PNAS RESEARCH ARTICLE | PSYCHOLOGICAL AND COGNITIVE SCIENCES

Is gender primacy universal?

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Edited by Susan Fiske, Princeton University, Princeton, NJ; received January 29, 2024; accepted June 22, 2024

Emerging evidence suggests that gender is a defining feature of personhood. Studies show that gender is the primary social category individuals use to perceive humanness and the social category most strongly related to seeing someone—or something—as human. However, the universality of gender's primacy in social perception and its precedence over other social categories like race and age have been debated. We examined the primacy of gender perception in the Mayangna community of Nicaragua, a population with minimal exposure to Western influences, to test whether the primacy of gender categorization in humanization is more likely to be a culturally specific construct or a cross-cultural and potentially universal phenomenon. Consistent with findings from North American populations [A. E. Martin, M. F. Mason, *J. Pers. Soc. Psychol.* 123, 292–315 (2022)], the Mayangna ascribed gender to nonhuman objects more strongly than any other social category—including age, race, sexual orientation, disability, and religion—and gender was the only social category that uniquely predicted perceived humanness (i.e., the extent to which a nonhuman entity was seen as "human"). This pattern persisted even in the most isolated subgroup of the sample, who had no exposure to Western culture or media. The present results thus suggest that gender's primacy in social cognition is a widely generalizable, and potentially universal, phenomenon.

gender | humanization | social perception | culture

Significance

The importance of gender across cultures has been the subject of considerable academic debate. This study supports the idea that gender is a fundamental social category across societies by investigating its primacy in social perception in a non-Western, minimally exposed culture: the Mayangna of Nicaragua. Findings reveal that, as in Western societies, the Mayangna prioritize gender over other social categories (e.g., race, age) in humanizing objects. These results demonstrate that the cognitive emphasis on gender observed in Western society is not limited to Western, Educated, Industrialized, Rich, and Democratic populations. They therefore give credence to the suggestion that gender's primacy in social perception may be an evolved part of human nature and provide an initial step toward testing this account.

Gender is a basic organizing principle in every human society. The specific roles and stereotypes associated with men and women may differ, but all cultures assign distinct social roles to men and women, and children are socialized accordingly (1–5). Despite this evidently fundamental fact of human life, in both scholarly research and public activism there has been growing skepticism around the importance and utility of the construct of gender and its role in understanding ourselves and others. Some scholars question whether gender is a meaningful category across all cultures, and credit Western or other cultural influences with creating and maintaining the gender binary (6, 7). Cross-cultural variation in the strength and content of gender stereotypes is used as evidence to suggest that the importance of gender in self- and social-perception may be limited, broadly, to WEIRD (Western, Educated, Industrialized, Rich, Democratic) populations (6, 8–10). That is, although gender stereotypes—where men are associated with agentic traits (e.g., strong, dominant) and women are associated with communal traits (e.g., kind, caring)—emerge in many cultures, there is also heterogeneity across place and time (11, 12), indicating that beliefs about gender roles and gender stereotypes are far from universal.

Furthermore, among those who agree that the tendency to identify and use gender in understanding another person is likely to be a universal phenomenon, gender is typically placed alongside other primary social categories that are used in this way, such as age and "arbitrary set" [e.g., race, ethnicity, religion, caste; (3, 5, 13)]. In other words, even for those who view gender as a primary category used universally in social judgments, gender tends to be seen as no more nor less primary than these other categories.

Nonetheless, the notion that gender is a—if not the—fundamental category in defining humanness resonates through the arts, humanities, and in public discourse: Gender has been called the "cornerstone of human existence" (14) and is understood as "an essential part of 'humanness'" (15, 16). Furthermore, studies have consistently shown gender to be a primary category people use to understand themselves and others, at least in Western contexts (3, 17, 18). A baby's gender is the first question asked of expecting parents (19); a person's gender is among the first categories observers register when identifying others (17, 20); and one's own gender is a primary identity through which a sense of self is formed (2, 21, 22). Recent research has gone even further in addressing the importance of gender in social cognition, showing that it is the primary social category used when seeing someone—or something—as "human" and more tightly bound to humanization than any other social category to which people belong, including race, age, sexual orientation, disability, and religion (23, 24). In other words, when we see someone as having a

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Author contributions: A.E.M., D.G.B., J.K., and J.L.T. designed research; D.G.B. performed research; A.E.M. analyzed data; and A.E.M., D.G.B., J.K., and J.L.T. wrote the paper.

The authors declare no competing interest.

This article is a PNAS Direct Submission.

