

## Is it sexist to recognize that men and women are not identical?

### A critical evaluation of neurofeminist rhetoric

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**Abstract:** Several authors have accused neuroscience and psychology of promoting sexism through the differentiation of psychological predispositions of men and women that would not be a product of socialization. We will analyze the argumentative and empirical problems of two academic articles of one of them, the biotechnologist Lucía Ciccía, and the central ideas on sexual dimorphism of two neuroscientists who have a similar perspective on the subject, Daphna Joel and Janet Hyde. We offer empirical evidence on psychological predispositions of men and women that interact with the environment but are not products of socialization, and we argue in favor of the possibility that some stereotypes are an effect and not a cause of the differences between men and women. Finally, we will present arguments to support the claim that an evolutionary perspective is relevant in order to construct a better explanation of the characteristics of each sex, and a valuable starting point to search for equal rights.

**Keywords:** sexual dimorphism, feminism, neurosexism, hormones

## **1. Introduction**

The term "neurosexism" was coined by Cordelia Fine in her book "Delusions of gender" to describe a phenomenon that would occur in the field of neuroscience, neurobiology, and cognitive science in a broad sense, and that would consist in assuming that there are essential differences in the brains of men and women (Fine, 2010, p.161). The dissemination of these studies, from her point of view, would generate self-fulfilling prophecies, reproduce stereotypes, and be used to oppress and marginalize women.

In the same vein, Daphna Joel argues that detecting differences in the brain has fundamental implications for society, since they "justify the differential treatment of men and women" (Joel, 2015). Other researchers adopt a similar perspective: Fine (2010, 2017), Eliot (2010), Ciccía (2015, 2017a) and Maffía (2017), director of the Gender Observatory of the Ministry of Justice and Human Rights of Argentina, who sums up the perspective of the previous authors when she considers that neuroscience is a contemporary version of sexism: "arguments are changed to say the same thing over time", she argues.

According to these authors, men's and women's psychological characteristics are entirely a product of culture, and there would be no brain traits that could establish psychological predispositions referring to interests and behaviors that are not the product of socialization. All of them have in common the fact of ignoring or disqualifying as a whole the voluminous scientific literature that comes from very diverse disciplines such as evolutionary psychology, behavioral genetics, transcultural psychology, experimental psychology, anthropology, ethology and neuroscience of development, as we will analyze in this article. These diverse disciplines arrive to the same conclusion: there are different psychological predispositions in men and women, and they are not only a product of socialization. In all cases we refer to averages (that is, the differences are not predictive of individual traits) and those predispositions interact with culture.

Lucía Ciccía (2015) already mentions in the title of one of her papers the attribution to neuroscience of "sexism", "synaptic-hormonal disciplining" and even "racism": "Genes, synapses and hormones: the continuity of sexist, racist and androcentric regulations under the genetic categorization of bodies". She considers that this discipline is "deterministic" in the same sense in which at the beginning of modernity the laws of physics assumed determinism. She refers to studies in which girls born with congenital adrenal hyperplasia (CAH) tend to choose boys as playmates and prefer boy's toys, and cites research that refers to the way in which levels of testosterone correlate with male and female games and with other behaviors (García-Falgueras & Swaab, 2010,

quoted in Ciccía, n.d.). She also points out that there are studies on the relationship between hormonal levels and visuospatial abilities, which claim that those abilities are the result of the ancestral male adaptation for hunting, and could be relevant for contemporary activities such as reading maps or navigation, and for disciplines such as chemistry or engineering (Hyde, 2016). Finally she adds that, according to those studies, men outperform women in mental rotation tests (Vries, 2009, Smith, 2015, Hyde, 2016).

Although she doesn't use the term "neurosexism", from the very title of her article (2015), the idea of this concept created by Cordelia Fine (2010) is present. Through an extensive historical analysis that lists the acts of discrimination suffered by women, gays and other groups during the 19th century, based on what she calls the legitimization of the "medical-scientific discourse", Ciccía argues that the categories and findings of contemporary neuroscience are as discriminatory as those that led to condemn Oscar Wilde and Alan Turing for their sexual orientation with "scientific" arguments. Biology would reproduce gender stereotypes since the 19th century, keeping women in the private sphere, dedicated to their role as mothers, favored by attributes such as emotionality, empathy and intuition, while men would be linked to cognitive abilities and abstraction. Ciccía only admits the existence of sexual dimorphism "for some neuronal disorders", but points out that "sex doesn't determine any cognitive ability in particular, those abilities are determined by social practices." In her view, "sex is a social construction" and "gender practice modifies neuronal wiring" (2017a). It may seem that sex differences are determined by a genetic and hormonal constitution, but such perspective "starts with stereotypes, and then people will say that the differences that are seen in the brain are the cause of stereotypes" (2017a).

In this article we will analyze the argumentative problems of two of Lucía Ciccía's articles (2015, 2017a), which contain an approach that is also present in the mentioned researchers. We will present some of the innumerable evidences of empirical studies of diverse disciplines on psychological predispositions in judgments, behaviors and inclinations that on average are more frequent in men and women, evidences that are not only a product of socialization, and that interact with the environment. We will argue that some stereotypes may be a consequence and not a cause of the differences between men and women, and we will point out that an evolutionary perspective is essential to examine men's and women's traits, and is a valuable framework to strive for equal rights.

## **2. Problems in Ciccia's evaluation of studies on sex differences**

The central thesis of Ciccia (2017a) is that "the current production of neuroscientific knowledge perpetuates the classic sexist and androcentric biases that served to support the hierarchical and binary gender regime." The "19th-century misogynist scientific discourse" would persist in the hypotheses adopted by current neuroscientific research, but "masked in new studies". Specifically, she accuses these studies of promoting "the inferiority of women" in the way that the "new critical feminisms" have suggested. But once this perspective is established, Ciccia doesn't begin by questioning the studies to which she refers. Without any argumentative or empirical justification, she links them with "a historically and political-cultural process" that refers to the 19th century, as if scientific knowledge wouldn't have evolved in the last two centuries.

