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Hane Htut Maung

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# Classifying sexes

Hane Htut Maung

Department of Politics, Philosophy, and Religion, Lancaster University

[h.maung1@lancaster.ac.uk](mailto:h.maung1@lancaster.ac.uk)

## **Abstract**

In the political discourse regarding gender identity, the concept of biological sex has been weaponised by gender critical commentators to oppose gender affirmation for trans people. Recently, these commentators have appealed to an essentialist model of sex based on anisogamy, or relative gamete size, to argue that one's sex is an immutable characteristic. I argue that the gender critical argument is unsound. The diverse purposes of sex classification and the complex variability of people's sexual characteristics show that an essentialist model is untenable. I then consider how a more adequate theoretical framework from the philosophy of biology can accommodate this complexity and capture how sex is classified in relevant contexts. Further implications of the framework are explored which concern the vagueness, polysemy, and mutability of sex. These undercut the gender critical argument and show that the appeal to biological sex fails to undermine gender affirmation for trans people.

## **Keywords**

Sex; Essentialism; Transgender; Homeostatic property clusters; Philosophy of biology

## Introduction

Sex categories are broadly considered to capture ‘biological characteristics generally related to reproductive anatomy or physiology’ (DuBois & Shattuck-Heidorn, 2021, p. 3). This paper presents a philosophical critique of how the concept of biological sex has been used in public discourse to oppose gender affirmation for trans people. By ‘trans people’, I mean all people who identify as genders other than those to which they were assigned at birth, including trans men (people who identify as men but were assigned female at birth), trans women (people who identify as women but were assigned male at birth), and nonbinary trans people (people who identify neither simply as men nor simply as women).

The weaponisation of biological sex to oppose gender affirmation for trans people has taken on various forms. An early example is Janice Raymond’s *The Transsexual Empire* (1979), which portrays trans women as ‘males’ who are appropriating women’s bodies and invading women’s spaces. Drawing on this claim, Sheila Jeffreys’ *Gender Hurts* (2014) suggests that using female pronouns to refer to trans women is objectionable because it fails to respect the ‘biological basis’ that underlies the subordination of women. Underpinning this is an assumption regarding ‘the fixedness of sex’, in contrast to the depiction of gender as ‘a moveable feast that can be moved into and out of’ (Jeffreys, 2014, p. 5).

In current political discourse, this particular use of biological sex is associated with the gender critical movement. This is an alliance of people who are critical of gender identity and instead consider biological sex to be the relevant property that determines womanhood or manhood. Furthermore, biological sex is assumed by gender critical commentators to be binary and immutable, such that a person is exclusively either female or male and cannot change sex. In their attempts to give their views scientific credibility, many gender critical commentators endorse an essentialist model of sex based on anisogamy, or relative gamete size (Bogardus, 2020; Byrne, 2018; Joyce, 2021; Wright & Hilton, 2020). Accordingly, these commentators consider womanhood to be defined by the production of large gametes and manhood by the production of small gametes.

My aim is to show that the gender critical argument is unsound. The philosophical approach I will be taking to the topic may seem unusual. Many philosophers, including Talia Mae Bettcher (2009), Katharine Jenkins (2018), and Lori Watson (2016) have already rejected the gender critical argument by emphasising the importance of gender identity in determining whether one is a man, a woman, or nonbinary. This is usually supported by what Bettcher (2009) calls the principle of first-person authority, which states that one should be treated as the decisive authority on one’s own identity (Bettcher, 2009). Likewise, Watson emphasises the paramouncy of ‘trying to understand someone else’s reality, the phenomenology of their existence’ (Watson, 2016, p. 247). I would like to stress that I am in full agreement with these scholars regarding the paramouncy of one’s first-person authority over one’s gender identity in determining whether one is a man, a woman, or nonbinary. However, given that gender critical commentators explicitly reject the significance of gender identity and instead consider biological sex to be important, there is also a need to address the concept of biological sex more directly to rebut the claims of these gender critical commentators on their own terms. The approach I will be taking in this paper, then, is to challenge the account of biological sex that is assumed by gender critical authors.

