 per cent were White (32 151), and 31.37 per cent Black (14 306). There were 6 670 Black Africans CAs or 14.23 per cent of the total number of CAs in South Africa; 1 904 or 4.06 per cent were Coloured; and 5 732 or 12, 23 per cent were Indian/Asians.[7]

Given the distributions in the legal and accounting professions, how is the decision of a Black (African) student to study law or accountancy considered 'materialistic'? Would a White student who decides to study law or

accountancy have been labelled 'materialistic'?

I once heard a dean at a Faculty Board meeting say that as far as transformation is concerned, he is 'a minimum compliance person.' Is labelling Black (African) students going into the legal and accountancy profession materialistic driven by similar disposition? Is this the subversion, by other means, of a country's effort to overcome the prevailing legacy of its racist past? Consider a hypothetical situation where ALL 'black South African' students take to heart Nattrass' subliminal injunction not to be 'materialistic'—by not going into law and accountancy—would that not render permanent the apartheid footprint on the professions? As the saying goes, there are many ways to skin the cat called transformation.

In reporting the survey results, Nattrass' analysis takes a curious turn. She constructs what she calls 'an anti-conservation index' or a *Fallist* index! (More about this below). The 'anti-conservation index' is a composite measure drawn from three questions. The questions include whether national parks should be scrapped, to whether disciplines like conservation biology are colonial and should be scrapped, and whether the respondents like having the redwing starlings on the UCT campus.

Nattrass links the 'materialist index' to the World Values Survey. She claims that the twelve questions used in the World Values Survey as composites for the materialist index were included in the UCT survey. The distribution for the variables was *not* presented in the table that reports the descriptive statistics. Most significantly, the materialist index drawn from the World Values Survey has nothing to do with whether a respondent was studying accountancy or law. There is no evidence that the survey included a question of whether a student was studying accountancy or law. The 'anti-conservation index' and the 'materialist index' are attitudinal measures. ***These attitudes are held by BSA and OS respondents in the study.*** Yet, in the conclusion, Nattrass reverts to a student's choice of professions (law or accountancy?). 'Materialist values' are presented as 'a key determinant of not desiring a career in conservation' (p.13).[1] The conclusions drawn concerning 'materialist values of the BSA students is neither consistent nor derived from the study; it would seem that they derive from the author's predisposition rather than science.

In the regression analysis on Table 3, the predictive power of the 'materialist index' is only 5 per cent (Regression 3.3. and 3.4); same as the 'anti-conservation index'. This is against a 28 per cent predictive power of the variable about a preference for having the redwing starlings around the UCT campus. The predictive power of the BSA race-category dropped from 16 per cent to 3 per cent. The question that follows is a simple one: Why emphasise the 'anti-conservation', 'materialist' values rather than whether one likes having redwing starlings on the campus? Why resort to the claim that the career aspiration of BSA students hinders their preference for studying biological sciences, when the attitudinal variables, ***regardless of race-categories***, have higher predictive powers?

Concerning the index based on the World Values Survey, citing Inglehart (1990) Held *et al.* (2009: 57) distinguished materialists from post-materialists thus: 'materialists [are mostly concerned] with physiological needs and stress physical and economic security… Post-materialists, by contrast, strive for self-actualisation, stress the aesthetic and the intellectual, and cherish belonging and esteem.'[8] How does taking up a career in conservation translate into being post-materialist?

Conservation is big business in South Africa.[9] In 2015 alone, the value of wildlife hunting value chain was R10.1 billion.[9] The hunting component of the value chain was valued at R5.1 billion. Trophy hunting of kudu alone was valued at R1.2 million, at R13 000 per head of the animal killed for trophy.[9] In the same year, a lion was sold for R230 000; the average price of a buffalo was R334 841 — eighty-four buf-

faloes were sold that year.[9] There are no halos waiting to be placed, *ipso facto,* on the heads of people in the industry. There are decent people concerned with protecting animals, habitats, and fauna. But there are those who operate the canned hunting business; some breed lions to be slaughtered. You could argue that those involved in the business are more concerned with economic security needs than 'self-actualisation.' What more, trophy hunting involves the needless slaughter of wildlife for the hunter's self-amusement.

What would have happened if Nattrass took into consideration the fact that her data shows that 89.4 per cent of the BSA students in the survey disagree with the statement 'that many of South Africa's national parks should be scrapped and the land given to the poor' (against 94.7 per cent of 'Other students')? Other than a problematic hook on which the author seeks to hang prejudice, it is difficult to see how not wanting to pursue a career in conservation translates into being 'materialist', and then proceeding to hang this on the neck of the BSA students. The issue of absent self-reflexivity raised earlier applies. Does Achebe's aphorism offer some insight?

As a penultimate issue in this section, let us return to the so-called Fallist index. Regressions 3.3 and 3.4 in the 'commentary' involve what the author refers to as the ''anti-conservation' (or 'Fallist')' index. Nattrass' claim that 'disciplines like conservation biology are colonial and should be scrapped from UCT' are Fallist positions or opinions. She offers no evidence that this is the case or that there is such an opinion that was issued by the 'Fallist movement.' Indeed, is there a Fallist opinion, in the singular, that 'conservation biology' is colonial and should be scrapped from UCT? If there is something about the Fallist movement, it is the absence of a central authority that would purport to speak for everyone involved in the protests. Indeed, you could argue that while the Rhodes Must Fall phase of the movement was driven by the poor record of transformation (epistemic and cultural Euro-centricism) of their respective universities, the prohibitively high university fees served as the driving force behind the Fees Must Fall phase. One phase highlighted epistemic and cultural barriers: the other the economic barrier.

The impression that emerges from the 'commentary' is of a researcher with a deep-seated antipathy towards the Fallist movement. Such aversion may be legitimate as points of difference. It is problematic when it corrodes the scientific endeavour. The troubling part is that Nattrass seeks to render as irrational important conversations that the South African education system (not just the higher education sector) needs to have and act upon. It is legitimate to object to some of the methods employed in the campaigns that defined the protest movements without demonising the demands or rendering the demands themselves irrational. The Fallist index would seem more a product of prejudice than a legitimate effort in pursuing a scientific inquiry.

Further, one suspects a second layer of presupposition in the author's argument (possibly in the research instrument, as well): the false belief that 'Africans don't do conservation'; that conservation is alien to Africa. The larger argument is not so much about conservation, *per se*, but the modality of conservation. If you dispossess people of their lands and sources of livelihood to create a wildlife reserve for (European and American) tourists, those dispossessed have a right to question your idea of conservation. Thandika Mkandawire once referred to the 'eco-fascism' of those who demand nature reserves at the expense of the welfare of African people.[10] If you have no ontological link to such land dispossession, you would see the conservation area but not its origin and persisting consequences. This is a classic case of ***ontological disconnect***—a disconnection from, and a lack of empathy for, the bearers of a collective memory of dispossession and who inhabit its aftermath. It is legitimate to argue that mass extinction of biological species, wanton depletion of wildlife, trophy hunting, and canned hunting are as colonial as one can imagine, and a marker of racial capitalism.

In lieu of a conclusion

The discussion above has sought to raise three distinct issues with Nattrass' commentary. First is the methodological deficiencies in the study design. Second is the dissonance between the results of the regression models in the commentary and the conclusions that Nattrass drew. The third is the extent of the corrosive effects of the author's presuppositions and prejudice on the premise and reporting of the study.

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Academics have a duty to exercise responsible scholarship

Academics who indulge in irresponsible scholarship, publish their results and are then called out publicly should not hide under the banner of academic freedom and freedom of scholarship.

The Issue

The issue concerns a professor at the University of Cape Town, Nicoli Nattrass, who published a two page commentary entitled 'Why are black South African students less likely to consider studying biological sciences?' The commentary was published by the South African Journal of Science (SAJS) in its May/June 2020 edition.

Public Reaction

Against Nattrass' commentary

The paper was met with widespread condemnation from diverse quarters on social media. The Black Academic Caucus (BAC) accused Nattrass of publishing research that was offensive to black people and accused her of being racist and publishing the research to further her white supremacist intentions.

Further criticisms were that

- the paper generalised to all black students in South Africa from a non-representative sample of only 114 black students who were opportunistically interviewed at the UCT campus.
- the paper 'was constructed on unexamined assumptions about what black people think, feel, aspire to and are capable of'; and that
- the paper 'had methodological and conceptual flaws that raise questions about the standard and ethics of research at UCT'.

As a result, UCT distanced itself from the content of the paper which it regarded as unethical and racist (not in those words, but the implication was clear) and referred paper to its ethics committee for investigation.

For Nattrass' commentary

There was support for Nattrass as well. The support centred around ideas of academic freedom, political correctness and censorship: apparently, UCT was dangerously close to stifling academic freedom and committing censorship. Further, Nattrass had somehow discovered a 'scientific truth' and this scientific truth was not politically palatable for the majority and hence the outcry. The hurt feelings of the majority could not justify the censoring of a scientific paper that told the truth.

Nattrass' reaction

Nattrass dismissed the allegations and asserted that:

- the paper had been cleared by UCT executives.
- the paper was relevant as it spoke to transformation at the University.
- UCT had caved into pressure from student activists and Black Academic Caucus; and that
- the criticism was also due to her being white.

My considered take

I read the paper and a few things stick out that suggest a flawed and problematic research. Firstly, I notice that her paper is a commentary and according to the guidelines of the South African Journal of Science, commentaries do not require a peer review process. So I can reasonably assume that her 2 pager commentary was not subjected to a peer review process. Perhaps, if this had been done some aspects of her commentary might have been revised.

Now my own personal issues with the commentary.

(1) Transformation is a minefield

Nattrass ought to have exercised additional care in framing her research problem. The framing of the problem as an issue of black agency [Why are black people less likely to study X… <for all intents and purposes you can replace X with anything you like>] will obviously result in prescriptions, speculations and solutions that imply knowledge and assumptions about black people; which assumptions she does not have; and which assumptions no one has.

As an expected consequence, Nattrass wades headlong into a morass of cultural speculations when she posits that the answer to her research problem is intricately tied to cultural factors:

- black people not having experience with the companionship that comes with pet ownership.
- black people having problematic attitudes towards wildlife; and
- black people are driven by materialistic considerations.

But none of these assumptions about black people have been tested before. And if they have, then an appropriate citation would have been helpful to avoid the specific accusation of basing her research on untested assumptions about black people.

Furthermore, from the nature of the title alone (a highly triggered minefield), Nattrass should have anticipated this accusation of unbridled cultural bias and pre-empted it by either making an explicit delimitation comment or by referencing to relevant studies. The consequence of this failure is that Nattrass appears irretrievably mired in cultural bias. And for a researcher this is fatal to the results.

I personally found this unjustified assumption-waving quite problematic — the assumptions were somewhat racist (I am the absolute last to whip out the race card in most situations) and I took some offence. I was born in a family that included five dogs, and grew up with the dogs as pets, companions and protectors. Further, I grew up in the rural areas, in the bush, and was much more in touch with wildlife than almost all suburban white people will ever be, whose physical experience with wild life is typically limited to annual holidays to Kruger National Park, for example.

Most black people I know have similar experiences. So just because black people don't usually jog with their dogs does not suggest that pets are invisible in the black family. And just because most urban black people live in townhouses which have strict rules on pet ownership doesn't mean black people know zilch about pets. And black people in townships have pets too. They may not sleep in the house on the bed but they are there.

Is pet ownership now the next racial frontier? Should I argue that the reason white people are so visibly obsessed with pet ownership as opposed to real world issues is that for them

the ranking order is : (1) them, white people (2) their pets (3) everything else? Is this where the conversation ought to go?

The comment about the unfavourable black attitudes towards wildlife is so nonsensical, I will not spare it any further thought at this stage.

(2) The fact that she is white is a factor in the criticism

OF COURSE! Just as much as my blackness has a lot to do with how I interpret her research — motivations, methodology and results. There is no such thing as a value-free, objective researcher and certainly there is no objective reader too. And for this reason (mostly), transformation is a minefield that needs to be approached with care but not avoided.

I am surprised that Nattrass does not see this. Perhaps she has spent too much time in the ivory towers of academia in Cape Town with its dog running white folk on the sea-point promenade that she is out of touch. Her whiteness is very much a factor in how she frames her problem and in how she interprets her results.

Her comments about pet ownership, attitude towards wildlife is her whiteness talking very loudly. I do not hear the voice of a researcher reviewing her results carefully and dispassionately extrapolating probable causes from her data. Just where is the link between pet ownership and studying biological sciences at university?

The link between owning a pet and studying biological sciences is tenuous at best and is a general non sequitur. Question: if my family does not own a car, am I unlikely to study engineering? Conversely, if my family owns lots of cars, am I likely to study engineering? Playing along with this line of questioning, if in my village the nearest clinic is half a day's walk away, am I unlikely to study medicine?

The fact is pet ownership and attitudes towards wildlife are cultural and value issues and Nattrass should have steered clear of those and not indulged in problematic speculations as possible solutions worth researching further. As it is she sounds very condescending when she talks about pets, wildlife and black people preferring higher paying jobs (who doesn't? I could do with a higher paying job!).

Further, her being white and studying why black people behave in a certain way and then telling them hey this is what I have found out about you and let me explain it to you is an additional problematic that reeks of white privilege through and through. Why does she, as a white person, feel she has to explicitly study us black people, the choices we make, why we decide what we decide, and why we want what we want out of life?

If, as she says, the study was about transformation at the university then it would have been ideal to approach the subject from an institutional, demand side perspective.

(3) Framing the problem

Transformation issues are institutional and if people behave in a certain way in an environment that lacks transformation, it is because they moderate their behaviours in response to the problematic institutional frameworks. So rather than frame the problem as an issue of black agency rooted in cultural and value issues (high paying job vs the low paying jobs vs love for animals vs pet ownership vs belief in evolution), the research problem would have been more interesting if it had investigated the problem from the demand side.

Nattrass looked at the problem from the supply side: supply of students to the biological sciences department and sought to understand why the quantity of supply is low. From the demand side, we would want to know who are the potential employers for graduates in biological studies? The demographics of these employers, their geographical location, et cetera. What are the requirements for the biological sciences degree programme. What is the throughput at the faculty? How many enrol, how many drop

out and why? These are some of the pertinent institutional questions that arise from a demand side approach to the problem.

In other words, a focus on the institutional aspects has a greater scope for useful insights for solutions than to focus on why black people behave the way they do. Black people are not monolithic but the factors that hold us back are structural and therefore are monolithic in aspect, so why not study those? Nattrass' problem is solely not about the qualitative aspects of enrolment but it is also about student cohort profiles: who completes, who doesn't and why?

Finally, a more effective title would have been along the lines 'why are enrolment figures of black South African students in biological sciences significantly lower than….'. This framing then points to institutions as the starting point of the research. Thus same problem, but different questions and therefore different answers.

Further thoughts

So this is what I find are the serious flaws with Nattrass' commentary.

Let me emphasise that I am all for academic freedom and freedom of scholarship. But these two noble ideas are not a cover for irresponsible scholarship that adds no additional insights to the important topic of transformation. From her commentary, I am not exactly clear what the possible solutions are to increasing black student enrolment in biological sciences. More pet ownership? More holidays at Kruger National Park? Should we start jogging with our dogs? Let them sleep on our beds?

Judging from her publication record, Professor Nattrass seems to be a researcher of considerable productivity and repute. This time, however, I believe she got it wrong and should have been a bit more circumspect and given herself time to fully develop her paper, publish it as a journal article rather than as a commentary. This way, her article would have been subjected to the normal, applicable peer review process. Likewise, the editor of the journal should have been cautious enough, given the title of the research alone, to subject the commentary to a peer review process. A long published record does not mean that a researcher's next output is beyond reproach.

To be fair and charitable, Nattrass is onto something with her commentary but unfortunately she is asking the wrong question. For, the problem we want solved is why the throughput of black students, appropriately defined, in the biological sciences is low. Why is it that, say, if 100 black students enrol only 30 graduate with their bachelors and only 5 proceed to post graduate studies, and yet when 30 white students enrol, 25 graduate with their bachelors and 20 go on to postgraduate studies? I am just assuming for example that this is the fundamental problem.

I am by no means stroking white peoples' egos here and giving them gratuitous props but unfortunately statistics do show that local white students tend to proceed to postgraduate studies in greater proportions than local black students with the result that most black postgraduate students at our universities are from the greater African continent. Incidentally, this is the umbrella problem to which Prof Nattrass' is a sub-problem.

Transformation is an important issue in South Africa and it cannot be that twenty six years into democracy we are still locked in transformation mode. We need to solve these transformation issues and move on to bigger and greater things in the developmental trajectory of the country. Nattrass has an opportunity to contribute to the solution.

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Black – and not offended

Universities, a leading South African academic once noted, are places of discomfort, testing boundaries, posing uncomfortable questions, challenging received truths. It is only natural that some will feel offended, occasionally, by the questions intellectuals ask. It is not that academic etiquette and basic ethical standards have been dispensed with in the formulation of such questions—only that questions, as interpretive acts in themselves, are bound to ruffle feathers. But when a question does cause upset, this does not relieve academics of the duty to respond on the basis of factual and rational analysis. Unfortunately, some of the responses to the recent commentary published by Nicoli Nattrass[1] fall short in this regard.

To begin with, initial statements by those who were 'offended' by the commentary in question did not elaborate on their reasons for feeling offended. For instance, the UCT Faculty of Science distanced itself from the commentary, stating that 'the article makes disturbing assumptions about all black South African students, including those in the Department of Biological Sciences and the Faculty of Science at UCT'[2]—without providing any indication what those assumptions were. In several media statements, parties who disagreed with the commentary cited 'assumptions'[3] made by Nattrass, presumably referring to her 'materialist index.'

While Nattrass does not explain the research process in detail, it is evident from the analysis that the survey respondents selected their own answers to the questions that were used to derive this particular variable. In what way, then, can this be 'offensive' if the regression analysis was based on the participants' own responses? The 'materialist' variable in the analysis in no way constitutes an 'assumption.' To be sure, this much is true of all the variables used in the statistical analysis.

This does not suggest, however, that Nattrass's commentary is beyond critique. The survey is described by the author as 'opportunistic'[4] and does not represent the UCT student population—let alone a more appropriate national black student population. It is entirely correct, therefore, that a survey of this nature cannot be used to infer anything about the population, although this fact does not invalidate participants' responses to the survey itself. As for the primary research question of the commentary, one might argue that the correct target group to survey would be students who are considering tertiary education in the future. Indeed, students already at university are likely to have adjusted their views on the topic as universities invariably influence their thinking over time. At risk of belaboring the point, there are several limitations in this commentary—some of which Nattrass identifies herself—but what remains to be explained is why they should have resulted in so much offense being taken.

Doubtless, the so-called 'politics of representation' is one important factor. Nowadays, it is considered politically incorrect to speak on behalf of oppressed groups if one is not from such a group oneself. Nattrass must surely know this. But what kind of world would we be settling for if white people restrained themselves from speaking out against racism on the grounds that they were not black? Or citizens of the world refusing to condemn the oppression of Rohingya Muslims if they were not themselves Rohingya Muslims? Apartheid would surely not have ended in 1994 if non-South Africans from around the world had not pressured their governments into isolating the racist regime.

And what exactly is so 'offensive' to the UCT executive and the Black Academic Caucus about claiming that some black South Africans want to pursue financially lucrative professions? Taken at face value, the censorious response of these two groupings suggests the workings of a reversal in which, perversely, they do not want the academic community to see the connection between poverty and material aspiration. Or perhaps they question their own aspirations in a white-dominated environment.

Nattrass has been hauled over the coals for allegedly perpetrating stereotypes about 'black people in general.'[5] But what kind of stereotype is the UCT executive and BAC perpetuating about 'black people in general' with their claim that we are all 'offended?' Are they not creating the disturbing impression that 'black people in general' are too sensitive to engage in scholarly debate when the topic under discussion is close to home? As two black academics, the UCT executive and BAC does not speak on our behalf—and we can only hope that other senior black intellectuals who are expressing their disquiet in private, will speak out in public and do what professors are meant to do: profess.

This does bring us, however, to one final, equally troubling matter. With the present debate playing out furiously in the media, what does this reveal about the academic process itself? Evidently, the ivory tower is not what it used to be. It is significant that intellectuals now see fit to take their first responses to news outlets rather than academic journals. If Nattrass's commentary were so ill-informed, it should have been coolly dismantled in the pages of the South African Journal of Science. That is, after all, why academic journals are established in the first place. Unfortunately, if the current furor is anything to go by, then the 'outrage porn' so typical of social media has clearly begun to infiltrate the academic project. And that is a prospect that should concern us all.

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Misinterpretation of why black students do not pursue studies in the biological sciences

We contest the findings and methodology of the recently published commentary (Nattrass N., S Afr J Sci. 2020; 116(5/6), Art. #7864). We echo the many previous voices and calls for concern over the tenuous methodology and unsubstantiated 'conclusions' of this commentary. Below we provide specific details about each of the instances where this commentary is technically unsound.

General premise

The premise of the commentary is itself flawed. Biology students in other universities reflect the racial profile of the country. For instance, data from our own institution indicate that black student enrolment in the biological sciences has nearly doubled in the last decade (from ~640 students in 2010 to 1150 students in 2020), while other groups' enrolment has remained constant. Consequently, the assumption in the title: that black students are not choosing biological sciences is not valid.

Data collection

The data collection was conducted in an opportunistic manner, not randomly. Random sampling is a necessity to exclude bias in this kind of study. As a result, the statistical methods used were not appropriate, since they assume randomness: for instance, it is not appropriate to calculate exact P-values with a non-random sample. Thus, to claim a representative sample was taken is unsubstantiated, and the conclusions drawn cannot be validly reached. It is further an unacceptably long inferential stretch to go from a small, non-random sample of UCT students to 'black students' in general.

Data analysis and interpretation

It is unclear whether the methodology was geared to test a specific hypothesis or to find a model that best fit the selected variables. The author's framing of the commentary suggests that it was meant to test the hypothesis that a number of pre-selected variables may influence a student's choice when considering studies in the biological sciences. However, as written, the analytical approach appears to use model selection, rather than test an *a priori* hypothesis. The author describes variables that appear to be sequentially added to the model before a best-fit model is selected. Instead of using *the best-fit models*, *where 'black South African' is no longer a significant variable*, the author makes inferences about each model. An appropriate approach would be to run a hypothesis test, where all variables are included (e.g., Regression 2.5 and Regression 3.4) and then interpret the relative importance of each variable within this chosen set of variables.

We wish to highlight that if a model selection approach was used, the variable 'black South African' effectively disappears as a significant variable in the models discussed. Accordingly, there are a number of potential flaws in the 'data analysis' that are worth highlighting. First, for the full, best-fit models, most of the R^2 values are low (pseudo-R^2 < 0.21; Regression 2.5 and Regression 3.4). When 'black South African' is included alone as a variable, the R^2 values for both Regression 2.1 and Regression 3.1 are below 0.025. We recognise that low R^2 values do not mean there is no relationship between the dependent and independent variables, since this must be judged also in the light of the sample size. Nevertheless, the extremely low values reported suggest there is considerable variation not explained in the single variable models. Therefore, other variables not included are likely to be far more important independent variables.