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This article contains supporting information online at https://www.pnas.org/lookup/suppl/doi:10.1073/pnas.2401919121/-/DCSupplemental.

Published August 19, 2024.

gender—any gender—we tend to see them as more human. In these studies, participants were asked to anthropomorphize various shapes and nonhuman entities (e.g., rocks, machines) and then indicate whether these entities had a gender, along with other social categories (e.g., race, age). Across studies, gender was the most highly ascribed social category, and, importantly, the only social category that predicted how "human-like" participants believed the entity to be. Thus, at least in the United States, gender seems to be the primary lens through which individuals categorize and understand others and see them as human.

Although these studies were conducted in the United States, the primacy of gender in social cognition is likely to be widely generalizable, given cross-cultural consistency in many other gender-related effects [e.g., social roles, power dynamics, mate-preferences; (25, 26)]. However, it is difficult to determine whether gender's importance in human social life across cultures is due to social learning and global cultural transmission (6, 7) or to more fundamental, potentially evolved, cognitive processes (18). That is, although the importance of gender is undoubtedly a result of both biological and ecological factors (27, 28), some argue that the primacy of (binary) gender in social cognition may reflect a Western phenomenon that has been globally perpetuated through colonization or cultural transmission (6, 7, 29).

In the present research, we examined whether gender primacy is likely to be solely a product of cultural transmission by assessing the phenomenon among the Mayangna, a non-Western, small-scale traditional society in Nicaragua with minimal contact with the industrialized Western world. A finding of gender primacy among this population would not allow us to definitively conclude that it is a universal or evolved part of human social cognition (after all, we are examining only one of thousands of human societies); nonetheless, the Mayangna provide an ideal context within which to examine whether gender's central role in North American social cognition is solely a function of cultural learning, because several features of Mayangnan culture make these individuals particularly unlikely to show gender primacy if doing so required cross-cultural transmission of Western beliefs or knowledge.

The Mayangna are an unindustrialized, small-scale traditional society in Nicaragua who have had minimal exposure to North American or other WEIRD cultures (30, 31). They are therefore unlikely to have learned to see gender as primary as a result of cross-cultural exposure. They are also a non-WEIRD culture that diverges from the United States in ways that are particularly relevant to the present research question; non-WEIRD societies tend to hold beliefs about gender and cognitive tendencies which diverge from those observed in North American populations. For example, less economically developed societies often demonstrate weaker gender differences in stereotypes and preferences, compared to more industrialized populations (32, 33). Furthermore, small-scale traditional societies are less likely to hold cognitive biases previously assumed to be universal but more recently found not to generalize beyond WEIRD cultures [e.g., fundamental attribution error, self-serving biases; (34)]. For these reasons, the Mayangna are unlikely to have acquired, through cross-cultural exposure, a cognitive tendency to perceive gender as primary, and they are also unlikely to have developed such a tendency as a result of having similar cultural values and beliefs to those that exist in WEIRD populations. As a result, if the Mayangna are found to categorize social (but nonhuman) objects in terms of gender more so than other social categories, it would suggest that this tendency is not a culturally specific outcome of North American socialization and might instead be the result of a more fundamental cognitive adaptation. Though the present research cannot definitively support the universality or evolved nature of the primacy of gender, examining this phenomenon among the Mayangna allows us to take an important first step in addressing this question.

Importantly, there are several theoretical reasons to expect that, like US participants, the Mayangna will see gender as primary in social cognition. Perceiving gender is imperative for reproduction and survival, the two core components of evolutionary fitness. Given that the cognitive ability to differentiate between male and female has been required for humans to reproduce, the tendency to recognize gender and prioritize gender perception above and beyond any other social category is likely to be evolved (35–37). From an efficient coding perspective, gender is a highly informative, and therefore highly valuable, social category. Research suggests that adaptive mental processes are those that make the most of limited resources, generating mental categories that are informative yet compact (38–41). As a unitary dimension, gender could hardly be more compact, sorting human beings into two categories with discernible differences; furthermore, among other social categories, its informativeness is unrivaled, in that it provides a wealth of information relevant to core features of human survival. In other words, with very little cognitive processing required, perceived gender tells us whom we can reproduce with, whom we should be threatened by or compete with, what roles someone might occupy, and so on.