It can be objected that addressing the claims of gender critical commentators on their own terms is counterproductive because it endows their claims with sufficient value for philosophical critique. However, there is a reason why such critique is important. The claims are not confined to the intellectual sphere, but have influences on social policy, public attitudes, and media narratives concerning trans people. In the United Kingdom, these influences have been especially palpable since the recent proposed reform of the Gender Recognition Act 2004, which was intended to enable one to change the sex marker on one’s birth certificate from female to male or *vice versa* via self-identification. This proposed reform was opposed by gender critical organisations, such as A Woman’s Place UK and Fair Play for Women, on the purported grounds that it would violate women’s ‘sex-based rights’.

As Ruth Pearce and colleagues note, this line of argument is predicated on the assumed priority of the ‘biological reality’ of sex over the ‘social ideology’ of gender (Pearce *et al.*, 2020). Such organisations have also lobbied for laws such as the Gender Recognition Act 2004 and the Equality Act 2010 to be interpreted in ways that classify trans women as ‘male’, which would exclude them from women’s spaces (Pearce *et al.*, 2020). Given the harmful social and material consequences that the gender critical commentators’ claims about biological sex have for trans people, such claims should not go unchallenged. As Matthew Cull (2022) notes ‘rectifying falsehoods about trans people spread in the culture wars and calling for legal changes for the benefit of trans people is a vital part of any reformist program’.

Furthermore, it is worth noting that the gender critical commentators’ claims about biological sex not only attempt to deny the identities of trans people, but also exclude intersex people. Under an essentialist model that assumes sex to be strictly binary, intersex people tend to be disregarded or dismissed as ‘anomalous’ (Joyce, 2021). Again, this is not confined to the intellectual sphere, but reflects a context where intersex people may be harmed by social practices that presuppose a binary model of sex (Clune-Taylor, 2019). This indicates a further reason why the claims of gender critical commentators should not go unchallenged.

And so, the philosophical analysis I offer is not supposed to be a mere theoretical exercise, but also a resource to challenge the discourses that seek to delegitimise trans identities and, as noted above, that exclude intersex people. Of course, it is doubtful that the debate over trans identities should even hinge on these theoretical issues regarding the ontology of biological sex. I am inclined to think that these theoretical issues tend to be given more normative weight than they warrant and that they ultimately should not matter for ethical decisions about the rights of trans people. As noted above, though, the fact that claims about biological sex have featured in these decisions indicates the need to attain a more satisfactory understanding of the concept of biological sex that reflects its diverse purposes. This might suggest that I am engaging in what Sally Haslanger (2012) calls ameliorative inquiry, wherein the aim is to specify which concept would be most helpful given certain political aims. While I am not opposed to this approach, I do not predominantly consider what I am doing herein to be an ameliorative analysis of sex, as my aim is mostly to offer a descriptive account that captures our actual classificatory practices in ways that the essentialist model fails to capture. Nonetheless, insofar as the account I offer acknowledges that sex classification serves diverse purposes that consider different features to be salient, it could certainly pave the way for further ameliorative inquiry into which features are relevant to which political aims.

The rest of this paper will proceed as follows. After expounding the essentialist model in more detail, I will argue that the diverse purposes of sex classification and the complex variability of people’s sexual characteristics show that the essentialist model is untenable. I will then consider how a theoretical framework from the philosophy of biology, namely the homeostatic property cluster theory (Boyd, 1999; henceforth ‘HPC theory’), can accommodate this complexity and reflect how biological sex is classified in relevant contexts. The application of the HPC theory to sex classification is not itself new (Stone, 2007). However, my contribution is to explicate some further implications of the theory that undercut the gender critical argument and show that trans identities are not undermined by biological sex.

## **The essentialist model**

### ***The role of anisogamy***

Our classificatory practices take on a variety of forms. Some of the categories we use are intended to capture theoretically significant intragroup similarities and intergroup differences, which we can then use to support inductive inferences. Philosophers often refer to these generalisable categories as natural kinds. Sex categories are often thought to be reasonable candidates for natural kinds, insofar as people classified under any given sex

category possess theoretically significant similarities with other people classified under the same sex category and theoretically significant differences with people classified under a different sex category. However, as will become clear, the above depends on what account of natural kindhood is assumed.

