

Beyond the Pale: How Cognitive Biases Influence Our Preference for White, Tree-based Paper

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ABSTRACT: The overwhelming use of bleached, tree-based white paper—a significant contributor to deforestation and toxic pollution—remains unquestioned despite the availability of environmentally superior alternatives like beige, tree-free sugarcane paper. This paper addresses an overlooked, pervasive barrier to eco-friendly consumption, the irrational aversion to tree-free paper based on a non-white color rather than function. This study investigates the extent to which cognitive biases may influence the preference for tree-based, white paper over beige, tree-free sugarcane paper. A Likert-scale survey ($N = 122$) was administered to secondary school students at a school in South Korea, which has adopted sugarcane paper by participating in my environmental initiative. An ANOVA demonstrated significant differences in agreement ratings across cognitive bias statements ($F(10, 1210) = 7.85, p < .001$). The results showed that *Familiarity Bias*, *Aesthetic Bias*, and *Appeal to Popularity* were the biases most strongly associated with white paper preference. Ultimately, this research serves as an initial investigation into the widespread preference for white, tree-based paper. It highlights the potential fruitfulness of addressing psychological factors preventing the adoption of sustainable alternatives, especially for adolescents, who will be the next leaders in climate change mitigation.

KEYWORDS: Psychology, Environmental Psychology, Cognitive Bias, Sustainability, Sugarcane Paper.

■ Introduction

In educational, professional, and personal settings, the use of tree-based, white paper to print worksheets, examinations, official documents, and other materials remains a widely accepted and largely unquestioned practice, quantified by the average office worker's consumption of 10,000 sheets of copy paper per year.¹ However, this widespread preference for white wood-pulp paper directly contributes to massive levels of deforestation each year, as an estimated 53.33% of trees worldwide are logged for paper production.² Since trees absorb significant amounts of carbon, deforestation substantially contributes to a gradual increase in the atmospheric concentration of greenhouse gases and hence to global warming.³ Moreover, the authentic hue of wood pulp is beige; the pure white of tree-based paper is the result of artificial bleaching of wood pulp in highly toxic, non-biodegradable chemicals detrimental to the environment and human health.⁴ An alternative to the standard white wood-pulp paper is sugarcane paper, which is made from bagasse – waste from harvesting sugarcane.⁵ While it is possible to bleach sugarcane paper, it is predominantly sold unbleached, as it is functional in its natural beige hue, and the companies that produce sugarcane paper tend to be environmentally conscious.⁶ Both of these factors make sugarcane paper a more environmentally friendly option.⁵ At my school, which has adopted sugarcane paper in some of its printers by participating in my environmental initiative, I have observed an aversion to sugarcane paper.⁷ For example, a few teachers, upon learning that the printer was filled with sugarcane paper, walked an entire flight of stairs to use the printer on the next floor, which had white paper. Some students cited concerns that they did not like the paper because it was “too beige.” The

school had introduced sugarcane paper during the previous academic year through pilot trials in selected printers, school assemblies, and classroom use. Empirical studies in behavioral economics and psychology have demonstrated that when making decisions related to climate change, individuals often deviate from rational decision-making in consistent, systematic, and predictable ways.⁸ Many of these deviations can be labelled cognitive biases: “systematic tendencies or distortions in human judgement and decision-making.”⁹

In terms of the two modes of cognitive processing proposed by Kahneman, cognitive biases—the mental shortcuts of System 1 thinking—often override the more rational, deliberate System 2 thinking.¹ For example, Dhami *et al.* conducted laboratory experiments where participants made decisions about contributing to a green fund that would reduce the future likelihood of a climate catastrophe.² The study found that present bias, the tendency to overvalue immediate outcomes and undervalue future ones, and loss aversion, where the pain of a loss is felt more intensely than the pleasure of an equivalent gain, decreased the participants' contributions to the green fund.^{3,4}

However, to my knowledge, there have been no papers specifically investigating the reasons behind the societal preference for white tree-based paper despite its environmental cost and the availability of myriad sustainable alternatives, like beige sugarcane paper. To explore this inquiry, I investigated cognitive biases present in students at a school that has adopted the use of sugarcane paper in a few of its printers.