However, it is important to note that this information processing argument suggests that the cognitive tendency to categorize humans based on gender exists irrespective of the content of gender differences. Nonetheless, the roles and stereotypes associated with each gender tend to be similar across cultures, due to: a) men and women holding similar biological roles across cultures, b) the similarity of ecological environments across cultures (26–28), and c) the human tendency to take advantage of biological differences between men and women through gender-based social roles (27, 28). For example, a key difference between human males and females in any culture is that females can bear a child while males cannot; in addition, males tend to be physically stronger and larger than females. These biological gender differences inform the social roles men and women tend to occupy, so many cultures look similar in terms of the way roles are divided along gender lines and, thus, how gender stereotypes form (26). Building on these insights, the universal importance of gender in processing social information as well as fundamental similarities in men's and women's biologically determined roles both increase the likelihood that perceiving gender prior to any other social category, and basing judgments of humanness on it, is a universal human tendency. We therefore hypothesized that the primacy of gender in social cognition would emerge across cultures, and, potentially, universally across the species.

To test this hypothesis, we examined whether the Mayangna demonstrate gender primacy when ascribing humanness. If they do, it may indicate that gender primacy, previously observed in North Americans, is a widely generalizable, potentially evolved adaptation rather than a culturally specific outcome of North American socialization. In contrast, if the Mayangna do not use gender categorizations in this way, it becomes more likely that the North American tendency to prioritize gender is a distinctive cultural phenomenon, as suggested by numerous psychologists and gender scholars (6, 8–10). To examine whether the Mayangna perceive gender as the most important social category, we adopted a procedure (23) that asks participants to anthropomorphize a nonhuman object (i.e., ascribe humanness to nonhuman entities) and then measures the extent to which they ascribe various social categories (including gender) and humanness to it.

The Current Research

In the current preregistered research (https://aspredicted.org/Z6Z_9KG), we tested the hypothesis that Mayangna individuals, like North Americans, use the social category of gender to humanize a nonhuman object more readily than they use other social categories, and, further, that they identify gender as the category that most strongly predicts humanness.

The Mayangna are an unindustrialized, small-scale traditional society in the Bosawas Biosphere Reserve in northern Nicaragua. The forested region in which they live is relatively remote and there are few roads within the reserve itself. For the Mayangna, the nuclear family serves as the primary unit of social and economic organization, and the sexual division of labor follows historical trends seen in Western societies (30, 31, 42). Missionary activity by the Moravians in the early twentieth century may have shaped religious activity and gender norms to some degree. However, our hypothesis—that humans universally hold an implicit belief that one's gender is a primary factor in determining what makes someone human—is independent of any specific gender norms or stereotypes that might be held (e.g., males as workers, females as nurturers). This implicit concept shapes the way that people perceive their social worlds and is unlikely to have been explicitly taught or discussed (23). Importantly, we make no claims about the strength or content of Mayangna gender norms; these individuals might hold weak (or strong) gender norms yet nonetheless use gender as a defining feature of humanness.

We preregistered two specific predictions that emerge from our overarching hypotheses: 1) gender will be the most strongly ascribed social category (compared to race, age, sexual orientation, disability, or religion) to a nonhuman object that is made to seem human, and 2) gender ascription will be positively related to the extent to which participants ascribe humanness to the object and more strongly so than other social categories to which people belong (race, age, sexual orientation, disability, or religion). These comparison categories were chosen both because they are widely used across many cultures (3, 5, 43, 44), and because the Mayangna specifically use and consider them in social categorization [(30, 31, 45); also see *SI Appendix*, SOM for more on this point).

We tested these predictions by adapting a procedure used by Martin and Mason [ref. 23; as described in the *Method* section below] where participants anthropomorphized a "pet-rock", using paints, markers and other materials to create a human-like form. After doing so, they were asked whether their rock belonged to any of the six social categories previously found to be relevant across cultures and within the Mayangna culture specifically (i.e., gender, age, race, disability, sexual orientation, and religion), and to rate the extent to which their rock was "human."

Sample

The Nicaraguan community sampled was composed of Indigenous Mayangna horticulturalists living primarily in the forested region of the Bosawas Biosphere Reserve. We aimed to recruit at least 100 participants; 102 individuals ultimately took part in the study (52 female, 50 male; ranging in age from 18 to 79 y; M_{age} = 32.44, SD_{age} = 12.09). Sample size was determined in advance based on the sample size used by Martin and Mason. Furthermore, sensitivity analysis reveals that we had adequate power to detect a small-to-medium-sized effect of gender compared to other social categories (dz = 0.247) and a small-to-medium-sized relationship between gender and humanization (r = 0.240). Six participants' responses were excluded from analyses due to confusion (e.g., pointing to a scale-point that was inconsistent with what they said verbally or indicating confusion about what the question was asking). This issue was unexpected, so this exclusion criterion was not preregistered in advance, but given the ambiguity in these responses, we decided that including them would be inappropriate. Nonetheless, none of the primary results change when including these responses; see Supplemental Online Material (SOM) for analyses with all data included.

