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Revisiting the Birthday Number Effect, Subjective Preferences, and Self-Esteem in College Students

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ABSTRACT. People tend to prefer details related to themselves. For example, people often like numbers associated with their birth date more than other numbers. This is known as the birthday number effect (Pelham et al., 2002). Discovery of this effect stemmed from the name-letter effect, a similar phenomenon in which individuals are likely to prefer letters in their name over other letters (Nuttin, 1985). The heightened fondness for details connected to oneself has been shown to influence decisions including where one lives and with whom one falls in love (Pelham et al., 2005). The present study attempted to replicate the birthday number effect. A significant preference for birthday numbers was found, $F(1, 97) = 17.85$, $p < .001$, $\eta_p^2 = .16$. Previous research has suggested that this effect relates to self-esteem, but this association had not yet been tested. No correlation between self-esteem and birthday-related numbers was found in the present study, $r(99) = -.02$, $p = .88$. However, the study did find that women had significantly lower self-esteem than men, $t(99) = -3.62$, $p < .001$, $d = -0.78$. The knowledge gained from this study provides a deeper insight into implicit feelings regarding the components of self-identity and how they relate to self-esteem in a college student population.

Keywords: birthday number effect, mere exposure, mere ownership, implicit egotism, self-esteem, college students

Beliefs and attitudes often impact a variety of mental processes and behaviors, and research has demonstrated that humans express these feelings in many ways, often without intention or conscious realization (Tracy et al., 2015). The human mind is home to a broad range of subjective information that can manifest in many interesting ways. Kitayama and Karasawa (1997) sought to determine if individuals would express unconscious feelings when rating numbers. They found that participants were more likely to rate numbers related to their birthdays, including the numerical month, day, and year, more highly than other numbers. They described this phenomenon as the *birthday number effect* (BNE). In the present study, we aimed to investigate and discuss the probable mechanism behind the BNE and how it may correlate with self-esteem in a college student population.

The idea leading to the discovery of this effect stemmed from the *name-letter effect*, in which people show a preference for the letters in their names over other letters (Nuttin, 1987). Interestingly, these subjective preference effects appear to be consistent across cultures (Nickell et al., 2003). Although the BNE has been shown to be replicable, the function or mechanism behind the effect is still contested. Several theories have attempted to explain why someone would show a stronger preference for the numbers related to their birthday compared to other numbers. Kitayama and Karasawa (1997) theorized a higher rating for a number connected personally to a participant was an indication the participant also had a higher self-image. In other words, the BNE was theorized to be associated with self-esteem. Implicit self-esteem is explained as an unconscious act of determining the value of self (Brown, 1993). This theory was supported by Dijksterhuis (2004) in which self-esteem levels were shifted higher or lower depending on the type of words shown after the letter "I." The letter "I" is perceived as an identification of oneself. Therefore, the participants implicitly linked the word following the letter "I" with how they felt

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about themselves, suggesting that self-esteem can be manipulated by shifting the context in which personally identifying details are presented. Research into self-esteem highlights differences between "state" and "trait" self-esteem. State self-esteem is the result of social evaluation and the influences of social comparison. However, trait self-esteem is more generally related to a sense of individual well-being (Wang et al., 2021). These differences are relevant to the study of mechanisms responsible for the BNE. Preference for numbers related to birthdays is likely associated with the more stable trait self-esteem rather than the more transient state self-esteem since it is likely related to personal identity.

The connection between the BNE and self-esteem will be discussed from three perspectives: implicit egotism, mere exposure, and mere ownership. First, implicit egotism is a theoretical basis for self-esteem in which individuals prefer information that relates to themselves (Pelham et al., 2002). Second, the mere exposure effect posits that repeated exposure to stimuli results in a stronger preference (Zajonc, 1968). Finally, the mere ownership effect suggests that a stronger preference for personal information relates to feelings of ownership (Beggan, 1992; Nuttin, 1985). Each of these perspectives may provide insight into the mechanism behind the BNE. Here, we will discuss each of these perspectives in more depth.