I hypothesize that one or more cognitive biases may significantly contribute to this phenomenon, with the status quo bias—the propensity to choose to maintain the status quo rather than make changes—contributing the most.⁵ This is because

this cognitive bias has been observed in other areas of climate action, as environmentally friendly choices often require active effort to depart from the status quo, such as opting into a green electricity tariff or specifically requesting a vegetarian meal, making them less likely to be adopted.^{6,7} In the case of paper, the status quo bias may hinder the wider adoption of sustainable alternatives like sugarcane paper, as white wood-pulp paper is the status quo, commonly accepted without question.

This investigation aims to explore how insights from cognitive psychology may help identify psychological barriers to the adoption of sustainable alternatives such as sugarcane paper. By understanding such psychological barriers to sustainability, we can develop targeted solutions for individuals and institutions and thus facilitate the widespread adoption of sustainable practices.

■ Methods

Data Collection:

Data were collected through a 5-point Likert-scale survey, titled “Paper Preferences and Perceptions,” and created using Google Forms.⁸ The target population was the students at North London Collegiate School Jeju (age 11 to 18), as they had prior exposure to beige, wood-pulp-free sugarcane paper following its adoption by the school. This study used opportunity volunteer sampling.

A waiver of individual parental consent was implemented, given the research context. The study posed minimal risk since it addressed a non-sensitive topic: preferences for school-provided paper. Moreover, the study—conducted in an educational setting—proceeded with explicit permission of Heads of Houses and teaching staff. Also, students were informed that the survey was not mandatory, which protected student assent, and anonymity was guaranteed.

Upon request, teachers allotted class time for optional survey completion in multiple classes across different year groups they taught, and Heads of Houses provided form time for all year groups to participate. This ensured that students across all year groups had access to the survey. Out of an estimated total population of 1400, 122 responded, which represents approximately 9% of the population. The low response rate was partially due to the survey being accessible to only certain classes and houses, as some teachers did not respond to emails requesting to share the survey. Despite the low response rate, the collected sample size is statistically sufficient to provide meaningful analysis, yielding a 8.5% Margin of Error with a 95% confidence level for a population of 1400. This is considered sufficient for exploratory research.⁹

The survey consisted of 2 sections. In the first section, students rated their agreement with 11 statements, each designed to measure a specific cognitive bias, on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The second section contained 7 statements assessing students’ perceptions of change, information, and values, also rated on the same 5-point scale. Single-item measures were used for each cognitive bias to maintain survey brevity and minimize participant fatigue within the context of a voluntary school-based survey.

The survey was designed with neutral titles and descriptions so that respondents were unaware that the study was investigating cognitive biases. For instance, the survey, its first section, and its second section were respectively titled “Paper Preferences and Perceptions,” “Factors Influencing Choice of Paper,” and “Perceptions of Change, Information, and Values”. The description contained a brief, factual explanation of sugarcane paper, devoid of persuasive or evaluative language. This approach was intended to prevent participants from consciously adjusting their responses to align with socially desirable or ‘unbiased’ thinking.

Data Handling:

Google Sheets (where the Google Form responses were automatically recorded) and RStudio (Appendix A) were used for data processing. Among the total of 125 responses to each statement, it was observed that three participants selected “3” (neutral) for all 18 statements. As it is highly unlikely that these respondents were neutral towards all statements in the form, their responses were removed. Consequently, 122 responses were included in the statistical analysis.

The Google Sheet was imported into RStudio and divided into two tables: “results_part1” for all the participant ratings of the 11 cognitive bias statements, and “results_part2” for all the participant ratings of the remaining 7 statements regarding change, information, and values. The mean values for the 11 cognitive bias statements and the remaining 7 statements were subsequently calculated.

Statistical Analysis:

To determine whether mean agreement ratings differed significantly across the cognitive bias statements investigated, a within-subjects Analysis of Variance (ANOVA) test was conducted. Subsequently, a pairwise t-test was performed with a Holm correction. Each test was interpreted using the standard $p < .05$ criterion for significance.

■ Results and Discussion

Results:

Means and Standard Deviations for the 11 cognitive bias statements and the remaining 8 statements are presented in Appendix C. On average, participants agreed with Familiarity Bias ($M = 3.6$, $SD = 1.1$) the most, and Authority Bias ($M = 2.8$, $SD = 1.2$) the least.

The ANOVA test showed significant differences in mean agreement ratings across cognitive bias statements, with a modest effect size, $F(10, 1210) = 7.85$, $p < .001$, $\eta^2 = .06$.