Further, the variable that makes the largest contribution to explaining variability in the Regression 2 is 'Agrees 'I support wildlife conservation but have no interest in having a career in it''. At this point, the variable 'black South African' is far from significant and no interaction effect is shown to support that these are linked to the dependent variable. The same outcome is apparent when additional variables are added to Regression 2 and Regression 3. Once extra independent variables are added to the regression, 'black South African' is no longer a significant independent variable. Moreover, and importantly, **the links between the variables 'black South African' and 'materialist values' are not supported by the data presented**. Table 1 shows Fisher's exact tests for several variables, but it does not include materialist values. Regression 3 shows no significance for the variable 'black South African' when the materialist index is included in the regression.

The author acknowledges that the variable 'black South African' is not significant when values and attitude are added into the regressions: '*Regression 2.3 includes whether the respondent agreed with the statement 'I support wildlife conservation but have no interest in having a career in it'. This turned out to be the largest single determinant of whether a student considered studying biological sciences or not. Importantly, including it rendered the other variables statistically insignificant. The variable 'black South African' remained statistically insignificant in Regressions 2.3, 2.4 and 2.5, and when dropped (Regression 2.6) the model improves*' (Nattrass 2020, p1) and elsewhere. Despite the data not supporting 'black South African' as a significant variable in the dataset, the author still includes statements regarding black South African students being associated with materialist values and negative attitudes towards wildlife (Nattrass 2020, p2). As such, these 'conclusions' are flawed, due to either missing or misinterpretation of the data.

Additionally, the findings of Loubser (2018), one of three cited works in the commentary, appear to contradict the finding that black South Africans may have a negative attitude towards the environment (see Loubser 2018, p23). There are possible flaws in this line of questioning too. For instance, many environmental protection activities have the potential to create win-win scenarios, such as increasing economic value and protecting the environment (e.g., clearing alien invasive plants increases water yields, while restoring native species). However, the simple line of questioning used in Loubser (2018) suggested that black South Africans are more likely to support economically costly environmental protection than other racial groups in South Africa. This suggests that black South Africans in this study favoured the protection of the environment over materialist values and contradicts the 'conclusions' of the commentary but this was not emphasised or acknowledged.

Ethical issues

The commentary appears to violate the South African Journal of Science's (SAJS) ethics policy

which states that ALL submissions and reported research conducted on people must be approved by an institutional ethics committee and such approval must be included in the methods section. This commentary qualifies as a submission that is reporting 'research' and 'data' collected and analysed by the author. As such, this commentary should be held to the ethical standards set out by the journal itself. It is unclear from the publication whether this study received the necessary ethics approval as this information was excluded from the commentary. The study should have had ethics clearance based on policies that all South African universities and SAJS subscribe to and such clearance should have been included with the commentary per the journal policy. We note that academic freedom or freedom of expression has its limits. Its limits begin where unjustified claims and flawed assumptions and conclusions are made which may continue stereotyping black people in an offensive way. Academic freedom does not free SAJS broadly from upholding ethical standards for any published pieces.

Conclusion

We stress that the 'conclusions' of this commentary are unsubstantiated by the data presented, and therefore baseless. Publishing it in the SAJS gives legitimacy to the 'findings' and sets back any meaningful debate on how we continue the work of transforming our society in general and academia in particular.

We respect the journal's freedom to publish opinion pieces, but we are concerned that a study that is actually a piece of experimental work should be masquerading as an opinion, and therefore evading the thorough peer-review that a journal of SAJS's standing must adhere to. The technically flawed data and analysis gives the 'opinion' an undeserved weight. Even though it appears in a commentary section, a non-expert would infer that this work has been through peer review and is held to the same high standards of other SAJS publications. In this case, the conclusions drawn could serve to promote ideological assumptions that are deeply rooted in a racialised and racist history. There is a plausible risk that the commentary could be used to further bolster racist arguments, racial in-sensitivity, used in a manner to perpetuate harmful racist stereotypes, and devalue efforts to diversify the fields of science, technology, engineering, and mathematics (STEM). 'Scientific racism' has been used in the past to justify racist policies like apartheid and to make an argument about the inferiority of black students/learners and indigenous people.

We sincerely hope that the SAJS Editorial board considers the loss of integrity that such a flawed commentary brings to a publication supported by the Academy of Science of South Africa, specifically at a time when South Africa needs everyone, especially academics, to work towards inclusivity within STEM fields.

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A question worth asking

The relative lack of black South African students registered for senior undergraduate and postgraduate courses in Biological Sciences, has long been an issue and remains an issue at the University of Cape Town (UCT). For example, the Honours and taught Masters courses in biological sciences have only a handful of black South Africans registered this year (2020). Research institutes are required to report on the numbers of black South African postgraduate students they are training, and transformation is a key component of a successful review. No-one has previously investigated the underlying reasons for the low numbers of black South African students doing Biological Science Honours and Masters courses at UCT including the highly acclaimed Conservation Biology course. I was Head of a Department in Biological Sciences for nearly a decade in the 2000s and I, like all other Heads before and after me have also failed to understand this issue from the prospective student's perspective. There has been plenty of speculation on these matters but neither I nor anyone else in my department considered running the kind of exploratory survey that Prof Nattrass[1] ran last year.

This issue is not unique to conservation studies at UCT. The relatively low numbers of black scholars in conservation science is observable at local and international conferences. I saw this at an International Conservation Congress in France (ATBC 2016). The field of evolution in particular is known for its failure to attract significant numbers of black scholars. Graves (2019)[2] considered higher levels of religiosity, lack of role models, biological racism, institutional racism and getting into medical school as explanations for this problem in the USA. That black people are under-represented in some fields within the biological sciences is a real, contemporary and global problem, not only a UCT problem. The objective of the Commentary by Prof Nattrass[1] is thus to be welcomed. It has started a much-needed discussion on transformation, and I hope this conversation can be more solution oriented over time.

I'm not familiar with the survey methodology but to me, neither the hypotheses nor the interpretation of the results was racist. By my reading of the Commentary, the key take-home message is that socio-economic considerations are the most important (middle-class materialism provides relief from familial financial obligations, access to good schooling, pets, Kruger Park holidays) not race.

Whatever one scored on the survey questions is not on its own correct, relevant, good or bad. Take materialism (worked out on a standard global scale using many questions); who says being a materialist is bad – and try telling that to the huge UCT classes in Business Science/Commerce or to the rich or the poor. Who says being a materialist is even bad for conservation (many rich people have made tremendous financial contributions)? Who says liking red-wing starlings is good (on what scale, for what)? Who says

having a pet is good/admirable? Who says fallism is good or bad? The survey questions did not have right and wrong answers.

Science starts with exploratory hypotheses and correlations. Prof Nattrass[1] has provided a few and has given her interpretation. Is she biased? Of course, everyone is. She has laid out her bias (the questions she thought might differentiate those thinking about studying conservation versus those not and her interpretation of these results). Could other survey questions be added, could the questions be improved? Of course! The Commentary calls for further research and other researchers should take up the challenge. They could do their own study, add new questions based on their own biases or hypotheses, write it up and importantly see if they are better predictors than those in Nattrass[1] and finally, take what scientific response comes their way.

I am a biologist, not a social scientist so I cannot comment on whether Nattrass's exploratory research was good enough (i.e. were good question spoiled by poor analysis, or was the analysis fundamentally limited by the failure to include other data, for example about student household income?). I don't know, but I think a scientific reply is what is needed, not the condemnation we have seen on email/twitter/web pages. Could Nattrass have used kinder (or more tactful) words in her Commentary? Possibly, but it is not obvious to me where, and besides space/brevity is an issue in science journals. Could she have explained the background thinking behind her hypotheses more carefully? Probably, though again, I presume she was constrained by the space limitations of a Commentary and I look forward to her response(s) to the letters proposed in the special edition. Even so, with regard to one of the most controversial aspects of her Commentary – the inclusion of the World Values Survey materialist index, Nattrass provided three references providing useful context in this regard. In the same volume of the South African Journal of Science is a study on bone sizes of black South Africans in comparison to other racial groups here and elsewhere[3]. One context for this paper was our high crime rate[3]. This paper is part of a global research effort which shows racial differences of bones. I am surprised this paper was not labelled as racist. Is comparing bone morphology across races different to comparing social or cultural values?

Other papers produced by Biological Sciences that evoke strong emotions amongst the public, students and academics are not played out in the media/email. Rather they (such as the penguin debate) are addressed through the pages of journals and workshops[4]. Therefore, opposition to this paper in the media seems to me primarily because it concerns race and values. My impression from reading some of the email strings going around UCT and from comments on social media is that the Commentary has been deemed offensive primarily because one racial group (black South African students) has been seen as being othered (through the reporting of statistical results and different scores) by a white researcher. I appreciate that most black South African students have a different lived reality to most white South African students. I also appreciate the frustration many black South Africans feel about the history of frequent othering by whites. But does othering, or at least perceived othering, make this paper racist? Not according to my understanding of racism (prejudice without data and analysis). We need to develop a better collective understanding of what racism means and we should be careful about accusing people of racism as this can have devastating effects on the people concerned and is detrimental to the quality of academic debate.

UCT is a very racialised institution. We are required to classify staff/students/committees according to racial composition, and the inclusion of black South African students and scholars on research funding applications makes a big difference to funding success. The National Research Foundation has instituted strict quotas for supporting postgraduate students based on race. Given this environment we must deal with race continuously and make generalisations, such

as why do some courses/Departments /academics have too few black South African students? People have criticised the Commentary because of its unnuanced discussion about race and generalisations about racial groups in South Africa. How then must we deal with what is race? The students interviewed in Nattrass were asked to self-classify their race very broadly (black or other). Future studies should possibly ask for a more detailed, nuanced self-classification to take the full diversity of South Africans into account but we will still need to make generalisations.

The Nattrass commentary has triggered heated arguments within the Department of Biological Sciences at UCT. Much of this debate has focused on why different readers perceive this Commentary as racist or just much needed research into a persistent problem dogged by opinions and assumptions. Why did I get involved? There were two reasons. Firstly, although I am more interested in the biology, than the social/cultural attitudes to conservation, for example the biological reasons for the declining population of the Clanwilliam Cedar (White et al 2010)[5], I know social aspects are just as important for implementation of the above kinds of conservation biological research. For example, Wilhelm-Rechmann et al. (2014)[6] looked at social/cultural factors of councilors and officials (Afrikaans, English, Coloured and Xhosa) and conservation implementation in the eastern Cape. They found that amongst other factors, eco-centricity was related to culture and that conservation is frequently interpreted as being a socially unjust endeavor, disrespectful toward people and lacking realism. This link between culture and eco-centricity is not unique to South Africa[6]. I see many parallels between this paper and Nattrass. Nattrass has taken the first step to address a long-standing, difficult but important issue in Conservation Biology education at UCT.

Secondly, in trying to understand why so many are accusing Nattrass of being racist, with debate I thought I could understand the 'this is racist, no it is not' problem. My experience in the debate has shown me that many white staff and students in Biological Sciences at UCT also feel confused about what is racism. They are concerned that whatever language and framing they use to understand and debate the issue will be construed as racist – they are thus largely silenced. We need to urgently resolve this issue, as it has cost valuable time and energy and frayed relations. Conservation is a field in crisis as we enter the Anthropocene and the 6th extinction. UCT needs diverse, highly qualified academics to train diverse postgraduate students if we are to help stem the rising loss of biodiversity while improving the lives of the poorest. To achieve this, difficult questions, including those on race and poverty will need to be asked.

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#BlackLivesMatter, even in research: A call to researchers to take a knee

South Africa, the United States, and the world are facing a new revolution, one that seeks to bring to the fore the plight of African people who have endured years of racism, slavery and unfair discrimination. In the United States, the *#BlackLivesMatter* movement has been at the forefront of voices that have raised concerns about the killing of African Americans in what is perceived as racially motivated killings. Recently, a wave of anti-racism protests spread around the world following the death of George Floyd. 'Taking a knee' has subsequently become a global symbolic gesture against racism. This gesture is associated with Martin Luther King Jr, who 'took the knee' to pray with anti-racism protesters in Selma, Alabama, in 1965[1,2].

In 2015, South African students across the nation participated in *#RhodesMustFall* and *#FeesMustFall* protests[3,4]. In these protests, students demanded, among other things, the removal of Cecil Rhodes' statue from a university campus and the Africanization of the curriculum. Hlophe[5(p1)] argues that the *#RhodesMustFall* and *#FeesMustFall* protests were actually about a need to 'close the gap between post-apartheid South Africa's principles and its reality.' As a consequence of these protests, interest in studies exploring strategies for decolonizing the curriculum has grown rapidly. In fact, 'it is not uncommon to hear speakers refer, almost casually, to the need to 'decolonize our schools,' or use 'decolonizing methods,' or 'decolonize student thinking.'[6(p2)].

However, missing in these discourses is the need to decolonize research. It would appear as though *#BlackLivesMatter* is only reserved for socio-political spaces. This apparent disconnection of science from socio-political issues is well captured by Hodson[7(p2)] who posits that 'regrettably, science is often portrayed as the de-personalized and disinterested pursuit of objective truth, independent of the society in which it is practiced and untouched by ordinary human emotions, values, and conventions.' However, García and Sharif[8] warn that racism may manifest through institutional policies and societal norms, and calls for research that is based on principles of social justice.

Racial undertones in research

In the South African context, racism and decolonization are emotive subjects given the colonial and apartheid history of the country. Nevertheless, despite this, recent research publications have raised concerns in the media regarding the extent to which researchers are sensitive to issues of racism. For example, Nattrass[9(p1)] published a commentary that sought to provide an insight into 'why do conservation biology, zoology, and the other biological sciences subjects struggle to attract black South African

students?' In this controversial paper, from which her institution, distanced itself[10], Nattrass[9(p1)] suggests that 'materialist values and aspirations (pertaining to occupation and income) as well as experience with pets and attitudes towards wildlife' may be the reason why Black students are less likely to consider studying biological sciences. Referring to the *#RhodesMustfall* and *#FeesMustFall* protests as the ''Fallists' protests', she argues that 'Given the 'Fallist' protests of 2015/2016, another possibility is that wildlife conservation itself might be regarded as colonial, and students might perceive a trade-off between social justice and conservation'[9(p1)]. De Villiers[10(p1)] reports that Nattrass' institution has since launched an investigation into 'methodological and conceptual flaws' in Nattrass' publication, which apparently is 'constructed on unexamined assumptions about what black people think, feel, aspire to, and are capable of'.

A similarly controversial paper was published in 2019, where Nieuwoudt et al. sought to assess 'the cognitive function and its association with age and education in a sample of young and middle-aged Colored South African women'[11]. These scholars made the following claims:

- 'The Colored community is, in terms of social class, considered the most homogenous group in South Africa and are generally described as a poor, lower working-class community'.[(p1)]
- Cognitive performance is impacted by several factors, including… sex, educational attainment, and ethnicity'[(p2)].
- Previous research has 'revealed lower cognitive function scores, particularly in Black African and Colored participants'[(p2)]
- Previous research has shown that 'Colored and Black African older adults achieved worse cognitive scores than White and Indian/Asian older adults'[(p10)].
- 'Having higher education, being White or Indian/Asian, increased wealth, being married and in good health was associated with improved cognitive functioning'[(p10)].

The researchers[11(p3)] state that 'all participants were informed of the purpose and procedures of the study and gave written consent to participate.' However, this is the same argument that is often submitted by the beneficiaries of Colonial settlers, who argue, to this day, that colonisation was constitutional and legal, and therefore Colonial settler beneficiaries should not return the land to the indigenous people[12]. Following a global outcry about its underlying racial undertone, Nieuwoudt et al.'s[11] paper was retracted by the journal editors.

It is noteworthy that even Dr. James D. Watson, who is heralded as a pioneer in modern genetics for his work on DNA, was called to order following his 'unsubstantiated and reckless personal opinions'[13(p1)], which suggested that Blacks were intellectually inferior to Whites[14]. Watson, who later apologized, had stated that he was 'inherently gloomy about the prospect of Africa' because 'all our social policies are based on the fact that their intelligence is the same as ours, whereas all the testing says, not really'[15(p1)]. Responding to these comments, the Cold Spring Harbor Laboratory stated that 'Dr. Watson's statements are reprehensible, unsupported by science, and in no way represent the views of CSHL, its trustees, faculty, staff, or students. The Laboratory condemns the misuse of science to justify prejudice'[13(p1)].

Asongu and Kodila-Tedika also published a controversial paper, in which they 'postulate and justify a hypothesis that countries which are endowed with higher cognitive ability are more likely to experience lower levels of slave exports probably due to relatively better abilities to organize, corporate, oversee and confront slave vendors'[16(p13)]. These researchers further state that their 'study has assumed that most types of intelligences are captured by the IQ. Hence, the reasoning-orientation and 'problem-solving' inclination underlying the IQ can be leveraged to avoid capture during slave trade'[16(p14)].

Sugar-coating decolonization

In light of the examples above, I argue that while the interest in *#BlackLivesMatter, #RhodesMustFall, #FeesMustFall*, and decolonization of the curriculum is welcomed, researchers should not ignore the complexity of racism and the concept of decolonization. As such, scholars need not be naïve to the sugar-coated narrative given to the concept of decolonization. Tuck and Yang[6(p2)] caution against 'the ease with which the language of decolonization has been superficially adopted into education and other social sciences, supplanting prior ways of talking about social justice, critical methodologies, or approaches which decenter settler perspectives.' Tuck and Yang[6(p2)] further argue that 'settler scholars swap out prior civil and human rights-based terms, seemingly to signal both an awareness of the significance of Indigenous and decolonizing theorizations of schooling and educational research, and to include Indigenous peoples on the list of considerations - as an additional special (ethnic) group or class.'

Winberg and Winberg[17(p248)] suggest that 'the process of decolonization does not reject established fundamental knowledge as the perversions of Euro-centric thought but rather looks at the nature of the curriculum and critically engages in establishing potentially different approaches to the way this knowledge is produced or applied, looking at the process of learning as a whole.' This view goes against Tuck, and Yang[6(p2)] who state that 'decolonize (a verb) and decolonization (a noun) cannot easily be grafted onto pre-existing discourses/ frameworks, even if they are critical, even if they are anti-racist, even if they are justice frameworks. The easy absorption, adoption, and transposing of decolonization is yet another form of settler appropriation'. This settler appropriation is evident in that some scholars suggest that 'educators involved in the decolonization of a curriculum should thus be mindful of implementing changes that would lead to improvement, not to degrading, the resultant curriculum'[17(p248)]. In line with Tuck and Yang's[6] views, I argue that decolonization cannot and should not be domesticated as an 'improvement' of a colonized curriculum, including colonized institutions of higher learning. Instead, it should be about deconstructing the colonized curriculum and reconstructing a new decolonized curriculum, one informed by research that is based on social justice principles.

In 2003, Nelson Mandela, a South African liberation hero, argued that 'education is the most powerful weapon you can use to change the world'[18]. In line with this, the South African education system has already undergone various curriculum reforms[19,20]. Underlying these reforms has been the need to introduce a decolonized curriculum that fosters citizenship. Citizenship education suggests that education should aim to educate children, from early childhood, to become clear-thinking and enlightened citizens who participate in the reconstruction and empowerment of the society[21]. If citizenship education is to be realized, research and curriculum designers should acknowledge and eliminate pseudo-science, which is perpetuating the narration that one race is superior to another.

According to Tuck and Gaztambide-Fernández[22], settler colonialism as a process rather than an event refers to the formation of colonies where the colonizer makes himself the arbiter of citizenship, civility, and knowing. This means decolonization of the curriculum and research would require the restoration of citizenship, civility, and knowledge back to the indigenous people. This is because colonization partly sought to 'invent man' through pseudo-science that justified the destruction of indigenous life and knowledge systems. This was done partly through a curriculum that adopted 'fort pedagogy' which is characterized by 'an insistence that everyone must be brought inside and become like the insiders, or they will be eliminated. The fort teaches us that outsiders must be either incorporated or excluded, in order for development to occur in the desired

ways'[23(p44)]. The *#BlackLivesMatter*, *#RhodesMustFall*, and *#FeesMustFall* activists are partly fighting against this 'fort pedagogy' in which African people are treated differently to others. Sadly, some research seems to promote this 'fort pedagogy' by implying that Black people are not equal to others.

Conclusion

In light of the recent anti-racism developments, therefore, I believe that institutions of higher education, including researchers, should 'take a knee' and reflect on their perceptions of racism and social justice. Researchers, including editors and reviewers, must ask themselves:

- To what extent do their research embrace social justice?
- To what extent are institutions of research using fort pedagogy, which systematically promotes the exclusion of others?

In responding to these questions, researchers cannot afford to sugar-coat the concept of decolonization, by continuing to produce research that is seen to imply that one race is better than another. It is time for researchers to take a knee, because black lives matter, even in research.

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We object to Bad Science: Poor research practices should be discouraged!

On 8 June 2020, we, a diverse group of African emerging researchers, published a response to the commentary titled 'Why are black South African students less likely to consider studying biological sciences?' (1) published in the South Africa Journal of Science (SAJS). There are mounting arguments, in both print and social media, regarding the merits of the Nattrass (2020) commentary, particularly around its strong racial undertones as well as poor and unethical research practices. Nattrass' commentary has been intensely divisive, managing to engender stereotypes, anger, and disappointment. Conflicting arguments have emerged, which involve responses by other academics, politicians, and the public, but much of the furore has been strongly biased towards and along racial lines, with very little attention directed at the flawed nature of the research. Such questions as the one asked by Nattrass (1) in the title of the commentary are valid and should be explored. Such research, in fact any research, must involve scientific rigour, robust methodological approaches, sensitivity and adherence to ethical principles. With the right approach and the involvement of multi-sector collaborators, we can begin to innovatively and constructively address the potential societal challenges that may arise. Science should be respected and trusted, and should build a fundamental basis for societal benefits and decision-making processes. Issues of race, whether socially constructed or not (2) are sensitive, and should be treated as such. When dealing with sensitive subjects, it is important to be cognizant of one's inherent unconscious biases. To drive this, scientists, editors, leaders in academia and industry, government research institutions, NGOs and publishers have taken steps to promote ethical conduct in research by signing The Singapore Statement on Research Integrity (3). The Statement was founded on four principles: *viz*. honesty, accountability, professionalism, and stewardship, which inform the fourteen responsibilities of ethical research conduct. As researchers, it is important that we use these principles and responsibilities to guide our research, and to maintain our responsibilities to each other, to the people and to the environment. For this reason, we wish to express our concern that the Nattrass (2020) commentary and the research contained therein, has violated many of these governing principles. Moreover, in publishing this commentary with all its methodological flaws and ethical problems, the South African Journal of Science (SAJS) has also violated these principles and responsibilities.

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1. Critical assessment of the research methodology employed

In our first response to this commentary, we questioned why this poorly conceived study was allowed to be published in SAJS. When exploring the methodology employed by Nattrass (2020), the Singapore principles have been considered. Accordingly, the commentary may have overlooked 3 fundamental professional responsibilities assigned to all researchers, which serve to enforce the use of integrity in research methodology. Regarding 'Research Methods (Responsibility #3): Researchers should employ appropriate research methods, base conclusions on critical analysis of the evidence and report findings and interpretations fully and objectively.'

The main finding that significantly fewer black students than 'other' students **considered studying the biological sciences** (Table 1, Nattrass 2020) is flawed, which is alarming as it forms the basis of the commentary, and may account for the interpretation of the regression models presented. Instead, closer examination of the actual data shows that when 'Other' students are placed in their respective individual races/categories, the percentage of black students could possibly be higher than each 'Other' individual race, i.e. 32.4% becomes higher than half (e.g. half white, half coloured) of 49.5% and becomes even higher when 'Other' students are divided into more of their respective individual categories. Thus, one is left to wonder about the extent and impact of variability that accounts for the data obtained from the 'Other students' groups. Indeed, the statistical analysis raises some questions as the author further affirms that 'there was a lot of variation that was left unexplored by the (regression) models'. Furthermore, the minimal nature of the data and biased sampling present a great limitation of making regressions difficult to fully explore even for the purpose of reporting preliminary findings.