She lists scientific studies that refer to the congenital adrenal hyperplasia disorder (CAH), which affects girls who have received high amounts of testosterone in the womb and show rough-and-tumble play, which is more common in boys, but she cites an article that mentions this topic only tangentially, instead of using other studies that address it directly.

Later on, she refers to studies in which men on average show greater visuospatial abilities, which would be mediated or conditioned by high levels of testosterone (Smith, 2015: 31-32), and others in which women's verbal skills would surpass those of men (Hyde, 2016: 53), "which is why it is postulated that testosterone correlates negatively with verbal capacity" (Ciccia, 2017a). In the same paper she quotes the researcher Madhura Ingahlalikar, for whom the complementary roles in procreation and social structure may have been the origin of the greater spatial ability of males and the greater verbal ability in women.

Ciccia concludes that studies on sex differences are not reliable, since they have "a low and controversial statistical power, without even repeating such experiments in order to verify if the same results are obtained." To evaluate if there are predispositions in men and women that are not the product of socialization, she will refer to a meta-analysis of Janet Hyde (2005).

Let us first examine the claim that studies on sex differences have "a low and controversial statistical power." The studies cited by Ciccia are not the only ones nor the main ones carried out so far on the subject. One of the sources of evidence for the role of hormones in psychological differences is the correlation between high levels of testosterone in the uterus of the mother of girls with congenital adrenal hyperplasia, and the preference for rough-and-tumble play (which is typical of boys). When Ciccia assess this evidence, she doesn't cite specific studies on CAH. Instead, she uses a paper that mentions CAH only tangentially, and whose main topic is identity and sexual

orientation (Swaab, García-Falgueras, 2010: 22-23). Among the studies on congenital adrenal hyperplasia that are not mentioned, we can find those of Pasterski et al. (2005) and Wong et al. (2013), with samples of 117 and 244 participants, Berenbaum et al. (1992), with a sample of 117 participants, and Servin et al. (2003), with a sample of 52 participants.

When Ciccía refers to the greater average abilities of men in their visuospatial abilities (mental rotation), she doesn't mention specific studies about this issue, but one of Smith on the neural bases of transgender identity (2015). The most comprehensive meta-analysis on this topic, which Ciccía doesn't mention, is a study of visuospatial abilities developed in ten European countries, in addition to Ghana, Turkey and China, which shows evidence that on average men are better oriented in three spatial dimensions, which is why the hypothesis that these skills would depend on culture is not supported (Geary & De Soto, 2001).

Given that it would be too extensive to mention here the evidence on psychological predispositions of men and women that are not only the product of socialization, since it comes from very diverse disciplines such as neuroscience, evolutionary psychology, behavioral genetics, evolutionary biology and ethology, among others, we will focus first on some of the studies in which testosterone levels in uterus correlate with male behaviors, since Ciccía mentions only those related to congenital adrenal hyperplasia but there are many more that have been done both with humans and with other species. We will concentrate on the first ones.

### **3. Studies on testosterone levels and behavior**

On the contrary of what Ciccía claims, studies on testosterone levels and behavior have medium to large samples. This is the case of Hines et al. (2002), with a sample of 679 participants. In this study the levels of prenatal testosterone correlated with typical boy's games, and the study of Auyeung et al. (2009) shows a correlation between high levels of testosterone and autism in a sample of 235 participants. In another study by Simon Baron-Cohen (2006), conducted with 193 participants, higher levels of testosterone in the mother's uterus correlated with lower levels of empathy in the offspring. There is also a meta-analysis by Blanchard et al. (2001), done with 26 studies and 20,000 participants, in which each younger male brother is 47% more likely to be sexually attracted to other males, because the mother would develop mechanisms to moderate the effect of testosterone. Thus, there is no evidence, as Ciccía points out, of the low statistical reliability of studies measuring testosterone levels and the typical behavior of each sex, since not only each of these studies has considerable samples, but their results are consistent with each other.

Ciccia attempts to justify her underestimation of sex differences by appealing to a meta-analysis done by Janet Hyde (2005). She points out that in a meta-analysis it would be more difficult for researchers to select data that fits their own research program. However, meta-analyses such as Hyde's may be biased in their selection of studies and classification of the data. In her meta-analysis, Hyde concluded that most psychological differences in sex are close to zero ( $d = 0.10$ ) or small ( $d = 0.11-0.35$ ), a few have a moderate range ( $d = 0.36-0.65$ ), and very few are large ( $d = 0.66-1.00$ ) or very large ( $d = 1.00$ ) (Hyde, 2005, p 581). Regarding this classification, she warned that "oversized proclamations of sex differences entail substantial costs in areas such as work and personal relationships(p.581)." But, as Del Giudice et al. (2016) pointed out in their comments to this meta-analysis, there are some surprising omissions in Hyde's work: some types of occupational interests and preferences show great differences (Lippa, 1998, 2010). For example, men tend to prefer occupations centered on objects and systems (e.g., mechanics, carpentry,  $d = 1.06$ ) and there are moderate dissimilarities in their preferences for artistic and social occupations ( $d = 0.62$  and  $d = 0.63$ , respectively). Women and men also show great differences ( $d = 1.29$ ) in the interest for people and things, with women more oriented to people and men more oriented to objects (Lippa, 1998, 2005). There is also a meta-analysis done with half a million individuals with a large effect size ( $d = 0.93$ ), which showed that on average men prefer to work with things and women with people (Su, R. et al., 2009).

Other evidence of sex differences comes from cases such as the one analyzed by Colapinto (2000), in which a Canadian man born male was raised as a female following medical advice and intervention after his penis was accidentally destroyed, but he started living as a male when he was 15 years old. In a study of boys with cloacal extrophy (penile malformations) that were operated and educated to look like women, boys said they felt "men trapped in women's bodies" (Reiner et al., 2004). Among 16 males in this situation, 100% had moderate to marked typical men's interests, and the majority (10 of 16) declared to be male.