Implicit Egotism

Implicit self-esteem can also be explained in the theory of *implicit egotism* which states that humans actively seek out and prefer personally connected details (e.g., items, places, names) over nonconnected details (Pelham et al., 2002). People are unconsciously biased to prefer something linked to their positive, self-related, characteristics. For example, Pelham and colleagues (2005) found that people are more likely to move to a state related to their name over other states (e.g., individuals named Virginia or Georgia are more likely to move to those states, respectively). This effect was found for city and street name preferences as well. In the same study, participants would reliably rate someone as more attractive if they were wearing a shirt containing a number in which the specific digit had been conditioned to be linked to their name earlier in the study. This supports the notion that whom someone finds attractive could be based at least in part on implicit egotism and suggests that a large impact on the process of decision-making goes unnoticed in major life events. Studies attempting to extricate implicit egotism from implicit self-enhancement have shown that people will adhere to the BNE even when they are presented with a threat to their self-concept. This suggests a bridge between the BNE and implicit egotism (Pelham et al., 2002). Research by Coulter and Grewal (2014) demonstrated that the BNE is present even in cases involving novel one-time circumstances, such as items selected for purchase at a store. Implicit egotism can be seen as a driving force in the motivations behind the BNE. Jones and colleagues (2002) found that the preference for the first letters of someone's first or last name was greater when compared to their preference for the most common letters in the English alphabet, suggesting that implicit egotism remains a stronger influence compared to the Mere Exposure Effect.

Mere Exposure Effect

Another theory proposed as an explanation for the BNE is the *mere exposure effect*, in which repeated exposure can result in an increased fondness or preference (Zajonc, 1968). Johnson (1986) found that people are more likely to prefer certain items from a list if the letters in those items were previously presented more often. There are three main models for this effect: Zajonc's Affective Model, the Two-Factor Model, and Processing Fluency (Montoya et al., 2017). Zajonc's Affective Model states that previously conditioned fear responses to fear-inducing stimuli can be nullified after multiple exposures without any negative consequences, sometimes eventually going as far as to induce a positive feeling instead (Zajonc, 1968). The Two-Factor Model further elaborates on Zajonc's concepts, suggesting that people ultimately become bored with certain stimuli, thereby decreasing item preference and creating an inverted-U shape preference distribution (Berlyne, 1970; Stang, 1973). A third theory potentially explaining the mere exposure effect is Processing Fluency, which states that information people have been exposed to over time is encoded and processed more quickly (Whittlesea et al., 1990). Based on this theory, if someone puts in less effort to recognize certain stimuli, like a number related to their birthday, a higher preference for these stimuli may result due to a sense of familiarity. Following this logic, individuals may believe they like these items more than others simply due to more efficient encoding and processing. With these theories in mind, someone being exposed often to numbers related to their birthday, typically in a positive way, could mean they are more likely to show a stronger preference for those numbers over others. There is also a possibility of a person experiencing negative feelings surrounding their birthday numbers based on past experiences even after repeated exposure. Williams and colleagues (2015) examined previous research on the occurrence of suicide on and around one's birthday. They indicated that the association between increased suicide risk around

birthdays may be due to multiple factors including the representation of numbers related to birthdays as more stressful (Williams et al., 2011). Historically, indications of older age, feelings of loneliness, and traumatic events may cultivate increased suicidal behaviors on birthdays (Alderson, 1975). Considering this information, it is logical to argue the Processing Fluency theory as the most likely and significant mechanism in use if the BNE is related to mere exposure. However, the question remains, is it possible for repeated exposure to create a sense of ownership over an item, and how much might the feeling of ownership change this preference?