It has long been discussed and demonstrated how targeted sampling is prone to determining the demographic selection and response behaviour of that select sample, leading to biased and discriminatory conclusions that might be drawn and ascribed to a population (4). The author affirms this by stating that this 'opportunistic survey… resulted in an over-sampling of black South Africans', and 'the results for the total sample are thus in no way 'representative' of UCT students.', which would in no way be representative of black South African students. This speaks to the issue of unconscious bias, which is discussed further in this rebuttal, and also highlights the sample selection bias that tends to steer data collection and interpretation towards false conclusions about different races, as previously shown (Ards et al. 1998). Various studies have demonstrated the impact of sample selection bias on the attribution of racial stereotypes and profiling, and increases the risk of assigning predetermined conclusions

onto the wider population. Notably, psychology research has identified the existence of the misattribution of cultural belief as the basis of decision-making and behaviour in minorities (5). In this study, the problem of oversampling minorities whereby they form the largest percentage of participants was identified as one of the major drivers used as a tool to draw conclusions that were more favourable to the researcher/psychologist. This achieved the goal of overemphasising the role of beliefs, ethnicity and race on behaviours of minority groups who tend to be considered to be 'exotic' and more 'cultural' in their behaviour and views, whilst the behaviour of whites would be predominantly driven by personality in contrast. According to Causadias and colleagues (5) oversampling of the race of interest and preconceived bias could serve to dehumanise minorities by 'denying their individuality'. In order to truly understand the research question, the Nattrass study should have focused on inclusivity, that is, sample size across different ethnicities and career choices. The flawed study design fails to account for a number of other factors that may determine career choice for South Africans and first-generation students in general. Furthermore, the data collection methods were not robust and the narrative excluded practitioners in the biological and conservation sciences, educational psychologists, higher education, or social sciences (socio-anthropologists).

Furthermore, when conducting questionnaires and surveys, researchers have to present the test results for construct reliability and validity (6). These measures are there to ensure that the questions that are asked are assessing the concept that is tested, and that they are consistent in doing so. The reliability measurement is a measure of quality and accuracy, telling us that the questions were designed to give a clear view of the concept tested, measured with Cronbach's alpha test of internal consistency. The internal validity is a measure that indicates that the same results would be achieved and would be consistent when the instrument of measure is repeated under the same situations (6). There was no indication that this was done with the instrument designed by Nattrass and from the results and the mismatch between the conclusion and the questions asked, it is clear that there was no reliability and validity of measure in this case. Therefore, Prof Nattrass could possibly extrapolate these findings as broadly as observed (1).

With regard to 'Research Records (Responsibility #4): Researchers should keep clear, accurate records of all research in ways that will allow verification and replication of their work by others.'

The commentary published by Nattrass (2020) reports on preliminary findings with the prospect of contributing to the knowledge base with regard to the attitudes expressed by a particular race of students, generalised within the South African context (1). According to the author guidelines of the SAJC, submitting these findings as a commentary would exempt the author from peer-review. To the reader, this suggests that the author may have been seeking to hinder and avoid critical examination of their research as well as to prevent open and objective discourse about the validity of the findings with the wider research community. This strategy would then serve as a tool for achieving early publication of their findings. Indeed this has been reiterated by the author within public platforms where it is admitted that the findings had garnered some excitement with colleagues suggesting rapid release of the findings as reported in media releases.

General consensus reiterates that a commentary is submitted following the publication of a research article or presented as a short and concise review or opinion piece of published methods, policies, etc. (7), with further emphasis that a commentary serves as an 'extended note that sets forth an expert's take on the meaning of a study' (8). Thus, commentaries are expected to promote, while providing critical assessment of, published work (7) which has undergone

peer-review possibly explaining (but not excusing) the exemption of the peer-review process with regard to the commentary. Therefore, by circumventing the peer-review process Nattrass (2020) was able to avoid open and objective discourse as the statements made and the research design would have been questioned, reviewed and objectively assessed.

2. Flaws with the peer-review process

The peer review process is a very important step in quality assurance of research findings, and ensuring that strong research standards and integrity are adhered to by researchers, and that information that is published is valid, true and adds value. According to Da Silva and Dobranski (9), there is a high level of gatekeeping by journals. Often times, only the Editor in Chief and /or Assistant Editors are involved -- a manuscript can either be accepted or rejected on the spot, without peer review, or can be sent-out to be scrutinised by one's peers (full peer review). Publishing the commentary suggests that anything can be published where an outlet presents itself, further threatening the validity, quality and trust of science and the scientific method. With the recent increase in research article retractions from top end journals (e.g. Mandeep et al., 2020), it has emerged that the major issues that resulted in the retraction are mainly unethical research practices, lack of repeatability and significant methodological flaws. This is evidence that all research must still be subjected to scientific and public scrutiny even after publication.

In our initial attempt to submit a rebuttal to this commentary, we were refused the opportunity by the editor, which led us to self-publish in social media. We experienced first-hand the gatekeeping that can happen. Further, in her comments in response to the Black Academic Caucus, Prof Nattrass (the author of the commentary in question) indicated that the commentary was not peer reviewed, which was confirmed by the editor of SAJS. This is shocking. Such non-scientific practices purporting scientific outcomes lay a foundation for distorting or corrupting the disciplines of science and their research methodologies. This calls for thorough review of different papers before publication, be it commentary, full research and reviews. Allowing this commentary to be published with its many flaws in the methodology and analyses, especially with content that is bound to be controversial, is deeply concerning. One would think that due to the nature of the 'study', the scientific process behind it and the analyses would be even more closely scrutinised before publication.

Editors are the point of decision making regarding whether a manuscript should be published or not. The commentary should have been stopped immediately at this point had the editor done the job. It is a general understanding that commentaries, research notes and perspectives are also peer-reviewed, and it is worrying to know that SAJS does not adhere to some of these international standards. There is no indication that ethical clearance was provided in the document that was published. Submissions involving research conducted on human or non-human vertebrates must meet the highest standards regarding both the ethical consideration given and reporting of the procedures followed. Full details are necessary so that a non-specialist reader can appreciate the need for the research undertaken. All reported research involving humans or other animals must be approved prior to commencement of the study by an institutional ethics committee. On publication, the specific ethics approval number must be provided.

Publishing bad science only serves to diminish public and peer trust and question the integrity of researchers.

3. Unconscious bias and its influence on research practices

Unconscious or implicit bias can be defined as existing the unconscious beliefs and prejudices that are ingrained in people, and influence the way that they perceive the world around them, as well as their behaviours (10). In academia,

unconscious bias can be reflected in academic HR processes where black researcher progression is dependent on a standard designed to keep them low and unrecognised (11), maintaining the low status of Black academic participation in STEMI (13). Unconscious bias can influence the way we conduct research, driving specific narratives because of our negative perceptions. We can ask questions that drive our negative mindsets about specific topics, and how we perceive the world to be. This goes against the scientific method, which advocates against bias. In conducting this research, publishing it, as well as engaging with it in the public, Prof Nattrass has exposed her own bias. As a respected Professor and academic, the public and the scientific community have trust in her word and in her work. She did not find a problem with her research and proceeded to defend even when the issues were clearly highlighted to here-narrowing this only to her freedom of speech and opinion. To us, this is a clear indication that she is not even aware of her own biases and is blindsided by narrow-minded views of black people.

The manner in which she approached the data gathering process has shown that she was driven by a specific mindset and sought to find answers that strengthened her view on a clearly complex problem. She has allowed her own pre-conception and ideas to drive the way she structured her questions and the conclusions she has made. The use of language was also insensitive and crass, said with a lack of care and empathy, which has resulted in her sounding very offensive to the reader. Had the author kept her own biases in check she would have conducted the research in a responsible way, she would not need to defend her stance in the way that she did through her responses in the media-further perpetuating the stereotype and painting those who question her as angry and racist.

Issues with purposive/convenient sampling

In her method, Nattrass uses the convenient or purposive sampling approach. While the method itself can be effective, it requires a high level of neutrality. The researcher relies on chance, but can also direct the sampling to areas where enough willing participants can be found. Nattrass sampled students during a break and did not consider whether these students studied in science, but instead shows that she placed her own assumptions first when she decided to continue with the study in the current format. As a result, the outcomes of the study were highly flawed. In her research findings, Nattrass compares black students against 'other races', without providing the reader a basis for understanding who or what the other races were. Her current conclusions based on this highlight more of her bias, in that the 'other races' likely showed more variability than the category Black that she refers to, as a result, she cannot draw up any conclusion.

Unconscious bias has also been cited as the main driver around gatekeeping in providing access to and career progression in STEMI careers for black students and academics. For the latter, issues around skills and ability have been highlighted as the main issues that prevent career progression for black students, women and men in STEMI. The idea that black people could excel in these areas seems to be more challenging, and forces the bar to be raised far higher for black students and academics when compared to white people (McCoy et al. 2017). Therefore, not only does unconscious bias affect the ability to do proper research, it affects the position of black people in STEMI (Brown et al. 2016, and the stereotyping with subsequent research like this study, just serves to perpetuate the already negative image of black people in STEMI.

Lack of Science Capital, mentorship and support limit black students success in STEMI

According to Professor Louise Archer of University College London, Institute of Education 'The more science capital you have, the more you see yourself as a science person – and the more likely you are to aspire to do that as a career'. Science capital refers to the extent of science-based information a child experiences, is involved and exposed to in their family, schools and general attitude around it. Black students in Universities in South Africa often are the first generation university students. They started university without knowing special researchers, either than the common known scientists they learn about in books. They do not see their black peers progressing in their careers after acquiring the degrees and PhDs in STEMI. They do not equate these to success if people are not employed or starting companies, or being recognised for high achievements. In 2020, we still see the challenges of the racial divides in STEMI.

In a recent blog post, a University of Cape Town Masters student in conservation ecology detailed her experiences in this field. Apart from the expenses associated with studying here, which naturally would exclude poor black students, she has highlighted the high lack of sense of belonging. In the field, she had no social or science capital because she was a black woman and she also had to live through the negative perceptions shown by her educators towards the surrounding communities where she worked. These individuals who refused to develop programmes for young children who live in the surrounding areas where the protected and conservation areas were built, simply because they could rob them and take their valuable goods. These unconscious biases are more divisive and prevent real action and change from taking place, and limits the opportunities of young black students. Further, from this blog post, it was clear that even among black people, there is a negative perception about those who study biology related degrees. Them, seeming more white and betraying their blackness, or being classist since they are able to afford the expenses associated with studying the degree. Without the visibility of STEMI professionals in black communities, the challenges of increasing access and opportunities will remain high. Creating the kind of interest needed in the field, requires that black STEMI professionals are recognised and visible to those in their communities, and those who arrive at these institutions of higher learning (11). Black students cannot be encouraged if they see that Black researchers are not progressing; black PhDs are unemployed!

There is a currently prevalent stereotyping that black students do not study the biological sciences, or STEMI in general. As shown by studies in the USA, these stereotypes have a negative impact on academic performance and career choices in STEMI (11). This is known as stereotype threat, where 'the fear of doing something that would inadvertently confirm a stereotype' (12) causes black students to under-perform at all levels (11). Furthermore, in South Africa, we cannot focus on these factors or put significant pressure on a racial group that were not allowed access to these fields in the past. In fact, a majority of researchers in the biological sciences are predominantly male and white, and even though participation by females has increased, largely it is white females. Clearly, there is no science capital. Furthermore, there is a prevalence of clique formation in universities and it is easy for black students to have a poor sense of belonging in these groups. There could also be differences in the experience of black students in STEMI in historically black universities versus historically white universities. None of these contexts could have been extrapolated from the results that this commentary has drawn conclusions from.

Practice responsible science: The divided responses of scientists, politicians and the public who defend the commentary and Prof Nattrass

- We need open conversations and debates that are based on logic and facts
- There is a large focus on race, but more importantly the discussion should be how we can encourage more participation in STEMI for the racial groups that were not allowed access to these fields in the past

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Bad science cannot be used as a basis of constructive dialogue: Response to Prof Nicoli Nattrass commentary

The media has been flooded with responses to the commentary authored by Prof Nicoli Nattrass from the University of Cape Town (UCT) and published by the *South African Journal of Science* on the 20th of May 2020. We regard this commentary as racist, offensive, damaging, and unscientific. Even more shocking has been the response attributed to Prof Nattrass by the media, wherein she reportedly claims that the statement issued by the UCT Executive condemning her commentary is '*bending to political pressure and prevents debate on transformation*' (News 24 06 June 2020). Prof Nattrass appears to operate from an assumption that her speculative opinion piece is contributing to a constructive scientific debate because she framed her correlations in scientific language and statistics. She appears not to acknowledge that personal bias may have fuelled the foundational assumptions of her study, and thereby does damage to the name of science – and biological sciences in particular – in an era where there is already a tenuous relationship between science and the broader public. This lack of self-reflection is unfortunately an indictment of how most of us are trained to believe that we, as scientists, are fully objective, and that our research carries no moral or emotional valence. Our response to Prof Nattrass's opinion piece highlights how damaging this lack of scientific introspection is in the hands of an esteemed researcher, and how an actual scientific investigation of the question '*Why are black South African students less likely to consider studying biological sciences?*' should look like.

The emotional valence of research: Why the commentary is racist, offensive, and damaging

At its core, the commentary is racist and offensive because it depicts and frames a whole racial grouping as largely governed by materialism, linked to a poor relationship with nature and pets. It fits neatly into the decades of narrative that seeks to position black people as incapable of thinking beyond their immediate circumstances. By asserting as a valid hypothesis that black students think national parks should be scrapped in favour of giving land to the poor, it belittles the negative impact that centuries of dispossession of land has had on black people. Finally, it is offensive because it positions the necessary debates around the protection of the environment and disastrous consequences of not doing so, as an exclusively white concern.

Although generalising about biological sciences, the focus of the commentary appears to be in the specific field of biodiversity/wildlife conservation. The piece effortlessly minimises the work of many prominent black scientists, researchers, and managers in the sphere of wildlife conservation. To cite a few

individuals, the Chief Executive Officer of the South African National Parks (SANParks), which is tasked with preserving South Africa's biodiversity and cultural heritage, is Mr Fundisile Mketeni, a black man. The Head of Conservation Services at SANParks is Dr Luthando Dziba, another black man. The many thousands of rangers and guides that work within the network of national and provincial protected areas are predominantly black; these people put their lives in danger on a daily basis to protect our wildlife, natural and cultural heritage for current and future generations, often in remote areas, with rustic accommodation at best.

The commentary is further problematic in that it portrays UCT as the microscope through which the participation of black students in biological sciences must be examined. In her speculative title, Nattrass manages to delegitimise the work of scientists and academics as well as undermine the aspirations of students at the other public universities, nationally. To cite a few, UCT's neighbour, the University of the Western Cape, has a vibrant Department of Biodiversity and Conservation Biology that teaches undergraduate courses and conducts world-class research. The University of Mpumalanga has a budding programme in Nature Conservation. The University of Venda hosts a prestigious Research Chair under the auspices of the South African Research Chairs Initiative, training students and conducting research in Biodiversity Value and Change. The best student presentation at the biennial Zoological Society of Southern Africa conference (2019) was by a black student from the University of the Free State's Qwaqwa campus. At all the institutions cited above, the participation of black students exceeds 90%. Although there is a clear lack of transformation in biological sciences (in fact, in all STEM fields) at many of our top universities, this is not universal; the University of Johannesburg being a case in hand. The assertion that black students do not consider careers in biological sciences largely reflects the nature of institutions: there are black students pursuing their studies in biological sciences, they are just not registered at UCT.

It is also unclear what reference the participation of black students is being measured against. There are many factors that may determine whether a student eventually considers and pursues a career in the biological sciences. For example, studies carried out by Centre for Research on Evaluation, Science and Technology (CREST) at the University of Stellenbosch have repeatedly shown that financial considerations (affordability) emerge as the single, most important determinant of whether a student will pursue a postgraduate degree or not. In the natural and physical sciences, where field work is typically the norm, sexual harassment is a contributing factor impacting women's career choices [1,2]. Mentorship, employable skills training, and role models in inclusive research communities are all factors that known to affect postgraduate student choices and success. Randomly highlighting factors such as materialism (using a scale not clearly validated for the South African population) and pet ownership, Prof Nattrass does not reveal actual interest in the broader research on barriers to participation.

Deconstructing claims of scientific validity: The fatal flaw in the science

At its core, quantitative research examines testable hypotheses, which are falsifiable ideas based on prior observations or extensive research. This opinion piece is based on no prior research or observations that we could find: there appears to be little evidence in the literature that pet ownership, positive exposure towards nature, positive attitudes towards conservation, or a lack of materialism leads to students considering a career in the biological sciences. Of course, with over 800 million cats and dogs kept as pets[3], globally, it is hard to see how pet ownership would predict choice of career path. As has been pointed out elsewhere[4], we all tend to work for financial security, and it is therefore very difficult to link such materialism to a specific career choice. Thus, the hypotheses posed are extremely hard to falsify, and there is no clear

a priori reason why we might expect links between the variables in question.

This brings us to the fatal flaw in the science. Prof Nattrass is guilty of conflating correlation and causation. She is getting responses that are valid in, and of, themselves (although it needs to be determined if the materialism scale has been validated for South Africans), but the answers are not linked. She may just as well have examined whether or not number of pets were correlated with any other direction of study. Why not Psychology or Geriatrics? After all, there is an established relationship between emotional well-being and spending time in green spaces[5], or pet ownership and health in older people[6]. Correlation is not causation unless you have established the link between the variables. As an experienced scientist, she should be aware of this very basic fallacy.

To answer her central question in an unbiased way, several options were open to Prof Nattrass. Convenience sampling, as was her approach, is valid for many situations, but is not broadly generalisable, especially with a sample size of just over 200 participants. Random sampling (drawing names or numbers from a database) would have yielded more generalisable results, with stratified random sampling (choosing a subset from the biological sciences and a subset of students from other fields) probably yielding more representative and potentially generalisable answers. Further, if Prof Nattrass strongly wanted to stay with quantitative research, she could have established some answers by posing the question, '*Why are you studying in this particular field?*' with a large number of potential answers to choose from.

The real conversation we ought to have

Notwithstanding the flaws in the Nattrass commentary, this conversation is indeed an important one. It is important not only for the sake of transformation, but because all scientific fields need to address the historical socio-economic class imbalances that exist within the entire South African National System of Innovation. At any time that a portion of the population does not participate fully, a significant pool of talent is excluded, and that can only be to the detriment of biological sciences. Talent is equally distributed amongst all people, be those black or white; linked to this is the aptitude of people for specific fields of study. What is required to inspire talented people with an aptitude for conservation and biological sciences to follow their hearts and study biology is not whether they owned a pet or grew up visiting the Kruger National Park; rather, it is ensuring that they have role models that they can identify with, ensuring that biological laboratories at school level are well equipped, investing in biological sciences at university level through adequate financial support to undergraduate and postgraduate students. If we cannot present *wow* moments of biological discovery to talented younger people, we cannot expect them to study biological sciences. The COVID-19 pandemic highlighted the dire need for a significantly higher investment in biological sciences[7]; the future of humanity may depend on talented students and scholars to realise this.

The *South African Journal of Science* is a flagship journal of the Academy of Science of South Africa (ASSAf). In turn, ASSAf aims to mobilise the best intellect, expertise, and experience in service of the nation. The commentary published Prof Nattrass does not live up to these ideals. Many scientists have criticised Prof Nattrass's piece, and just as many have stood up for her, in the name of academic freedom. Yes, as scientists we have freedom of thought and speech, but this freedom does not shield us from the consequences of our speech. Publishing a piece that is inherently flawed undermines one's own scientific credibility. Furthermore, science and scientists are not neutral or 100% objective, otherwise there would be no need for peer review and ethics committees. Assumptions and conclusions need to be evaluated by a community committed to responsible science. There are, or should be, checks and balances against our personal biases. Debate must be encouraged, and based on facts, logic and the ability to admit fault or

accept correction. That is what should distinguish scientific advice, scientific debate, and thought from unexamined philosophies.

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Intellectual laziness and academic dishonesty: A threat to academic freedom?

The National Plan on Higher Education[1] released in 2001 states that:

> *The value and importance of research cannot be over-emphasised. Research, in all its forms and functions, is perhaps the most powerful vehicle that we have to deepen our democracy. Research engenders the values of inquiry, critical thinking, creativity and open-mindedness, which are fundamental to building a strong, democratic ethos in society.*

Academic freedom matters; it matters a great deal. It is a sine qua non for the success of our science system. When scientists invoke academic freedom whenever they are expected to account, then this poses a threat to academic freedom. It is a perversion of the principle of academic freedom, when it appears to be equated to 'free speech when exercised by scientists', irrespective of whether what the scientist says is informed by expert knowledge or is informed by the findings of rigorous academic research. Academic freedom goes considerably beyond free speech. Amongst other things, academic freedom means that scientists have the freedom not to be hindered in their pursuit of 'truth', in an attempt to push back the boundaries of knowledge, and that they have the freedom to disseminate their findings without fear of victimisation. This freedom comes with responsibility and society must hold scientists to higher levels of ethical conduct of research, of accuracy and truthfulness in their reporting. When they appear to fall short, society has an obligation to hold them to account. Scientists pose a threat to academic freedom when they (ab)use academic freedom as both a spear and a shield: a spear used to attack and a shield behind which they hide when expected to explain themselves.

It is disingenuous to give the public the impression that academic freedom is unfettered; otherwise any rabid racist, or misogynist, or antisemite would have a convenient defence, as long as they claimed to base their utterings on 'research'. Denigrating people under the cloak of academic freedom is not and cannot be acceptable. This would undermine academic freedom. Instead, it would strengthen confidence in the academic endeavour when the public is made aware that there are strict protocols and policies to ensure that academic freedom is not abused. For example, research proposals involving humans or involving animals have to be scrutinised by Research Ethics Committees. It is often a requirement that consent is sought from those that will be subjects of an inquiry. Where there are allegations that these protocols may not have been observed, then it is obligatory for a university to investigate possible violations. This is one of the responsibilities of any Senior Executive responsible for the Research Portfolio within a university. We should also bear in mind that members of a university executive are themselves often active researchers; or they have come through the academic ranks.

One would assume that they do not give up their freedom to express their views on academic matters simply because they are members of the Executive. It is intellectually lazy for those who 'speak truth to power', to often portray those in authority as censorious, when in fact they may be holding scientists to account in order to protect the integrity of the academic project. It is troubling that people who know better, would appear to give the impression that Executives of universities or Boards of Science Councils would go on a fishing expedition or witch-hunt and conduct investigations outside of accepted institutional policies and procedures. Most importantly, all South African citizens enjoy protection under the Promotion of Administrative Justice Act 3 of 2000, which was promulgated

> *To give effect to the right to administrative action that is lawful, reasonable and procedurally fair and to the right to written reasons for administrative action as contemplated in section 33 of the Constitution of the Republic of South Africa, 1996; and to give matters incidental thereto.*

Investigations of academic misconduct are often conducted by independent committees of a researcher's peers; otherwise the credibility of the findings would be questioned. We find it troubling that an impression would be created that such investigations are uncommon and are conducted or influenced by university executives.