Lippa also mentions numerous sex differences in problematic behaviors and mental disorders such as depression, anxiety, antisocial behavior, substance abuse, autism and various language problems (1998, 2005). He warns that minimizing these gender differences can cost more than considering its existence and investigating its causes. He also highlights great differences in a number of child behaviors, such as the tendency to associate with others of the same sex, play styles and other interests (Lippa, 2005, Maccoby, 1999).

Sexual orientation also shows great differences in men and women (Lippa, 2005), as well as sexual desire (Baumeister et al., 2001). A recent meta-analysis of 1788 papers and 1600 participants

supports the conclusion that the choice of toys is influenced by predispositions that come from learning and from other sources, but the difference seems to be decreasing in recent years (Todd et al., 2017).

We cannot complete here the extensive enumeration of sex differences that can be found in Lippa's article (2006), but we'll add a few more studies. One about human universals done by Donald Brown (2004) points out that men and women are seen as different around the world, women are more directly concerned with children and men are on average more competitive. Ellis has found 65 sex differences that seem to be universal (2011), without a single replication error throughout ten studies.

#### **4. Sex differences as a result of evolution**

A common feature between the meta-analyses of Janet Hyde and Daphna Joel is that they systematically ignore the studies that take into account the evolutionary history of our species, and in particular Darwin's theory of sexual selection. According to this theory, men and women faced different adaptive strategies in ancestral environments. Omitting them is like studying engineering and ignoring mathematics and the laws of physics.

Very different and consistent research programs support the same conclusion: there are psychological differences between men and women, and they are not only the result of socialization. Neuroscience, genetics, evolutionary biology, transcultural psychology and new studies of transsexuality show that human beings have dimorphic psychological mechanisms that are the result of evolution and that affect in particular sexuality and reproduction, as well as diverse preferences and behaviors. Two central problems presented by the works of Daphna Joel and Lucía Ciccía are, on the one hand, that they neglect the theory of sexual selection, which raises a general framework for the understanding of sex differences, and on the other hand, that they ignore the fact that there are traits that on average predominate more in each sex. In this way, they miss an essential key that explains a considerable portion of human behaviors that interact with culture.

In principle, most of those who write on this topic acknowledge that we are the result of natural and sexual selection, but in practice some perspectives denote a methodological dualism that has long been abandoned by scientific research. If we refer to the stomach, the intestine, the sight or the legs, this perspective has no problem in recognizing that we are animals, but evolution seems to stop in the neck if we talk about psychological predispositions. In this way, it is ignored that men

and women faced different pressures in the evolutionary history, and it is considered that the body and the mind are separate entities. For those who accept the theory of evolution, it is clear that the human brain must contain adaptations that process information from the environment. This is the case, for example, of the biologically adaptive strategies we call emotions. Men and women differentiate into chromosomes, genetics, hormones and neurophysiological traits. Explaining gender differences exclusively through sociocultural aspects, denying biological ones, constitutes a questionable form of reductionism, in this case a sociological one. A complementation of levels of analysis seems to be preferable.

According to Darwin's theory of sexual selection (1859, 1871), developed in Robert Triver's theory of parental investment (1972), by investing more in reproduction, women (and females of most of species) are more selective, while human males tend to be as selective as women in long-term relationships but less selective in short-term relationships (Buss & Schmitt, 1993). Thus, men and women faced different reproductive strategies in the history of the species, from which different psychological predispositions could derive, as reported by studies such as those listed below. Women and men around the world tend to prefer different traits in the choice of a partner, although they also have common preferences (Buss, 1989, Schmitt 2005, Schackelford et al., 2005, Lippa, 2009). Women tend to feel more sexually attracted to men of higher status because of their economic wealth, intelligence or power (Buss, 1989, Townsend, 1990), are more likely to avoid physical harm and give less signals of being interested in dominating and reaching status positions (Campbell et al., 1998, Watson et al., 1998). Contrary to what one might suppose, this tendency does not disappear in economically independent women but it increases (Townsend, 1998). Men and women have personality differences that on average can be found all over the planet, as reported by Schmitt and colleagues in a study conducted with 17,637 participants in 55 countries (2008). There is an approximate ratio of 10 murders perpetrated by men for each murder perpetrated by a woman (Kellermann and Mercy, 1992).

In her book *Brain Gender* (2005), Melissa Hines suggests that there is no evidence that men and women are identical or substantially different, as John Gray points out with his popular metaphor that "men are from Mars and women of Venus (1992). "Some dissimilarities between men and women are moderate and others, such as the styles of play or toys chosen, are large and begin at 12 months of age (Berenbaum & Hines, 1992, Jadvá et al., 2010). Hines also conducted studies that show that girls tend to prefer living beings (dolls, stuffed animals) and boys prefer vehicles, cars, planes and weapons (Alexander & Hines, 1992). Likewise, girls and boys prefer 80 to 90% of the time to play with those of their own sex (Hines & Kaufman, 1994).

Many of the differences mentioned can be seen in other mammals: greater aggression and interest in objects in males, greater parental investment and interest in members of the same species in females. Among humans and chimpanzees, male offspring usually spend more time away from mothers than female offspring, which could also reveal a greater risk propensity (Lonsdorf et al., 2014). The case of the hyena is atypical, since the female has more testosterone than the male, its character is more aggressive, and adds evidence in favor of the effects of testosterone (Dloniak and others, 2006).

Human females show greater social interest and more abilities to relate socially from very young age, but since socialization could reinforce that role, its origin would not be entirely clear. Gerson et al. studied these differences in 48 baby monkeys that grew in a controlled environment (2016). Compared with males, females of two or three weeks look more to the face ( $d = 0.65$ ), specifically to the eyes ( $d = 1.09$ ) and between the fourth and fifth weeks they establish more contact with known and unknown caregivers ( $d = 0.64$ ).