Mere Ownership Effect

The mere exposure effect is similar to another effect that past research has suggested to be a contributing factor to the BNE, the *mere ownership effect*. This theory posits that individuals will show a higher preference for items for which they feel a sense of ownership compared with other items (Beggan, 1992; Nuttin,1985). Belk (1988) demonstrated that individuals start seeing items they own as an extension of themselves and will often use them as tools to help define their identity. For example, the belief in zodiac symbols and astrology and their ability to determine someone's personality[1] implies that people can find an identity and a sense of ownership of their birthdate (Di Natale et al., 2022). Finding an identity through and feeling ownership of a birthdate can result in a shared sense of identity with others sharing the same birthday-related numbers. Cialdini and De Nicholas (1989) found that participants were less likely to admit they shared a birthday with someone who scored higher than them on a social personality test compared to someone who scored higher than them on an intelligence test. This suggests that people find the prospect of having poorer social skills than someone else more intimidating than feeling less intelligent. Without the knowledge of others' social skills, participants were more open to sharing their birthdays. Relatedly, Burger and colleagues (2004) demonstrated that participants were (a) more likely to do a favor for someone and (b) more likely to donate a larger amount of money to a charity if they believed they shared the same birthday as the person asking for the favor or money, respectively. These studies support the notion that numbers related to birthdays are often meaningful to people due to personal identity and social bonding.

Nickell and colleagues (2003) suggested that the mere-ownership effect is responsible for both the name-letter effect and the BNE, stating that people tend to prefer these letters and numbers because of their relationship to their sense of ownership. This is also related to the endowment effect, in which the favorability of owned items broadens to include details of other individuals to whom one is close in addition to details of oneself (Zhao et al., 2014). Within the context of the BNE, this suggests that someone may feel similar ownership and preference to a family member, close friend, or spouse's birthday as they would their own. Because numbers related to birthdays are stimuli that people are exposed to often, and because people often feel that their birthday belongs to them personally (despite sharing the same birthday with others), a likely theory is that both mere exposure and mere ownership are contributors to the heightened preference for numbers related to birthdays.

[1]Also an example of the Barnum or Forer effect.

Present Study

The BNE is a replicable effect likely produced due to some combination of implicit egotism, mere exposure, and mere ownership. In the present study, we sought to test preferences for numbers related to birthdays relative to other numbers. We tested preference for both birth month numbers and birth date numbers. Previous research found a preference for higher birth date numbers, (i.e., numbers over 12; see Kitayama & Karasawa, 1997). The reasoning behind this specific number preference is unclear. Higher birth date numbers do not include birth months (i.e., 1–12), so it may have to do with overlap between the use of these numbers for dates and months. We investigated whether participants found numbers greater than 12 to be preferable to numbers 12 or smaller, regardless of their own birthdays. Additionally, we looked for number preference differences based on gender. Previous research has demonstrated that gender differences are prominent for self-esteem (e.g., Zuckerman et al., 2016), but gender differences in the BNE are unknown.

Recent sociocultural events and history threats that could potentially impact self-esteem should be considered. One factor is how the type and duration of internet usage for college students could impact self-esteem. Wright and colleagues (2023) found college students to be more prone to an increased amount of time spent on electronic devices like smartphones, specifically using social media. The increased social media time combined with the effects of the COVID-19 pandemic have proven to be harmful to college student's mental health. Social media has been shown to decrease the amount of time college students will spend studying and/or sleeping. These factors have major impacts on college student's overall well-being (Kolar et al., 2021). In addition to the amount of time spent on social media, Wright and colleagues (2020) also found that the type of social media can impact someone's overall well-being and