The commentary by Professor Nicoli Natrass in the South African Journal of Science, and some of the responses to it, provides some examples of these troubling tendencies.

(a) Does an 'opportunistic survey' require ethics clearance? If it does, did she obtain such clearance? It would be troubling if an 'opportunistic survey' does not require ethical clearance.
(b) Did the 'subjects' give their consent? Do they need to give their consent in an 'opportunistic survey'? It would be troubling if 'opportunistic surveys' do not require consent by those involved. This would be open to abuse.
(c) Was the sample size big enough to justify a sweeping generalisation that '*....difference between black South African students and other students……..pertained to career aspirations, attitudes towards evolution and experience with, and attitudes to, animals*'.
(d) Has the author conducted similar research before, namely African people and animals, which may reveal a prior bias? Bias in research is an example of academic dishonesty.
(e) Reproducibility: would someone else conducting the same 'exploratory survey' on another group of African students arrive at the same conclusions?
(f) Can credible publishable conclusions be arrived at, about Africans and land, based on an 'exploratory survey'?

The question whether a research finding derives from the evidence presented goes to the heart of the review process, whether by peers or non-experts. The implied correlation between race and 'attitude towards evolution' in this research is at best a spurious correlation. An example of a spurious correlation is that '*per capita consumption of mozzarella cheese correlates with civil engineering doctorates awarded*'. In general, attitudes towards evolution seem to be strongly influenced by religious beliefs. Whether one believes in creation or evolution or is agnostic is independent of race. There are fundamentalist Christians of all races, all over the world.

A gentle reminder: our ancestors were dispossessed of their land and, in the process, massacred in large numbers. They were forcefully removed and herded into barren and sometimes overcrowded 'native reserves' or homelands; under Apartheid some of these were cynically granted political 'independence'. It is conceivable that some of these forced removals were aimed at making land available for private game farms for the enjoyment of wealthy tourists. The land question remains a divisive and potentially explosive issue in our society and to treat it in what appears to be a cavalier manner, hardly

qualifies as responsible research. As an African child growing up under Apartheid in rural Eastern Cape, my people held the view that some White people treated their pets better than African people. A White child would be encouraged to play with their pets, but scolded when they wanted to play with an African child. The English phrase 'a man's best friend' does not only apply to or have meaning for English-speaking people. In my ancestral village, most families own and take good care of their pets, despite the grinding poverty. When researchers arrive at conclusions which do not accord with our personal experiences, we have an obligation to correct them. Spurious observations from exploratory investigations cannot Trump other forms of knowing.

The Centre for Research on Evaluation, Science and Technology (CREST) at Stellenbosch University conducts research, amongst other things, on contributions to the academic endeavour, and they disaggregate the research outputs by race and gender. White authors are still disproportionately responsible for a large proportion of research captured in all the traditional databases. Academic freedom is a privilege enjoyed by all scientists and research is not an instrument for validating our personal prejudices. The knee jerk responses from scientists to 'threats' to academic freedom gives the impression to members of the public that academic freedom is a vestige of unearned privilege enjoyed by White people. This poses a serious threat to academic freedom. It may inadvertently be an invitation to or an excuse for politicians to consider whether this needs to be regulated. This is a real threat to academic freedom posed by scientists themselves.

Framing a research question in itself requires some background research. Not every question is worth investigating: 'how many angels can dance on the head of a pin' is a common 'example'. Jumping into an opportunistic investigation without the proper background work may be a sign of intellectual laziness. Scientists know that ill-posed research questions would be one of the reasons that many manuscripts are not accepted for publication. In most instances a manuscript is subject to a peer review before it gets published. In the case of Professor Natrass's paper, there was no peer review. Would it have passed a peer review process? This is one of the issues for consideration by those that express a view on this matter. Although I am not a social scientist, I do not believe that it would have passed a peer review process. Personally I would not have recommended it for publication. I challenge any self-respecting social scientist to publicly confirm that they would approve the manuscript for publication. It is disingenuous to claim that this is a 'commentary'. Members of the public may not know the difference between a commentary and a peer-reviewed article. Be that as it may, a scientist should always maintain the same high standards of academic rigour, irrespective.

We understand this 'opportunistic' investigation to be about what influences the choice of career options by university students. Since this is a universal issue, namely an issue that confronts students of all races all over the world, then the obvious question that comes to mind is the rationale for the focus on African students and the choice of conservation biology. One would assume that some background work was undertaken that informed the choice of this combination. Otherwise another or the same researcher can now choose racial group X and subdiscipline Y and produce another research paper, an example of intellectual laziness. The author creates the impression to the reader that biological sciences and conservation biology can be used interchangeably. At present high school students have a choice of Life Sciences and it is not clear whether the author checked the data of Grade 12 results to support her assertions. Do we know how many African students choose Life Sciences as a matric subject? Do we know how many pass Life Sciences and which degree programmes they registered for at university, even just at the University of Cape Town? There is a wide range of sub disciplines at university level that would fall under biological sciences including

anatomical sciences; physiological sciences; molecular biology; environmental biology; conservation biology; genetics, etc. The author does not enlighten us whether or not African enrollments are also low in these sub disciplines. At least we do know that there is a high demand for places in the medical sciences. How does this observation fit in with her conclusions? The author could have requested data from the Department of Higher Education and Training, whether evidence of enrollments in the Classification of Educational Subject Matter (CESM) category containing biological sciences supports her hypothesis. The author could have enlightened the readers whether the racial distribution of enrollments in conservation biology is an 'outlier' when compared to enrollments in other programmes. During my previous life at Wits University I observed that men appeared to be underrepresented in therapeutic sciences; white students in Mining Engineering; women in Electrical Engineering, African students admitted to the MBA programme; and Indian students over-represented in Dentistry, etc. 'The invisible hand' of the market, first mentioned by Adam Smith in the 1700s, could be a more plausible explanation for some of these. Researchers are often 'skeptical' about their own initial findings and do not rush to publish, simply because they have discovered something or they have been invited to do so. They would check and doublecheck. The rush to publish is often driven by non-academic motives; and it is a threat to the integrity of the academic project.

The question of career choices by high school or university students generally is not new; it is not unique to the University of Cape Town, it is not unique to South Africa. It is a global issue. There are many reasons that have been advanced for under-representation or over-representation by race or gender. All of those reasons that we can think of sound more plausible than the conclusion in this research. These would include issues like parental influence; peer influence; influence by teachers; following in the footsteps of someone they admire; available career guidance; availability of bursaries and scholarships; employment opportunities. Let us just briefly address two of these issues, namely funding and employment opportunities.

Firstly, students' scholarships and bursaries either from the public or private sectors are often targeted at certain programmes. Both the private and public sectors use the language of 'scarce skills'. How many times have we heard academics in the humanities and social sciences complaining about the disproportionate funding channelled towards STEM disciplines? The financial services sector is chasing graduates with strong quantitative skills. The accounting profession is recruiting from high school, Black students in general and African students in particular to address the gross underrepresentation of Black people in the accounting profession. Provinces are funding students in Health Sciences to address the health disparities and inequities in health provision in our country. The list goes on. Are these less plausible than the relationship that African students supposedly (do not?) have with their pets?

Secondly, highest paying jobs in South Africa are disproportionately occupied by White people. Should we conclude that this is because White people are materialistic; or there is a more plausible explanation for this observation? It can be hypothesised that some learners would prefer to take French or Spanish as a second language rather than isiXhosa. If this were to be established, should we conclude that white learners make this choice because their parents are racist[2] and regard isiXhosa as a second-class language or even worse? It is worth reminding ourselves that a few years ago, within the university system, we grappled with the national problem of unemployed graduates. This problem persists. Disproportionately unemployed graduates are African. Should African students now be described as materialistic if employment opportunities were one of the issues they would take into consideration when making career choices? How reliable is the mathematics or statistics underpinning the calculations on materialism?

Most of the books that have been written about the 2008 financial crisis, point to the lure of Wall Street for graduates from especially the prestigious universities in the US. Would it be fair to describe these predominantly White graduates as materialistic? Then most of us are materialistic, irrespective of race, gender, or country of origin. Sweeping negative generalisations about people is offensive; and it is racist when generalisations are made about racial groups. Such generalisations undermine our democracy. People who feel offended by this should rightly call it out. It is intellectually disingenuous and lazy to hide behind academic freedom.

There are other examples of academic disingenuity that one believes pose a serious threat to academic freedom and institutional autonomy. In many academic departments almost everywhere, one sometimes notices that disproportionately the academic staff are graduates of the same university; or share the same country of origin; or are adherents of the same religion; or their skin complexion is similar; and the list goes on. And this would be presented as 'academic merit' when maybe it is just crass 'academic nepotism'. Or sometimes people gloss over wrongdoing by highly rated researchers, because other institutions would be prepared to hold their noses and snap them up to boost their research output or institutional ranking. Or denigrate the achievements of female or Black applicants and dismiss them as 'just a transformation candidate'. Or investigations of similar cases of academic dishonesty resulting in a gentle slap for those that belong to a self-styled and self-referential 'academic aristocracy' and heavy sanctions for the 'children of a lesser God'. Such conduct undermines academic freedom. Scientists have a responsibility to protect academic freedom and institutional autonomy for this and future generations. We expect nothing less.

The International Science Council, to which our Academy of Science of South Africa is affiliated, aims to be '**the global voice of science**'. In a statement it released on 9 June 2020 'In the wake of the death of George Floyd and the global response that it has ignited…', we are reminded of the following:

> *The Principle of Freedom and Responsibility in Science is enshrined in the Statutes of the International Science Council. It states that the free and responsible practice of science is fundamental to scientific advancement and human and environmental wellbeing. Such practice, in all its aspects, requires freedom of movement, association, expression and communication for scientists, as well as equitable access to data, information, and other resources for research. It requires responsibility at all levels to carry out and communicate scientific work with integrity, respect, fairness, trustworthiness and transparency, recognising its benefit and possible harms.*[3]

Loyiso Nongxa writes in his personal capacity. He is a Fellow of the Royal Society of South Africa and a Member of the Academy of Science of South Africa.

Notes

1. www.dhet.gov.za/HED/policies/national_plan_on_higher_education/
2. This is adapted from a Twitter comment that was shared on one of the WhatsApp groups.
3. https://council.science/current/news/statement-on-combating-systemic-racism-and-other-forms-of-discrimination/

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Attitudinal difference surveys perpetuate harmful tropes: A comment on Nattrass, *S. Afr. J. Sci.*

We reply to the article, 'Why are black South African students less likely to consider studying biological sciences?', authored by University of Cape Town (UCT) researcher Nicoli Nattrass[1] and published in the *South African Journal of Science* on 27 May 2020. At the time of writing our reply the article had already received sharp criticism from the Black Academic Caucus at UCT and in a statement released on 5 June 2020, the UCT executive distanced itself from the content of the paper, inviting rigorous, respectful review of the published research.

Nattrass' article[1] follows two papers published in 2019 by scholars associated with South African universities, both of which were widely denounced for the racist undertones of their content. The first article was authored by Stellenbosch University researchers who reported on low cognitive functioning of coloured women linked to education levels and lifestyles[2]; see comment by Le Grange[3]. The second article was co-authored by an adjunct professor at UCT and examined the role of cognitive ability or intelligence on slave exports from Africa[4]. These publications gave rise to a broader debate on enduring racism in science and the re-ascendency of race science internationally.

In this reply, we focus on the methodology of attitudinal survey used for the study reported by Nattrass (and by many other scientists). There are two lines of argument that we weave together: the quality of the research as reported, and problems inherent to comparative attitudinal survey research (regardless of how well it is executed). It should be noted that the Black Academic Caucus at UCT has also critiqued the research design, identifying many of the points we make here, and they have additionally included a discourse analysis of the paper (circulated via e-mail).

To demonstrate how problematic a survey design can be, particularly when it is not rigorously executed, we share data and observations that counter the apparent findings of Nattrass' study. We then argue that the publication of this research, in this manner, is detrimental to the biodiversity sector in which the tropes being perpetuated, can cause enormous harm. In the process we hope to encourage scientists to be more reflexive about their methodology, and we encourage the *South African Journal of Science* to publish works that are worthy of the young people of this country - research in which they can recognise themselves, rather than being forced to look at reductionist portrayals, legitimised under the banner of science.

Poor survey design

Nattrass[1] describes the study on which she reports in her paper as 'exploratory' (p.1), and the findings as 'tentative' (p.2). She is nonetheless confident enough in the study to publish the findings in a high-profile journal. One would therefore expect the article to meet high standards of rigour and ethics.

Starting Assumptions

The title in no way suggests the tentative nature of the findings or the exploratory nature of the study, and indeed misrepresents even the tentative findings. The reference to 'black South African students' is an over-statement of the scope of the study and the findings.

It is worth noting that there is an ethical dimension to selecting a research topic and its formulation as a title. As Raffe, Blundell and Bibby[5] wrote in relation to the ethics of survey research:

> *With respect to the public, researchers should pursue openness, sensitivity, accuracy, honesty and objectivity in their choice of topic, methods, analysis and dissemination. This includes respecting the interests of different groups in society; avoiding research designs which preclude particular outcomes of the enquiry* (p.15).

Nattrass' paper[1] is based on a number of problematic assumptions. As a start, it equates studying in the biological sciences ('conservation biology, zoology, and other', p.1) with an interest in wildlife conservation. It does not take into account that there are many additional study areas that a person interested in wildlife could choose to study, particularly if they kept their eye on the job market (as the survey respondents seemed to do). It fails to qualify or justify its focus on the biological sciences as just a small sub-section of the study fields that have relevance to the conservation of wildlife as practiced in contemporary South Africa (others being, for example, environmental sciences, veterinary sciences, resource economics, environmental education, geographic information systems, or bio-informatics).

One would therefore be justified to counter the starting assumption and enduring conclusion that black South African students are less likely to study in this field, with the data recently analysed in the mid-term review of the implementation of the 20-year Biodiversity Human Capital Development Strategy (BHCDS, SANBI and the Lewis Foundation[6]). This data has been sourced by Jenkin[7] from the Department of Higher Education's publicly accessible database, the Higher Education Management Information System (HEMIS). Jenkin used the study fields scoped as relevant to the core biodiversity sector by the Human Sciences Research Council for the BHCDS[6]. According to HEMIS some 40,034 students enrolled in biodiversity-related study fields in South Africa in 2018. In this body of students, 75% of the enrollment in three-year degree courses relevant to biodiversity were black (politically defined); 69% of those graduating with a three-year degree in these fields were black. Significantly, because employment as a scientist typically requires a post-graduate qualification, 63% of Masters and 59% of PhD students in biodiversity-related study fields in South Africa in 2018 were black (up from respectively 25% and fewer than 19% in 2000).

It would seem that the assumption that black South African students are *less likely* (than others) to consider studying biological sciences, is questionable and perhaps based on a particular course at a particular institution, or on trends in a previous decade. This is highly problematic, given the limitations of the sample for testing the assumption, considered next.

Sampling

Nattrass[1] noted that the survey was opportunistic, as it used one of the weakest sampling techniques available to survey researchers, a non-probability sampling technique called convenience sampling. She notes that the sample of 211 students was neither 'representative' (p.1, her quotation marks) of the students at UCT, nor the black

students at UCT. Similarly, the sample would then also not be representative of the students at the 25 other universities in the country where black South Africans are enrolled, or not, in the biological sciences. The power of survey research is its claim to greater external validity, which in turn is dependent on probability sampling that allows for the use of inferential statistics, and generalisation. Since this study cannot lay claim to external validity, its findings are overstated.

The findings are further weakened by the poor **construct and content validity** of the survey design (answering the methodological question: Does the instrument really measure what it is said to measure?). The paper does not contain the full survey instrument, but the items provided allow us some comment on survey design. There is no substantiation given to support assumptions that: 'I like having starlings around at UCT' equates to 'attitudes towards animals'; that a '"Fallist"' attitude is also an 'anti-conservation attitude; or that agreement with the statement 'Humans evolved from apes' equate to support for evolution (for example). To elaborate on just one item: 'Humans evolved from apes' is a misrepresentation of general evolution theory (which rather states that humans and apes derived from common ancestors but followed separate evolutionary branches) and can surely not be viewed as a valid item for students' attitudes towards evolution, not to mention the leap to a lack of interest in studying biological sciences (which also implies, through the reasoning in the rest of the paper, that those interested in the biological sciences are unlikely to be religious). The author does not indicate how the validity of these controversial survey items was determined. This links to the issue of **reliability**. The reader is not provided with the reliability coefficient of the survey instrument, which is fairly standard practice when survey research is reported. The way in which the research was conducted certainly raises reliability concerns (answering the question: Can the results be repeated?). A once-off survey during a lunch break may not produce reliable results; we do not know how students might have responded on another occasion or in other contexts; more on this later.

These issues are related to basic matters of rigour in survey research. We now turn to more general concerns that seem to be endemic to the attitudinal difference survey, and on the basis of which the methodology perpetuates what ultimately manifests as racist tropes.

General Features of Survey Research

Attitudinal surveys have to force people into making choices they would not actually make (or make without qualification) in real life. An example in this case, is the forced choice between 'addressing social justice' or 'wildlife conservation'. This is a non-choice in the view of many environmentalists. The 1992 Earth Summit argued that development and sustainability issues need to be addressed together; and Raworth[8] is among many contemporary economists who argue that economics for the 21st century should address both planetary and social needs. In many communities, from the Limpopo to the Amazon, the protection of nature is the basis of people's livelihoods and well-being. It is only a particular, narrow framing of economic development that suggests that There Is No Alternative to exploitative economic development as the basis for addressing social inequality[9]. In South Africa (as in Brazil) exploitative economic development has in fact exacerbated rather than addressed social inequalities, made so vividly obvious by the Covid-19 crisis.

Another issue with attitudinal difference surveys is that they fail to allow for the complexity (richness and messiness) of real people's values and views. The study being critiqued here was undertaken on campus during lunch. We can imagine the conversations that would have taken place after and perhaps during the administration of the questionnaires and interviews - conversations we ourselves have had with students about the starlings on our own campus ('I love them too guys, but we had to fumigate the building the last time they nested

at the entrance'); about career choices, coloniality in the curriculum, what we knew when we chose our study area; what our parents and friends said about our choices; which companies come to the career fairs; where the best bursaries are; etc. There is no room for the qualitative and nuanced dimensions of people's intentions, feelings, understandings and actions in the tiny, tidy tables of narrow survey findings. In the real-life situations that surveys promise to accurately portray, it would seem that attitudes and even values are not fixed; they shift. Social psychologist Shalom Schwarz[10] proposed, based on extended studies in 80+ countries, that there are 10 clusters of basic personal values that are present across all cultures and in all healthy individuals; that each of these values can be engaged if triggered, in any of us; that the relative strength of these values change over our lifetime and *even in the course of a day*, so that we may explain ourselves differently whether we are in a social or work or private space; and that the more each of these different values are engaged, the stronger they become. Schwarz' findings resonate with our own experience. As a practical example, the wealthiest families in South Africa (white) presumably do have materialist values, since they have put some effort into accumulating this wealth, but they have also supported wildlife conservation.

It is therefore misleading to reduce complex human beings to a binary (constructed) attitude or a fixed and one-dimensional value. According to Schwarz, psychologically and culturally, multiple values co-exist in individuals and constructed groups. Unfortunately, the comparative attitudinal survey, in order to measure and distinguish, has to pin a value on a person, and pin it down in time, as with a butterfly taken out of its multi-path flight to be pinned for museum display.

One participant on a conservation leaders' WhatsApp group discussing Nattrass' paper (anonymously shared) stated: 'The study was very narrowly scoped so quite unable to answer such a big question'. Different dimensions of the 'big question' around black people and conservation in South Africa have been addressed through a variety of study types including historical, socio-political and anthropological works by Jane Carruthers[11], Farieda Khan[12], Michelle Cocks and co-researchers ([13-14]). Aphiwe-Zona Dotwana's study[15] focussed on black women graduates who, like herself, chose to study in Botany and Zoology. It was complemented with an in-depth analysis of HEMIS data, showing an increase in the number of black women entering these fields. Her use of interviews and a social realist analysis revealed an interplay of structural factors affecting the young people's life stories.

When respondents are forced into choices framed by the starting assumptions of the questionnaire designers, the findings may actually tell us more about the assumptions of the person(s) designing the questionnaire, than the respondents. In the case of Nattrass[1] the framing of the questions suggest that the researcher(s) assumed views that are somewhat sentimental towards wildlife and somewhat one-dimensional in relation to black and/or poor people's lives: assuming that no poor people grow up with animals, for example, or that conservationists all grow up with pets, or would all appreciate bird proliferation on campus. Most of the assumptions evident in the questionnaire would be out of step with the mainstream approaches to conservation in South Africa, and with the framings of wildlife by indigenous peoples around the globe. The broader point is that a survey design, unless backed up by extensive prior research, starts with the assumptions of the designer, which therefore have a significant influence on the outcomes, but unlike in other research genres, the researcher's standpoint is not made clear upfront.

Wanting your academic choices to lead to a career, which the study suggests is the single biggest indicator as to whether a student has considered studying in the biological sciences or not, seems sensible. Currently there are many unemployed graduates with an

environmental degree. There would seem to be not enough paid jobs for all the South Africans, black and white, who are choosing to study in this field. When WWF-South Africa advertises its annual internship programme, they receive hundreds of applications, for around 10 available positions. In 2019, 236 of the 410 applicants were black. These students have not necessarily studied Conversation Biology at UCT, but that does not mean that they are not interested in wildlife and conservation. Those who are well networked, informed and in a position to do so, choose the subjects that are most sought-after in modern conservation agencies. As one senior park manager (black) put it in an interview about skills needs[6]: 'I can't appoint a frog specialist. I need someone who can manage the wetlands'.

Discussion

From our perspective in the field and working with environmental scientists and educators for over three decades, the published paper suggests an author who saw no need to substantiate her assumptions, did not situate the study she reports on in context, and who (along with reviewers and editor) have not adequately thought about the implications of what one has to consider, on balance, an unsupported title.

How is this possible, given that the researcher, her affiliation institution, and the journal, all have sound reputations? We believe that the choice of methodology is part of the reason for this seemingly uncritical judgement. Does the methodology not have all the trappings of solid science? There are three tables in a two-page paper, with a seemingly careful statistical analysis, confidence intervals included, giving us objective answers to contested questions. As the Radical Statistics Education Group[16] noted, 'the use of statistics … is often thought to lend an aura of infallibility to research results' which could be 'used to silence the legitimate concerns of those wishing to speak up for their own interests' (p.3).

To publish, one also needs something worthwhile to say. What do we learn from Nattrass'[1] paper that made it worth publishing? The starting assumptions, that shaped the survey design, still stand at the end of the analysis. This despite Table 2 'showing that attitudes were better predictors of having considered studying biological sciences than the crude indicator of being a black South African' (p.1). On page 2 the author continues to use the 'crude indicator' in the conclusions, re-stating that 'the survey results suggest that black South African students are less likely to consider studying biological sciences than other students'.

The survey, and in particular the 'attitudinal difference' form that divides populations into groups based on unexamined assumptions that there are innate differences between them (e.g., race-based groupings) is a prime example of Modern Western Science which Le Grange[3] traced to the eurocentric worldview in which the researcher is the centre of the universe (akin to Da Vinci's Vitruvian Man) with the right to 'other' and survey all on the periphery of his gaze. This researcher stands outside of the objects being surveyed, and there is no need to declare a standpoint because the position of surveillance[17] is one of ultimate power. Instruments, it is inferred, provide the necessary neutrality and sharpness of vision. However, from this short analysis it is clear that the vantage point of the researcher has an integral effect on the study outcomes, and that the instrument itself is clouded by some inherent limitations, particularly when it is not used with care.