## **5. Sex differences in the brain: criticism of Daphna Joel's meta-analysis**

Daphna Joel's meta-analysis (2015) was very influential among neurofeminists such as Ciccía, who maintains that her writings follow the line of this Israeli researcher (Ciccía, 2017,c). For Joel, the brains of men and women are not typically masculine or typically feminine, but rather a mosaic, which denies the existence of significant structural differences. As Del Giudice et al. (2016) pointed out, the strategy used in her meta-analysis would imply that if a man doesn't have any of the typical male preferences (e.g., boxing, construction, golf, video games), then he should be included in the category of "mosaic" and not in the "typically masculine" one. As if for not watching football a man should be excluded from the male sex.

There is no brain structure entirely female or male. The brain has sets of traits associated with sex. Some of them may have feminine characteristics, and others may have masculine features. But this does not imply, as Daphna Joel (2015) and Lucía Ciccía (2015) have claimed, that there are no sex differences in the brain, or that cultural influences don't matter. There are significative biological differences at the level of chromosomes and in the levels of testosterone that floods the uterus in the eighth week of gestation, masculinizing the brain. They correlate with different preferences and behaviors. We are more similar than different, but those differences are relevant,

they are not sexist biases of the researchers nor they imply an opposition to the conquest of equal rights.

A meta-analysis by Feingold (1993) shows consistent sex differences in personality across ages, years in which data were collected, educational levels and nations. There are small and multiple differences in brains: measurement, density, cortical asymmetry, in the nucleus of the hypothalamus and many others. There are 93% chances of knowing if a brain is female or male, according to a study conducted with 1566 individuals (Chekroud et al., 2016). Machine learning was able to distinguish female from male brains with 93% accuracy, based on gray matter structure (n=1,300). Highly differentiated components include orbitofrontal and frontopolar regions, proportionally larger in females, and anterior medial temporal regions, proportionally larger in males (Anderson et al., 2018). The paper concludes: "These findings demonstrate that the brains of males and females are highly distinguishable. Understanding sex differences in the brain has implications for elucidating variability in the incidence and progression of disease, psychopathology, and differences in psychological traits and behavior."

## **6. The Empathizing-Systemizing theory: the implicit theoretical framework when Ciccia refers to a greater male tendency towards abstraction**

When Ciccia (2015) points out that "high levels of testosterone represent a hallmark of quality for the development of those cognitive performances that require a greater capacity for abstraction", although she doesn't mention it, she probably refers to the Empathizing–Systemizing theory of Simon Baron-Cohen (2002, 2004), which emerged from his studies on autism, a disorder that correlates with high levels of testosterone in the mother's womb. Besides having impairment in cognitive empathy and perspective taking, individuals with autism spectrum disorder (ASD) tend to have interests that are unusually circumscribed and narrow (e.g., finding patterns and similarities in disconnected things, exploring fragments or details that perhaps nobody noticed before). Baron-Cohen includes those behaviors in the category "Systemizing", because they are oriented to identify underlying rules of various systems. It is not unusual for a person with ASD to be particularly talented in practices that involve those types of skills.

Baron-Cohen hypothesized that autism could represent an extreme of the typical male profile (Baron-Cohen, 2002). Men on average are more interested in knowing how things work, such as when they open the hood of the car, and the same thing happens with mathematics, which

has rules about how numbers are related to each other. On average, men are more interested in objects and processes than in people, which are also, on average, of greater interest to women, a focus that arises from their greater predisposition to empathy, as evidenced by numerous studies like the one with a sample of 5186 participants, in which the empathy and systematization quotient was measured, and women on average rated better in empathy, while men rated better in systematization (Wright & Skagerberg, 2012). In a meta-analysis of cognitive empathy with 88,056 volunteers, women performed better in the "Emotion reading in the eyes" test (Warrier et al., 2017).

Physics and engineering are the equivalent of the mechanical and constructive games of childhood. Systemizing interests include technical systems (computers, vehicles and other machines), natural systems (ecology, geography, chemistry, physics, astronomy or geology) and abstract systems (politics, economics). The Empathizing–Systemizing theory was recently tested in the largest study that was conducted so far, with a sample of half a million people (Greenberg, 2018). The study added evidence in favor of the hypothesis that women on average are more empathetic, men on average are more system oriented, and individuals with ASD on average show an "extreme male brain" profile.

Although, as we have pointed out, Ciccía doesn't mention the Empathizing–Systemizing theory, or any other theory that postulates a greater masculine propensity to systematization, her analysis seems to be a straw man fallacy of Baron-Cohen's theory. On the one hand, we can question why abstraction should be considered a "seal of quality" and why motherhood should be given a lower status, given that both activities (recognizing patterns and raising a child) require intelligence and many other valuable skills. Ciccía also attributes without evidence a discriminatory intention to researchers, but she doesn't quote any claim made by scientists suggesting this intention. On the other hand, the preference that women show on average for careers that focus on people or living things (and not on systemizing, or abstraction, in Ciccía's words, which on average is preferred by men), is an individual choice that deserves to be respected and not discredited by establishing a hierarchy that is not at all obvious, since being a psychologist, a doctor, a veterinarian or a biologist, all careers with a higher percentage of women, is not less valuable than being a physicist, a mathematician or an engineer.

In contrast to what Ciccía says, Baron-Cohen doesn't refer to a "seal of quality" that through testosterone would result in a greater "capacity for abstraction" of the male (Ciccía, 2015). The psychologist suggests that women on average tend to prefer activities centered on people, and men activities centered on objects and on pattern recognition (systematization). Baron-Cohen (2005)

uses the word "systemizing", and not the word "abstraction". Even if we considered that both words have the same meaning, he refers to preferences, and not to capacities.