A traditional account of natural kindhood is essentialism, according to which all members of a category possess the same essential property (Ellis, 2001). This essential property is a necessary condition for membership of the category, and so its presence or absence determines what is included or excluded from the category. For example, the essential property of water is the chemical composition  $H_2O$ , such that only samples with the chemical composition  $H_2O$  qualify as samples of water. A liquid that superficially resembles water but does not have the chemical composition  $H_2O$  does not qualify as water.

Essentialism has featured in the discussion about sex classification. We saw earlier that anisogamy is sometimes invoked as the basis for defining sex. This is an approach that is drawn from work in evolutionary reproductive biology. For example, Jussi Lehtonen and Geoff Parker write:

To see this, we must be clear about how the two sexes are defined in a broad sense: males are those individuals that produce the smaller gametes (e.g., sperm), while females are defined as those that produce the larger gametes. (Lehtonen & Parker, 2014, pp. 1161–1162)

This essentialist model considers the production of large gametes to be the essential property that determines femaleness and the production of small gametes to be the essential property that determines maleness.

As noted earlier, the essentialist model is endorsed by some gender critical authors who oppose trans identities. For example, in an opinion piece decrying what they call ‘transgender ideology’, Colin Wright and Emma Hilton write:

In humans, as in most animals or plants, an organism’s biological sex corresponds to one of two distinct types of reproductive anatomy that develop for the production of small or large sex cells—sperm and eggs, respectively—and associated biological functions in sexual reproduction. (Wright & Hilton, 2020)

In her recent book on the topic, the gender critical journalist Helen Joyce uses the essentialist model to argue that sex is binary and immutable:

‘Sexes’ are classes of organisms defined by the developmental pathways that evolved to produce gametes: eggs and sperm ... For there to be even three sexes there would have to be a third gamete, and there is not. (Joyce, 2021, p. 65)

Likewise, Alex Byrne suggests that ‘females produce large gametes (reproductive cells), and males produce small ones (Since there are no species with a third intermediate gamete size, there are only two sexes)’ (Byrne, 2018).

Given that they deny the importance of gender, gender critical commentators take sex to be the relevant criterion that determines whether someone is a woman or a man. Accordingly, anisogamy is not only taken by some gender critical authors to define femaleness and maleness, but also to define womanhood and manhood. For example, Tomas Bogardus suggests that there is a need to ‘develop a variety of feminism on the foundation of this traditional, biological understanding of manhood and womanhood’ (Bogardus, 2020, p. 892). This is taken to undermine trans identities, because the production of either large gametes or small gametes is considered to be an immutable characteristic. Indeed, Wright and Hilton even suggest that affirming trans identities reflects ‘a dangerous and antiscientific trend toward the outright denial of biological sex’ (Wright & Hilton, 2020).

As noted above, the use of biological sex to deny trans identities is not confined to the intellectual sphere but has been influential in the contemporary political climate of the United Kingdom. Earlier, I mentioned the recent discourse surrounding the proposed reform of the Gender Recognition Act 2004, but the same kind of rhetoric has also manifested in the Conservative Party leadership race. Notably, the political candidate Penny Mordaunt posted the following comment on social media:

I am biologically a woman. If I have a hysterectomy or mastectomy, I am still a woman. And I am legally a woman. Some people born male and who have been through the gender recognition process are also legally female. That DOES NOT mean they are biological women, like me. (Mordaunt, 2022)

Again, this comment is underpinned by two key gender critical assumptions. First, there is the assumption that biological sex is what ultimately determines whether one is ‘really’ a woman. Second, there is the assumption that biological sex is an immutable characteristic that persists despite changes in other parts of the body.

### ***Problems with essentialism***

Having laid out the essentialist model of sex based on anisogamy, I now argue that it is problematic and ultimately untenable as a theoretical tool in the debate over trans identities. This is for two reasons. First, the concept of sex serves multiple purposes and the different constraints that these purposes impose cannot be satisfied simultaneously by appealing to a single property. Second, people exhibit considerable diversity and complexity with respect to their sexual characteristics, which confound a simplistic essentialist classification.