Concluding statement

Numbers do matter, especially at what De Sousa Santos[9] refers to as 'the existential point where reasons and emotions meet in order to nurture the will and the capacity to struggle against domination and oppression' (p.x): *These* numbers matter: in 2018 16,870 black women and 13,305 black men enrolled for a degree in a biodiversity-related field. These *emotions* matter: How does any headline starting with 'Why are black students less likely to …' make us feel? The othering that happens in studies that insist on separation into groups and then continues that separation even if the data does not concur, are experienced

emotionally. One participant in the earlier cited social media group (arising from a *Tomorrow's Leaders Today* event organised by Wildlands) simply said: 'It's hard to be a black scientist'.

Finally, what does this *materially* mean for the field and therefore, also for wildlife? We end with reference to the unemployed (black and white) graduates with degrees in the biological and broader environmental sciences. There is actually much work for these young people - work in rehabilitating mined areas; in protecting wildlife from exploitative trade; in safeguarding and enhancing rural people's livelihoods through land and water management, eco-tourism, and more. However, this work is chronically under-funded, with the fiscal allocation to some conservation agencies being as little as 25% of what they need to be effective[6]. As a result, these agencies have too few funded positions. Fiscal priorities are at least partly shaped by perceptions. For example, even though the number of people employed in the biodiversity sector are comparable to the number of people employed in mining[18-19], there is an enduring perception that mining is better for poverty eradication than wildlife conservation. Tropes that position the environmental sector as a marginal, anti-development indulgence for people who love animals more than social justice, are unhelpful. They leave officials furious and frustrated as they take away their power to argue for bigger budgets, which would result in wildlife (and water, wetland, and livelihood) wins and more employment opportunities for those thousands of young South Africans who *do* choose to study in biodiversity-related fields.

As researchers we need to pay closer attention to the methodology we use, its power to either transform the contexts about which we care, versus inherent methodological biases. The *South African Journal of Science* needs to publish research in which the scientists of the future and the present will recognise themselves, which means it needs to be based on well executed research, and a choice of question and method that are both ethically and conceptually appropriate.

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Response to Commentary: 'Why are black South African students less likely to consider studying biological sciences?' (Prof. N Nattrass)

The Commentary 'Why are black South African students less likely to consider studying biological sciences?' offers a mistaken description of a problem which it then addresses through a distressing mixture of poor research methods, ethnocentric concept formation and ahistorical thinking. It instantiates problematic assumptions about students, especially black students, and how they make choices. Its methodological individualism gives rise to inadequate findings that lend themselves to racist interpretations. It fails to contextualise. Its publication as a Commentary in a prestigious journal has enormous implications for the standing of both quantitative and qualitative research in South Africa.

The investigation appears to have assumed that, to address the question of what is presumed to be black under-representation in conservation science 'in South Africa', values – rather than histories and contexts – should be the focus. It assumes that the 'problem' to be solved is student 'choice' (understood via their 'values'), rather than institutional constraints or histories of exclusion. It appears to assume that UCT students can stand as a proxy for 'South African students.' In so doing, it misses both the facts that the disciplines in question have robust enrollments in other universities, and that institutional histories, including of exclusion and discipline-making, matter. Most importantly, it uncritically mobilises ideas that are drawn from and lend themselves to racist thought and to the harm that such thought inflicts.

In investigating 'student choices', the research operationalises a set of ideas about animals and evolution as a proxy for values which are presumed to be cultural, fixed and unchanging. Such an approach, as many commentators have noted, completely overlooks long histories of exclusion – from land as much as tertiary education – of the category of students in question, and long histories of privilege for those whose subject choices and understanding of environmentalism are not in question. Even if exploring 'values' was an adequate approach to the issue in question – which is clearly not the case here – the work fails to understand how values are formed, which and whose values count and why.

The Commentary seems to make a distinct set of presuppositions about the relation between 'starlings', 'evolution', 'apes,' 'pets', 'materialism' and reasons for study, and then racialises the responses. It sets up false dichotomies between social justice and environmental conservation, and between belief and context.

While the author may argue that the terms in question may be proxies for larger schemas, they are drawn from under-examined presuppositions about relations in the world that run the risk of being ethnocentric or worse. Ethnocentrism by knowledge producers in dominant systems, combined with ahistoricism, especially in places strongly shaped by histories of racist thought and practice, runs the risk of producing racist knowledge or of being interpreted as such. This is the case in the commentary in question.

Good scholarship is based on robust method, conscious of its own biases and limitations. It is directed in its concern for the broader contextual and historical factors that shape current social configurations; alert to how the framing of questions may shape the possibility of harm to others; and particular about understanding power relations in research relations and findings. Neither the Commentary nor the author's responses to critique have demonstrated any of these facets. It is a matter of concern that the Journal has published this study. It authorises poor conceptualisation and investigation as scholarly method. Given their role in identifying research problems and setting research agendas, Commentaries should be subject to extremely critical scrutiny.

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Research into human cognition, attitudes, and beliefs requires a social sciences approach

Submitting the report as a 'commentary' may inadvertently have had potentially unintended consequences

Because Prof Nattrass submitted this scientific study[1] as a 'commentary' (which it was not) and the SAJS accepted it as such, two matters may inadvertently have contributed to the furore that followed publication. Firstly, as a 'commentary' this scientific article was not reviewed. Some of the obvious flaws that would have been picked up by reviewers and corrected by the author prior to publication of the article, were therefore missed. Secondly, the 'commentary' format, necessarily brief, led to several omissions that may have escalated the already serious flaws in the methodology of the research and the way it was reported: i) it was too short to accommodate the necessary conceptual or theoretical framework that should underpin, motivate, and explain research involving humans in a society, and ii) vital information about the methods used (such as the logic behind the sampling method, and its shortcomings) was missing. Nattrass acknowledges and explains some problems in her subsequent longer responses[2-3].

Perhaps the Editorial Board needs to reconsider its policy about what articles can be accepted as 'commentaries'. While the journal's policy states that '*the summarised results of research projects, or comments on such research findings, that have direct policy implications and/or immediate social value*'[4] will be published, the scientifically flawed research in the abbreviated commentary submitted by Professor Nattrass would never be used as a basis for policy change or be of immediate social value.

The investigation about humans in a social setting used an inappropriate scientific research approach

A fundamental drawback of the Nattrass research is that, in spite of the author's later denial that *'the exploratory research was not designed to produce scientific research output'*,[2] it is a truncated report of a scientific investigation, prematurely published. It reveals the psycho-statistical mind-set common to scientists, based on the assumed objectivity of the researcher, and focussing on hypothesis testing, cause-effect relationships, consensus-seeking, and generalisation. However, humans are not organisms like seeds or plants, with variables that can be investigated scientifically. Humans are idiosyncratic individuals whose beliefs, attitudes, and behaviours are influenced by a complex web of factors that are fundamentally affected by people's life experiences. These factors are typically referred to and investigated as 'variables' in scientific research (Nattrass stating[1], for example, that '*The key outcome variable was whether students had ever considered studying zoology or the biological sciences*'). Investigating a limited number of variables

over-simplifies the complex reality of humans in their social settings. The sheer number and nature of the human factors involved result in 'confounding variables' in scientific investigations – variables that cannot be controlled or accounted for. Such studies may simplify the investigator's understanding of the complex factors but are inadequate for explaining humans' beliefs and behaviours. The conclusions from such studies are thus often fundamentally flawed. It is little wonder that the reported study showed that '*all the regression models left a great deal of the variation unexplained*'.[1]

Understanding human behaviours and reasoning is best researched using social sciences approaches

Research involving human participants is more appropriately conducted as social sciences investigations, as implied by Nattrass in subsequent correspondence[2-3]. Social sciences researchers would be likely to build on a conceptual framework based on a thorough knowledge of the relevant literature, including pertinent psychological theories pertaining to humans and the constructs being investigated. Such a framework would have fundamentally changed the motivation for the study, the design of the research, the interpretation of the findings, and the tone and wording of the reported research. Professor Nattrass's commentary does not mention the ethics protocol followed, a necessary requirement for university researchers. University social sciences research involving human participants would have required an ethics application to be submitted to a human research (non-medical) ethics committee made up of members from appropriate research fields, who could make informed decisions about the proposed research. Members of such a committee would have applied specific requirements that include, among other factors, respect for the rights and dignity of participants as humans; an appropriately worded motivation for the study; suitable research questions to guide the research; and carefully designed instruments (particularly their wording). The survey wording would probably be based on prior open-ended interviews so that students' views, rather than the researcher's seemingly uninformed ideas, could be used to structure the survey instrument. The ethics committee would have returned to the applicant for rewording, poorly worded survey items such as leading questions and ambiguous double-questions (e.g. '*national parks should be scrapped in favour of giving land to the poor*'[5]).

The importance of identifying appropriate factors to investigate, based on experience and prior research

The wording of the published commentary suggests that the study was based on unsubstantiated speculation (*'A large part of the answer **is obviously** …', 'Yet there are **likely to be** other reasons too …', 'The survey … explored **these possibilities***'[1]). Although Nattrass makes an effort to substantiate her thinking in her later, longer responses[2-3] the lack of a suitable explanatory conceptual framework makes these appear biased and unconvincing. Of fundamental importance when the researcher is not in the field being investigated is consultation with people who are experienced in the field. Consultation with veteran biology educators would have revealed that some of the fundamental assumptions that led to the research questions for the 'commentary' lacked validity or were unsuitable to investigate as variables likely to provide the researcher with answers to her questions. More importantly, experienced biology lecturers could have identified factors more likely to contribute to student's choice of what to study, so these could be investigated, for example, the impact of admired family members, teachers, or mentors, who made biology seem exciting or were in biology-related careers. Language-related issues also play a critical role for students learning science through a medium of instruction that is not their mother tongue[6-7].

Biology lecturers would also have been able to point out that a faulty assumption guided the study, reflected in the title, that ' … *biological sciences subjects struggle to attract black South African students*'[1]. A check on the facts would have shown i) that many black experts

occupy biology-related careers[5], and ii) that the representation of black students in the convenience sample from UCT was radically different to that of other South African universities[5,8], which typically comprise 80% to 90% black students. Furthermore, using a convenience sample rather than a stratified random sample means the interviewers may not have spoken to students who did chose to study biological sciences, whose replies would have shown the researcher where her interpretations of the data were flawed.

Three factors contributed to the invalid conclusions

***Inappropriate use of correlations to assume causation, a basic flaw in logic*.** Correlations do not imply a cause-effect relationship between two variables, so any cause-effect relationships claimed will not be valid. Furthermore, because of this any claims based on assumed causation cannot be used for predictions (e.g. *'Agreeing that 'humans evolved from apes' was the second biggest predictor of considering studying biological sciences'*, '*showing that attitudes were better predictors' 'Materialist values (a key determinant of not desiring a career in conservation'*[1]).

Incorrect generalisation of the results from a specific sample to the whole population. For example, by stating '*Table 1 shows that less than one third of black South African students reported having considered studying biological sciences* …'[1]) falsely implies that all black South African students were consulted. Inappropriate overgeneralisations, often involving wording using present tense reporting and plural nouns, and lacking the definitive adjective 'the' when referring to the sample, appeared to be a major factor contributing to the angry responses to the 'commentary'.

Unsubstantiated, speculative explanations. The absence of a conceptual framework (based on a thorough understanding of the literature or theories of human psychology) makes the tentative explanations provided in the commentary seem like speculative flights of fancy. Without providing a theoretical foundation, or evidence from the students themselves, the article claims that believing that humans evolved from apes was probably because of poor schooling and strength of religiosity. Other highly speculative claims[1] attributed lack of interest in studying biology to '*materialist values and aspirations ...experience with pets and attitudes towards wildlife … likely also to be shaped by a student's socio-economic background*'; that '*black South Africans may be interested in …. the higher-paying occupations (accountancy, law)*'; and that '*interest in conservation as a career and in studying biological sciences might increase as the black middle-class grow'.*

In conclusion

A number of problems may have contributed to the strong public outcry following the publication of the commentary. These include the inappropriateness of prematurely publishing an exploratory, preliminary study; doing so under the guise of a 'commentary'; using a scientific rather than a social sciences research approach; omitting the essential conceptual / theoretical framework to justify and interpret the study; providing insufficient methodological details to allow readers to judge the quality of the work; the overt methodological problems visible in the scanty information provided; the over-generalised claims made from a specific convenience sample; the unfounded conclusions that have been drawn; and the apparent lack of attention to ethical matters. As mentioned by one staff member in the rebuttal being submitted by the School of Animal, Plant and Environmental Sciences at the University of the Witwatersrand '*academic freedom has its limits. Its limits begin where unjustified claims and flawed assumptions and conclusions are made which may continue stereotyping blacks in an offensive way. Academic freedom does not free SAJS broadly from upholding ethical standards for any published pieces*'.

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In defence of exploratory research: A reply to critics

Abstract

My Commentary 'Why are black South African students less likely to consider studying biological sciences?' (S Afr J Sci. 2020;116(5/6)) has been criticised on a variety of grounds. Many of these involve misrepresentations or misunderstandings of my research. Some appear to be rooted in hostility towards quantitative social science paradigms. Many condemn what they see as racist assumptions and interpretations. I defend my explicitly exploratory research, showing that the research design was in line with standards for such research and was rooted in well-established existing literatures. I dispute that my research was in any way racist or entailed racial essentialism. Rather, it emphasized that attitudes and beliefs were better predictors of study and career choices than self-identified racial identities *per se*. I defend the analysis of the 'red-green divide', materialism, attitudes to wildlife and experience of pets and attitudes on other issues. I acknowledge some useful suggestions for further and fuller research to enhance an evidence-based understanding of the challenges of transformation facing the University of Cape Town and the conservation sector more broadly.

Introduction

Reflecting at length on a two-page Commentary[1] in the *South African Journal of Science* (SAJS) is a strange experience. As critics and friends have told me, my Commentary was 'dull'. Yet it has evoked an extraordinary volume of outrage and debate. At the last count (as of 5th July), almost sixty newspaper articles had been published criticising or defending the Commentary and/or commenting on the censorious and persecutorial reaction of my employer, the University of Cape Town (UCT).

The first substantial criticism of my Commentary came from UCT's Black Academic Caucus (BAC). The BAC critique[2,3] framed many subsequent responses (including several of the rebuttals published in this issue of SAJS). It was followed by my own university's 'Executive' issuing an unprecedented public statement, tweeted to 207,000 'followers', that named me and subjected what they called my 'research paper' to a detailed condemnation. Tracking media and social media suggests that the UCT statement further set the tone and frame for much of what followed. The rebuttal by Mnguni[4] for example, condemns my paper on the basis of media reports of the statement by the UCT Executive.

The SAJS responded to the clamour by announcing, on 11th June, that it would publish a special issue to give 'space to rebuttals in the form of social and intellectual criticism of the published work with an opportunity for response by the author'. A number of rebuttals were submitted and (apparently) all were accepted. A small number of

non-rebuttals were also submitted, despite this not being the focus of the call for the special issue. Some were published;[5,6] others were rejected.

I now have an opportunity to respond to the rebuttals published here as well as elsewhere (including by the BAC[2,3]). Given the diversity and length of the rebuttals, it will not be possible to answer every query, comment or criticism. I will not be addressing the UCT statement or the 'Executive's' related actions as I have discussed these elsewhere.[7-10] Nor will I comment specifically on the implications for academic freedom (many others have done so[11-18]). What I do here is to pull out and address the major themes that recur in the various criticisms about the Commentary itself.

The basic charge

The basic charge against my Commentary is that it is 'racist'.[4,19] A slightly more subtle criticism is that I am unaware of my 'own biases … and narrow-minded views of black people'.[20] My 'assumptions' about students were 'problematic' whilst my 'presuppositions' were 'under-examined' and 'Eurocentric or worse'.[21] My 'presuppositions' that 'explain my conclusion… involve a set of racially charged tropes', leading to 'bad science hanging on the horns of prejudice'.[22] My 'deep-seated antipathy towards the Fallist movement … corrodes the scientific endeavour'[22]. Glennon et al[23] are more indirect: My conclusions 'could serve to promote ideological assumptions that are deeply rooted in a racialised and racist history.' Rosenberg and le Grange[24] write that I *assume* that there are 'innate differences between … race-based groupings.'

My 'whiteness' may or may not be part of the problem for my critics. It certainly is for Dziwa,[25] who describes my 'assumptions' as 'somewhat racist' and suggests that I am 'irretrievably mired in cultural bias':

> *Perhaps she has spent too much time in the ivory towers of academia in Cape Town with its dog running white folk on the sea-point promenade that she is out of touch. Her whiteness is very much a factor in how she frames her problem and in how she interprets her results. … Further, her being white and studying why black people behave in a certain way and then telling them hey this is what I have found out about you and let me explain it to you is an additional problematic that reeks of white privilege through and through. Why does she, as a white person, feel she has to explicitly study us black people, the choices we make, why we decide what we decide, and why we want what we want out of life?*

I agree with criticisms[5] of this kind of racialised demarcation of research areas.

Some critics go so far as to accuse me of deceit. Mothapo et al.[20] suggest that I submitted my piece as a Commentary in order 'to hinder and avoid critical examination of their research as well as to prevent open and objective discourse about the validity of the findings with the wider research community'.

It is difficult to disprove allegations about assumptions, presuppositions and intentions. Below, I argue that there was nothing racist about my assumptions or presuppositions and I explain my intentions. I argue further that neither the questions in my survey nor my analysis of the data invokes racist stereotypes or tropes, as critics have asserted or implied.

Several critics invoke the spectre of my research having the (possibly unintended) effect of bolstering racism. I think that it was the BAC[2] that first suggested that my Commentary in the SAJS might galvanise white supremacists. Others have followed: My findings 'lend themselves to racist interpretations' and 'runs the risk of producing racist knowledge'[21]. 'There is a plausible risk that the commentary could be used to further bolster racist arguments, racial insensitivity, used in a manner to perpetuate harmful racist stereotypes' and undermine transformation.[23] I cannot address this anxiety, but I find it implausible that a dull, two-page commentary in the SAJS will have such wider repercussions.

Some of my critics make bold statements that are simply wrong. Dziwa,[25] for example, writes that I 'asserted that the paper had been cleared by UCT Executives'. I have never asserted this, although I have pointed out that the Deputy Vice-Chancellor for Research, who apparently took the lead in drafting the UCT statement about the Commentary, had chaired a meeting where I presented my findings, and had not raised any criticisms at the time.[7,10] I will not be correcting all such errors.

Also commonplace in the 'rebuttals' are misunderstandings and misrepresentations of my research, especially from critics who appear not to understand or appreciate quantitative social science. Several critics allege that I examine attitudes and then 'racialise'[21] the responses and that my explanations are 'race-based'. As I show below, the opposite is true: I use attitudes to *deracialise* responses. I shall address this further below. I shall try to explain clearly – for non-social scientists – what my regression models show.

Many of my critics charge me – explicitly or implicitly – with the crime of racial essentialism. For example, Mzilikazi et al[19] assert that the Commentary 'depicts and frames a whole racial grouping as largely governed by materialism, linked to a poor relationship with nature and pets'. Firstly, the Commentary was clear about the sample not being representative and hence that findings could not be generalized to UCT students let alone a 'whole racial grouping'. Secondly, the charge itself reflects a misunderstanding of what racial essentialism looks like. A statement such as 'coloured women are both unintelligent and unhealthy' (which is a summary of the controversial and retracted 2019 Stellenbosch paper – see Jansen[26]) seems to me to be an example of racial essentialism, in that it apparently endorses the unity of 'coloured women' as a racial group and associates an 'essential' set of physical or mental characteristics to this group.

Many critics have tried to shoe-horn me into some kind of race science box by assuming that I view 'black South Africans' as a 'racial group' and that I proceeded to associate this group with an 'essential' set of attitudes and beliefs. I dispute that I do either of these things. As I discuss below, I framed my Commentary in terms of 'black South Africans' not because I accord the group any natural status but because this distinction is relevant for transformation. Nor do I identify any 'essential' attitudes or beliefs. Rather, I show that a set of attitudes, each of which is likely to shape study and career choices, cut across self-identified racial categories and differ within racial categories. The fact that combinations of these attitudes and beliefs were more prevalent among black South Africans than others helps us to understand why black South African students in my sample were less likely have considered studying biological sciences or to want careers in wildlife conservation. In showing that attitudes and beliefs are better predictors than self-identified racial identities *per se*, I provide a deracialized explanation for an outcome that initially appears to be partially racialized.

Many of the rebuttals in this volume comment on the limitations of my sample and statistical analysis. I accept some of these criticisms – and acknowledged them in the Commentary itself. The research I reported was explicitly exploratory. The Commentary also acknowledges the weakness of the overall models in that much of the variation in my dependent variables is left unexplained. Exploratory research is not equivalent to predictive or confirmatory research (see Swedberg[27]). Many of my critics ignore or skirt this distinction, either criticising me for having conducted (in their account) predictive and confirmatory research on a non-representative sample, or taking issue with the fact that I published the results of exploratory research at all.

In this response to my critics, I first discuss the meaning of exploratory research. I then turn to the challenge of transformation that prompted me to publish the Commentary. I consider further the title and the context. I then discuss the research design, including specifically the value of quantitative social science, the sample, and the selection of questions. I

examine the questions asked of respondents, the variables used in my analysis and the interpretation of the relationships identified in my regression models, with respect to materialism and economic incentives, the 'red-green divide' (i.e. the relative ranking of social and conservation concerns), attitudes towards wildlife and pets, and other attitudes. I show that all of my variables were rooted in well-established social science literatures. I question whether any of these reproduce racial tropes or stereotypes.

I can do little about the offence that my Commentary might have caused other than to record my regret that it did so. But I can and do defend my exploratory research and published Commentary as acceptable social science.

Exploratory research

Exploratory research entails a wide range of methods, and there are debates over which are best and most appropriate (see discussion in Swedberg[27] and Nilsen et al.[28]). Methods are messy, results are tentative, but there is general agreement that exploratory research is an important component of scientific endeavour especially when it comes to understanding society. John Dollard, in his book *Caste and Class in a Southern Town*, which is one of the early flawed yet classic explorations of race in America, had the following to say in the preface:

> *I would not have the reader think that I believe this book to be a good example of scientific work in its best and terminal form. I see it rather as an exploratory work of science, of the fumbling and fiddling out of which more authoritative descriptions of reality will emerge. I wish I could be certain that we would have the time for a final scientific description of our society before we shall be called to account for its disastrous imperfections.*[29.p.xiv]

Critics of my methodology should read my Commentary in this light. The reason I published my results as a Commentary, rather than a full research article, was to flag their exploratory nature. I called explicitly for further research into what is clearly an important challenge: transformation at the university and within conservation. I believed that reporting my exploratory research was in line with the SAJS's guidelines for commentaries, and indeed for commentaries in academic journals generally (see further discussion of this by the anonymous student in Appendix A). My Commentary was in fact submitted and accepted for publication with the subtitle 'An Exploratory Analysis'; the subtitle disappeared during production (which I failed to notice).