An assessment of participants' global cultural knowledge (as described below) suggested that these individuals have little familiarity with Western or global popular culture. First, the majority (90%) had never left Nicaragua and only about half (56%) reported leaving their village at most once a year (often to nearby, similarly isolated villages). Much of the sample had never seen a Western movie (39%) or used the internet (47%). The vast majority of participants could not recognize faces of 13 globally famous individuals, and only a few participants recognized celebrities such as Barack Obama (9%), Elvis Presley (2%), or Oprah Winfrey (1%). Nonetheless, in addition to conducting our main analyses on the full sample, we also tested our hypotheses within a smaller subsample restricted to the most isolated participants; these were individuals who had never used the internet, never seen a Western movie, could not recognize any of the 13 popular icons in our global cultural knowledge quiz, and rarely left their village (n = 21; see *Method* for more detail).

Results

Our first hypothesis was that gender would be the social category that is most highly ascribed to participants' rocks, compared to age, race, sexual orientation, disability, and religion. A result supporting this hypothesis would suggest that, even in a society with little-to-no exposure to Western culture, gender is the primary lens through which humanness is understood—giving credence to the argument that the primacy of gender in humanization is widely generalizable. Using pairwise t-tests to compare gender ascription to each of the other social categories, this hypothesis was supported: Gender was more strongly ascribed to rocks than was age, $t(100)$ = 2.73, SE = 0.05, P = 0.008, d = 0.27, M_{diff} = 0.14, CI_{95} = 0.04, 0.24; race, $t(100)$ = 3.48, SE = 0.08, P < 0.001, d = 0.35, M_{diff} = 0.29, CI_{95} = 0.12, 0.45; sexual orientation, $t(99)$ = 7.11, SE = 0.09, P < 0.001, d = 0.71, M_{diff} = 0.65, CI_{95} = 0.47, 0.83; disability, $t(100)$ = 13.65, SE = 0.09, P < 0.001, d = 1.36, M_{diff} = 1.23, CI_{95} = 1.05, 1.41; and religion, $t(100)$ = 6.58, SE = 0.09, P < 0.001, d = 0.66, M_{diff} = 0.61, CI_{95} = 0.43, 0.80. Table 1 reports means and contrasts across all social categories.

Table 1. Means, SDs, and distributions for each social category, and its relationship to humanization

			Distribution (1 to 3)			r_{human}
Social Category	M	SD	(1) No	(2) A little	(3) Yes	
Gender	2.73_a	0.53	4	19	78	0.28**
Age	2.60_b	0.65	9	23	70	0.12
Race	2.43_c	0.80	20	18	64	0.17
Sex. Orient.	2.07_d	0.92	39	16	46	0.05
Disability	1.50_e	0.77	68	17	17	−0.12
Religion	2.13_d	0.92	37	15	50	0.13

Different subscripts indicate a significant difference between means; **P < 0.01. Means indicate the extent to which each social category was ascribed (1 = no, not at all – 3 = yes, definitely). Distribution indicates how many participants chose each response; r_{human} = correlation between social category and humanness.

Gender remained the most strongly ascribed social category when analyzing subsets of participants who had never used the internet or social media (all $ps < 0.01$), never seen a Western movie or television show (all $ps < 0.032$), could not recognize any of the 13 cultural icons (all $ps < 0.001$), and left their village once a year or less (all $ps < 0.021$). Furthermore, when examining only those participants in the "most isolated" subset ($n = 21$), the same results emerged, with gender most highly ascribed compared to age, $t(20) = 2.50$, $SE = 0.10$, $P = 0.021$, $d = 0.55$, $M_{diff} = 0.24$, $CI_{95} = 0.04, 0.44$; race, $t(20) = 3.08$, $SE = 0.20$, $P = 0.006$; $d = 0.67$, $M_{diff} = 0.62$, $CI_{95} = 0.20, 1.04$; sexual orientation, $t(20) = 2.68$, $SE = 0.18$, $P = 0.014$, $d = 0.59$, $M_{diff} = 0.48$, $CI_{95} = 0.11, 0.85$; disability, $t(20) = 6.16$, $SE = 0.21$, $P < 0.001$, $d = 1.35$, $M_{diff} = 1.29$, $CI_{95} = 0.85, 1.72$; and religion, $t(20) = 2.77$, $SE = 0.22$, $P = 0.012$, $d = 0.61$, $M_{diff} = 0.62$, $CI_{95} = 0.15, 1.09$; see Fig. 1.

