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Caldwell Brown, S. (2017). Nurturing students' natural writing style to better communicate research to the public. *Scholarship of Teaching and Learning in Psychology*.

Abstract

In many institutions, students are given the instruction to model their written work on existing published work. However, scholars typically write for other scholars, and this can lead to the so-called 'curse of knowledge', a cognitive bias wherein experts struggle to adopt the point of view of less knowledgeable parties. Students modelling their work on that of published academic works may be jeopardising their ability to communicate science clearly to laypersons, an emerging priority in academia. This article provides a wide-ranging discussion of this issue, informed by the findings from a pilot study which suggest that laypersons perceive the writing of students to be clearer, easier to understand and more detailed than the writing of established researchers. Regardless of intended career path, it is imperative that psychology graduates be able to articulate thoughts and ideas clearly and this article highlights the tangible implications of discouraging students from assimilating into a writing style typical of scholars which may prove outdated when open-access publications become mainstream.

Keywords: academic writing, classroom engagement, science communication, public engagement, knowledge transfer.

Nurturing students' natural writing style to better communicate research to the public

With any piece of written work, one must ask who will be reading the work produced – *know your audience*. Historically, scholars have dedicated their time to publishing the findings of research in peer-reviewed journals – this practice of course persists. In doing so, scholars have been writing predominantly for other scholars. But it is not just scholars who have undergone Ph.D programs who are reading published works in peer-reviewed journals – students are reading them too, because their studies depend on doing so. Modelling their writing on that of published academic works may not be as positive as it seems when factoring in the emerging priority that is engaging with the public. Encompassing a variety of discussion points, some old, many new, this article finds that laypersons prefer the writing style of students to that of scholars, and that this is something that ought to be embraced in educational institutions for the benefit of communicating science with the public.

Communicating psychology to general audiences

Students learn by imitation, like anyone else. For the most part, students imitate scholars, who are notoriously bad writers. Honing in on the social sciences, Billig (2013) argues: 'No-one is born with the ability to produce the convoluted sentences that academic social sciences regularly write' (p. 40). Though focusing predominantly on social psychologists, Billig makes some rich observations which are applicable to scholars of any discipline. More than anything though, he highlights the potentially negative side-effect of the continued insistence from most psychologists that psychology is a *science*. Billig explains that social psychologists are minor players, envious of those psychologists engaged in more biological and physiological research; those with fancy gadgets rather than questionnaires. Put simply, Billig proposes that social psychology is thought of as *less*

scientific – though this could (and should) be said of psychology as a whole, compared to pure sciences. The raw data of interest to psychologists is people, not physical laws, and one way to appear more scientific is to include superfluous nonsense in written works—Such was the finding of Fernandez-Duque, Evans, Christian and Hodges (2015) who found that US students rated the quality of short explanations for psychological phenomena as higher when the explanations contained additional neuroscience information, offering no further insight (other recent research including by Baker, Ware, Schweitzer and Risko, in press, calls this finding into question).

It is likely that scholars of all disciplines are typically perceived by laypersons to write in a jargon-filled way, as would be expected – high-levels of expertise necessarily include highly-specific language. To focus on psychology, how laypersons can be expected to understand or appreciate findings when they are not written in a way which is accessible remains questionable. Note also that psychologists are considered less credible witnesses than psychiatrists (Greenberg & Wursten, 1988) and that medical students consider psychology lectures as ‘soft and fluffy’ (Gallagher, Wallace, Nathan & McCrath, 2015).

Shortly after the publication of Billig’s 2013 text, Pinker’s ‘Sense of Style: The Thinking Person’s Guide to Writing in the 21st Century’ (2014), was published. There has been much discussion into academic writing in recent years and this is likely due to the fact that scholars increasingly communicate with non-academic audiences. There is now an increasing emphasis for scholars to communicate and engaging with the public – it is an emerging priority in the UK. This is variously known as: *public engagement*, *knowledge exchange*, or *knowledge transfer*. Oftentimes the interaction is limited, with scholars simply *informing* the public – such as at a talk at a science festival. It can also involve *consultation* with the public, or even *collaboration*. Research grants now come with public engagement (call it what you will) woven into the project.