Most exploratory research is not designed to be published.[27] This was true of my research. The motivation behind the survey I analysed in the Commentary was to collect data on various aspects of living with wildlife at UCT and on student preferences and attitudes pertaining to study and career choices relevant to conservation. The survey was intended primarily to support student projects and to inform ongoing discussions in the Institute for Communities and Wildlife in Africa (iCWild) about transformation.

The challenge of transformation

Transformation in South Africa relies on 'racial' categories inherited from the apartheid era and re-institutionalised by the post-apartheid state.[30] Government has the power to give social life to categories and the dangers of this approach are frequently pointed out.[30-32] The South African government Department of Higher Education and Training demands that institutions report (on transformation) using old apartheid racial categories. This prolongs the life of these outdated racial categories even though it also reminds us of the long-historical reach of racial discrimination. At UCT these categories are also national in that a distinction is drawn between South Africans and people from the rest of the world.

I am part of iCWild, a relatively new inter-disciplinary institute at UCT committed to problem-driven, often action-oriented, policy-relevant research. We accept students from all over the world without prejudice. We are also

committed to UCT's overall project of transformation and to growing the number of black South African researchers and practitioners in the broad field of conservation biology. Scholars who are not white and middle-class are likely to have insights rooted in different cultural backgrounds and values[33-35] and are also more likely to understand and to be able to engage effectively with many of the communities living in closest proximity with wildlife across Southern Africa. I look forward to having a more diverse set of senior colleagues in the fields in which I work.

Senior courses in the Biological Sciences Department are important feeders for post-graduate research in Conservation Biology. The Department of Biological Sciences does not have readily available data on the number of black South Africans in the undergraduate or postgraduate degrees, but it is widely acknowledged in the department that black South Africans are under-represented (see Midgley[6]). The current Head of Department commented in an email (4th June) that there were black South African students in first year classes but 'the numbers decrease as one moves to senior courses.' This year there were no black South Africans in the Masters' course in Conservation Biology. In iCWild we have been successful at improving the diversity of our student cohort, but we struggle to grow the number of black South African scholars.

In my Commentary I analysed survey data to see if we could learn anything about how attitudes and preferences might shape individual study and career choices in a sample of UCT students. Of course, the survey barely scratched the surface of the many factors that probably shape preferences and choices. Of course, a two-page Commentary could only mention in passing, rather than expand on in any detail, the socio-economic, and institutional forces, as well as the legacy of apartheid, that shape and constrain the context within which individual choices are made. Yet the exploratory research produced some suggestive and interesting results. I presented these at the three-year institutional review of iCWild and was encouraged by both external reviewers to publish the results. This is why I submitted the Commentary to the SAJS. I agreed with the external reviewers that the challenge of transformation is so complex and multi-facetted that we should be sharing even our exploratory results where these perhaps shed light on this important, yet under-explored, topic.

Transformation is not only a challenge at UCT, but also for the conservation sector across South Africa. A 2010 report on 'A Human Capital Development Strategy for the Biodiversity Sector: 2010-2030', by SANBI and the Lewis Foundation,[36] showed that black South Africans were under-represented in leadership and senior levels in their broadly defined 'biodiversity sector'. Factors thought to be associated with this included absolute shortages of suitably skilled black South African graduates, non-competitive salaries and the quality of education in schools attended by the majority of black South Africans. The report noted that the percentage of black South Africans working in the biodiversity sector increased between 2000 and 2007, but that it still fell short of its equity target. Worryingly, more than 30 percent of people working in the sector were reportedly not qualified to take on the responsibilities for which they had been appointed, leading to a presumed need to attract suitably qualified post-graduates from elsewhere in Africa and the world. The report included data from the Higher Education Management Information System (HEMIS) for a broadly defined 'biodiversity' cluster, which included biological sciences, horticulture, soil sciences, geography and agricultural extension. It found that the number of black graduates grew in the 2000s, but that the challenge of producing more post-graduates remained pressing.

Some of my critics seem to believe that there is no longer a problem of transformation in either the biological sciences or the conservation sector (and hence, by implication, my research was misguided and unnecessary). Glennon et al[23] conclude that the problem does not exist because the number of black South Africans studying

biology at Wits has grown. Mzilikazi et al[19] similarly report that there is no problem at the University of Johannesburg (UJ). Rosenberg and le Grange[24] suggest, citing unpublished analysis of more recent data from HEMIS, that transformation has gained pace in the broadly defined biodiversity sector, but they provide no data specifically on black South Africans in the biological sciences, or in conservation biology, or in conservation careers. (They also say their definition of black was 'politically defined' but do not explain what this means).

It was gratifying to read (in Mzilikazi et al[19]) that UJ and some other institutions have successfully attracted more diverse students into biological sciences. We can surely learn from their successes. As Mzilikazi et al[19] proceed to acknowledge, however, 'there is a clear lack of transformation in biological sciences at many of our top universities', i.e. not only at UCT. I note also that neither Mzilakazi et al nor any of my other critics point to a single prior study of either this 'clear lack of transformation' at 'many of our top universities' or the successes at UJ and elsewhere. Mzilakazi et al[19] proceed to suggest that what we need are more inspirational role models, better science teaching in schools and more resources for study at university. I agree with Mzilakazi et al[19] on this; including questions about role models in my survey might have been useful. But would these reforms suffice? Mzilakazi et al[19] provide no evidence that the factors I identified among UCT students are not *also* important.

Haffajee[37,38] reports that 13 out of South Africa's 20 national parks are managed by black South Africans and that many of the senior scientists at South African National Parks (SANParks) are black. She concludes that the entire premise of my research would have fallen over if I had made 'one phone call to SANParks'. Yet in her own interview with him, the managing executive for conservation services at SANParks (Luthando Dziba) noted that 'more needs to be done to achieve the transformation of the conservation sector as a whole, including within SANParks' and that progress to date has been 'rather modest'.[38] Many people from across the conservation sector have written to me making the same point: Despite progress, more needs to be done.

The title and context

The title of my Commentary seems to have been a source of some confusion. For example, Glennon et al[23] read it incorrectly as implying that 'black students are *not* studying biological sciences'. Others have ignored the question mark and read it as making a generalizing claim (e.g. Rosenberg and le Grange[24]). The title of my Commentary posed a question: 'Why are black South African students less likely to consider studying biological sciences'? The 'less likely' is important and speaks directly to the *marginal effects* reported in my Commentary (more on this later). I accept, though, that not stating in the title that it was an 'An exploratory analysis' may have caused confusion and it is unfortunate that this sub-title got dropped during production.

In reflecting on titles and potential misunderstandings about generalization, it is useful to consider another paper on student attitudes at UCT. Shose Kessi (who was subsequently appointed Dean of Humanities) co-authored a research article titled: 'Coming to UCT: Black students, transformation and discourses of race'[39]. The title of this paper is clearly more generalising than my own. The paper provides a fascinating analysis of comments and photographs by 24 students who participated in a transformative 'photovoice' project. The sample appears to have been a convenience sample (perhaps even a snowball sample). Nonetheless, the article concludes with a generalization: 'Despite the increasing numbers of black students at UCT, their sense of belonging to the university remains limited.'[39,p.12]

Why is it that my Commentary, with a more qualified title and an explicit statement in the text that the data are not representative across UCT, has been read as making generalizations about 'black students', when the Kessi and Cornell research article, which makes an explicit generalization based on a sample that

clearly cannot be used to make generalizations, did not generate outrage?

I prefer evidence to speculation, but do need to consider briefly the political and intellectual context of identity politics. Identity politics has generated movements such as Black Lives Matter and #MeToo. It has noble origins in the black feminist lesbian movement that found expression in the Combahee River Collective[40] which argued that the most radical politics was rooted in identity issues rather than working to end somebody else's oppression. An effect of this approach has been to privilege identity over other factors, to enable reductionism and essentialism (where a claimed identity must result in certain views) and to produce intolerance and incivility in South African academia.[41] An identity politics approach permits my detractors to position me, first and foremost, as a white author and once this racial identity has been asserted it becomes legitimate to condemn me for subjecting 'black lives' to a hostile 'white gaze'.

Another possible reason for the torrent of criticism on social media is that the focus of the Commentary was on student preferences and choices rather than on institutional racism. Kessi and Cornell[39], it would seem, can – and without provoking outrage – make generalizations (and on limited evidence) about what black students feel about UCT because such generalization are in line with what has become a hegemonic framing of UCT in terms of institutional racism and white privilege. This framing represents black (South African) students as marginalised (and even humiliated) by unsafe academic spaces dominated by white professors teaching colonial subjects of little relevance to them.[41-45] My Commentary may have offended in part because it seems to be paying insufficient attention to the institutional context within which students make choices.

The hegemonic framing of UCT as institutionally racist has provoked much needed discussion. But it has also resulted in a hostile environment for those seen to be on the wrong side.[46-48] Many students and academics have written to me to say that they were concerned (even appalled) by the attacks on me and the Commentary but were reluctant to say anything publicly for fear of reprisals. One of these students attempted to publish a rebuttal of the BAC's criticisms of me but was apparently turned down by the SAJS for being anonymous. I have taken the step of including it as Appendix A because it stands as an example of the many voices that have been silenced in this furore.

The narratives and images discussed by Kessi and Cornell[39] provide insights into how some (perhaps many) students experience racism and alienation on campus. Survey research into patterns of social segregation at UCT and other universities[49,50] is also revealing of the continued salience of race in everyday life. Yet there are clearly many factors shaping student choices and experiences that transcend race, and this too is a vitally important area of study.

Student choice and agency

If we are considering access into and progress through higher education in general, then we know – from numerous studies – that students are constrained by socio-economic factors: poverty, poor schools and the racialised legacy of apartheid. There are huge structural barriers to most young people realizing their aspirations.[51-53] Access to higher education and the likelihood of completion of diplomas or degrees are affected by class background.[51,54-57] School students might be told 'you can do anything'[58] but of course they face very unequal opportunities.

What we don't know much about is how students make choices – and exercise agency – within the structural constraints. A 2002 study analysed high school students' subject choices (as well as institutional preferences), finding that the most important factors were interest, wanting to make a difference, and job opportunities.[59] More recent studies emphasise the pressure that is placed on younger people, especially by adults challenged by structural disadvantage, to obtain an education that can pave the way to a 'lucrative' career.[53] Research in a KZN high school suggest

that career choices are often driven by the anticipated financial rewards (i.e. being paid a 'huge salary', as one student put it).[60] School students in Cape Town, when asked about their career aspirations, almost all said that they wanted to be lawyers, doctors or successful in business[51].

There are, to the best of my knowledge, few studies on career choices of university students in South Africa, particularly where this is of direct relevance for conservation. The SANBI/Lewis Foundation report[36] into the challenge of transformation in the biodiversity sector noted that values and attitudes were probably important factors shaping subject choice and thus also the entire pipeline into the biodiversity sector.[36, p.11,16.41)] Abrahams et al,[61] using data from a survey of students at a historically disadvantaged university, found that 'anticipated benefits influenced the students' career choice, with the potential for personal growth and development, for future high earnings and for promotion to the top of the organization being the most important. In reviewing the available studies, the authors concluded that there are many variables – including 'socio-cultural factors' and family role models – affected career choices of students, but that job opportunities also featured prominently. [61 p.211]

Given this prior research, it seemed appropriate to start exploring preferences amongst UCT students with regard to subject areas and careers of relevance to conservation. These are students who had the necessary qualifications and access to resources to study at UCT. Within this sample, attitudes and beliefs are likely to be more important than direct structural constraints – although attitudes and beliefs themselves are, of course, rooted in broader cultural contexts beyond the control of any individual student. My UCT-based critics,[21,62] however, reject my research in part because it focuses on student preferences and choices rather than the wider context of history, institutional mechanisms of exclusion, ongoing socio-economic inequality and so on. Dziwa[25] seems to make a similar claim, that the study of transformation should be 'approached … from an institutional, demand-side perspective'. I disagree. Student choice and agency are *also* valid topics for research and should be part of our ongoing discussion about transformation.

The idea that students make choices seems to offend some of my critics, many of whom seem to imagine that young people are simply the victims of structural forces beyond their control. Yes, as I and others have shown elsewhere,[51,63-65] many young people face highly constrained choices in life. The legacy of the past weighs heavily on young people through the inequalities in schooling, social networks, the labour market and so on. Nonetheless, young people make choices and exercise agency – as, of course, was demonstrated through their resistance to apartheid.

A series of studies, using qualitative research, have pointed to the 'resilience' exercised by young people in navigating through a 'structural' landscape that constrains but does not prevent their agency.[51,53,66-70] There is also a long literature on the ways in which agency in South African history has been shaped by norms, values and beliefs. One example of this that is very relevant to educational decision-making is the rich ethnography and historiography around 'red' and 'school' traditions in the Eastern Cape.[71-73] Memoirs by scholars such as Chabani Manganyi[74] and Mamphela Ramphele[75] provide life history examples of agency and choice, speaking eloquently about race, social class and family, and how individuals exercised choice within the bounds of 'fate'.

Paradigmatic intolerance and misunderstanding

Another source of misunderstanding of, and hostility towards, my Commentary, particularly from those outside of the social sciences, is about the nature of survey research and how analytical findings should be interpreted and read. Survey data analysis necessarily abstracts from the complexity of individual lives, does not speak easily or directly to historical and social context and is

limited by the inevitably crude character of standardised questions. Many scholars in the Humanities prefer qualitative methods over survey research. Some of the criticisms of my methods thus reflect the divide between scholars in qualitative, ethnographic, participatory or discursive traditions and the social sciences, where the analysis of survey data is undertaken to produce summary statistics and to explore patterns and connections in the data using techniques including factor and regression analysis. Ross,[21] for example, dismisses my survey research as 'methodological individualism'. Khan and Alves[62] dismiss it as an unacceptable Western research method. Both assert that it is therefore 'racist'.

This methodological hostility towards quantitative methods is particularly evident in debates over transformation and how to study it. In the introduction to their recent edited collection: *Transforming Research Methods for the Social Sciences: Case studies from South Africa*, Laher and Kramer note that the reviewers of the book manuscript had questioned the inclusion of quantitative and experimental methods, to which they had responded: 'We stand firm that all methods have value' and 'cannot support a narrow view of what exactly constitutes transformative methods in contexts like ours.'[76, p.10] I agree.

Another (related) part of the problem is that many critics appear to have focused on the descriptive statistics rather than the regression analysis which reported average marginal effects of what can be understood broadly as conditional correlations. The descriptive statistics, which were included to show how the distribution of the attitudinal variables used in the regression analysis varied between students who self-identified as 'black South African' and all other students (i.e., other self-identified categories of South Africans, or foreign students including from African countries). I presented the breakdown in this binary way ('black South African' versus all others) because of the focus on transformation, and because it was the variable used in the subsequent regression analysis.

Some of my critics worry that I do not have a 'control group' in the analysis. In some cases, I think this is a misunderstanding of how the use of binary variables works in multiple regression. Consider my initial dependent variable: students who had considered studying biological sciences have the value 1 for this variable; students who had not considered it have a value of 0, and thus serve as the 'control'. Other critics seem to be arguing that I should have controlled in the regressions for what faculty students are in, or for whether they were actually doing biological sciences. The key outcome variable used in my exploratory analysis was whether students had ever considered studying biological sciences – irrespective of whether they actually were studying biological sciences. There was no obvious or necessary reason to control for faculty or actual subject choice in this exploratory research, though I accept that this would be an interesting thing to explore in future research on a larger, probabilistic sample.

A note on ethical approval and causing offense

The data used in my Commentary drew on an exploratory survey of living with wildlife at UCT (discussed further below). The questionnaire and sampling method obtained ethics approval through the Commerce Faculty (where I have a permanent academic appointment), in line with university policy.

There has been much confusion amongst my critics about whether ethical approval was granted for my research. In social survey research, ethical approval is granted for the data collection, not for the ensuing research papers using the data. There are potentially many different research papers that can be written on data from a single social survey so there can be no reasonable expectation that the full range of possible papers be presented for ethical clearance at the time that a social survey instrument is cleared. Furthermore, papers in the social sciences are not 'cleared' by a committee dedicated to ensuring that no 'offensive' papers are published (as seems to be the demand of many of my critics).

This is for good reason. If censorship of this kind had been introduced in the 2000s, it probably would have prevented the publication of all of my work on AIDS denialism, including my estimation of the number of people who died unnecessarily because of the delayed use of antiretrovirals.[77-81] During that time, I caused great offense to the South African president and his health minister. I was pushed off an academic platform for daring to suggest the Health Minister was mistaken. Some colleagues in the Humanities believed I was being offensive for dismissing 'African science', not giving sufficient attention to 'alternative knowledges' and paying too little attention to 'subaltern voices'. There is no question that I outraged some people and that my work 'harmed' President Mbeki and his Health Minister. My research was used in the Treatment Action Campaign's successful legal action that forced the government to provide antiretroviral drugs through the public sector to prevent the transmission of HIV from mother to child. My work was offensive, but it helped to save lives. When I look back over my academic life, I am sure that this will be the work I will be most proud of.

My exploratory Commentary, by contrast, will barely be remembered beyond the fuss it has caused. Yet it too deserves not to be censored just because some people have read it as being offensive.

The sample

In my Commentary, I described the sample as 'opportunistic' as I left it up to the student researchers to approach respondents, which they did mostly during the lunch break. Describing the sample as 'opportunistic' is unusually honest for social science survey-based research. Samples of this kind are more usually described as 'purposive' or 'convenience' samples. In the social sciences, samples are often far from perfect, with 'purposive' or 'convenience' features.

A recent example is the web-based survey that StatsSA conducted during the lockdown to explore the impact of COVID-19 on income and employment.[82] StatsSA was explicit about the fact this was a convenience non-probabilistic sample which meant that findings could not be generalized across South Africa. Yet, the data were analysed and published because the information is clearly of interest and better than nothing when it comes to informing policy making.

For some of my critics, using data from a non-representative survey to reflect on preferences pertaining to studying biological sciences and a career in conservation was simply 'bad science' (and, some added, unethical). I accept that a larger, more representative sample would have been better, but I do not accept the charge that what I did was unacceptable social science. As discussed earlier, exploratory research and the testing of novel hypotheses and/or the trialling of unusual and innovative (some have called them quirky or even bizarre) questions is a very common component of scientific endeavour. This is especially the case with under-researched topics. In our case, we sought to obtain a sufficiently large and diverse sample of students to explore whether particular questions resulted in sufficient variation across the sample that they could be useful for regression analysis – and then to explore correlations and other statistical relationships between variables.

Data from non-probabilistic samples commonly form the basis of empirical research within the social sciences. This is true for diverse research methods, ranging from ethnographic description, to case studies, experimental design, action-research interventions (such as the photovoice intervention discussed in Kessi and Cornell[39]) and social surveys. Qualitative studies in particular have a very loose approach to sampling. For example, a study of career choice in a South African township school invited 47 students to participate; 12 did so; the ensuing sample was described as 'purposive'.[83] Kessi and Cornell[39] used some kind of convenience or snowball sample. A study based on 20 high-school learners participating in focus groups described this it as a 'convenience sample', and despite this not being representative,

concluded on the basis of this evidence that the 'career counselling needs of Black learners in rural schools still go unmet'.[60, p.260] Cocks et al, for their study of understandings of nature amongst Xhosa-speaking people in the Eastern Cape conducted a non-random 'purposeful sample' aimed at 'representing a spread of economic status, age, and gender'.[35, p.827]

Adesina[22] is particularly critical of my opportunistic sampling frame. He suggests that even exploratory research should have used a systematic, probabilistic sampling frame, using student records. This, of course, is but one of several possible ways of drawing a representative survey sample.[84,85] Mzilakazi et al[19] concede that convenience samples are appropriate in 'many situations,' but concur with Adesina that I should have drawn a random sample using student records. This is like saying that, if we want to go on an exploratory drive, we need to drive a Rolls Royce. Adesina seems ignorant of the facts that Rolls Royces are not only expensive but can easily turn out to be inappropriate. In South Africa, survey response rates among students (and some other sections of the population) are generally low and almost certainly non-random. In reality, social scientists typically make do with imperfectly realised samples and then have to consider how to interpret our findings. Sometimes it is better to drive a jalopy and be honest about it.

Even if we had chosen to draw a probabilistic sample of the kind suggested by Adesina, and then emailed the questionnaire to the selected students, it would likely have suffered from such selection bias that even judicious weighting of the sample could not 'correct' for it. In contrast with face-to-face interviews, which provide respondents with the opportunity to discuss the research and the questions posed,[86] students are likely to see the email as spam, and lacking any context, be prone to rejecting the survey as a waste of time. One could, of course, provide incentives to students in order to encourage participation but, this cannot be relied on to solve the problem. For example, Finchilescu et al[49] surveyed students across four South African universities in a mass emailing, and via adverts at login, offering students the opportunity to enter a draw for a R1,000 prize if they participated. The authors did not specify how many students they reached (they might well have not known) but it is likely to be in the tens of thousands. Their final sample was 2,559 students, of which 59% were white and 61% were women. Their sample clearly suffered from selection bias and cannot be considered representative. In a later paper based on the same data set, Tredoux and Finchilescu[50] acknowledge explicitly that the realised sample was unrepresentative and non-probabilistic.[50, p.294]

Does this mean that they should not have done any statistical analysis on the sample, and that the two interesting papers[49,50] based on this data should not have been written or published? According to critics such as Glennon et al,[23] the answer is a firm 'yes' because, they believe, one simply cannot run any probabilistic statistical analysis on a non-random sample. Perhaps this is because they are zoologists and botanists. Social scientists are much more comfortable working with data sets that are far from perfectly random or representative. This is what happens when you work with human actors who can exercise choice and decline to participate. For social scientists, including Tredoux and Finchilescu,[50] it is acceptable to explore how patterns of answers in non-representative surveys regarding attitudes and preferences over-lap with race. As they explain, the key issue was that despite being unrepresentative, 'there was considerable diversity within the sample, and it was considered suitable to our primary purpose of exploring the potentially mediating effect of a number of variables on the contact–prejudice relation'[50, p.294] This was precisely the approach adopted in my survey and exploratory analysis.

My students and I opted for a directly personal approach where students were offered the opportunity to participate in a short survey primarily during lunchtime, when wildlife like starlings and pigeons were very much in evidence, and when UCT's many rodent bait

stations could be pointed out and discussed. I am convinced that this resulted in better response rates and more meaningful discussions and participation. Our face-to-face friendly approach also included giving students a snack bar in appreciation of their time. The snack bars, together with the short and somewhat quirky nature of the survey, meant that demand for participation at times exceeded our supply of snack bars and questionnaires. My student researchers had no problem obtaining interviews. I also had no reports of any student being offended by any of our questions.

Some of my critics have argued that instead of obtaining this sample of students, I should instead have started with surveying (or interviewing in-depth) a sample of students in the biological sciences. It is likely that this would reveal the factors that shape the decision to study biological sciences. I hope someone does this research. I disagree, though, that such research had to be done *before* doing my exploratory survey with a wider mix of students. I am told by colleagues in Biological Sciences that despite more than 20 years of discussing the failure to transform biological sciences the department as a whole has to date relied solely on discussions within staff and student meetings to try and understand and resolve the problem, evidently with very limited success.

The analytical strategy

The analytical strategy in the Commentary focused on two questions of interest to iCWild when considering the challenge of transformation: were black South African students in our sample less likely to have considered studying zoology or any other biological sciences, and were they more likely to agree with the statement 'I support wildlife conservation but have no interest in a career in it'. If we observed a 'race effect' in these questions, could the outcomes be better explained by attitudinal variables? There was no assumption that 'race' mattered and, if it appeared to do so, the challenge was to explain how and why.