Next, given variation in the tendency to both ascribe gender and humanize nonhuman entities, we tested our hypothesis that the *extent* to which one ascribes gender is related to the extent to which one ascribes humanness. We analyzed the relationship between gender and humanization in several ways to test for robustness. First, the simple relation between gender ascription and humanization was statistically significant; the more a participant ascribed gender to their rock, the more "human-like" they believed it to be, $b = 0.60$, $SE = 0.21$, $t(95) = 2.82$, $P = 0.006$, $CI_{95} = 0.18, 1.02$. Second, although no other social category ascription was significantly related to humanization, we nonetheless ran a regression equation that simultaneously entered all potential social categories as predictors of humanness. In this analysis, gender was the only significant predictor of humanization, $b = 0.72$, $SE = 0.28$, $t(89) = 2.56$, $P = 0.012$, $CI_{95} = 0.16, 1.28$; see Table 1 for means and correlations, as well as *SI Appendix*, Table S4 in SOM for regression results with all predictors simultaneously entered, and *SI Appendix*, Fig. S3 for a visual depiction of this relationship.

Furthermore, when examining humanization as a binary variable by combining all values less than "fully human" and comparing these to "fully human" (0 = less than human, 1 = human), results held, $b = 1.05$, $SE = 0.42$, $Wald\ X^2 = 6.21$, $P = 0.013$. Moreover, this remained the case when we included other social categories in the model, $b = 1.41$, $SE = 0.58$, $Wald\ X^2 = 5.86$, $p = 0.015$. Results also held when treating gendering as a binary variable by combining values less than three ("definitely has a gender"), such that 0 = low gendered, 1 = high gendered, $b = 0.72$, $SE = 0.27$, $t(95) = 2.67$, $P = 0.009$, $CI_{95} = 0.19, 1.25$; this result also held when including other social categories (0 = low [social category], 1 = high [social category]) in the model, $b = 0.74$, $SE = 0.33$, $t(89) = 2.23$, $P = 0.028$, $CI_{95} = 0.08, 1.40$.

Finally, when using ordinal regression, the substantive results remained the same. Given that cell counts for the lowest level of the gender rating were small ($n = 4$), we dichotomized the explanatory variable (0 = rating of 2 or lower, 1 = rating of 3). Using an ordinal regression, gender was a significant predictor of humanization (OR = 3.274, $B = 1.186$, $P = 0.011$); the odds of high humanization were three times greater for high values of gender compared to lower ones. See *SI Appendix*, SOM, for additional details on these analyses.

Discussion

The current study demonstrates that, among the Mayangna, gender emerges as the primary social category people use to ascribe humanness to a nonhuman entity. In the process of anthropomorphizing rocks, the Mayangna were more likely to ascribe gender than any other social category assessed, including age, race, disability, religion, and sexual orientation—categories which are argued to be broadly universal and are important to the Mayangna specifically (*SI Appendix*, SOM). Gender was also the sole predictor of how human-like the Mayangna perceived their creations to be. Thus, this work provides compelling evidence in support of our hypothesis that gender is the primary social category used in humanization, not only in Western societies but also in a non-Western, small-scale traditional society. Despite their minimal exposure to North American or other WEIRD cultural influences, the Mayangna, like North American participants in previous studies, predominantly used gender to humanize nonhuman objects. This finding aligns with the suggestion that the cognitive prioritization of gender in social categorization is a widely generalizable phenomenon that might be an evolved adaptation, rather than a tendency specific to North American culture.

Notably, the Mayangna were remarkably similar to North American participants in their prioritization of social categories more broadly. Although gender was the most strongly ascribed, age and race followed closely behind. These results are consistent with theories suggesting that age and race (often categorized as "arbitrary set") are universal human social categories (3, 5) because they serve important evolutionary purposes [i.e., discriminating kin, determining reproductive ability; (43, 44)]. Indeed, it is likely