To hone in on Scotland, or the so-called central belt of Scotland where some two thirds of the population dwell, the diversity of public engagement opportunities is vast. The University of Glasgow and The University of Edinburgh dominate in each city. As far as written mediums go, *The Conversation* is a popular online resource, with scholars working closely with journalists to produce commentary on research and current events. Its reach is considerable, and this is effectively down to the use of Creative Commons licensing, the polar opposite of the conventional academic publishing model.

In terms of writing, a more generic example, and one which appeals to students, is that of blogging; this is something that scholars are often encouraged to do (Green, 2015). Jolley, Coiffait and Davies (2016) explain that blogging as a means of self-reflection is embedded in academia in UK, as part of the Postgraduate Certificate in Teaching in Higher Education (PCTHE). Yet, recent unpublished research by Davies, Jolley and Coiffait (2016) finds that UK psychologists are put off by the time it takes to create and maintain a blog. Certainly, one thing blogging probably cannot achieve, ironically, is engaging with the public – research shows that scholars blog in such a way that suggests that their target audience is in fact *other scholars* (Mewburn & Thomson, 2013). Or put another way, longstanding academic conventions of writing for other scholars has influenced how they now communicate on other mediums, intended for other audiences. This is the *curse of knowledge* at play.

The curse of knowledge: in theory and in practice

Returning to the two books mentioned above, and to formally introduce theory into this article, both discuss the curse of knowledge, or what Ambrose, Bridges, DiPietro, Lovett and Norma (2010) call a *blind spot*. Pinker (2014) goes into some detail on the mechanics of the curse of knowledge, explaining that researchers tend to forget their intended audiences.

As discussed, this has historically been other scholars, who will share some understanding of the theoretical or conceptual underpinnings of the research discussed. In other words, it's acceptable, and perhaps necessary, to use jargon. But, with research becoming increasingly more 'open', the rise of Massive Open Online Courses (MOOCs) blogs, and any number of other written mediums in which scholars engage with general audiences, it is essential that those future scholars produced by educational institutions are able to deliver content in a straightforward fashion. It is a skill that that they must learn.

Ariely (2015) notes that the curse of knowledge happens to us all, but is especially problematic for scholars. As explained by Dror (2011), experts can become over-confident, and even arrogant. This would impact on their writing. Students appear to embrace a style of writing that they think will help them 'join the club' and worry that writing in a clear and simple way will raise suspicion that they don't know what they are talking about. As counter-intuitive as this appears, it's logical. It is worthy of note that there is likely a generation gap here, with established scholars more attuned to writing in particular ways at the expense of clarity. This is apparent when reading the majority of responses to the annual question posed by *Edge*, which asks some of the most influential scientists, economists, artists, and philosophers to 'answer' a different question each year. For instance, 175 thinkers recently offered their thoughts on 'what scientific idea is ready for retirement?' Responses were collated as a book (as is the case every year), edited by Brockman (2015), and a cursory scan of any of the resulting books demonstrates the curse of knowledge in practice – it is doubtful that most people would be able to read and understand much of its content.

The curse of knowledge: in teaching contexts?

Summarising complex research areas is at the heart of much student assessment, with the vast majority of assessment being in written format. Assessments are of course written with scholars in mind, as it is them who mark their work; this process works much like peer review. With students often being told to model their writing on published works, it is likely that they will adopt a writing style which may prove to be incompatible with the role of scholars as public intellectuals, consulting with media, engaging with the public, etc. To paraphrase Albert Einstein, to explain something simply is to demonstrate a strong understanding of the phenomenon under discussion; this is something that all researchers ought to strive for in order to communicate their research findings as widely as possible.

To hone in on public engagement, future generations of psychology graduates are likely to be heavily involved in the process of communicating research to diverse audiences as a matter of routine. It is therefore critical that they are equipped with the skills to adapt their written and oral accounts of research to laypersons from various backgrounds. Given young people are already armed with the skills to communicate effectively to different audiences across multiple social media platforms, it would be wise to nurture this skill and apply it effectively in academic contexts.