The first problem with the essentialist model concerns the polysemy of sex classification. Anisogamy is a model that is intended to be useful in the field of evolutionary reproductive biology. It may be useful as a classification in this narrow context because it facilitates investigations of evolutionary selective pressures and reproductive strategies in different species (Lehtonen & Parker, 2014). However, evolutionary reproductive biology is not the only context in which the concept of sex is used. There are other scientific, clinical, social, and legal contexts, in which a classification based on anisogamy is inadequate. Rather, different definitional criteria are used across different contexts (Hodson et al., 2019; Johnson et al., 2007; Miyagi et al., 2021; White, 2021).

The polysemy of sex is discussed by Sally Hines (2020) and Kim Hipwell (2021), who chart the different ways in which sex has been classified across history and across different disciplines in the present day. For some of these classificatory purposes, such as elite sports, attempts to enforce a binary classification have been problematic (Erikainen, 2020). Moreover, as noted by Catharine MacKinnon (1991), some social and legal purposes use sex and gender interchangeably, so that maleness and femaleness are taken to be features that pertain to gender. In these contexts, male and female may be predicates that apply to gender identity rather than to anything to do with reproduction.

It is worth noting that polysemy is not unique to sex classification but is a common feature of many biological categories. For example, Rose Novick and Ford Doolittle point out that the concept of a biological species is polysemous and ‘can be understood as a collection of interacting patchworks, generated by the application of various species subconcepts to new domains’ (Novick & Doolittle, 2020, p. 79). Likewise, regarding sex classification, Miriam Miyagi and colleagues argue that “‘male’ and ‘female’ should be treated as context-dependent categories with flexible associations to multiple variables’ (Miyagi et al. 2021, pp. 1568–1569).

And so, a major problem for the gender critical argument is that there is no good *prima facie* reason for thinking that the anisogamy subconcept of evolutionary reproductive biology is any more relevant to the practices and policies concerning trans identities than any other subconcept used in other technical contexts. Although the gender critical argument

presumes the relevance of the anisogamy subconcept, this assumption is not defended at any substantial length in the scholarly literature. Without such a defence, relative gamete size appears to be of no more theoretical or normative significance to the rights of trans people than other characteristics that are used in other domains to classify sex.

The second problem with the essentialist model concerns the inability of the anisogamy subconcept to capture the variability that people exhibit. This has been noted at least as far back as Simone de Beauvoir:

It is extremely difficult to give a generally valid definition of the female. To define her as the bearer of eggs and the male as bearer of the sperms is far from sufficient, since the relation of the organism to the gonads is, as we have seen, quite variable. On the other hand, the differences between the gametes have no direct effect upon the organism as a whole ... (de Beauvoir, 1949, p. 48)

For example, there are many people who do not produce gametes. There is also a recorded instance of a person with ovotesticular syndrome who had produced both large gametes and small gametes (Parvin, 1982). If relative gamete size is assumed to be the basis of sex classification, then the above would suggest that there are people who fall outside of this classification. The essentialist model is thus problematic because it excludes intersex people and people with gametic infertility.

The above should be sufficient to refute the essentialist model, but gender critical commentators have responded by making a modification to the model which is intended to accommodate these cases and maintain the binary classification based on anisogamy. According to the modified essentialist model, people who do not produce gametes can still be defined as either female or male based on what gametes they would have produced if they had completed the relevant developmental pathways. For example, Byrne writes:

... females are the ones who have advanced some distance down the developmental pathway that results in the production of large gametes — ovarian differentiation has occurred, at least to some extent. Similarly, males are the ones who have advanced some distance down the developmental pathway that results in the production of small gametes. (Byrne, 2018)

Bogardus couches this in language that is more explicitly teleological:

To account for cases in which a male is (due to youth, advanced age, “malfunction”, etc.) currently unable to produce small, motile gametes, proponents of this definition will likely need to import teleological notions of proper function. And *mutatis mutandis* with females. (Bogardus, 2020, p. 875, n. 5)

The suggestion here is that these people would have produced either large gametes or small gametes if their reproductive organs had developed in the supposedly ‘proper’ ways.