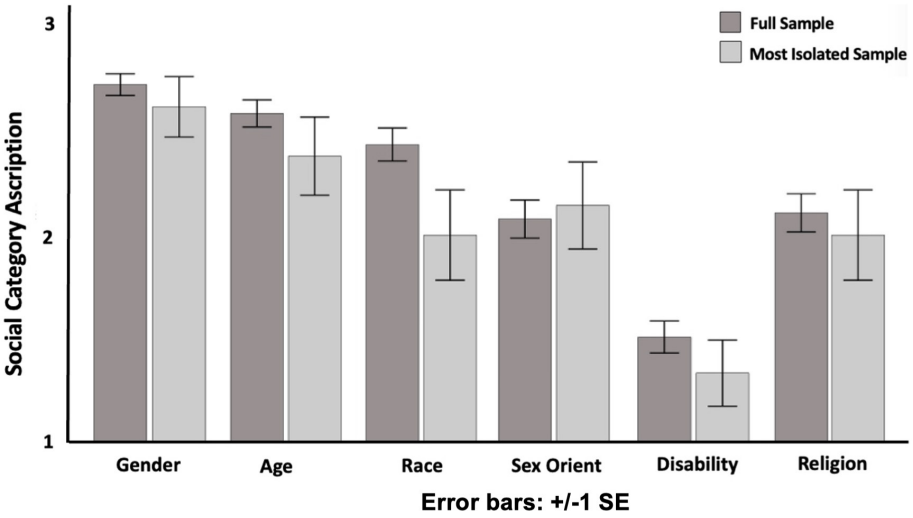

Fig. 1. Social category ascription, separated by subsample.

that age communicates important reproductive signals that intersect with gender; it is therefore unsurprising that age followed closely behind gender. [This pattern was also found in Martin and Mason's (23) North American sample.] These findings thus not only contribute to research attesting to the primacy of gender specifically, but also to research on the universality of social categories more broadly. Nonetheless, although these social categories were chosen due to their universal significance in psychology (3) and their relevance to the Mayangna (30), future research could explore whether other social categories or indicators (e.g., dress, wealth) are relevant to humanization among the Mayangna, and compare the importance of these categories with that of gender.

Although the Mayangna may have some exposure to other cultures in Nicaragua or South America, they are relatively isolated—and our "most isolated" subsample (who have never seen a Western movie or used the internet, rarely left their village, and could not identify any Western, South American, or Nicaraguan cultural icons aside from Daniel Ortega) demonstrated the same pattern. However, given that this study shows the primacy of gender in only one small-scale, non-WEIRD, isolated culture, more cross-cultural research is needed to examine whether and where gender does not take primacy. Gender division and recognition are implicated in a variety of human functions (e.g., cooperation, coordination), and gender is communicated through multiple modalities (e.g., social learning, cultural practices) that our study could not isolate. Thus, future research should explore gender's primacy in environments where roles, stereotypes, or ecological factors vary, such as matriarchal cultures and egalitarian societies, to thoroughly examine the boundaries of this effect. In our view, these factors are likely to shape the content of gender but not the primacy of it. Our argument centers on the importance of gender as an organizing framework for human perception and not the function, stability, or universality of gender roles or stereotypes across cultures.

Importantly, discussions about gender's primacy often revolve around the importance of gender as a category, and more specifically, a binary one. Indeed, only one participant (1%) in our sample identified their rock as a category other than male or female (they referred to it as both), meaning that the vast majority of Mayangna participants used binary gender in categorizing their rock (see *SI Appendix*, SOM for more details). Nonetheless, our conclusions are restricted to questions about the primacy of perceiving gender across cultures, and not about the social meaning of gender within any culture or its interpretation as a binary category. Furthermore, our results should not be interpreted as prescriptive; even if humans evolved to perceive binary gender as the most fundamental social category, this finding has no bearing on questions regarding whether gender should be prioritized or perceived as binary.

In summary, these findings represent a significant step toward understanding the extent to which gender primacy is a universal feature of human social cognition. Although more evidence is needed to conclude that the primacy of gender is a universal phenomenon, these data are consistent with this account. Given that the Mayangna are an isolated, non-WEIRD, culturally distinct society, these findings provide strong evidence that gender's primacy generalizes across highly diverse cultures and offer a first step toward determining whether it is universal.

Method

We recruited participants based on the village's household census. We used a random number generator to select 100 households out of a total of 300 in the society. Only one person per household was allowed to participate in the study. After identifying the list of households, a field research assistant asked the head of household or their spouse to participate in the study. Those who agreed came to the research site, which was set up inside the village, and were escorted to a table where the research study took place. A total of 102 participants took part (51% women; M_{age} = 32.44, SD_{age} = 12.09). Participants sat at this table and were given an ordinary rock from their village, a basket of materials, and an iPad with video-recorded verbal instructions for the study. All materials were translated from English to Spanish (and backtranslated from Spanish to English) prior to the study, and then translated from Spanish to the Mayangna language by a research assistant fluent in Spanish and Mayangna (for original materials in English, Spanish translations of those materials, and Spanish-to-English backtranslations, see http://tinyurl.com/GPrimacy). A research assistant fluent in Spanish and Mayangna was present to answer participants' questions. The study obtained IRB approval through Arizona State University (00017994). Details on informed consent can be found in *SI Appendix*, SOM.