Given that there has been such widespread misrepresentation and misunderstanding of my analytical strategy, it is worth explaining it in some detail. My regression results reported average marginal effects. In each case, I started with a simple (bivariate) regression which had a single explanatory or independent variable which took a value of 1 for students who self-identified as black South Africans, and zero for other students. Regression 2.1 shows that being a black South African reduced the average marginal probability of having considered biological sciences by 17 percentage points. This is not a huge effect. It certainly does not mean that no black South African students at UCT had considered studying biological sciences. Nor can this statement be considered to be a general statement about all black South African students either at UCT or across the entire country (as many of my critics insist my paper was suggesting). It merely shows that, in this sample of UCT students, self-identification as black South African reduced the probability that a respondent would agree that they had ever considered studying biological sciences.

The other regressions in Table 2 were multivariate regressions, that is they included further (in this case, attitudinal) independent variables. Regression 2.2 includes the attitudinal binary variable taking a value of 1 if respondents agreed with the statement 'Addressing social inequality is more important than wildlife conservation' and zero if they disagreed or neither agreed nor disagreed. This binary explanatory variable also had a statistically significant, negative relationship with the dependent variable. In Regression 2.2, the 'black South African' binary variable remained statistically significant and its coefficient only declined slightly: conditional on the other variables in the model, agreeing that addressing social inequality is more important than wildlife conservation reduced the average marginal probability of having considered the biological sciences by 14 percentage points, and self-identifying as black South African reduced it by 16 percentage points. Regression 2.3 added a further binary

variable taking the value of 1 if the student respondent agreed with the statement 'I support wildlife conservation but have no interest in a career in it' and zero for those who disagreed or neither agreed nor disagreed. Including this binary variable reduced the size effect of self-identifying as black South African and rendered it and the other variable statistically insignificant.

In other words, what we are learning here is that, conditional on the other variables in the regression, agreeing with the statement 'I support wildlife conservation but have no interest in having a career in it' reduced the average marginal probability of having considered studying the biological sciences by 41 percentage points. This is a large effect that overwhelmed the effect of 'race' in the initial regression on this sample of students. The size effect of the binary variable taking the value of 1 if respondents agreed with 'I support wildlife conservation but have no interest in a career in it' remained large and statistically significant even after controlling for attitudes towards human evolution and extent of experience with different kinds of companion animals (more about these variables later).

To reiterate: my results show that attitudes were a better predictor than 'race' (or more precisely, racial and national identity) – and this is what I wrote in the Commentary. This is not racist analysis – it is precisely the opposite.

Some of my critics have fundamentally misunderstood, and I would suggest misconstrued, my empirical strategy. Notably, Glennon et al,[23] and Adesina[22] seem to think that I started out with racist assumptions, made racialised 'findings' and then failed to appreciate the logic of my own analysis (that the effect of race disappears when other explanatory variables are included). They use exclamation marks and bolded text, giving the strong impression they think they have made some amazing discovery about my own results which I was presumably too blind to see. I am totally perplexed by this misreading of my Commentary. It speaks volumes about their own blindness to what I actually wrote, and how wrapped up they must have been in their own indignation about what they thought was my racism, that they could not, or would not, acknowledge what was actually set out in the two pages comprising my Commentary.

Given that agreeing with the statement 'I support wildlife conservation but have no interest in having a career in it' had by far the largest impact, I took the further analytical step of exploring potential determinants of this attitude. This entailed selecting questions about wildlife, about the perceived validity of the conservation project itself, and indicators of materialist values which could reasonably be considered of relevance to career choice. Table 3 presented a set of regressions showing that the score on the World Values Survey materialism index and the score on an anti-conservation index were positively, but weakly, associated with the dependent variable, whereas a positive attitude to local wildlife (the red-wing starling) at UCT was negatively, and more substantively associated with it.

Glennon et al[23] reject this analytical strategy in its entirety, saying that what I should have done was use only the best fit models (derived from all variables). This probably speaks in part to differences between natural and social sciences, and to their likely lack of familiarity with the range of analytical approaches adopted in analysing social survey data. A key strategy in the Commentary was to show how the inclusion of attitudinal and other variables 'got rid of' an apparent 'race effect'. The point of showing a succession of regressions was precisely to demonstrate this for the reader.

The strategy of first reporting descriptive statistics for variables and then the results of regressions where each control variable is included for theoretical reasons, is a common strategy in the analysis of survey data in economics (see e.g. Henry and Kollamparambil[87] for a recent example using South African data). Variables are not included just because, in some data mining sense, they are the 'best fit'. Variables are rather selected for inclusion because it is meaningful to do so and in order

to draw particular implications, such as saying 'controlling for occupation, education, skills and experience, people who are female, or black, or have a higher body mass index, are paid x percent less than expected'. In my Commentary, the regressions were set up to show that there was a simple relationship between being a black South African and the variable of interest, but that this relationship lost substantive and statistical significance once our attitudinal variables of interest were included in a multiple regression.

This strategy of showing the simple regression and then adding additional variables in subsequent regressions was similar that used in a recent co-authored paper on the relationship between culling predators and livestock losses the following year in the South African Karoo (see Nattrass and Conradie,[88,p.781], and Nattrass et al.[89, p.1227] This approach is common in economics. The only economist I am aware of amongst the authors included in this special issue is Hassan Essop, and as he and Long[5] point out, they were not offended by the Commentary. They, like many others (including me) point to limitations with the sample but are clear that the results of regression analysis should not be read as assumptions.

Were the questions in the survey (and my subsequent analysis of the data) racist and designed to put black South Africans in a bad light as some of my critics contend? Are they, as the BAC claimed, 'based on historically fictionalised stereotypes about black people conjured in "the white imagination"'[2] that are harmful by intent (and empirical outcome)? A first step towards addressing this entails discussion of the questions themselves, reflecting on the logic (and analytical intent) behind them, and on whether there are any grounds for believing that these are based on harmful stereotypes. I shall discuss the questions in two groups: the first pertains to the 'red/green' divide; the second pertains to general attitudes and values and experience with companion animals.

The Red/Green Divide

Four questions were included in the survey because they speak to the 'red/green' divide that is evident inside and outside of the academy. Students were presented with a set of statements and they could choose a response on a Likert scale ranging from 'agree strongly', 'agree', 'neither agree nor disagree', 'disagree' or 'disagree strongly'. For the purposes of the analysis in the Commentary I created binary variables out of a non-binary set of responses where 'agree' and 'agree strongly' were coded as 1 and other responses as zero. The statements presented to students were as follows:

1. 'Addressing social inequality is more important than wildlife conservation'.
2. 'I support wildlife conservation but have no interest in having a career in it'
3. 'Many of South Africa's national parks should be scrapped and the land given to the poor'
4. 'Disciplines like conservation biology are colonial and should be scrapped at UCT'

Ross[21] suggests that question 1 above sets up a 'false dichotomy between social justice and environmental conservation' (see also Haffajee[37,38]). Rosenberg and le Grange[24] similarly criticise me for setting up a 'forced choice', noting the efforts since the 1992 Rio Summit to reconcile social justice objectives and environmental protection.

I disagree. Firstly, the students were not presented with any forced choice. They could choose to agree strongly, agree, disagree, disagree strongly or neither agree nor disagree. The binary variable I constructed from the question separated those who clearly agreed with a ranking of social inequality above wildlife conservation from those who were neutral, or who disagreed. Secondly, the binary variable I constructed is meaningful because the relative ranking of addressing social inequality and wildlife conservation is socially and economically relevant. There is a longstanding international body of research on

the relative ranking of concerns about social justice and environmentalism and on how this plays out in the activist domain in a red/green divide.[90-96] Theories of sustainable development and ecosystem services approaches have sought to reconcile development and conservation objectives, yet in practice and in the presence of budget constraints, the problem of relative ranking of projects and in allocating particular parcels of land for development or conservation purposes persists.[97-99] The debate over whether 'half the earth' should be set aside for protected nature reserves and what that means for human livelihoods and biodiversity[100-102] is a contemporary manifestation of the red/green divide.

For those working to address social justice, wildlife conservation is often portrayed as a 'bourgeois' pursuit, and in the South African context as not caring for the poor. I recall that when my husband and I dedicated several weeks in 2000 to helping clean and feed endangered African penguins rescued from a huge oil spill in Table Bay, we were criticised for spending our time on this rather than assisting poor people. The Johannesburg Child Welfare Society placed an advert in a national newspaper with a (white) child pouring oil onto his head with the logo 'Now will you help me'? All this is evidence of a very real red/green divide in everyday South African life – and one that transcends simple racial divisions and classifications.

The relative ranking of red/green issues is clearly of contemporary interest in the South African context where unemployment is high and there is a pressing need for labour-intensive economic growth.[63] Given our history of apartheid, the persisting overlap between race and class,[64-65,103] it is reasonable to explore the relationship between race and red/green issues and see if it shapes both the feeder stream into conservation biology (biological sciences) and whether students have an interest in a career in conservation. Studies of stakeholders involved in land-use planning have shown that there are racial/cultural differences with regard to the relative ranking of economic growth and nature conservation,[98] so exploring the red/green divide with an eye for seeing how this might help us think about student preferences, is consistent with such work.

I do not agree that asking students for their response to question 1 'Addressing social inequality is more important than wildlife conservation' is normatively loaded as there are reasonable and morally sound arguments that can be made in defence of agreeing, disagreeing or remaining neutral. Some critics argue that precisely because of South Africa's history of land dispossession, ongoing inequality and patterns of racial disadvantage, black South African students are more likely to answer in the affirmative. I agree that this is a reasonable hypothesis. Which is precisely why I thought that the answers to this question might turn out to be a better determinant of whether students had considered biological sciences than being a black South African *per se*. This was an underlying hypothesis that shaped the empirical strategy – and I think my critics and I are on the same page here.

Where we are clearly not on the same page is that my critics castigate me for even asking this question because, they say, finding that black South Africans are more likely to agree will supposedly feed into and reinforce a racial trope about black people not caring about conservation. The BAC[3] sees this as a 'gotcha' question, proposing instead that I should have rephrased the question to read: 'Addressing social inequality and wildlife conservation are equally important'.

Firstly, it is worth noting that students who thought that addressing social inequality and wildlife were equally important could have opted to disagree or to remain neutral on the question as originally formulated. Secondly, if we had asked the question in the way suggested by the BAC, we would learn nothing about any potential red/green divide within the sample as the relative ranking of addressing social inequality and wildlife conservation is removed by the design of the question.

Presumably this was what the BAC intended in order to see off any potential data analysis that might (in their mind) reflect badly on black South African students. However, I disagree with the BAC that the question we asked reflects and reinforces any racial trope or stereotype. Firstly, agreeing that addressing social inequality is more important than wildlife conservation is not a normatively problematic stance. Secondly, less than half of black South African students in the sample agreed, and although this was a higher proportion than was the case for other students (which could well speak to the legacy of history as well as the pressures that characterise our society today) the difference was not statistically significant. In short, not only did my research not assume any racial stereotype, but even if the question could be twisted to be read as a stereotype, the results undermined rather than supported it.

Question 2 asked students for their responses to the statement 'I support wildlife conservation but have no interest in having a career in it'. This also speaks to the red/green divide, this time focussing more on career aspirations. More than two-thirds of all students in the sample agreed with this statement, which is unsurprising because a career in wildlife conservation is not a mainstream career choice for anyone. Yes, a higher proportion of black South African students agreed with this statement. But I see no reason why there is any inbuilt bias in this question, or that the result reflects badly on black South African students.

According to the BAC[3], this is a 'gotcha' question because it does not allow students to signal that they might consider such a career if circumstances changed. The BAC suggests that we could have added 'at this time' to the end of the question. I am not convinced that this would have made any difference to the answers as this qualification is implicit in the question. Furthermore, the question is already complex (and I have been criticised by others for not breaking it down into two questions: one about supporting wildlife conservation and another about having no interest in a career in it). Adding 'at this time' potentially adds a further layer of complexity to the already complex statement.

Question 3 asks students for their responses to the statement 'Many of South Africa's national parks should be scrapped and the land given to the poor'. This probes the red/green divide more directly by contrasting different land uses (scrapping some national parks, redistributing to the poor). Previous research has pointed to the attitudinal differences towards the ranking of development and conservation land uses in South Africa.[98]

'Fallism'

Question 4 asks students for their responses to the statement 'Disciplines like conservation biology are colonial and should be scrapped at UCT'. This question tries to look at the issue through the lens of the current critique of colonialism, i.e. the theoretical perspective which rose to prominence during the 2015/16 student protests at UCT and elsewhere. The question picks up on the claim by a student activist, in a much publicised video of a meeting in UCT's Science Faculty in 2016,[104] that 'decolonizing the science would mean doing away with it entirely and starting all over again to deal with how we respond to the environment and how we understand it'. The article submitted by Van den Heever for this special issue, but declined by SAJS, comments specifically on this video:

> *In the course of the #ScienceMustFall campaign the issue was verbalised by a student at the University of Cape Town thus: '[S]cience as a whole is a product of Western modernity and the whole thing should be scratched off, if you want a practical solution on how to decolonise science, we'd have to restart science from … an African perspective.' The debate unleashed by this video clip hinged on different perceptions of what the university (in general, but then also specifically the University of Cape Town) had come to be perceived as, namely as the institutional guardian of Western*

> *scientific episteme, as a site of epistemic violence… In this view, hegemonic Western episteme normalises and naturalises the internalisation of an alienation from African (or, for that matter, any colonialised) subjectivity. Epistemic violence is the internalised experience of being a colonialised subjectivity. If decoloniality implies the promotion of 'subaltern reason', then the issue of who has the right to define what is to be researched and what counts as knowledge becomes a very acute issue and the site for flashpoints of contestation regarding who may speak about who/what in what manner.*

(Van den Heever, unpublished manuscript sent to me as a personal communication).

The BAC[3] argues that my research reinforces a stereotype that black people are anti-science. I am unaware of any evidence suggesting that such a stereotype exists, though it was certainly the case that on UCT campus, the activism displayed in the video[104] and in the #ScienceMustFall campaign, was clearly anti (Western) science. It was thus reasonable for my students and I to see if this perspective had any resonance within our sample in 2019, and if so, whether it was correlated with variables of interest.

In the exploratory analysis reported in the Commentary, I constructed an index by allocating scores of 1 through 5 respectively for answers ranging from disagree strongly to agree strongly for questions 3 and 4, and then added them together. I called this the 'Fallist' index.

This short-hand label seems to have caused some offense. I regret this. Fallism is a much broader set of ideas[105] than indicated by the questions comprising the index, or as expressed by the student in the video[104]. Fallism on university campuses globally is linked to a critique of universities as colonial and as characterised by 'white' or European/Western knowledge and practices that are seen as marginalising and even devaluing black lives, leading to feelings of abjection and rage.[41-45] It was a mistake for me to have tapped into this by using this particular short-hand term. That said, however, this does not invalidate the use of the questions, or the construction of the index as a summary indicator. It does not invalidate exploring whether this kind of critique of conservation biology and national parks as colonial impositions may have had some resonance in shaping whether students were more or less likely to have agreed to the statement 'I support wildlife conservation but have no interest in pursuing a career in it'.

I cannot help but wonder whether the anger over my having called these questions 'Fallist' was perhaps displaced anger at the fact that support for the kind of 'science must fall' discourse exemplified in the 2016 video[104] was not evident in the data. As the descriptive statistics show, hardly anyone agreed the conservation biology was colonial and should be scrapped. Of course, we would need to draw a larger, representative sample of students, and develop additional questions pertaining to Fallism and science, before making a generalization about students' attitudes towards Fallist discourse and ideology. My suspicion, given this exploratory survey, is that such a survey would find a wide range of views with limited support for anti-science discourse among the student body as a whole. What we can say, however, is that there is no evidence from the analysis presented in the Commentary that can be seen as supporting a supposed stereotype that black South Africans are anti-science.

Some of my critics argue that by asking these various questions pertaining to the red/green divide that my objective – and indeed the consequence of my Commentary – was to reinforce an alleged racial stereotype or trope that black people are not in favour of conservation. I dispute this. Where is the evidence that such a stereotype even exists? As Haffajee[37,38] and Mzilikazi et al[19] point out, there are many black people working in conservation in South Africa, including in

leadership positions. I agree, whilst noting also that there remain important, ongoing challenges to promote further trans-formation.[106] So, where does this supposed stereotype (that black people don't favour conservation) come from? Does it even exist?

The role of colonial governments in demarcating and policing protected areas has certainly fuelled an Africanist narrative construing protected areas as (white) colonial impositions and framing their perpetuation as playgrounds for rich foreign tourists as a form of ongoing injustice and exploitation.[107] This could potentially fuel the perception/narrative that conservation is a 'white thing' and hence something alien to African lives. Yet other African voices contest this narrative[108] and the historical record reveals that African elites, especially in the post-colonial period but also under colonialism, often shared an interest with white conservationists in protecting wildlife resources. Importantly, at a 1961 international conference in Arusha, Tanzanian President Julius Nyerere declared that:

> *The survival of our wildlife is a matter of grave concern to all of us in Africa. These wild creatures amid the wild places they inhabit are important not only as sources of wonder and inspiration but are an integral part of our natural resources and of our future livelihood and wellbeing.* (cited in Bolaane,[109, p..247]).

Nyerere's statement proved politically and ideologically important in mobilizing support from African elites in Botswana to join with white conservationists to prompt the unwilling colonial government to designated Moremi (in the Okavango) as a reserve to protect wildlife from unconstrained hunting (mostly by South Africans).[109] Southern and East African governments have continued to support wildlife conservation, and the expansion of community-based natural resource manage-ment (CBNRM) across the region has enabled wildlife to increase in ways that support rather than undermine local livelihoods.[110]

If there is a racial stereotype about black Africans not caring about conservation, it is in the minds of the critics making this accusation, not in my mind. I agree with Dziwa[25] that blanket statements about black people holding unfavourable attitudes towards wildlife are 'nonsensical'. Dziwa seems to think we differ fundamentally on this, but we are actually on the same page here. Where we are not in agreement is that I was prepared to explore whether *at the margin*, beliefs about the coloniality of conservation etc might shape subject choices or career preferences. This is not the same thing as making racist, generalized assumptions. Rather, it entails probing variation in attitudes between students and – as is clear from the descriptive statistics and the results of the multivariate modelling – these differences transcend racial categories.

Evolution

The survey asked students if they strongly agreed, agreed, neither agreed nor disagreed, disagreed or disagreed strongly with the statement 'Humans evolved from apes'. The analysis in the Commentary included a binary variable taking the value of 1 if students agreed or agreed strongly the statement (and a value of zero for all other answers). This question has been the subject of particular criticism.

International opinion polls ask about belief in evolution (see e.g. Williams[111] for the UK and Pobiner[112] for the USA). Most Americans reject biological evolution,[112] with disbelief in evolution linked to schooling, religiosity, and social networks.[113,114] There is also an emerging social science literature probing the connection between belief in evolution, religious orientation and other variables of interest such as animal rights.[115]

In the South Africa context, might questions about evolution be particularly problematic? According to the BAC[3]:

> *Because of racism most black people are sensitive about being associated with apes or monkeys. The question in*

> *its original form asks black students to indirectly associate themselves with apes. The question becomes psychologically even more problematic when/if the interviewer is white.*

(I should note here that most of the student interviewers were black and none of them reported any such awkwardness during the research.) Athreya and Ackermann[116] argue persuasively that human origins research has been shaped by colonial attitudes and imaginaries that have perpetuated the primitivizing and othering of non-European cultures. This might generate suspicion and distaste amongst African students towards theories of human evolution. In this regard, I concede that this question *might* be regarded as racially loaded. The BAC[3] suggests that it might have been better to ask students to respond to a statement like 'I am not convinced by the theory of evolution'. This is a useful suggestion. It is certainly something to explore further before embarking on a major survey.

I suggested in the Commentary that the relatively low percentage of students (and in this case, especially with regard to black South Africans) agreeing with the statement probably had to do with inadequacies in the schooling system and with high levels of religiosity. If black South Africans were less likely than other students to agree with the statement because of the kinds of negative associations outlined by Athreya and Ackerman,[116] then this would obviously confound the issue. Yet the relationship between schooling, religiosity and belief in evolution is still worth exploring, though ideally with more and better questions. International surveys ask about science and evolution in different ways,[117-119] and there is more for us to learn here.

In the US, research has shown that apparent racial differences concerning evolution turn out to be better explained by social conservativism, religiosity etc[120] – in much the same way as I found that attitudes towards studying biological sciences is better explained by attitudes towards conservation than by 'race'. According to the most recent (6th) wave of the World Values Survey,[121] most South Africans agreed that 'Whenever science and religion conflict, religion is always right'. About three-quarters of black South Africans and two-thirds of other South Africans prioritized religion over science when there is a conflict. The extent to which these differences can be linked to schooling and political attitudes (as in the American studies discussed above) is something worth exploring further. It might also be a productive line of inquiry for future surveys of student preferences for particular subjects, especially the biological sciences, given that evolution lies at the heart of their curriculum.

For some of my critics, the problem was not with the question itself, but rather with the suggestion in the opening paragraph of the Commentary that I was expecting (or assuming) that belief in evolution differed according to race. I did not assume any such relationship. I did *hypothesize* that it might differ given the overlap between race and class in South Africa, how these give rise to schooling opportunities, and the negative association (demonstrated in the international literature) between disadvantaged schooling and belief in evolution. The fact that a higher proportion of black South Africans than other South Africans in the 6th wave of the World Values Survey agreed that in conflicts between science and religion, religion is 'always right', provides further reason for holding such a tentative, exploratory hypothesis. Is this racist? I think not. Nongxa[122] makes a similar point about the likely role of religion in shaping attitudes towards evolution and uses this to criticise me for presenting what may well be a 'spurious correlation' between race and attitude to evolution. I agree it probably is a spurious correlation, which is why I flagged in the Commentary that the result probably speaks to the degree of religiosity in South Africa. More work is required to tease out the relationship between race, religion and belief in evolution.

Finally, there have been criticisms of this question for being confusing and not a good test of understanding (or acceptance) of evolution. Most obviously, it is not strictly true that humans did evolve from apes, but rather that humans and apes share a common ape-like ancestor.[24] I accept that the more popular formulation used in the survey as an indicator of support for evolution could have elicited a disagree response from those who would have preferred the statement to have read that Humans and apes share a common ape-like ancestor. If we had phrased the question like this, however, it would probably have perplexed students who are not well versed in this literature, thus generating a different type of noise in the attitudinal data. It is always hard deriving attitudinal questions. If I were to be part of another survey team, I would suggest that we ask the question both ways and try to learn something from the distribution of answers.

Materialism

Another source of controversy over my Commentary has been over my use of the concept of materialism. There is an enormous literature on materialism in contemporary South Africa. Southall[123] discusses at length the association of the 'black middle class' with a lifestyle defined by consumption and the imperative of acquiring the income to support this – and hence the imperative of an appropriate education in order to access high-paying opportunities. Individuals such as Kenny Kunene (who is infamous for serving sushi on the bodies of near-naked women) and phenomena such as *izikhothane* (a youth subculture involving the burning of expensive clothes, shoes and even money) fuel stereotypes. As Southall points out, novelists such as Zakes Mda (in *Black Diamond*, 2009) and journalists such as Fred Khumalo further contribute to this representation of the 'black middle class'. Southall concludes that this narrative is at least partly true.