While it may seem to accommodate more cases, this modified essentialist model is untenable. A significant problem is the way in which it invokes teleology. It has long been accepted in modern biology that phenotypes are not realisations of prior plans or goals, but are contingent outcomes of complex causal processes (Oyama, 2000). That is to say, there is no designer or predetermined purpose that directs how organisms evolve and develop. Hence, the notion of a ‘proper’ developmental outcome is not an empirical fact presented by the world, but is a value judgement imposed onto the world. Likewise, the notion of biological function does not reflect a prior goal of a biological system, but is an instrumental device that serves to focus enquiry (Ratcliffe, 2000). Evolutionary theory can provide a causal historical explanation of how certain phenotypes became more common than others, but such an explanation does not entail the evaluative claim that these phenotypes are the ‘proper’

outcomes. This suggests that the modified essentialist model begs the question, insofar as it presupposes the production of either large or small gametes to be the desired goal and considers any other outcome to be a deviation from this goal rather than a phenotype in its own right.

Nonetheless, even without the teleology, the modified essentialist model is problematic because of the way in which it relies on a counterfactual claim. To salvage the binary classification based on anisogamy, the model suggests that people who do not produce gametes are ultimately either female or male based on what gametes they would have produced under different circumstances. However, this raises the question of what these different circumstances are taken to be. The answer is not simply given, but will depend on decisions about which features of people are held constant and which are allowed to vary across counterfactual scenarios. In turn, these are informed by value judgements concerning which features are deemed more salient than others.

In some cases, the counterfactual claims may initially appear relatively straightforward. For example, a person with XX chromosomes and ovaries who has undergone the menopause may still be reasonably classified as female based on the counterfactual claim that the person would still be ovulating if menopause had not occurred. Likewise, a person with XY chromosomes and testes who has not yet undergone puberty may still be reasonably classified as male based on the counterfactual claim that the person would produce small gametes if puberty had occurred. However, even in these seemingly straightforward cases, other counterfactual scenarios cannot be precluded that would yield different classifications. For example, in the former case, the counterfactual claim could be made that the person would have produced small gametes if the gonads had differentiated into testes instead of ovaries. Similarly, in the latter case, the counterfactual claim could be made that the person would have produced large gametes if the gonads had differentiated into ovaries instead of testes. Hence, under the modified essentialist model, how cases such as the above are classified will depend on which counterfactual scenarios are assumed. Contrary to the aims of gender critical commentators, the model does not preclude us from classifying trans women as female on the grounds that they would have produced large gametes under different developmental circumstances.

Other instances present much more serious challenges to the modified essentialist model. In the above cases, the counterfactual claims about what gametes the people would have produced are based on their gonadal types, since large gametes are produced by ovaries and small gametes are produced by testes. However, there is ample evidence that intersex people exhibit significant degrees of complexity and variability with respect to their features associated with biological sex, including their gonadal types (Ainsworth, 2015; Blackless et al., 2000; DuBois & Shattuck-Heidorn, 2021; Fausto-Sterling, 1993). Sometimes, the gonadal types are mixed and cannot be classified exclusively as either ovaries or testes. For example, Anne Fausto-Sterling (1993) describes people with ovotesticular syndrome who either have both testes and ovaries or have ovotestes that contain both ovarian cells and testicular cells. In other cases, the gonadal types may be indeterminate, such that the cells comprising the gonads are neither ovarian nor testicular. For example, some people with various forms of gonadal dysgenesis, including Turner syndrome, Swyer syndrome, XX gonadal dysgenesis, and mixed gonadal dysgenesis, have streak gonads, which 'consist of fibrous tissue without germ cells, follicles, or their remnants' and have 'no reproductive or hormonal function' (Bösze & László, 1979, p. 544).

In the above cases, counterfactual claims about what gametes people would have produced under different circumstances cannot be based on what gonadal types they have, because these gonadal types are either mixed or indeterminate. Instead, if we want to classify people as either female or male, then we need to appeal to other features besides their gonads. These might include, but not be restricted to, combinations of chromosomal, hormonal, physiological, and anatomical features.