self-esteem. Social media applications with a majority image-based platform (e.g., Snapchat) have a larger role in negatively affecting well-being than non-image-based platforms (e.g., Twitter). Due to the increase in the amount of average time spent on social media since the COVID-19 pandemic, the relationship between self-esteem and the BNE may not be as strong as was previously demonstrated. The effects of the COVID-19 pandemic are still being researched. However, lifestyle changes and habits developed during this period of isolation and instability likely negatively impacted adolescent mental health. Socialization is important for adolescents' development in order to learn how to participate in society as well as become accepted by their chosen social groups (Perez-Felkner, 2013). COVID-19 perpetuated an imminent threat to this social development period and might have impacted the emergence of certain psychopathologies (Mittal et al., 2020). Lu and colleagues (2020) importantly noted how the sedentary behavioral habits developed during the pandemic could be risk factors for the development of certain mood disorders. Self-esteem has been observed to mediate the relationship between predictors of anxiety and psychological consequences (Rossie et al., 2020). Considering this information, the way we measure and conceptualize self-esteem moving forward may need to be modified to consider the effects of the COVID-19 pandemic on college students' self-esteem. The retrospective ages of the participant pool reflect an important period of development, and these factors may have influenced self-esteem in the participant sample of the present study.

In previous research into the BNE, it was suggested (but never confirmed) that self-esteem or a similar mechanism may play a role in this effect. Rather than simply assume that any bias for birthday numbers might be due to self-esteem (Kitayama & Karasawa, 1997) or implicit egotism (Coulter and Grewal, 2014; Pelham et al., 2002) as was suggested previously, here we directly tested the association. This is the first study to directly investigate the claim of self-esteem potentially influencing the BNE. Based on the theories of implicit egotism, mere exposure, and mere ownership, it is logical to assume that self-esteem may play a role in the BNE. The likelihood that one attributes importance to details of one's life may be connected to the importance that one places on oneself generally. However, it is necessary to measure self-esteem directly to determine what effect, if any, self-esteem has on the BNE. We hypothesized that participants would have a preference for numbers related to their birthday, consistent with the BNE and that these preferences would be associated with self-esteem.

Method

Participants

One hundred one students (70 women, 31 men) from the University of North Georgia research participant pool volunteered to be part of this study. A power analysis was conducted to determine the required sample size for our bivariate correlation using the formula $r = \frac{\sqrt{t^2}}{t^2+df}$ where t represents the critical t value to reach α of .05. Using a desired power level of .80 and aiming to detect a medium effect size (r = .30), the analysis indicated that a minimum of 70 participants would be needed to achieve the desired power level. Participants were all between 18 and 25 years old except for one 37-year-old participant. Demographic data other than age and gender (e.g., race and ethnicity) was not collected. Consistent with Roberts and colleagues (2020), we acknowledge that this is a limitation of this study and plan to collect demographic data in future research. Informed consent was provided prior to starting the study. Participants were granted partial course credit as compensation for their participation. This study adhered to all ethical guidelines and was approved by the University of North Georgia's Institutional Review Board.

Measures

This study used a questionnaire to collect preference responses for various categories and was designed on Qualtrics (www.qualtrics.com). Nine sets of items were created for participants to rate in terms of individual preference including the numbers 1–50 and other distractor topics (i.e., animals, days of the week, time of day, and the seasons). The rating scale was identical for all items. Participants were asked to indicate how much they liked each item using a 4-point scale of 1 (*I don't like at all*), 2 (*I don't like*), 3 (*I like*), and 4 (*I like a lot*). The rating options used in this study are similar in nature to the scales used by Kitayama and Karasawa (1997) in which they simply requested a preference rating for a variety of different items. All items in a set were rated individually. The first set of items was numbers 1–10. The second set of items presented were the four seasons (i.e., spring, summer, winter, and fall). The third set of items was numbers 11–20. The fourth set of items were animals (i.e., cat, dog, snake, bunny, tiger, octopus). The fifth set of items was numbers 21–30. The sixth set of items was the days of the week (i.e., Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday). The seventh set of items was numbers 31–40. The eighth set of items was time of day (i.e., morning, afternoon, and night). The ninth set of items was numbers 41–50. The distractor topics (e.g., seasons, days of the week) were included to prevent participant fatigue while rating numbers 1–50 and to keep the true nature of our study masked. We did not want participants to

suspect that we were primarily interested in numbers related to their birthdays. Therefore, numbers 1–50 were used. Both "types" of birthday-related numbers of interest to this study fit within this range, followed by distractor numbers. Specifically, *birth month* numbers ranged from 1–12, whereas *birth date* numbers ranged from 1–31. The numbers 32–50 were distractors.