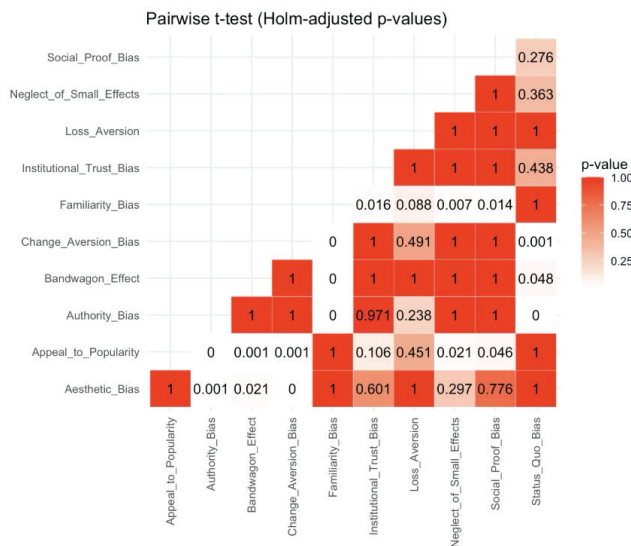


Figure 1: Heatmap of Holm-Adjusted P-Values from Pairwise T-Tests of Cognitive Biases. The heatmap indicates the statistical significance of pairwise differences between biases after Holm correction. Familiarity Bias, Appeal to Popularity, and Aesthetic Bias received relatively higher ratings, while Authority Bias, Bandwagon Effect, and Change Aversion Bias were rated lower overall.

The post hoc results in Figure 1 revealed several significant pairwise mean differences between the biases. *Familiarity Bias* was rated significantly higher than *Social Proof Bias* ($p = .003$), *Neglect of Small Effects* ($p = .005$), and *Institutional Trust Bias* ($p = .012$). *Appeal to Popularity* was rated significantly higher than *Social Proof Bias* ($p = .010$), *Neglect of Small Effects* ($p = .015$), *Institutional Trust* ($p = .035$), *Change Aversion* ($p < .001$), *Bandwagon Effect* ($p = .005$), and *Authority Bias* ($p < .001$). *Aesthetic Bias* was rated significantly higher than both *Change Aversion Bias* ($p = .002$) and *Authority Bias* ($p < .001$).

In contrast, *Change Aversion Bias* was rated significantly lower than *Status Quo Bias* ($p = .001$) and *Familiarity Bias* ($p < .001$). The *Bandwagon Effect* was rated significantly lower than *Familiarity Bias* ($p = .001$). *Authority Bias* was rated significantly lower than both *Status Quo Bias* ($p < .001$) and *Familiarity Bias* ($p < .001$). Overall, these findings indicate that *Familiarity Bias*, *Appeal to Popularity*, and *Aesthetic Bias* had generally high mean agreement ratings, while *Authority Bias*, *Bandwagon Effect*, and *Change Aversion Bias* were rated lower on average. Therefore, the null hypothesis—that there would be no statistically significant difference in the mean ratings of the cognitive biases—is rejected. The alternative hypothesis is thus accepted, which suggests that several cognitive biases may be associated with students' preference for white paper. These findings therefore suggest that certain cognitive biases may be more strongly associated than others with adolescents' preference for white, tree-based paper.

Discussion:

The findings support the hypothesis that students' preference for white, tree-based paper over beige sugarcane paper may be associated with several of the cognitive biases investigated. However, it does not substantiate the part of the hypothesis that status quo bias most significantly contributes

to the explored phenomenon, as participants showed the highest mean ratings for *Familiarity Bias* and *Appeal to Popularity*. This could be explained in light of the adolescent age range of the sample. According to Pinho *et al.*, adolescents' personal norms are significantly shaped by majority norms. Hence, one possible interpretation is that participants may have gravitated towards what is familiar and popular—such as the widespread use of white paper—to fit in.¹¹

Similarly, the high rating for *Aesthetic Bias* could be interpreted in the context of adolescents' heightened susceptibility to self-consciousness.¹² Adolescents are often particularly attentive to physical appearance and self-presentation. This may have extended to the materials they use, potentially contributing to their preference for pristine white paper over the beige alternative, although this interpretation was not directly tested in the study.