Research questions

This pilot study aims to consider if laypersons' understanding of psychological research is affected by how it was written, by comparing the writing styles of two groups – *scholars* and *students*. It does so by comparing original abstracts (scholars) and those re-written (students), comparing layperson understanding across five domains of interest: *clarity*; *ease of understanding*; *level of detail*; *engagement*; and *informativeness*. It is expected that student-written summaries will be preferred due to the perceived abilities of students to write in a simpler way.

Methodology

Participants

A final sample of 64 participants was used in analysis, after removal of missing data ($N = 22$) and data from those participants failing to correctly answer one or more of three control questions ($N = 11$) as outlined below. The sample consisted of 43 females (67.20%) and 21 males, with a mean age of 34.05 ($SD = 14.91$) and an age range of 18–74. The majority of the sample was British (40.63%), with the remainder coming from mainland Europe (23.44%), North America, (18.75%), Asia, (7.81%), Africa, (1.56%) and South America (1.56%). Forty four participants (68.80%) had a University level qualification (i.e. minimum of Bachelor's degree), with holding a psychology degree factored into the exclusion criteria. Opportunity sampling was employed, with participants invited to take part in the study in the second quarter of 2016 and participants were offered the opportunity to enter a prize draw (£20 Amazon voucher). The sample was collected from poster appeals in public spaces across the central belt of Scotland, with most posters distributed in public libraries across Glasgow and Edinburgh. Posters were used in public spaces in an effort to target laypersons with varied backgrounds and of diverse socioeconomic status. A number of online survey hosting websites were also used as well as personal appeals on social media.

Design, Materials, and Procedure

The study employed an experimental design, with participants randomly allocated to one of two conditions (between-subjects), completing an online questionnaire (within-subjects). Half of the sample ($N = 33$) were exposed to stimuli written by professional psychology researchers, the other half ($N = 31$) were exposed to stimuli created by first year undergraduate psychology students (see Appendix A) with data collected after all taught content was delivered in a 2015/2016 psychology programme at a large University in

Scotland. The research received ethical approval [info omitted in line with blind peer-review process].

A survey was designed (see Appendix B), with the study presented to participants as a research project into 'Evaluating the clarity of psychology research'. The research was conducted online using the Qualtrics survey tool.

Participants were then presented with either the original abstracts from real research (Hölzel, Lazar, Gard, Schuman-Olivier, Vago & Ott, 2011; Norton & Sommers, 2011; Salthouse, 2006) or summaries of the same research written by first year undergraduate psychology students (see below). The research encompassed *cognitive ageing*, *mindfulness* and *racism*. Each summary appeared on a separate page and was accompanied by five scale questions (measured on a 7-point Likert scale) measuring how clearly written, easy to understand, detailed, engaging, and informative the preceding summary was. The research which was summarised for the current study was selected on the basis of covering topics which were considered 'representative' of the sort of research which laypersons might expect psychologists to explore, with the topics covered having real-life implications. Quality was controlled for by drawing papers from a high-quality journal (*Perspectives on Psychological Science*) with the mainstream nature of the journal aiding selection of diverse topics. Furthermore, the journal is not an open-access journal, meaning that the articles chosen would not have been written with laypersons in mind. The 'most-cited' feature was used to select individual research articles.

After evaluating the three summaries (see Appendix C), participants from both conditions completed a ten-item multiple choice measuring scientific literacy, with items taken from the 2012 General Social Survey (see National Science Board, 2014) as used by Cooper and Farid (2016). Questions appeared randomly, and were included on a separate

page. The questions were included to ensure the sample had a basic level of scientific knowledge and therefore able to read and understand the materials. A final page asked participants for basic demographic information.

Results

Perceptions of who writes more clearly: scholars or students?