There are, however, many likely motivations behind an emphasis on well-paid employment. Materialist values, in South Africa as elsewhere, can be understood in diverse ways. They can be a response to social pressures, i.e. to the obligation to support poorer, dependent kin, i.e. pressure to convert 'private' wealth into 'social' wealth.[124-128] They can be a response to the pressures of consumerist advertising, including the promotion of consumer credit,[129] or to neo-Pentecostal religious convictions.[130] They can reflect an aspiration to recognition or status, framed by consumption.[69,123,131-133] Or they can simply be the consequence of the easing of apartheid-era restrictions on the opportunities facing black South Africans, i.e. to 'freedom'[51,134] or 'a realization of citizenship' and 'an assertion of racial pride'.[123, p.169-70, 173]

The analysis in the Commentary was based on questions drawn from the World Values Survey. The World Values Survey[135] has, for many decades in many countries, asked questions about values and attitudes, many focused on the difference between 'materialist' and 'post-materialist' values. The questions pertaining to materialism are based on earlier work by Inglehart[136-138] in which he argued, following Maslow's hierarchy of needs,[139,140] that physiological needs followed by physical safety are the most fundamental ('materialist') needs and hence it is likely that these concerns will dominate at lower income levels. Inglehart argued that, with rising incomes, social values shift towards 'post-material' concerns (pertaining to self-expression, environmental concern and quality of life).[141] This is of relevance to conservation, given the evidence linking a post-material value orientation to support for environmental protection[142,143] and evidence showing that people in developing countries are less likely to support environmental protection when explicitly framed as being at the expense of economic growth.[144]

Respondents in the World Value Survey are invited to rank what they think their country's top two goals should be from a battery of between four and twelve questions touching on law and order and economic growth and stability (the 'materialist' orientation) as well as environmental concerns and shifting to a more decentralised society where ideas count

more than money ('post-materialist' orientation). Lant Pritchett[145] used such data collected over time to argue that the median voter in most developed countries has shifted from holding materialist to post-materialist values whereas the median voter in developing countries has remained materialist. He argues that this is causing a mismatch between the kind of development aid donor countries wish to provide, and the kind of growth-oriented economic financing developing countries desire (see Loubser[146]).

There are of course legitimate concerns about cross-country comparisons using the World Values Survey[147,148] given that concepts and questions may be understood differently in different contexts. Yet cross-national studies have shown that materialism is not uniquely associated with 'the West'[149] and a case can be made that the materialist/post-materialist distinction travels well cross-culturally because feeling secure or insecure about survival is meaningful in most (and probably all) societies.[150] Some South African scholars[151,152] have argued in favour of including additional questions (probing so-called 'pre-modern' value orientations, such as access to water and other basic needs).

The debate over the international comparability of questions posed in the World Values Survey has implications for how we study big questions of comparative political science, for example the links between value orientation, living standards and support for democracy. Whether the use of the World Values Survey questions to probe differences between students in the same local context (in my case, at UCT) is a different issue. What is most relevant here is whether the World Values Survey questions were adequate to distinguish a 'materialist' orientation amongst UCT students, and then to see how that maps onto whether students agreed with the statement 'I support wildlife conservation but have no interest in pursuing a career in it'. As this was exploratory research, we included several questions probing financial versus other motivations in career choice (which I did not report on in the Commentary) as well as the standard battery of questions from the World Values Survey.

For some of my critics, the word 'materialism' appears to have been read not in the sense operationalised within the World Values Survey, but rather as a judgement with profoundly negative connotations. Perhaps they imagine that I am picking up on the well-established scholarly debate on conspicuous consumption. Adesina[22] for example, detects what he sees as a negative attitude towards materialism and even, bizarrely, a 'subliminal injunction' in my Commentary that advises or instructs black South African students not to be materialist, that is not to go into law or accountancy.

It is possible that some of my critics are working with a notion of materialism that is embodied in Madonna's 1984 hit 'material girl'. Madonna sang that 'the boy with the cold hard cash is always Mister Right', because 'we are living in a material world and I am a material girl'. Materialism here is clearly associated with prioritizing money over love. The enormous literature on transactional sex is relevant here and speaks to some very important current gender and sexuality issues.[153-157]

Some ways of measuring materialism clearly carry normative freight. For example, Richins and Dawson[158] developed a much-used scale which tries to explore the extent to which the acquisition of possessions is of central concern to someone's life and the extent to which obtaining wealth and possessions is the marker of a successful/good life. The scale they develop includes explicitly normative values, such as responses to statements like 'I like to own things that impress people' and 'I enjoy spending money on things that aren't practical' and 'I like a lot of luxury in my life'[158, p.310] Materialism understood in this way has been linked to self-centredness, self-doubt and the social and individual disadvantages of emphasizing products and material possessions over experiences, and the trade- off between social relationships and material pursuits.[159,160]

The World Values Survey does not operationalise materialism in this way. Materialism was not operationalized in this way in my Commentary. There is nothing inherently unworthy or undesirable in prioritizing economic stability and growth over environmental and other concerns. As Somerset Maughan once wrote:

> *There is nothing so degrading as the constant anxiety about one's means of livelihood. I have nothing but contempt for the people who despise money. They are hypocrites or fools. Money is like a sixth sense without which you cannot make a complete use of the other five. Without an adequate income, half the possibilities of life are shut off.*[161, p.314]

Adesina[22] (2020) claims, strangely, that I have argued elsewhere[65] that '"crass materialism" characterizes black South Africans in the post-apartheid era'. Seekings and I make no such claims in the book he refers to[65] which focusses on the politics and economics of enduring poverty and inequality in South Africa. Does Adesina think that it is offensive even to write about inequality in the income distribution, and about state failure to deliver welfare to the poor in case this is seen as reducing black lives in some way to material conditions?

Economic incentives

Some critics appear to be uncomfortable with the association between materialism (as a value orientation) and economic incentives, even implying that it was racist of me to suspect that black South Africans might prioritize better-earning jobs over conservation careers. I disagree that this is racist logic. Indeed, it is axiomatic in economics that people – all people – respond to material incentives.

The use of economic incentives is now recognised as 'one of the most effective mechanisms for mainstreaming biodiversity conservation in bioregions'[162, p.1] – though concerns remain about this potentially crowding out intrinsic motivations.[163] The only negative stereotype linking race and materialism of which I am aware is the old colonial trope that Africans are 'lazy' and economically irrational. More specifically, the 'backward-bending supply curve' argument held that African workers' 'wants were so limited that if offered wage increases, they would, unlike other men, respond by working less.'[164, p.232] Such theory has long been discredited.[164,165]

Haffajee[37] argues that it is 'race science' and 'nonsense' to suggest that subject and career choices among black South African students might be shaped by economic considerations. She and others imply that my 'white privilege' prevents me from understanding the experiences of black South Africans. It seems to me that it is Haffajee herself who is insensitive to the pressures on many South Africans to seek better-paying jobs, not only for their own personal benefit but also to enable them to honour their perceived obligations to others. This, in a context of poverty and dependency, is often referred to as 'black tax'.[166] The racialised origins and nature of inequality in South Africa mean that it would be surprising if black South Africans were *not* more likely (than white South Africans) to prioritise economic considerations over 'post-materialist' concerns.

As is clear from the findings in the SANBI/Lewis Foundation report,[36] black South Africans in the biodiversity sector, like other people, are driven by *both* a passion for nature conservation *and* considerations pertaining to career advancement and salary. Research into motivations and aspirations amongst black South African entrepreneurs similarly revealed both a strong desire to make enough money to support their families as well as make a difference to society, work on something they were passionate about etc.[167] The exploratory research reported in my Commentary was not seeking to cover every possible dimension or meaning associated with materialism. Rather, the analytical strategy was to employ the World Values Survey conception of materialism to see if it had any impact *at the margin*, or more specifically, on the average marginal probability of supporting wildlife

conservation but having no interest in a career in it.

In the USA, research has shown that African Americans are under-represented in animal welfare fields because of the importance of civil rights (another manifestation of the red/green divide) and (inter alia) concerns to obtain a well-paying job.[168] Neumann[169] found, using survey data, that in the USA 'the typical animal welfare volunteer is female, White, pet-owning, heterosexual, employed, childless, married or partnered, Democrat-leaning, between the ages of 40 and 59, has an income between $50,000 and $99,999, and is Protestant'. Kilbourne and Pickett[170] found a link between materialism and attitudes and practices pertaining to the environment. Lu et al[171] found a negative relationship between materialist value orientation and interest in ecotourism and willingness to pay a premium for ecotourism products and services.

Adesina[22] argues that I could have worked harder to collect data that would have enabled me to control for additional factors, notably economic class, rather than rely on the implicit link between materialism and socio-economic status. The exploratory survey did ask a set of questions about how students were funded, whether they had loans or were also working to put themselves through university. These questions, unfortunately, generated in-sufficient variation across the sample to be used as any indication of relative socio-economic status. Ideally, if we were to run a full survey, with a representative sample, then we would certainly reconsider how we might measure accurately students' socio-economic backgrounds. We might, for example, ask students for permission to access their application forms on which parental income is recorded along with other details about their school background. This would, of course, entail a whole other set of ethical considerations and would have to be approved by the relevant faculty ethics committees.

Attitudes to local wildlife and experience with pets

The binary variable whether people 'liked' having starlings around at UCT was drawn out of a set of questions we asked students about attitudes towards, and experience of, local wildlife. Our initial informal discussions with students to inform the questionnaire design suggested that conservation biology students were fascinated by starlings, whereas at least some students in other disciplines and faculties regarded them as 'dirty, flying rats'. Research on attitudes to pest animals has shown that people with experience of companion animals (pets) were more likely to have positive attitudes to wild animals, including pest animals.[172-175] It was thus not unreasonable in my exploratory research to include questions about wildlife that might be perceived as pests as well as the number of different kinds of pets that students had owned.

Redwing starlings are indigenous birds, many of whom have made their home at UCT. They are the subject of a great deal of research. Many have had brightly coloured bands placed around the legs by research scientists for identification purposes. Redwing starlings can tolerate a wide range of food and are known to raid food from students. Some students feed them. A recent masters dissertation found that redwing starling adults eat 'junk food' from students, but do not feed it to their chicks.[176] A recent scientific article, also based on research conducted by a Masters' student, showed how redwing starling diet varied depending on whether human food was available (during the week and in term time) and when it was not.[177] The research for that paper entailed the analysis of multiple observations of starlings (identified by their leg bands) and linked to GPS co-ordinates, and data contributed by multiple students and staff, including volunteers linked to iCWild. It was neither racist nor bizarre for us (as suggested by one commentator[178]) to ask students about their

attitude towards this most visible form of wildlife on campus.

My student research assistants also hypothesized that students who had more experience with pets (defined in the questionnaire as 'animals you fed, touched and felt close to') during their childhood might be more interested in zoology and the other biological sciences and in particular be less concerned about handling live and dead animals. We thus thought that there could be a relationship between a student's past experience with pets and whether the student had ever considered studying biological sciences. Any apparently racial differences in career choice among UCT students might be due to different experiences with pets. I see nothing inherently offensive about asking questions in a survey about pets.

What should we make of the argument that by even asking questions about experience with pets and whether students 'liked' the local wildlife I was being 'racist' because the results could feed into a negative trope or stereotype about black South Africans not liking animals? Survey research elsewhere suggests that pet ownership is experienced and understood differently across socio-economic classes.[179,180] There is also a substantial qualitative and quantitative literature from America showing that pet ownership and attachment can vary across ethnic groups[179,181,182] To the best of my knowledge, however, very little has been written about pet ownership and attachment in South Africa. Spicer's research in Cape Town[183] is pioneering in this regard. Spicer shows that pet ownership varies across space and class, but she provides plenty of evidence that black South Africans in Cape Town have pets and love them. Dziwa[25] grew up in a family with five dogs that were 'pets, companions and protectors' and Nongxa[122] makes a similar point. It is very likely that these experiences are widely replicated elsewhere. If there is a 'trope' out there about black South Africans not having or caring about pets, it is not one that I have come across or hold.

Part of the problem with questions about pets, and my inclusion of this data in the analysis, seems to be that it has been interpreted, in Dziwa's words, as 'whiteness talking very loudly'.[25] The assumed trope/stereotypes that are being complained about do not necessarily have any historical or empirical validity, but rather appear to reflect what my detractors think is going on in my mind. To reiterate: I was not assuming that black South Africans did not have or like pets. I thought it was likely that experience with different kinds of pets, at the margin could make a difference to whether a respondent had ever considered studying biological sciences (and the regressions showed this was indeed the case). Given the financial burden that comes with pet care, it was a reasonable to suspect also that socio-economic inequality and the legacy of apartheid make it less likely that black South Africans, on average, would have as much experience with pets as other students. Ideally we need more and better data, especially on socio-economic background, to understand these interconnections better.

Studying Culture: Is it permissible if 'race' is involved?

As all sociologists know, values and attitudes are embedded in social structures which are historically derived, yet continually adapting, and which transcend the lives of individuals.[184] Attitudes and practices towards animals are likewise embedded in a changing cultural frame.[185] This makes culture – understood as fluid – a legitimate topic for survey research, even if the kinds of questions we ask can at best only provide 'signals' about a much richer and dynamic sub-strata of ideas, beliefs and practices.

There is an international literature on cultural differences regarding the management of animals and the environment. For example, Aslin and Bennett[186] discuss the different 'world views' within Australian aboriginal culture and individual attitudes, and those of Anglo-Australians steeped in a Greco-Roman philosophical tradition. This, they find, has an

important bearing on how wildlife and feral animals are managed, with Aboriginal Australians, for example, having a wider, more tolerant and embracing notion of how humans fit into the natural world and thus being more accepting of feral cats (seeing them as belonging to the country), and Anglo-Australian managers wishing to eradicate them. Aslin and Bennett conclude that studying comparisons of this kind can 'help provide social perspective on the western scientific knowledge systems, biological concepts, and often-unexamined assumptions that underpin much formal wildlife policy and practice'.[186, p.32]

As noted earlier, cultural differences concerning nature and the environmental crisis have been explored in the South African context amongst land-use planning stake-holders using the 'New Ecological Paradigm' and the 'Inclusion of Nature in Self scales'.[98] A key finding was that racial/cultural differences varied according to the scale used. The paper was not afraid to grapple with the issue of race and culture when it came to responding to the ecological crisis and managing natural areas. More specifically, the study found that 'Xhosa participants, who comprise the vast majority of all stakeholder groups in our study domain, are more likely to resonate with messages that de-emphasize the ecocrisis and limits to growth scenarios' even as they (unlike 'white' and 'coloured' respondents) considered them-selves part of rather than separate from nature:[98, p.212]

> *Clearly participants associated with the previously disadvantaged Black majority (Xhosa and Coloured) tend to show lower – and different – levels of ecocentricity than members of the White minority. These differences are likely underpinned by a wide range of factors, notably higher poverty and lower educational levels but also a strong appreciation for the primacy of economic growth as a means for overcoming poverty, and mistrust of the motives of the conservation sector.[98,99] Interestingly, Sheppard (1995) showed that African American adults eschewed ideas of limits to growth and were more likely to prioritise economic growth over environmental concerns than their White counterparts.*[98, p.211]

Are my critics suggesting that this kind of quantitative cultural analysis is now unacceptable in South Africa today? Are they suggesting that the international literature on ethnicity and animal practices, attitudes and attachment should not be replicated in South Africa in case it is perceived as coming from a place of white privilege and thus as racist? I sincerely hope not. Such censorship (and self-censorship) is a first step on a dangerous slippery slope that could quickly cut off many important areas for social research. It would threaten research into the relationship between 'race' and socio-economic status (or class) in South Africa, making it harder to design policies aimed at alleviating poverty and reducing racial inequality.

Conclusion

There is no doubt that more and better questions could have been used to inform my exploratory survey and the data analysis. It is obviously the case that a larger and (more) representative survey would have been a better platform for statistical analysis. I accept the many criticisms about the limitations of my sample and the data analysis. I had hoped that by publishing the research in a Commentary that this would also have helped flag the exploratory nature of the research. I accept the points made by Sanders[187] and others that the Commentary format may have been an undesirable format for presenting my exploratory research, at least without referencing a longer, more detailed discussion. It may also be useful for the journal to develop policy specifically towards the presentation and publication of *exploratory* research where it can be more easily understood and delineated from *confirmatory* research (see Nilsen et al[2]).

During the painful but still interesting process of writing this reply I have come to understand that the way I presented the exploratory research in the Commentary may have been

confusing. Jaeger and Halliday,[188] in writing about the difference between exploratory and confirmatory research, provide a set of warnings about the style of presentation for exploratory research, notably that such research should be careful about how underlying hypotheses are presented. I wish I had read this paper before writing the Commentary (discovering their paper was one of the many positive things I have learned through all this). So, how would I have written the introduction differently? Here is an attempt in track changes:

> An exploratory survey of University of Cape Town (UCT) students in mid-2019 drew attention to an important, but under-researched, question for transformation: why do conservation biology, zoology and the other biological sciences at UCT~~subjects~~ struggle to attract black South African students? A large part of the answer is obviously that persisting inequalities within South Africa including in the schooling system make it less likely that black South Africans will have the opportunity to reach university or they will meet the entrance requirements for science courses. This Commentary focusses on additional possible reasons, notably student choices and the attitudes that might help us move beyond race in understanding the challenge of transformation both for UCT and the conservation sector. More specifically, the Commentary explores the role of ~~Yet there are likely to be other reasons too, notably~~ materialist values and aspirations (pertaining to occupation and income) as well as experience with pets and attitudes towards wildlife – all of which are likely also to be shaped by a student's socio-economic background. Given the ~~'Fallist'~~ student protests of 2015/2016 and the associated critique of colonialism on campus, another possibility is that wildlife conservation itself might be regarded as colonial, and students might perceive a trade-off between social justice and conservation. The survey, conducted by researchers from the Institute for Communities and Wildlife in Africa (iCWild) at UCT, explored these possibilities. The key outcome variable for the analysis presented here was whether students had ever considered studying zoology or the biological sciences, irrespective of whether or not they met the entrance requirements. The analysis shows, through a set of multiple regressions, that students who agreed with the statement 'I support wildlife conservation but have no interest in a career in it' were much less likely, at the margin, to have considered studying biological sciences. We then explore the role of materialist and other values in shaping, at the margin, this career preference. The analysis is exploratory and does not seek to provide a full explanation of study or career preferences. Rather, the intention is to start a conversation and prompt further, more representative research in this under-researched area.

This edited version of the introduction might address the concerns of some of my critics, but certainly not all of them. An old friend and colleague wisely observed about the contestation over my Commentary that it was 'like a Rorschach test', with people seeing and imagining it very differently. Those whose objections are rooted also in a rejection of survey data analysis, or in the fact that I am a white person doing this kind of work, will not be propitiated and neither will those who have adopted a strong position against any form of statistical exploration on a non-probabilistic sample. It is possible that some of my particularly hostile critics will continue to read my introduction as racist, or as betraying racist assumptions despite my efforts to elaborate on the rationale behind the questions.

I would also like to make the point here that many other natural scientists, social scientists, people working in conservation and members of the general public have written to me to say that they see nothing wrong with the Commentary as originally formulated and titled. My inbox is full of supportive emails from both 'black' and 'white' people. Many of the academics and students have expressed concern about the wave of condemnation and hatred (and I do not use these words lightly) that rolled cross the social media about my

Commentary. A common theme in these emails is that they supported me, did not think that I or my work was racist, but were too scared (again, I do not use this word lightly) to speak out in any forum at all.

This brings me back to the points I made in the opening pages of this reply about what has become a hegemonic position at UCT (and, it seems, on many other campuses in South Africa and globally) about race – and linked to this, about what are seen as acceptable topics to research, and how, and by whom. This hegemonic ideology is intolerant of alternative perspectives. The 'rebuttal' by Ross[21] in this special issue, and by Kahn and Alves[62] from UCT's Office of Inclusivity and Change, are examples of how a series of condemnatory pronouncements and statements of truth-by-assertion rather than argument has largely replaced genuine academic engagement about race on my campus. Ross's rebuttal is best read as a form of virtue-signaling in this highly charged context. Unfortunately, such virtue-signaling can also degenerate into what Benatar calls 'vindictive victimhood'[47] and what younger people tell me is known as 'cancel culture' where those deemed to be on the wrong side are subject to vitriolic condemnation and shunned. This totally eliminates debate. This has terrifying (again, I do not use the word lightly) implications for both universities and democracy. I am thus grateful to the SAJS for resisting pressure, including from my own institution, to withdraw the Commentary and instead provide this opportunity for exchange of views and ideas. Without reasoned debate we are lost.

Obviously, my results barely scratched the surface of what we need to know. I agree with Rosenberg and le Grange[24] that 'there is no room for the qualitative and nuanced dimensions of people's intentions, feelings and understandings and actions in the tiny, tidy tables of narrow survey findings.' Additional qualitative and ethnographic research could prove very productive. I accept the argument made by Mothapo et al[20] about the importance of improving the institutional climate at universities and encouraging a greater sense of belonging amongst all students in the sciences. I also accept that it is quite possible that, in a larger, more representative sample, the statistical associations I picked up in the analysis would not be replicated. None of this, however, means that my exploratory research should not have been published as a Commentary.

The value of the exploratory research lies chiefly in the two 'signals' I picked up in the data analysis, and which I hope could help inform a wider and inter-disciplinary exploration of the challenge we face with regard to increasing the diversity of scholars and colleagues skilled in both biological sciences and conservation biology. These were worth reporting, with all the necessary caveats concerning the limitations of the sample and the overall weakness of the models.

The first of these signals was that in this sample of UCT students, supporting wildlife conservation but having no interest in a career in it was a better predictor of ever having considered biological sciences than 'race', and indeed, including it in a multiple regression knocked out the statistical significance of 'race'. Attitudes towards the relative ranking of addressing social inequality and wildlife conservation, as well as the number of different pets owned, had smaller, but still statistically significant effects. The second signal was that supporting wildlife conservation but having no interest in a career in it was correlated with a materialist value orientation (as defined by the World Values Survey) and attitude to the local wildlife at UCT (proxied by attitude towards the redwing starlings). Including these indicators in a multiple regression knocked out the statistical significance of 'race'.

Some scholars might reasonably reject these findings because of the limitations of the sample and/or the questions. Others might be prompted to explore the issues further using different and better methods (as suggested by Midgley[6]). My hope, in writing the Commentary – and again through the additional context I have provided here – is

that my research be understood as exploratory, reasonable and grounded in an extensive scholarly literature. Rather than being condemned as 'racist', it should be seen as a contribution to the early stages of thinking and conceptualising that might inform a wider, and more interdisciplinary research initiative on a topic that clearly is worth researching: transformation. Our universities and our society as a whole will be better places when our professors, lecturers and students reflect better the rich diversity of our society here in Southern Africa, and when we can draw on global scholarship as well as local understandings to address the pressing social and environmental challenges of our time. I hope that the debate over my Commentary will contribute to this objective.

Editor's note:

In this response, Prof. Nicoli Nattrass refers to Appendix A. With her knowledge, the appendix has been removed. The document was not 'apparently turned down for being anonymous' as she states. It was turned down ***because*** *it was anonymous. In common with other academic journals, the* SAJS *does not publish material of any kind from unnamed sources. Despite our encouragement to submit formally, the author declined.*

The contribution by Prof. Gerhardus van den Heever to which Prof. Nattrass refers was declined for publication in this special issue as his contribution was not a response to Prof. Nattrass's Commentary.

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