## **7. The study of sex differences is socially relevant and doesn't imply a sexist attitude**

After listing the few studies to which she refers, Ciccia (2017a) concludes: "In short, just as in the 19th century, but masked by a specialized language, the findings of neuroscientific research that studies sex differences support an image of men representing the higher stage of human species (...) High levels of testosterone represent a hallmark of quality for the development of those cognitive performances that require a greater capacity for abstraction." In contrast, she points out that more primitive connectivities and less specialized functions are attributed to the female brain, and these features would reflect her biological destiny, circumscribed to procreation and motherhood. Ciccia concludes that this perspective "legitimizes the hierarchical and binary sexual scheme, "the cornerstone of the patriarchal-capitalist system, so that the brain operates as the main guarantor of gender stereotypes."

The fact that men and women don't have the same preferences doesn't imply the inferiority of women. The defense of equal rights and opportunities shouldn't be confused with the denial of differences. Men and women don't have to be identical in their characteristics to have access to basic human and civil rights.

Daphna Joel (2012) wonders why, if it isn't correct to evaluate whether blacks are equal to whites, we can ask whether men are equal to women, and answers that "The only reason we want to do it is to justify differences in society." She even proposes to abandon the terms "man" and "woman", because they create the illusion that we are totally different, and declares that "our gender is one of the prisons in which we live (...) I dream with a world without gender in which we are free to choose everything, some will choose only to be a woman, others will choose only to be male, some will choose both." Joel claims that all humans are "intersex", and she considers that an evidence of this claim is that one third of males have breasts with feminine form. But Joel's main assumptions don't have empirical support: the categories of men and women are not an invention of patriarchy, the recognition of sex differences doesn't imply the adoption of a negative attitude toward transgender and intersexual individuals, and heterosexuality is not an oppressive cultural mechanism. The mere fact that a person considers herself part of a "gender spectrum" presupposes a gradation between two poles, and if someone feels as a mixture of both sexes, this does not imply

"gender neutrality". Joel's ideal of abolishing all sexual categories presupposes that sex is self-limiting, but traits that are more frequent in one sex than in another can be beneficial at an individual and social level.

In "Sex and Gender are Dials, not Switches", David P. Schmitt (2016) argues that human sexuality is not capable of being classified into clear and completely distinguishable categories ("neither atoms can be", he writes). There are intersex categories, for example, people with complete androgen insensitivity are genetically male (they have one X chromosome and one Y chromosome in each cell), but they have the external sex characteristics of females (although they don't have an uterus and therefore don't menstruate and are unable to conceive a child). There are disorders of sexual development such as congenital hyperplasia or Swyer's syndrome, Klinefelter syndrome or 5-alpha reductase syndrome, in which a person with XY chromosomes has a feminine aspect until he reaches puberty, when his body begins to acquire a masculine appearance. Although they are educated by their parents as women, when they reach adolescence, most of them develop a masculine identity (Phornphutkul et al., 2000). These cases occurred in greater proportion on an island near the Dominican Republic, where inbreeding (union between blood relatives) was frequent, and such practice increases the risk of genetic diseases. In times when the explanation was ignored, those children were called "twelve eggs", since at twelve years old their testicles appeared.

The most important expressions of sexual diversity can't be understood only in one dimension. Although the feminine and masculine categories are useful as heuristics, there may be more variation under the labels. Schmitt suggests thinking of sex as interconnected and multidimensional dials, rather than as a few categories of switches. "Dials that depend on genetics," he writes, "hormone levels, organizational effects in the uterus, activations in puberty and a wide range of social, historical and cultural factors" (Schmitt, 2016).

The neglect or dismissal of research, just because it doesn't fit to the preconception that men and women should be identical, will only delay the progress of science, allocate budgets to research based on premises without evidence, deny budgets to research based on premises with empirical support, and delay the resolution of problems that may be more relevant for each gender.

The biologist Heather E. Heying argues: "You can be offended because women breastfeed, you can be offended by reality, but being offended by reality is an answer that shows that you reject reality. Men and women are different in height, in muscles, in places where fat accumulates in the body: our brains are also different (Heying, 2018)." Accusing a researcher for studying biological factors, or feeling offended by the evidence, as if those studies were acts of discrimination against women, is a misunderstanding of what biology means. Biological predispositions interact with the

environment, their presence is not a destiny, and cannot be used as an excuse for the promotion of inequities and injustices. Otherwise, the naturalistic fallacy would be committed, which results from deriving "ought" from "is". Eyeglasses, agriculture, wheelchairs and contraceptive methods are not natural and are valued. Alzheimer's and Malaria are natural and considered disvaluable.

The central thesis of Lucia Ciccio (2017,a), according to which "the current production of neuroscientific knowledge perpetuates the classic sexist and androcentric biases that served to support the hierarchical and binary gender regime", has no empirical support. If, as we have pointed out, on average women are more empathetic than men and a stereotype identifies empathy with women, this may be due to the fact that some stereotypes reflect reality, and aren't just a prejudice. It seems that placing things in categories is rational and makes us intelligent, unless we talk about gender issues. We should criticize inadequate generalizations and prejudices about individuals based on their belonging to collectives. Several studies have challenged the conventional idea that stereotypes are always inaccurate, exaggerated and destructive, analyzing them empirically, revealing an intuitive statistics that may fail eventually, but in many cases is accurate (see "Stereotype accuracy: Toward Appreciating Group Differences", Jussim & McCauley, 1995).

There is usually no simple one-to-one correspondence between empirical conjectures and political agendas, and we don't think it is appropriate to argue supposing that such correspondence exists. For example, some people propose a biological explanation of trans identity or of homosexual desires because they promote the acceptance of sexual and gender diversity and assume that biological evidence justifies considering them "natural options", while other people propose a biological explanation because they promote the rejection of sexual and gender diversity and assume that the knowledge of biological causes justifies considering them "disorders" and looking for "cures". This is just one example of the lack of one-to-one correspondence. Therefore, assuming that each empirical conjecture necessarily implies a certain political agenda, can lead to unfair accusations and generate misunderstandings regarding the intentions of the author. It could be relevant to evaluate the political agenda of the researchers, but in a less simplistic way.