To test the hypothesis that students' interpretations of research would be perceived to be clearer to laypersons than original abstracts, an independent t-test was conducted. The test compared means scores on the ratings of original abstracts and abstract-style summaries written by first year undergraduate psychology students, in terms of how clearly written, easy to understand, detailed, engaging, and informative they were found to be amongst the layperson sample

The results showed that those abstract-style summaries produced by first year undergraduate students were rated as *clearer* ($M = 5.24$, $SD = 1.13$, $N = 30$) than original abstracts ($M = 4.45$, $SD = 0.99$, $N = 33$), $t(61) = -2.96$, $p = .004$, two-tailed. The effect size for this analysis was found to exceed Cohen's (1988) convention for a medium effect ($d = 0.74$). The student summaries were also rated as *easier to understand* ($M = 5.11$, $SD = 1.14$, $N = 30$) than original abstracts ($M = 4.22$, $SD = 1.03$, $N = 33$), $t(61) = -3.26$, $p = .002$, two-tailed. The effect size for this analysis was found to exceed Cohen's (1988) convention for a large effect ($d = 0.82$). Finally, the student summaries were also rated as *more detailed* ($M = 5.41$, $SD = 1.13$, $N = 30$) than original abstracts ($M = 4.61$, $SD = 0.84$, $N = 33$), $t(61) = -3.24$, $p = .002$, two-tailed. The effect size for this analyses was found to exceed Cohen's (1988) convention for a large effect ($d = 0.80$). The student summaries were also rated as *more engaging* ($M = 4.58$, $SD = 1.31$, $N = 30$) than original abstracts ($M = 3.90$, $SD = 0.81$, $N = 33$), $t(61) = -2.50$, $p = .018$, two-tailed, and *more informative* ($M = 5.33$, $SD = 0.95$, $N = 30$)

than original abstracts ($M = 4.78$, $SD = 0.89$, $N = 33$), $t(61) = -2.39$, $p = .020$, two-tailed, reaching levels approaching significance.

The hypothesis that the student-written summaries would be favoured by laypersons over original researcher-written abstracts is therefore upheld. Specifically, the student-written summaries were rated as clearer, easier to read and more detailed than original abstracts, to levels of statistical significance. They were also rated as more engaging and informative, but not to levels of statistical significance – one-tailed tests would have led to these also being significant. The effect sizes for the significant effects were found to exceed Cohen's (1988) convention for a medium and large effect ($d = 0.74$, $d = 0.82$, $d = 0.80$).

[INSERT TABLE 1 AROUND HERE]

It should also be pointed out that the scores varied across all three summaries: Summary A was found only to be more engaging; Summary B was found only to be more clearly written, easier to understand, and engaging; and Summary C was found to be more clearly written, easier to understand, more detailed, more engaging, and more informative. That is, student-written summaries for summary C (see Appendix A) were significantly different from the original abstracts for all five domains measured. The results were compounded for statistical reasons. Appendix D presents the scores for individual summaries.

Discussion

The findings indicate that to laypersons, summaries of research written by first year undergraduates are perceived to be clearer, easier to understand and more detailed. This suggests that research could perhaps be communicated to laypersons more effectively if restated by students. The findings of the pilot study could be the result of various limitations,

Commented [SB1]: Moved from discussion as per suggestion of R4 – with new appendix created and inserted at end of manuscript. Author expected presentation of means and sds for individual sums would be better positioned separate from the main results as these are not the results.

as outlined below, but the conceptual and theoretical underpinnings cannot be ignored – nor their implications.

To reiterate the theoretical underpinnings of this article, it appears that students, who have not yet undergone training in academic writing, unburdened by the so-called curse of knowledge, communicate research in a way which laypersons find more appealing. This is an intuitive, if troubling finding. Importantly, it *suggests* that as students progress through an undergraduate programme, learning to mimic academic writing found in published academic works, they will assimilate into a writing style which will be more difficult for laypersons to understand – this is a substantial loss. Given the various digital mediums in which young people now communicate, it is clear that young people are clearly equipped with strong writing skills in terms of conveying information to a broad range of parties.

Furthermore, and to return to the focus of this article, with public engagement becoming an increasing priority in academia there is much to learn from students. So much student work is written, seen only by scholars – why students are not encouraged to engage more with the public, writing literature reviews for publicly accessible resources, for instance, is a mystery; the findings of the pilot also provide good justifications for encouraging such activities. By incorporating creative assessments into the curriculum which actively encourage students to consider different recipients of their writing, students can better adapt their writing to different audiences in the long-term. This is a desirable transferable skill, enhancing attractiveness in the job market. With long-term shifts in terms of open-access publications, the need to write clearly has never been more important.