In contrast, the results demonstrated that *Authority Bias* had the lowest mean agreement, which may reflect patterns identified in previous research on adolescence. As they seek greater independence, adolescents tend to develop a propensity to question and defy authority.¹³ Consequently, the endorsements of sugarcane paper by authority (expressed as “a respected institution” by the survey) may have had little impact on students' paper preferences.

There was a surprisingly significant difference in mean ratings between the ostensibly similar biases, *Familiarity Bias* and *Change Aversion Bias*. While *Familiarity Bias* had the highest mean agreement, *Change Aversion Bias* had the second lowest. Self-serving bias may partially explain this discrepancy, although this interpretation was not directly tested in the study: participants may have perceived the *Change Aversion Bias* statement “I do not feel comfortable with the idea of switching because I don't like change” as admitting a character flaw. As people tend to avoid admitting failure, participants may have been unwilling to agree with the *Change Aversion Bias* statement.¹⁴ On the other hand, the *Familiarity Bias* statement, “I feel uncertain about sugarcane paper because I'm more familiar with white paper”, was perhaps less likely to be interpreted as a personal shortcoming.

Likewise, while the statements of the *Bandwagon Effect*, *Authority Bias*, and *Social Proof Bias* were phrased in a way that implied a lack of independent thought—a potential character flaw—the statement for *Appeal to Popularity* was more generic and less direct. Thus, students—adolescents in their pursuit of autonomy—may have been more inclined to reject the statements for the *Bandwagon Effect*, *Authority Bias*, and *Social Proof Bias* statements and agree with the *Appeal to Popularity* statement, despite the potential similarity of the four cognitive biases, although this interpretation remains speculative.

These findings align with the mean ratings of other statements investigated in the study, which provided further context for the participants' attitudes towards sugarcane paper. For example, the high mean ratings (3.7 for both) for “I do not mind trying new materials if they are more sustainable” and “Sustainability is one thing I consider when choosing materials, but not the only thing” may indicate generally positive attitudes toward sustainability. However, the comparatively lower

mean rating (3.2) for “I would support my school/workplace adopting sugarcane paper, even if it felt unfamiliar at first” may support the possibility that *Familiarity Bias* is associated with students’ white paper preference.

Table 1: Means and Standard Deviations for Each Cognitive Bias. Familiarity Bias, Appeal to Popularity, and Aesthetic Bias received the highest mean ratings, while Authority Bias and Change Aversion Bias received the lowest.

Cognitive bias	M (1 d.p.)	SD (1 d.p.)
Status Quo Bias	3.4	1.2
Loss Aversion	3.2	1.2
Aesthetic Bias	3.4	1.3
Bandwagon Effect	3.0	1.2
Appeal to Popularity	3.5	1.2
Familiarity Bias	3.6	1.1
Authority Bias	2.8	1.2
Neglect of Small Effects	3.0	1.3
Institutional Trust Bias	3.1	1.2
Social Proof Bias	3.0	1.1
Change Aversion Bias	2.9	1.2

Table 2: Means and Standard Deviations for Each Statement About Change, Information, and Values. Participants generally agreed with statements supporting sustainability, but showed slightly less agreement with adopting sugarcane paper if it felt unfamiliar.

Statement	M (1 d.p.)	SD (1 d.p.)
I do not mind trying new materials if they are more sustainable.	3.7	1.1
I would support my school/workplace adopting sugarcane paper, even if it felt unfamiliar at first.	3.2	1.2
I feel confident I understand the differences between sugarcane paper and white paper.	3.5	1.1
I need more information before deciding whether sugarcane paper is a good choice.	3.4	1.2
I see myself as someone who cares about environmental issues.	3.4	1.0
Sustainability is one thing I consider when choosing materials, but it's not the only thing.	3.7	0.9
I prefer materials that look professional, even if they aren't the most sustainable option.	3.2	1.1

Interestingly, the mean rating for “I feel confident I understand the differences between sugarcane paper and white paper” was 3.5, and the mean rating for “I need more information before deciding whether sugarcane paper is a good choice” was 3.4. The similarity in the mean ratings indicates that while participants felt they had some understanding, they acknowledged a need for more information. The high ratings of 3.5 and 3.4 may suggest that a perceived lack of information could be associated with a preference for white paper, along with the other aforementioned cognitive biases. Since participants reported a general lack of information, providing additional information may increase adolescents’ openness to sugarcane paper.