Fig. 2. Example rocks decorated by participants, organized by humanness ratings.

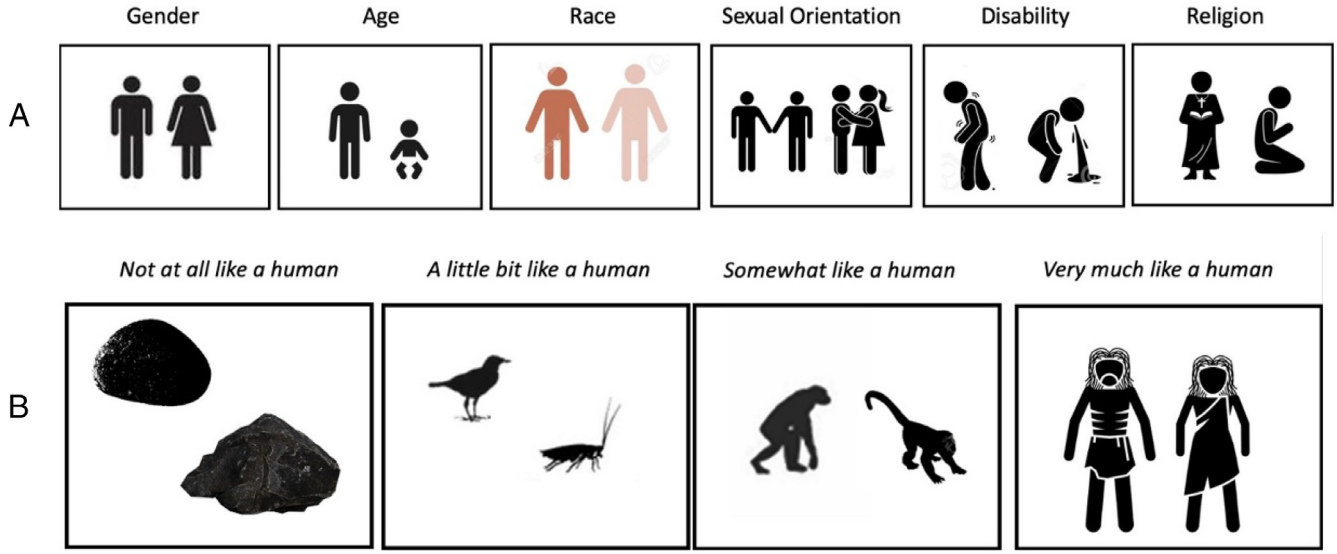

Fig. 3. (*A*) Social Category and (*B*) Humanization scales.

Participants were told via video that "we would like you to create a "pet-rock" for us. That is, take the art-supplies you see and make a rock that resembles a human being." To ensure participants understood what it meant to anthropomorphize, they were further told: "you will take a regular rock and turn it into a rock that resembles a human being. Many things that are not human–like you–can look and act like humans. Sometimes we see animals, gods, or nature as if they are human, just like us. In this study, we would like you to create a rock that is like a living being. That is, give it features that humans have, like eyes and a nose. You could also give it a name and a unique personality. Imagine what experiences it would have and how your rock might behave if it were alive. While your rock should be similar to a human, it's also ok if your rock looks more like an animal or just a rock. How you decorate it is up to you." Along with their rock, participants were given a basket of materials including paint, googly eyes, tape, stickers, and markers. Given that individuals in this population may not have been familiar with these art supplies, they were also provided with instructions on how to use each of the materials in the instructional video. After watching the instructional video, each participant was given 15 min to decorate their rock. Fig. 2 shows examples of rocks decorated by participants.

After creating their anthropomorphized rocks, participants were asked questions about their creation. These questions were adapted from Martin and Mason (23), with several differences: First, given that participants were broadly unfamiliar with converting attitudes into a numerical scale (31), the social category and humanization questions were changed from a five and 100-point scale, respectively, to a three and four-point scale. Second, pictures were added to aid with comprehension (Fig. 3).