Suggestions for improving the communication skills of psychology students

Billig's 'six rules for good writing' (2015, p. 215) offer a good starting point in the appraisal of how best to encourage both students and established scholars how to write more

clearly. Firstly, use of simple language is recommended, avoiding technical terms wherever possible. This is a natural start, but not necessarily one which would come naturally to students should they model their written work on published academic research, as they are told to. How simple is simple will of course vary depending on the medium, but clarity is always key. Being clear is not the same as 'dumbing things down', and students must be encouraged to see the difference. Billig (2013) specifically champions simple sentences with active verbs as well as avoiding becoming personally attached to technical terms. This can only enhance clarity. Discussing Leech et al.'s (2009) findings that since 1961, there has been a 200% increase in the appearance of acronyms in academic writing, Billig reflects on the likely reason being due to saving space on physical publications by minimising word count. The figure has no doubt increased since the publication of Leech et al.'s research. The trade-off is clarity, and with the future of physical journals appearing dubious, it is difficult to justify reliance on acronyms; a simple inclusion of hyperlinks (or something similar) could cover all bases efficiently. Thirdly, and the final rule to be covered in this article is to write about *people* and not *things*. This is a jarring proposition, as psychology often reduces large samples of a population to mean scores on some abstract measurement of attitudes, beliefs, etc.

Anecdotally, it is transparent that many undergraduate students feel constrained by the limitations of academic formatting, stopping them from engaging in creative expression. If they want to pursue a career in academia, then it is something to 'get over'. But, by encouraging alternative mediums, with creative assessment criteria, students can sharpen their communication skills by engaging in visual mediums, for instance. To this end, more oral assessment such as 'mock public engagement' exercises can only help students improve their confidence, being evaluated in ways which more readily mirror the 'real world'. In terms of enhancing the student experience, engaging in such activities can help show the

relevance of skills gained in future professional lives; if communicating with the public, students could derive satisfaction from engaging in authentic, real-world tasks (Ambrose et al., 2010). Additionally, and to revisit blogging, Fullwood, Nicholls and Makichi (2014) notes that blogs can be a *creative* outlet. Tasks which incorporate blogging may appeal to those students who consider themselves creative, but feel constrained by having to conform to academic writing in assessments. By way of example, the psychology programme at The Open University (principally delivered online) includes assessments which ask students to write a blog. Diversity is key, as our reliance on interacting with digital devices continues to mould our preferences for reading.

Rather than continue to list more ways in which we can help students to write better, just one suggestion will be put forward – engage in exercises which demand concise writing. Concise writing is good writing. A good example of concise writing can be found in Pinker's summary of human impediments: 'Humans are cursed with the deadly combination of a highly fallible memory and an overconfidence in what they know' (2014 p. 302). Encouraging students to say what they have to say, clearly, is easy enough to do – *they do it every day*. With social media, students are already well-versed at summarising what they have to say; encouraging them to carry this habit over into academic writing should therefore be an easy enough transition. Given we are largely teaching so-called 'digital natives', it seems unwise not to encourage them to conjure up creative new ways to express themselves. We live in an increasingly *visual world* (Hadlington, 2015), with people increasingly prefer information to be provided in a shorter timeframe (Carr, 2010). TED talks are of course very popular, with many notable psychologists communicating highly complex information in a clear and engaging manner using this visual medium (see Levitin, 2015, for instance).

The findings from the pilot study suggests that students are in fact *better* at presenting detailed information in a clear, easy to read manner, and yet it is known that in a clinical

setting, psychologists tend to write psychological reports which are difficult for non-psychologists to read (Harvey, 2006). Something happens along the way, and it would be valuable to try and establish when and how the breakdown occurs. Returning to public engagement, it would be interesting to challenge students to develop new ways to engage the public using emerging digital mediums.