Overall, the study’s findings suggest that to decrease aversion to non-white, tree-free paper among adolescents, promoting their environmental benefits should be done in conjunction with addressing the cognitive biases that contribute to the preference for white, tree-based paper over non-white, sustainable alternatives. For instance, making the eco-friendly alternatives appear more familiar, popular, or aesthetically pleasing may serve as a useful strategy for the adolescent age group, who will be responsible for leading climate action in the future.

Limitations:

The research design—a cross-sectional study—is a limitation, as although it allows identification of correlations between certain cognitive biases and a preference for white paper, it does not allow the establishment of a causal relationship between the two. As data was collected at a single point in time, it is unclear whether a cognitive bias causes white paper preference, if the preference for white paper strengthens the cognitive bias, or if there exists a bidirectional relationship between the two variables.

The use of opportunity sampling limits the generalizability of the study’s findings. As participants were drawn from a single school—a necessary choice due to their prior exposure to sugarcane paper—this sample might not be representative of other student populations or the broader public. Also, demographic information of participants was not collected, which introduces the possibility that the results do not equally represent the perspectives of all year groups. Additionally, because participants were recruited from a school already exposed to sugarcane paper, the findings may not fully reflect responses from populations with no prior exposure to tree-free paper alternatives. Although participants had prior exposure to sugarcane paper through school implementation, white paper remained the more familiar and socially normative material. Therefore, the high Familiarity Bias ratings may reflect relative familiarity rather than complete unfamiliarity with sugarcane paper.

Furthermore, the construct validity of the survey items is a notable limitation. Since no established scales exist to measure cognitive biases in relation to white paper preference, the survey’s statements were made by the researcher. Although they were refined multiple times with expert feedback, they have not been externally validated. Hence, it is uncertain whether the statements accurately and distinctly measure all of the

intended cognitive biases. For example, although related, the *Bandwagon Effect* emphasizes adopting beliefs because many others hold them, *Social Proof Bias* emphasizes using others' behaviour as evidence for correctness, and *Appeal to Popularity* concerns judging something as preferable because it is widely liked. This conceptual overlap may have reduced construct validity and construct distinctiveness across some survey items. As a result, some statistically significant differences between cognitive biases may have been less clearly distinguishable conceptually than they appeared numerically. Also, it must be noted that paper preference could also be influenced by variables not measured in this study, such as the affinity for high contrast between black and white or the paper's texture.

The reliance on self-report data collected via a Likert scale survey is also a limitation, as it might have introduced the possibility of social desirability bias, meaning participants may have responded in a manner they felt was socially acceptable and 'environmentally conscious' rather than providing their true opinions. This may have inflated agreement with sustainability-supportive statements or reduced willingness to endorse statements perceived as socially undesirable. Although social desirability bias was inevitable due to the reliance on self-report data, this study minimized this demand characteristic through the use of deception by omission—participants were not informed that the study was investigating cognitive biases—and anonymity.

■ Conclusion

Nevertheless, this study provides a novel psychological framework for understanding the societal preference for white, tree-based paper, a phenomenon highly underexplored due to its pervasiveness. While a purely environmental perspective may assume that awareness automatically leads to action, the psychological approach to sustainability explored by this study recognizes the potential unconscious role of cognitive biases in hindering climate action. Through a survey and an ANOVA, it was found that *Familiarity Bias*, *Appeal to Popularity*, and *Aesthetic Bias* were the cognitive biases most strongly associated with white paper preference. Hence, this research illuminates the importance of addressing the psychological barriers to the adoption of sustainable materials, particularly for current adolescents, who will be the next leaders of climate action. Future research could strengthen these findings by comparing participants with prior exposure to sugarcane paper to participants without such exposure. Another area for future investigation is whether the psychological factors behind white paper preference are replicated in adults, who have more control over the institutional procurement of paper.

■ Acknowledgments

I would like to express my gratitude to Mr. Maddison, the Head of Psychology at my school, for his guidance and support throughout the research process, particularly in ensuring the ethical conduct of this school-wide study.

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Seoha Han is a student researcher who combines psychological research with efforts to change unsustainable systems. She looks forward to continuing her interdisciplinary research at university and beyond.