## **8. Conclusions**

We have evaluated how, unlike what Ciccio claims, the literature on sex differences is considerably more voluminous than the half-dozen studies that she cites in her texts, and that the studies that she includes in her writings aren't neither the only nor the main articles on the subject.

On the other hand, the papers that she criticizes don't have "a low and controversial statistical power." They are not limited to samples of few participants but have thousands of them, and they are studies that tend to be consistent with each other. When she refers to meta-analyses, she presupposes that they are less prone to bias, but as we have seen in the criticisms received by the meta-analyses of Janet Hyde and Daphna Joel, the first one omits that some types of occupational interests and preferences show great differences (Lippa , 2010), and the second requires that a male doesn't lack a single typically masculine trait to admit him into that category, as pointed out by Del Giudice et al. (2016). Ciccia's writings neglect the theory of sexual selection, which explains sex differences as the result of the confrontation of diverse strategies by men and women in the history of human evolution, and the innumerable studies that are the result of this evolutionary perspective.

Feminist political agenda would benefit if it incorporated the voluminous body of evidence provided by biological and evolutionary perspectives. The recognition of sex differences can improve women's physical and psychological health, and thus contribute to the design of public policies based on scientific evidence.

It is true that in the past the differences between men and women were considered a proof of the superiority of men over women. However, to claim, as Ciccia does, that "the sexist and androcentric presuppositions that accompany the production of scientific knowledge continue to be justified biologically" is a jump to the conclusion that has no empirical evidence in contemporary neuroscientific studies.

Faced with the voluminous evidence of empirical studies of recent decades, instead of continuing to deny the differences of psychological predispositions of men and women that are not only the product of socialization with the term "biological determinism" (which is a misnomer, since no researcher denies that we are referring to averages and predispositions that interact with the environment), we should ask ourselves if some of the sex differences can and should be modified. The thesis that "discrimination against women is wrong" is not the same as the thesis "men and women are biologically indistinguishable". If we want to change the world, we must first know it.

## **References**

Alexander, G. M., & Hines, M. (2002). Sex differences in response to children's toys in nonhuman primates (*Cercopithecus aethiops sabaeus*). *Evolution and Human Behavior*, 23(6), 467-479.

- Anderson, N. E., Harenski, K. A., Harenski, C. L., Koenigs, M. R., Decety, J., Calhoun, V. D., & Kiehl, K. A. (2018). Machine learning of brain gray matter differentiates sex in a large forensic sample. *Human brain mapping*.
- Auyeung, B., Baron-Cohen, S., Ashwin, E., Knickmeyer, R., Taylor, K., & Hackett, G. (2009). Fetal testosterone and autistic traits. *British Journal of Psychology*, 100(1), 1-22.
- Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001). The “Reading the Mind in the Eyes” test revised version: A study with normal adults, and adults with Asperger syndrome or high-functioning autism. *Journal of child psychology and psychiatry*, 42(2), 241-251.
- Baron-Cohen, S. (2002). The extreme male brain theory of autism. *Trends in cognitive sciences*, 6(6), 248-254.
- Baron-Cohen, S. (2004). *The essential difference*. Penguin UK.
- Baron-Cohen, S., & Wheelwright, S. (2004). The empathy quotient: an investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *Journal of autism and developmental disorders*, 34(2), 163-175.
- Baron-Cohen, S., & Belmonte, M. K. (2005). Autism: a window onto the development of the social and the analytic brain. *Annu. Rev. Neurosci.*, 28, 109-126.
- Baron-Cohen, S., Chapman, E., Auyeung, B., Knickmeyer, R., Taylor, K., & Hackett, G. (2006). Fetal testosterone and empathy: evidence from the empathy quotient (EQ) and the “reading the mind in the eyes” test. *Social Neuroscience*, 1(2), 135-148.
- Baron-Cohen, S. (2006). *Prenatal testosterone in mind: Amniotic fluid studies*. MIT Press.
- Baumeister, R. F., Catanese, K. R., & Vohs, K. D. (2001). Is there a gender difference in strength of sex drive? Theoretical views, conceptual distinctions, and a review of relevant evidence. *Personality and social psychology review*, 5(3), 242-273.
- Berenbaum, S. A., & Hines, M. (1992). Early androgens are related to childhood sex-typed toy preferences. *Psychological science*, 3(3), 203-206.
- Blanchard, R. (2001). Fraternal birth order and the maternal immune hypothesis of male homosexuality. *Hormones and behavior*, 40(2), 105-114.
- Brown, D. E. (2004). Human universals, human nature & human culture. *Daedalus*, 133(4), 47-54.
- Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and brain sciences*, 12(1), 1-14.
- Buss, D. M., & Schmitt, D. P. (1993). Sexual strategies theory: an evolutionary perspective on human mating. *Psychological review*, 100(2), 204.