Implications of the findings

A variety of inter-related topics have been discussed, stemming from observations on student's writing. A specific application of the findings relates to what is likely to happen to academic writing when publishing moves to mainstream open-access – this is likely to happen in Europe by 2020 (Khonami, 2016). One would expect that knowing that the intended audience has changed, the writing style must change too. Returning to the curse of knowledge, the world runs on co-operation, and so working from something which better resembles a universal playbook can only be positive. We of course, as a species, must continue to surrender trust to experts on topics we know little of (Brotherton, 2015) and this applies to us all. In the case of open-access publishing, just because research is all of a sudden 'out there' does not mean that it will be understood. But if the real desire to communicate research exists, then a good start would be for it to be as clear and concise as possible so that laypersons stand half a chance. This begins with teaching the researchers of tomorrow how best to communicate their findings. Based on the findings of the pilot, it would appear they are already well-equipped to do so – it is the process of completing a psychology programme which saturates this ability.

Returning to the world of public engagement, and from experience (Brown, 2016), it has been found that general audiences typically believe what they want when you present them with research findings. This may be more likely in social psychology, given the topics

of interest are topics where most people are likely to have already formed opinions (Billig, 2013). People believe what they want to believe, and this is problematic. Developing the skills to *persuade* is critical – general audiences will not rely on published findings to inform their decisions, nor should they, with or without images of brains, and no matter how strong your writing skills are. This is something that students ought to be getting to grips with throughout their degree. There is of course a risk that persuasion is misconceived as ‘selling something’, but given the widespread prevalence of misinformation online, progressively replacing expert advice (Lewandowsky, Ecker, Seifert, Schwarz & 2012), it is clear that the status quo is no longer fit-for-purpose.

Effectively, the present research measures the writing styles of experts, and more research into how experts (in this case scholars) communicate with the public would be very valuable indeed in this area of misinformation. The role of the Internet here cannot be overstated. With correct opinions no more likely to be found online than incorrect ones (Levitin, 2014), students must be empowered with confidence to know how to spot a ‘bad apple’, and how to communicate this to friends, relatives, and other laypersons. In this respect, the need for critical thinking has never been greater as the Internet is awash with false information. Worryingly, people are more likely to forget information when they expect to have future access to it online (Sparrow, Liu & Wegner, 2011) and given the Internet is inherently dynamic, the knowledge it holds routinely changes. Importantly, and to allude to Pinker’s (2014) concise summary of human’s greatest faults, research shows that we actively search for information online which exaggerates our belief in the knowledge we already possess (Fisher, Goddu & Frank, 2015). With search results increasingly refined to support our worldviews, we are less likely to be exposed to results which challenge or views (Levitin, 2014). Being able to clearly communicate with others, informing them that a news

article is misinformed or that medical advice passed down the generations is in fact dangerous, is extremely valuable and noble.

Limitations and recommendations for future research

The empirical work is not without its limitations, the most immediate being the small sample size. Though the medium to large effect sizes in the analyses suggest the findings to be relatively robust, replication is needed in order to establish whether the trend found in the results is generalizable (the differences in mean scores also did not differ by a full-point on the scale). In terms of future research, comparison of open-access and restricted publications would be a valuable pursuit, as would a comparison of first year and fourth year (or even postgraduate) students, to better test the assumption that students assimilate into a particular academic writing style over time. If the results in the present study are indeed the product of the curse of knowledge, such an approach would be able to determine changes in writing style over time, using the same experimental approach with laypersons as in the present study. Future works could also rely upon research produced by students, in collaboration with scholars – both could write summaries to compare experimentally. This is important as the present study ultimately worked from research paraphrased by students. The effect found could be localised to paraphrasing skills. The present study, a small-scale pilot, is not rigorous enough to unpack exactly what it is which impacted on the significant differences.

It could be, for instance, due to emotion – the preferred student-written ratings may have simply felt more familiar, or less intimidating. It is important to note however that participants did not know who produced the written work they were exposed to. This aspect of the research must remain in future works.