Commonly, XX chromosomes, high oestrogen, a uterus, a vagina, and breast development are considered to mark femaleness, while XY chromosomes, high testosterone, and a penis are considered to mark maleness. However, in some of the aforementioned cases, the various features do not align in these ways. Accordingly, decisions must be made regarding which features are to be privileged over others when assigning people to female and male categories. In turn, these decisions are informed by value judgements concerning which features are deemed more salient than others with regards to our classificatory interests. For example, Swyer syndrome is often associated with XY chromosomes, indeterminate streak gonads that do not produce gametes, low endogenous oestrogen, low endogenous testosterone, minimal breast development, the presence of a uterus, and the presence of a vagina (King & Conway, 2014). People with Swyer syndrome are usually classified as female and are prescribed exogenous oestrogen to initiate and maintain puberty. Here, the gonadal and hormonal features are indeterminate such that secondary sexual characteristics do not occur without exogenous hormonal treatment. There are also further ambiguities, insofar as the chromosomes support a male classification while the genitals support a female classification. The decisions to classify people with Swyer syndrome as either female or as male thus have to rely on further value judgements about whether to privilege the chromosomal or the anatomical features.

It is sometimes objected that ovotesticular syndrome, gonadal dysgenesis, and other intersex conditions are so statistically rare that they do not present serious challenges to our classificatory practices. This is suggested by Byrne, who claims that ‘even if some people are outside the binary, they are a miniscule fraction of the population’ (Byrne, 2018). In response, the rarity of a phenotype is not a sufficient reason to exclude the phenotype as a category. For example, red hair is a statistically rare hair colour that is estimated to have a global prevalence of 1% to 2%. This prevalence goes even lower when more specific populations are considered. Across much of Asia and Africa the prevalence of red hair is less than 1%, while it is 0.57% in the whole of Italy and 0.24% in Sardinia (Cavalli-Sforza et al., 2004). Nonetheless, the rarity of red hair does not suggest that red hair is not a category of hair colour. It would be wrong to claim that the only kinds of hair colour in Sardinia are black, brown, and blonde. Likewise, the rarity of intersex does not suggest that the only ‘proper’ developmental outcomes are the production of large gametes and the production of small gametes. It would be wrong to disregard intersex people because they comprise a minority of the population.

The above shows that the essentialist model of sex based on anisogamy, even in its modified form, is untenable. Given the complexity and variability exhibited by people with regards to their sexual characteristics, including their gonadal types, decisions about how people are to be classified cannot always be determined by claims about what sorts of gametes they would have produced under different circumstances. Rather, these decisions have to appeal to other characteristics of the people and value judgements have to be made regarding how significant these features are for our classificatory purposes. While I have focused on anisogamy, the aforementioned problems also apply to other essentialist models of sex based on single characteristics. And so, the gender critical commentators are appealing to a model of biological sex that fails to capture how sex is classified across different relevant contexts. To reflect the complexity of biological sex classification more accurately, a different sort of philosophical model is required. As I will show, the gender critical argument is discredited by such a model.

### **The complexity of sex classification**

#### ***The homeostatic property cluster theory***

In the philosophy of biology, Richard Boyd (1999) has proposed an account of natural kindhood, namely the HPC theory, which can accommodate categories that cannot be accommodated by essentialism, such as biological taxa. A homeostatic property cluster (HPC) is a set of properties that tend to cluster together due to contingent causal processes

called homeostatic causal mechanisms. These mechanisms are not deterministic but probabilistic, such that the presence of one property does not necessitate that of another but makes it statistically more likely. In the HPC theory, a natural kind is a category whose members share enough of the properties. Crucially, the members do not have to possess all of the properties and there is no single essential property that is necessary for membership of the category. Different members of the category can possess different combinations of properties.

The HPC theory has recently been applied to sex classification by Alison Stone (2007), who notes that there are multiple properties associated with biological sex, including chromosomes, hormones, gonads, genitals, and other anatomical features. People can possess these properties in various combinations, although some of them tend to cluster together more frequently. Accordingly, Stone defines femaleness and maleness as follows:

To be female is to have enough of a cluster of properties (ovaries, breasts, vaginas, etc.), which cluster because they encourage one another's presence ... To be male is to have enough of a cluster of properties (testes, penis, scrotum, etc.), which cluster because they encourage one another's presence. (Stone, 2007, p. 45)

Hence, membership of a given sex category does not require all properties to be present and there is no single essential property that is necessary for membership. Rather, membership just requires enough of a cluster of properties to be present.