- Campbell, C., Mzaidume, Y., & Williams, B. (1998). Gender as an obstacle to condom use: HIV prevention amongst commercial sex workers in a mining community. *Agenda*, 14(39), 50-57.
- Cantor, J. M., Blanchard, R., Paterson, A. D., & Bogaert, A. F. (2002). How many gay men owe their sexual orientation to fraternal birth order? *Archives of Sexual Behavior*.
- Chekroud, A. M., Ward, E. J., Rosenberg, M. D., & Holmes, A. J. (2016). Patterns in the human brain mosaic discriminate males from females. *Proceedings of the National Academy of Sciences*, 113(14), E1968-E1968.
- Ciccia, L. (2015). Genes, sinapsis y hormonas. *Iberoamérica Social: Revista-red de estudios sociales-Open Journal System*, (V), 83-94.
- Ciccia, L. (2017a). La ficción de los sexos: Hacia un pensamiento Neuroqueer desde la epistemología feminista.
- Ciccia, L. (2017b) Programa radial "Estereo Tipas" del 7 de septiembre de 2017. Online en video "Estéreo Tipas | Entrevista a la Dra. Lucía Ciccia."
- Ciccia, L. (2017c) Programa radial "Pensamiento Neuroqueer en respuesta a la opresión patriarcal de las Neurociencias", grabado el 25 de septiembre de 2017. Online.
- Ciccia, L. (n.d.). Potencial de acción: desde las neuronas hacia la Epistemología Feminista. Online.
- Colapinto, J. (2000). *As nature made him: The boy who was raised as a girl*. HarperCollins Publishers.
- Darwin, C. (2004). *On the origin of species*, 1859. Routledge.
- Darwin, C. (1871). *The descent of man*. *The Great Books of the Western World*, 49, 320.
- Del Giudice, M., Lipka, R. A., Puts, D. A., Bailey, D. H., Bailey, J. M., & Schmitt, D. P. (2016). Joel et al.'s method systematically fails to detect large, consistent sex differences. *Proceedings of the National Academy of Sciences*, 113(14), E1965-E1965.
- Dloniak, S. M., French, J. A., & Holekamp, K. E. (2006). Rank-related maternal effects of androgens on behaviour in wild spotted hyaenas. *Nature*, 440(7088), 1190.
- Eliot, L. (2010). *Pink brain, blue brain*. Oneworld Publications.
- Ellis, L. (2011). Identifying and explaining apparent universal sex differences in cognition and behavior. *Personality and Individual Differences*, 51(5), 552-561.
- Feingold, A. (1993). Cognitive gender differences: A developmental perspective. *Sex Roles*, 29(1-2), 91-112.
- Fine, C. (2010). *Delusions of gender: How our minds, society, and neurosexism create difference*. WW Norton & Company.

- Fine, C. (2017). *Testosterone rex: unmaking the myths of our gendered minds*. Icon Books.
- Garcia-Falgueras, A., & Swaab, D. F. (2010). Sexual hormones and the brain: an essential alliance for sexual identity and sexual orientation. In *Pediatric Neuroendocrinology* (Vol. 17, pp. 22-35). Karger Publishers.
- Gerson, S. A., Simpson, E. A., & Paukner, A. (2016). Drivers of social cognitive development in human and non-human primate infants. In *Social Cognition* (pp. 116-146). Routledge.
- Grey, J. (1992). *Men are from Mars, women are from Venus: The classic guide to understanding the opposite sex*.
- Heying, H. (2018) James Damore at Portland State, panel "We Need to Talk About Diversity" . Heather E. Heying, Peter Boghossian, Helen Pluckrose, James Damore. 17 de febrero de 2018, Universidad de Portland. Video Online.
- Hines, M., & Kaufman, F. R. (1994). Androgen and the development of human sex-typical behavior: Rough-and-tumble play and sex of preferred playmates in children with congenital adrenal hyperplasia (CAH). *Child development*, 65(4), 1042-1053.
- Hines, M., Golombok, S., Rust, J., Johnston, K. J., Golding, J., & Parents and Children Study Team, A. L. S. O. (2002). Testosterone during pregnancy and gender role behavior of preschool children: a longitudinal, population study. *Child development*, 73(6), 1678-1687.
- Hines, M. (2005). *Brain gender*. Oxford University Press.
- Hyde, J. S. (2005). The gender similarities hypothesis. *American psychologist*, 60(6), 581.
- Hyde, J. S. (2016). Sex and cognition: gender and cognitive functions. *Current opinion in neurobiology*, 38, 53-56.
- Geary, D. C., & DeSoto, M. C. (2001). Sex differences in spatial abilities among adults from the United States and China. *Evolution and Cognition*, 7(2), 172-177.
- Greenberg, D. M., Warrier, V., Allison, C., & Baron-Cohen, S. (2018). Testing the empathizing–systemizing theory of sex differences and the extreme male brain theory of autism in half a million people. *Proceedings of the National Academy of Sciences*, 201811032.
- Jadva, V., Hines, M., & Golombok, S. (2010). Infants' preferences for toys, colors, and shapes: Sex differences and similarities. *Archives of sexual behavior*, 39(6), 1261-1273.
- Joel, D., Berman, Z., Tavor, I., Wexler, N., Gaber, O., Stein, Y., ... & Liem, F. (2015). Sex beyond the genitalia: The human brain mosaic.
- Joel, Daphna (2012) "Sex, Gender and Brain. A Problem of Conceptualization". Conferencia "NeuroCultures - NeuroGenderings II", 13-15 septiembre 2012, Universidad de Viena. Video online.