Concluding remarks

To once more draw from Billig, it has been argued that educating students will become a greater source of income for scholars, with publication of research no longer allowed to interfere with: “The customer satisfaction that fee-paying students demand’ (2013, p. 209). Certainly, we owe students a first-class education and more dedication to encouraging undergraduate psychology students to improve their writing skills is a small task with potentially large, and positive ramifications in the long-term, especially in the realm of knowledge transfer or public engagement. At the very least, we must move beyond the ideal that students should model their work on published works, especially when students embark on academic careers. The intended audience of work published in journals today, other scholars, is likely to be different than the intended audience of work published in journals in the near future – *absolutely anyone*. With this in mind, developing communication skills must be an essential emphasis for staff with teaching responsibilities.

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Table 1. Means and Standard Deviations across all Measurements, by Summary Type

	Original		Student	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Clearly written*	4.45	0.99	5.24	1.13
Easy to understand*	4.22	1.03	5.11	1.14
Detailed*	4.61	0.84	5.41	1.13
Engaging	3.90	0.81	4.58	1.31
Informative	4.78	0.89	5.33	0.95

Note: * Denotes statistically significant differences in mean scores to $p < 0.05$ level

Appendix A: Pilot Data Generation Strategy and Resulting Materials

First year ($N = 9$) undergraduate psychology students were invited to take part, with participation framed as being in the interests of developing academic writing; accordingly, a number of filler questions were included with this in mind. The resulting sample used for data collection included three participants with a mean age of 19 ($SD = 1.73$), and an age range of 18–21. All three participants were male, two were British and one was Scandinavian.

Participants were asked to select one of five articles and summarise it in no more than 150 words, specifically asked to pay attention to what the researchers did, how they did it, what they found out, and why it is important. Though given a choice of five studies to summarise in their own words (Hölzel, Lazar, Gard, Schuman-Olivier, Vago & Ott, 2011; Oishi, 2010; Norton & Sommers, 2011; Roberts, Kuncel, Shiner, Caspi & Goldberg; Salthouse, 2006), only three were selected by participants. The intended strategy to deal with duplicate summaries was rendered void when reviewing responses to the question ‘Were you interested in the subject matter it explores before you studied psychology?’ All participants indicated ‘Yes’ (from a forced ‘Yes’ or ‘No’ response), with only those who selected Yes intended to be retained. Also, none had read their chosen target article prior to taking part in the study (another forced ‘Yes’ or ‘No’ response), with any who had done intended to be omitted. Open-ended data collected on ‘What made you choose this article for the purposes of this exercise?’ was therefore used to generate data, with participants who selected a summary as they found the topic interesting chosen. This was considered equivalent to the initial strategy. The rationale here was that established researchers are also interested in their research topics and that output disseminated in written format is unlikely to be produced by scholars who have no interest in the research. The language of the summaries was ‘tidied up’

by the researcher to minimise typographical errors, matching the standard of each equivalent original abstract. The materials used as experimental stimuli are listed below.

Summary A, adapted from Salthouse (2006).

The hypothesis was: the rate of age-related decline in measures of cognitive functioning will be less pronounced for people who are more mentally active, or, equivalently, that the cognitive differences among people who vary in level of mental activity will be greater with increased age. There is a lack of research on the interactive effect of age and mental activity on cognitive functioning. However this research paper concluded that evidence was not consistent with this optimistic interpretation. There are very few examples of what the paper argued as the most convincing type of evidence—demonstration that the differences in mental performance associated with varying levels of mental exercise increase with increased age.

Summary B, adapted from Hölzel, Lazar, Gard, Schuman-Olivier, Vago and Ott (2011).

Mindfulness meditation involves non-judgmental attentiveness to experience in the present moment from the perspective of acceptance. The paper outlines how the practice has been shown to produce positive changes to several psychological symptoms, such as anxiety disorders; it also has a beneficial effect on physical health and aids general psychological well-being. The aim of the paper is to consolidate research about mindfulness meditation into a theoretical framework whilst highlighting neuroscientific evidence for support. The paper explores components which mindfulness exerts an effect on, attention regulation, body awareness, emotional regulation and a change in perspective on the self. The distinction between these components is deemed as significant where these mechanisms have separate benefits but are in interplay with each other. The paper concludes that further research into

the mechanisms behind these changes must be conducted, as well as further consolidation of each component into a comprehensive model.