In addition to these measures, the Rosenberg Self-Esteem Scale was used. This measure consists of ten 4-point scale items, with response options ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). This scale was created by Rosenberg (1965) to measure characteristics of global self-worth, including positive and negative feelings about oneself. The Rosenberg Self-Esteem Scale is a reliable measurement tool for determining individual differences in self-esteem, having strong internal reliability (α = .77–.88) and test-retest reliability (α = .82–.88; see Blascovich & Tomaka, 1993; Silber & Tippett, 1965).

Other information was collected from participants in a demographics questionnaire. The items collected included date of birth (MM / DD / YYYY) and gender (i.e., man, woman, nonbinary/ third gender, or prefer not to say).

TABLE 1

Number Preference Ratings by Condition

BD Month	Woman	Small	3.19
		Large	3.04
	Man	Small	3.00
		Large	2.87
BD Date	Woman	Small	3.16
		Large	3.18
	Man	Small	3.13
		Large	2.47
Non-BD Date	Woman	Small	2.77
		Large	2.76
	Man	Small	2.73
		Large	2.52
Non-BD Month	Woman	Small	2.76
		Large	2.77
	Man	Small	2.73
		Large	2.51

Note. Ratings for birthday (written here as "BD") numbers and nonbirthday numbers are displayed, broken out by birth date (1–31) versus birth month (1–12), gender, and birth date size (i.e., small = 1–12; large = 13–31). Generally, there was a preference for birthday-related over nonbirthday-related numbers, and women tended to rate all numbers regardless of category higher than men.

Procedure

Participants signed up for the study using the University of North Georgia's research participant pool website (Sona/NERD). Informed consent was obtained electronically through Qualtrics. Then participants confirmed that they were at least 18 years old in order to participate. Following consent and eligibility confirmation, instructions were provided, in which participants were informed that they would have to rate a series of items using scales provided and complete a demographics questionnaire. Participants confirmed that they understood the instructions. Consistent with Kitayama and Karasawa (1997), the individual preference items were presented in the following set order: (a) numbers 1–10, (b) seasons, (c) numbers 11–20, (d) animals, (e) numbers 21–30, (f) days of the week, (g) numbers 31–40, (h) time of day, and (i) numbers 41–50. The Rosenberg Self-Esteem Scale was proctored in a counterbalanced order between participants to reduce order effects, with half completing the scale before the preference items and half completing the scale afterward. Once the preference items and self-esteem scale were completed (in either counterbalanced order), the participants completed the demographic questionnaire. Afterward, a debrief was displayed, followed by researcher contact information for participants to use if they had any questions.

Results

To test the hypothesis of birthday number preference and how it is influenced by gender, a 2 (Birthday vs. Nonbirthday Number) × 2 (Birthday Number Type) × 2 (Birthday Number Size) × 2 (Gender) mixed design ANOVA was conducted. The first two factors were within-subjects and the last two were between-subjects (see Table 1).

A significant main effect was found for Birthday Number, $F(1, 97) = 17.85$, $p < .001$, $\eta_p^2 = .16$; participants rated their combined birthday numbers (month and date) higher than other numbers. Additionally, there was a significant main effect of gender in ratings of all numbers, $F(1, 97) = 5.91$, $p = .017$, $\eta_p^2 = .06$; women consistently rated all numbers higher than men (see Figure 1). Both women and men showed a greater preference toward numbers relating to their birth month and birth day. However, women showed a higher preference for all numbers than men.

However, no significant main effect was found for birthday number type (date versus month), $F(1, 97) = 0.23$, $p = .64$, $\eta_p^2 = .00$. Participant preferences did not differ between birthday numbers related to month versus day. Finally, a main effect for birthday number size (small, 1–12, versus large, 13–31) neared significance, $F(1, 97) = 3.68$, $p = .06$, $\eta_p^2 = .04$. Participant preferences may subtly differ between small

and large birthday-related numbers. There were no significant interactions between any of these four factors, $Fs < 2.66$, $ps > .11$.