- Proceedings of the National Academy of Sciences, 112(50), 15468-15473.
- Jussim, L. J., McCauley, C. R., & Lee, Y. T. (1995). Why study stereotype accuracy and inaccuracy?.
- Jussim, L., Eccles, J., & Madon, S. (1996). Social perception, social stereotypes, and teacher expectations: Accuracy and the quest for the powerful self-fulfilling prophecy. In *Advances in experimental social psychology* (Vol. 28, pp. 281-388). Academic Press.
- Kellermann, A. L., & Mercy, J. A. (1992). Men, women, and murder: gender-specific differences in rates of fatal violence and victimization. *The Journal of Trauma*, 33(1), 1-5.
- Lee, Y. T. E., Jussim, L. J., & McCauley, C. R. (1995). *Stereotype accuracy: Toward appreciating group differences*. American Psychological Association.
- Lippa, R. (1998). Gender-related individual differences and the structure of vocational interests: The importance of the people–things dimension. *Journal of personality and social psychology*, 74(4), 996.
- Lippa, R. A. (2001). On deconstructing and reconstructing masculinity–femininity. *Journal of Research in Personality*, 35(2), 168-207.
- Lippa, R. A. (2005). *Gender, nature, and nurture*. Routledge.
- Lippa, R. A. (2006). Finger lengths, 2D: 4D ratios, and their relation to gender-related personality traits and the Big Five. *Biological Psychology*, 71(1), 116-121.
- Lippa, R. A. (2006). Is high sex drive associated with increased sexual attraction to both sexes? It depends on whether you are male or female. *Psychological Science*, 17(1), 46-52.
- Lippa, R. A. (2009). Sex differences in sex drive, sociosexuality, and height across 53 nations: Testing evolutionary and social structural theories. *Archives of sexual behavior*, 38(5), 631-651.
- Lippa, R. A. (2010). Sex differences in personality traits and gender-related occupational preferences across 53 nations: Testing evolutionary and social-environmental theories. *Archives of sexual behavior*, 39(3), 619-636.
- Lonsdorf, E. V., Anderson, K. E., Stanton, M. A., Shender, M., Heintz, M. R., Goodall, J., & Murray, C. M. (2014). Boys will be boys: sex differences in wild infant chimpanzee social interactions. *Animal behaviour*, 88, 79-83.
- Maffía, D. Conferencia sobre género, ciencia y cultura, Centro Cultural de la Ciencia, reseña publicada el 6 de julio del 2017 en el sitio del Ministerio de Ciencia <http://www.mincyt.gob.ar/noticias/experiencias-sobre-ciencia-y-genero-12965>

- Maccoby, E. E. (1999). *The two sexes: Growing up apart, coming together* (Vol. 4). Harvard University Press.
- Pasterski, V. L., Geffner, M. E., Brain, C., Hindmarsh, P., Brook, C., & Hines, M. (2005). Prenatal hormones and postnatal socialization by parents as determinants of male-typical toy play in girls with congenital adrenal hyperplasia. *Child development*, 76(1), 264-278.
- Phornphutkul, C., Fausto-Sterling, A., & Gruppuso, P. A. (2000). Gender self-reassignment in an XY adolescent female born with ambiguous genitalia. *Pediatrics*, 106(1), 135-137.
- Reiner, W. G., & Gearhart, J. P. (2004). Discordant sexual identity in some genetic males with cloacal exstrophy assigned to female sex at birth. *New England Journal of Medicine*, 350(4), 333-341.
- Savic, I., Garcia-Falgueras, A., & Swaab, D. F. (2010). Sexual differentiation of the human brain in relation to gender identity and sexual orientation. In *Progress in brain research* (Vol. 186, pp. 41-62). Elsevier.
- Servin, A., Nordenström, A., Larsson, A., & Bohlin, G. (2003). Prenatal androgens and gender-typed behavior: a study of girls with mild and severe forms of congenital adrenal hyperplasia. *Developmental psychology*, 39(3), 440.
- Schmitt, D. P. (2005). Sociosexuality from Argentina to Zimbabwe: A 48-nation study of sex, culture, and strategies of human mating. *Behavioral and Brain Sciences*, 28(2), 247-275.
- Schmitt, D. P. (2008). Evolutionary perspectives on romantic attachment and culture: How ecological stressors influence dismissing orientations across genders and geographies. *Cross-Cultural Research*, 42(3), 220-247.
- Schmitt, D.P. (2016), "Sex and Gender are Dials, not Switches", *Psychology Today*, 3 de marzo 2016. Artículo online.
- Smith, E. S., Junger, J., Derntl, B., & Habel, U. (2015). The transsexual brain—A review of findings on the neural basis of transsexualism. *Neuroscience & Biobehavioral Reviews*, 59, 251-266.
- Shackelford, T. K., Schmitt, D. P., & Buss, D. M. (2005). Universal dimensions of human mate preferences. *Personality and individual differences*, 39(2), 447-458.
- Su, R., Rounds, J., & Armstrong, P. I. (2009). Men and things, women and people: a meta-analysis of sex differences in interests. *Psychological bulletin*, 135(6), 859.
- Todd, B. K., Barry, J. A., & Thommessen, S. A. (2017). Preferences for 'Gender-typed' Toys in Boys and Girls Aged 9 to 32 Months. *Infant and Child Development*, 26(3), e1986.

- Townsend, J. M., & Levy, G. D. (1990). Effects of potential partners' costume and physical attractiveness on sexuality and partner selection. *The Journal of Psychology*, 124(4), 371-389.
- Townsend, J. M., & Wasserman, T. (1998). Sexual attractiveness: Sex differences in assessment and criteria. *Evolution and Human Behavior*, 19(3), 171-191.
- Trivers, R. (1972). Parental investment and sexual selection (Vol. 136, p. 179). Cambridge: Biological Laboratories, Harvard University.
- van Anders, S. M., & Watson, N. V. (2006). Relationship status and testosterone in North American heterosexual and non-heterosexual men and women: Cross-sectional and longitudinal data. *Psychoneuroendocrinology*, 31(6), 715-723.
- Vries, G. J., & Södersten, P. (2009). Sex differences in the brain: the relation between structure and function. *Hormones and behavior*, 55(5), 589-596.
- Warrier, V., Grasby, K. L., Uzefovsky, F., Toro, R., Smith, P., Chakrabarti, B., ... & Lubke, G. (2017). Genome-wide meta-analysis of cognitive empathy: heritability, and correlates with sex, neuropsychiatric conditions and cognition. *Molecular psychiatry*.
- Wong, W. I., Pasterski, V., Hindmarsh, P. C., Geffner, M. E., & Hines, M. (2013). Are there parental socialization effects on the sex-typed behavior of individuals with congenital adrenal hyperplasia?. *Archives of Sexual Behavior*, 42(3), 381-391.
- Wright, D. B., & Skagerberg, E. M. (2012). Measuring empathizing and systemizing with a large US sample. *PLoS One*, 7(2), e31661.