Summary C, adapted from Norton and Sommers (2011).

This study looked at the possible causes of the recent increase in 'reverse-racism' cases and Whites' increasing concern about anti-white bias in the United States. The researchers asked 209 white and 208 black participants to rate to what extent they felt Blacks and Whites were the target of discrimination in each decade from the 1950s to the 2000s. They found that both groups acknowledged little racism against Whites but substantial racism against Blacks in the 1950s. However, Whites' ratings showed a significant increase in anti-white bias in the past six decades, so that anti-white discrimination is now viewed as more prevalent than anti-black discrimination. This suggests that for Whites, racism is a zero-sum game, where less anti-black racism means more anti-white racism. These findings are relevant, because viewing Blacks' progress as threatening, may mean more resistance to positive change for a group that continues to achieve poorer outcomes than Whites.

Appendix B. Survey Questions

Participants were initially met with a single web-page which provided information about the study and gather informed consent. On a separate page, they were presented with the following explanation:

On the following pages, you will be presented with five short summaries of (real) psychological research projects – the topics will vary. Please read each summary carefully, and respond to the questions which follow - the questions have been designed to capture how clear you found each summary. A good way to think of this is how easily you could explain the research to someone else who has not read the summaries.

Participants were then presented with either the original or adapted summaries, one page at a time – see Appendix A. After each of the three summaries, and on a separate page, participants were asked to rate on a seven-point scale ('Strongly disagree', 'Disagree', 'Somewhat disagree', 'Neither agree nor disagree', 'Somewhat agree', 'Agree', and 'Strongly agree') how *clearly written, easy to understand, detailed, engaging, and informative* they found the preceding summary to be.

After this process, and on a separate page, participants were presented with ten questions measuring scientific literacy, with the closed-response options of 'Yes' or 'No'. Three questions (see hashtags below) were included as filler questions to ensure materials were being processed carefully. Presented in a random sequence, the questions were:

- *The centre of the Earth is very hot*
- *One plus one is three#*
- *The continents on which we live have been moving their location for millions of years*

- *Strawberries are red#*
- *All radioactivity is man-made*
- *Electrons are smaller than atoms*
- *There are 5 hours in a day#*
- *Lasers work by focusing sound waves*
- *The universe began with a huge explosion*
- *The Sun revolves around the Earth*

Participants were finally presented with a page asking them to provide basic demographic information. Specifically, they were asked for their gender ('Male', 'Female', 'Custom'), their age (open-ended, numerical), if they have a University level qualification such as a Bachelor's degree ('Yes', 'No'), and their nationality (open-ended, text).

Appendix C: Participant Screening

Before hypothesis testing occurred, the pattern of results on scientific literacy questions was considered. The accuracy of each of the seven questions was 95%, 98%, 89%, 80%, 83%, 98% and 84%, with an overall accuracy of 90%. Critically, there were no significant differences by gender, qualification, or age, with the pattern of results suggesting a level of scientific literacy on a par with the wider population. As such, no concerns were raised ahead of hypothesis testing.

Appendix D: Means and Standard Deviations for Individual Summaries

Commented [SB2]: New addition based on changes made – see comment on p 11 in the final paragraph of the Results section.

	Cognitive ageing				Mindfulness				Racism			
	Original		Student		Original		Student		Original		Student	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Clearly written	4.03	1.47	4.39	1.71	4.64	1.37	5.55	1.23	4.70	1.38	5.66	1.38
Easy to understand	3.91	1.42	4.16	1.57	4.00	1.39	5.44	1.37	4.76	1.62	5.55	1.52
Detailed	3.91	1.42	4.16	1.57	5.55	1.00	5.70	1.22	3.82	1.21	5.31	1.52
Engaging	4.46	1.23	5.16	1.34	4.21	1.14	4.89	1.38	4.36	1.71	5.25	1.42
Informative	3.12	1.02	3.52	1.67	5.36	1.06	5.53	1.28	4.46	1.42	5.71	1.13

Note: Emboldened means denote higher student scores than original summaries, to levels of varying statistical significance