Together, these findings confirm the ubiquity and replicability of the BNE. Women rated all numbers higher than men regardless of birthday affiliation; however, the BNE was still found in both genders that we analyzed. Contrary to previous research finding birth dates to be more highly rated than birth months, participants showed similar ratings for both—perhaps even showing a slight preference toward smaller birthday numbers, suggesting the BNE may not be biased toward large numbers as previously reported (Kitayama & Karasawa, 1997). Previous research suggested a heightened BNE for higher rather than lower numbers. The slight preference for smaller versus larger numbers in the present study may be attributed to fatigue effects because the order of preference items was not counterbalanced between participants. However, this design is based on the original study by Kitayama and Karasawa (1997), suggesting that there may be additional factors such as generational changes or sample variability. Future studies should counterbalance all item preference sets to see which pattern of results (i.e., either Kitayama & Karasawa, 1997, or the present study) is replicated in a design without potentially confounding order effects.

These results demonstrated the replicability of the BNE and provided a nuanced understanding of how other factors, including gender, may impact the strength of this effect. However, it was of particular importance in this study to investigate whether self-esteem impacts the BNE as previously suggested. Despite previous suggestions of the BNE relating to self-esteem, no correlation between self-esteem and birthday-related numbers was found, $r(99) = -.02$, $p = .88$. When subgrouped by gender, no correlations between self-esteem and birthday-related numbers were found for men, $r(31) = .00$, $p > .99$, or women, $r(70) = .12$, $p = .31$.

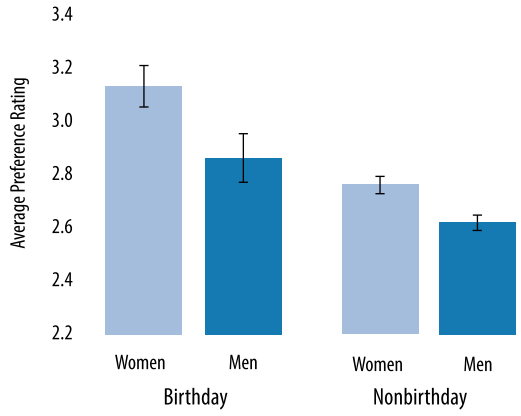
Finally, an independent-samples t test comparing self-esteem and gender found that women ($M = 16.96$, $SD = 5.82$) had significantly lower self-esteem than men ($M = 21.35$, $SD = 5.12$), $t(99) = -3.62$, $p < .001$, $d = -0.78$, 95% CI [-1.22, -0.34]. Despite women rating all preference items (e.g., birthday numbers, nonbirthday numbers, and distractor items) higher than men, self-esteem was markedly lower for women. This highlights the ubiquity of the BNE. Women had a more prominent BNE than men despite having lower self-esteem (see Figure 2).

Discussion

In this study, we sought to test the BNE, an effect in which individuals prefer numbers associated with their birthdays over other nonrelated numbers. We also wanted to test prior claims or suggestions of the BNE being a result of heightened self-esteem or similar factors. Participants in our study tended to exhibit the BNE, providing supporting evidence for the replicability of this cognitive effect. This effect was found to be stronger for women than men. In fact, women rated all preference items more strongly than men including birthday numbers, nonbirthday numbers, and distractor

FIGURE 1

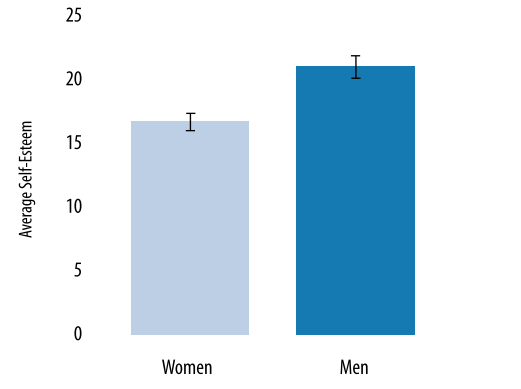
Number Preference Ratings for Birthdays and Nonbirthdays Between Genders



Note. Birthday number versus nonbirthday number ratings shown for female and male participants. Error bars represent standard error.