Social Category Ascription. Participants were first asked social category questions; these came before the humanization question because the latter included an image of human beings, which might have evoked salient social categories. They were asked about six social categories from Martin and Mason (23) and found in other research to be important and essentialized social categories [i.e., gender, age, race, religion, sexual orientation, and disability; (46, 47)]. Important social category distinctions unique to the Mayangna people were identified in advance by coauthor J.K. who has expertise in Mayangna culture; these categories included important racial groups and religious identities unique to this population. Specifically, while gender, age, sexual orientation, and disability were similar across this population and the United States, the Mayangna people neighbor Miskito villages and occasionally have contact with White researchers in the area, making these salient racial categories. Participants also have familiarity with multiple religious groups, based on the Moravian and Catholic influences in the early and mid-twentieth century. See *SI Appendix*, SOM for more information on the social categories included, as well as other descriptors participants spontaneously mentioned.

Participants were told, "we will now ask you about certain features of your rock. We would like to know whether you thought of any of the following social categories or groups when you were creating your rock." In randomized order, they were asked about: 1) gender ("Did you think about the rock as being male or female or having another gender?"), 2) race ("Did you think about the rock as being Mayangna, Miskito, or a different racial group?"), 3) age ("Did you think about the rock as being a child, a teenager, or an adult?"), 4) sexual orientation ("Did you think about whom this rock might be attracted to or their sexual behavior"), 5) religion ("Did you think about your rock as Catholic, Moravian, Evangelical, or a different group?"), 6) disability ("did you think about your rock as being sick or disabled?"). Participants indicated social category ascription on a three-point scale: 1 = no, not at all, 2 = maybe a little, 3 = yes, definitely. For each social category, they were also shown a picture with stick figures as an example; see Fig. 3*A*.

Humanization. To measure humanization in a sample of individuals not familiar with this concept, we showed participants an image of a scale with illustrations of 1) a rock, 2) an insect and a bird, 3) a monkey and an ape, and 4) two human beings. They were told by the experimenter, "People's rocks sometimes vary in how human-like they are. Sometimes they are very human and similar to you or other people you know [the experimenter pointed to the fourth image]. Sometimes they are similar, but a little different, like a monkey [the experimenter pointed to the third image]. Sometimes they are like a bug or other species that is a little bit like a human [the experimenter pointed to the second image]. And sometimes they are just like a rock and not very human at all [the experimenter pointed to the first image]. Which one was your rock? Participants indicated their humanization rating on a scale from 1 = not at all like a human, 2 = a little bit like a human, 3 = somewhat like a human, 4 = very much like a human. This item was adapted (from refs. 48, 49). See Fig. 3*B*.

Westernization. Given our goal of recruiting individuals who are unlikely to possess considerable knowledge about Western or global popular culture, we also assessed participants' familiarity with global popular culture [as in refs. 50–52] by asking them to identify images of 13 celebrities from Western culture, South America, and Nicaragua: Donald Trump, Barack Obama, Hillary Clinton, Oprah Winfrey, Will Smith, Brad Pitt, Elvis Presley, Abraham Lincoln, Lionel Messi (Argentinian soccer player), Rodrigo Chaves Robles (Costa Rican president), Luis Enrique (Nicaraguan singer), Carlos Godoy (Nicaraguan musician), Oscar Duarte (Nicaraguan soccer player). To assess participants' exposure to the national culture of Nicaragua, we also showed them an image of Daniel Ortega, the current President of Nicaragua.

For each image, participants were asked, "Who is this?", and they responded aloud in an open-ended fashion. On average, participants correctly identified fewer than one of the 13 popular cultural icons ($M = 0.95$ images, SD = 1.84, Mode = 0); although the majority of Nicaraguans correctly identified Ortega (89%), few recognized the other Nicaraguan cultural icons ($M = 4\%$), the other South American icons (35%), or the American icons (19%). These results suggest that the Mayangna participants had minimal knowledge of Western or

broader global popular culture. It is noteworthy, however, that most of them were familiar with President Ortega. This picture recognition may be due to the fact that, during election time, political representatives reach the village of Amak to campaign, bringing pictures of Ortega with them. Participants' familiarity with his image, therefore, may not reflect a knowledge of broader Nicaraguan (and certainly global) culture. Indeed, participants recognized very few of the famous Nicaraguans they were shown (4%). Thus, we separated our sample into two subgroups, our "full sample" ($N = 102$) and our "most isolated sample," which includes only those individuals who have never used the internet, never seen a Western movie, could not recognize any of the 13 popular icons in our recognition quiz (excluding Ortega), and rarely leave their village ($n = 21$).

Data, Materials, and Software Availability. XLSX data have been deposited in OSF (https://osf.io/v6ru8/) (53).

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