FIGURE 2

Self-Esteem Differences by Gender



Note. Average Rosenberg Self-Esteem Scale ratings shown for women and men. Women had significantly lower self-esteem than men. Error bars represent standard error.

items. These findings are similar to those in related effects such as the name-letter effect (Hoorens & Nuttin, 1993). The establishment of this name-letter effect is the early relative to the BNE seeing as they both involve the unconscious, self-serving, preference for personal elements (Kitayama & Karasawa, 1997).

As for self-esteem, we failed to find a correlation between self-esteem and the BNE. The BNE, as described by Kitayama and Karasawa (1997), is believed to be motivated by implicit egotism. Also, Greenwald and Banaji (1995) suggested that one must have high self-esteem to implicitly favor items related to themselves. The present study does not support this conclusion. In fact, we found that women tended to have significantly lower self-esteem than men—despite having an equally strong BNE. We are not arguing the BNE is generated by lower self-esteem; we failed to find a correlation between self-esteem and the BNE. However, women had the highest ratings for item preferences and lowest ratings for self-esteem. These findings coincide with previous research on self-esteem and gender differences. Historically, women have faced many tribulations in which self-esteem and their self-concept have been threatened. A conglomeration of research has delved into the efforts of modern society and the long-term effects of the marginalization of women. For instance, Kling and colleagues (1999) provided evidence of men having higher self-esteem than women across measures, ages, and nationalities in their meta-analysis. More recently, Zuckerman and others (2016) analyzed this same gender difference across past studies and concluded that lower self-esteem in women in developed countries is thought to derive from a period of acceptance. Women now see themselves as part of the majority and are therefore subject to comparison to their male counterparts, which leads to dissonance. Women's awareness of discrimination is thought to be part of why lower self-esteem is seen in current research involving self-esteem and gender differences (Zuckerman et al., 2016).

It is also important to consider social media usage among college students of all genders. Social media usage can increase the diagnosis of depression and anxiety in college students. This has been credited to the lack of physical activity and sleep, resulting from an extended time on electronic devices (Hu et al., 2001). Vogel and colleagues (2014) found those who used social media applications were more likely to have lower self-esteem than those without social media. This may also be due to comparisons made to other social media users. Impacts on physical and mental health stemming from social media use, alongside problems of increased social comparison, could logically result in a decrease in overall self-esteem.

Considering the results of the current study, women seem to associate themselves with their birthdays similarly to men, but is their self-esteem still low due to discrimination or comparison? We therefore conclude: (a) the BNE is a strong, replicable effect for men and women; (b) the BNE is not driven by self-esteem in college students; and (c) there are significant gender differences in self-esteem not impacting the BNE.

Limitations

This study has several limitations that are important to mention. One limitation here relates to the population from which the sample was pulled. We utilized the university's student participation pool, which is comprised primarily of college students of young adult age with a bias toward women over men. We understand that this is not a representative sample of the broader population. Despite having significantly more female than male participants, the gender differences found related to self-esteem are consistent with prior research. Therefore, we can cautiously surmise that other gender-related findings are generalizable to a larger, more representative population.

We also acknowledge the lack of demographic data that was collected. Any demographic data collected for this study related to specific hypotheses or study design. Future research should collect more complete demographic data including information regarding race/ethnicity and socioeconomic status in compliance with current APA standards. Participants should also be sampled from a more diverse population. This increases the generalizability of findings while also increasing equity of opportunity for participation.

Applications

There may be many potential applications of general knowledge around the BNE. For instance, more self-awareness around how people view items related to themselves could help make people more conscious consumers and less likely to be scammed. Newer marketing techniques known as mass-personalization programs involve tailoring prices and products to individual consumers to increase sales (Coulter & Grewal, 2014). As consumers, having more awareness of marketing practices will help to decrease the occurrences of falling victim to manipulation.

As demonstrated in the present study, women tend to have a somewhat stronger BNE than men despite inverse differences in self-esteem. Industries and businesses could benefit from this information pertaining to marketing and services tailored to each gender. Therefore, even more caution should be taken by women while participating in consumer practices. Algorithms creating custom entertainment and marketing online, through social media, and over the phone have become a growing topic of interest and concern. The BNE

and similar cognitive effects may prove to have myriad applications in the future in terms of the consumer understanding the power their unconscious biases may have in them becoming active participants in marketing games.

Future Directions

Future research into the BNE could improve upon the present study to expand upon these findings. In upcoming studies, fewer question categories and numbers for participants to rate would be beneficial, because possible fatigue effects impacted number and distractor ratings toward the end of the preference item lists. This might explain why previous research (Kitayama & Karasawa, 1997) found a preference for large numbers, whereas we neared a significant but inverse finding. Future research should also counterbalance all preference rating item lists between participants to eliminate possible order effects.

Additionally, participants may have pre-existing biases toward certain numbers, and this was not assessed in this study. For instance, the number 13 could have been rated lower because of the negative connotation associated with this number (e.g., "Friday the 13th"). Superstitions about the number 13 likely evolved from early Roman history into the modern-day fear capitalized on by entertainment and movie industries (Scanlon et al., 1993). As such, the birthday number effect might have had no impact on the ratings for this number. Another example could be the number 25, which might have been rated higher because of Christmas occurring on the 25th of December and the connection to biblical history (Nothaft, 2012). Gamblers may have particular feelings around the numbers seven or 21. These preferences would relate to the influence of mere exposure on preference rather than the impact of implicit egotism. Future research should directly probe the impact of these pre-existing number biases other than birthday numbers.

Finally, future research should aim to have a larger, more diverse sample to confirm that our findings related to self-esteem and the BNE were not generated solely by the homogeny of our participant sample. In this study, our sample was 70% women with a vast majority of the individuals ranging in age from 18-25. Young adult women have been shown to have the lowest rate of self-esteem when compared to men of the same age and both genders of older age (Sprecher et al., 2013). Further research should also capitalize on cross-cultural designs. Collectivist and individualistic cultures value self-esteem in categorically different ways (Diener & Diener, 1995). The BNE study conducted by Kitayama and Karasawa (1997) sampled only Japanese participants, whereas our study only sampled Americans. This suggests, although perhaps not universally, that the BNE and similar cognitive effects are likely to generalize to a culturally and globally large population of interest.

The gender differences in self-reported self-esteem may not be attributed to the BNE but are important to note. Self-esteem in women is still significantly lower than in men despite current movements supporting women's inclusivity and recognition. Current studies should take into account this reported difference in college-aged women. Studies such as Veldhuis and colleagues (2020) that apply modern behaviors such as "selfie" taking and social networking are pivotal to understanding the differences shown in the present study. Future research should focus on understanding what factors in modern-day society are lowering self-esteem, while cognitive effects hypothesized to demonstrate pieces of the self-concept, such as the BNE, are still represented.

Finally, future research should seek to dig deeper and directly test—as we did here—the various alternative potential explanations for the BNE. These include implicit egotism, mere exposure, processing fluency, and mere ownership. Our findings related to self-esteem suggest that implicit egotism is unlikely to be the driving factor for the BNE. However, research should explicitly test the others. Mere exposure and processing fluency are highly probable explanations and could be investigated directly to determine if those mechanisms better explain this cognitive effect. The present study is the first to directly test proposed causes of the BNE, and we found no reason to believe self-esteem to be a driving factor. Future research should aim to continue this effort to better understand the connections between our preferences, motivations, and underlying mechanisms.

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