As noted earlier, the clustering is not accidental. Certain chromosomal, hormonal, gonadal, and anatomical properties tend to cluster together because of homeostatic causal mechanisms:

Certain properties – having XX chromosomes, ovaries, vagina, breasts, etc. – often occur together, and so they form a cluster. This is not accidental. These properties often co-occur because having XX chromosomes encourages the formation of ovaries, which, in turn, tend to secrete relatively high quantities of female hormones. This, in turn, encourages the growth of female genitals, and so on. (Stone, 2007, p. 44)

Although it is not accidental, the clustering is nonetheless contingent. The causal processes are not deterministic but probabilistic, and so the various properties can come apart:

Still, although all these properties tend to encourage one another's presence, they need not always occur together ... But if enough of these properties do occur together, then the body to which they belong is female. (Stone, 2007, p. 44)

Accordingly, a given sex category may include members who possess different combinations of properties.

In addition to the chromosomal, physiological, and anatomical properties mentioned by Stone, I argue that psychological and social properties can also be included in the clusters, as these also causally interact with the biological properties. To be clear, this is not to suggest that biological properties determine psychological and social properties. After all, such biological determinism has long been falsified (Hubbard, 1990). Rather, it is the observation that our cultural conceptions of gender influence and are influenced by how we interpret and shape the bodily attributes associated with sex. As with all complex behavioural characteristics, one's gender identity is likely to be shaped by multiple social, cultural, biological, and psychological factors that interact in complex and dynamic ways throughout development. Indeed, quantitative behavioural genetic research has suggested that while there is a small heritable influence, the majority of the variation in gender identity is attributable to environmental variation (Burri et al. 2011). What this sort of research doesn't

capture, however, is the way that gender identity formation is an agential process whereby one is actively working out how to navigate one's biological and cultural circumstances, including whether to endorse, tolerate, or reject the various norms associated with them. Accordingly, Judith Butler notes:

... all of us ... are in the active position of figuring out how to live with and against the constructions—or norms—that help to form us ... my sense is that we may not need the language of innateness or genetics to understand that we are all ethically bound to recognize another person's declared or enacted sense of sex and/or gender. (Butler, 2015)

In turn, our cultural conceptions of gender also influence how we conceptualise sex. As Diane Richardson notes, 'without the concept of gender we could not make sense of bodies as differently sexed' (Richardson, 2015, p. 210). Consider, for example, how cultural conceptions of gender and sex as binary influence the controversial medical and surgical interventions that modify the biological characteristics of intersex infants to align them with male or female categories, or how behavioural expressions of masculinity and femininity are influenced by attitudes regarding biological sex. Hence, by including psychological and social properties in the clusters, the HPC model can accommodate some of the complex ways in which sex and gender come together and overlap.

A strength of the HPC model of sex classification is that it accounts for the complex variability of people's sexual characteristics, and so it includes intersex people. As argued earlier, the essentialist model based on anisogamy assumes a discrete binary classification based on relative gamete size, and so fails to account for people who do not produce gametes and people with both ovaries and testes. By contrast, the HPC model acknowledges that people can exhibit various combinations of chromosomal, physiological, anatomical, psychological, and social properties. Accordingly, female, male, and intersex categories can be informed by the relative degrees to which people instantiate the relevant properties.

Another strength of the HPC model is that it captures the actual practices of scientists and clinicians who are involved in sex classification. I noted earlier that the model based on anisogamy is a useful device to facilitate enquiry in the specific field of evolutionary reproductive biology but is unsuited to other contexts. Accordingly, these other contexts use other subconcepts of sex that are based on different definitional criteria. For example, some scientific approaches take sex classification to be informed by various combinations of gonadal, hormonal, physiological, and anatomical properties (Ainsworth, 2015; Blackless et al., 2000; DuBois & Shattuck-Heidorn, 2021; Fausto-Sterling, 1993). In neuroscience and psychology, Daphna Joel (2012) suggests that sex pertains to neuronal and behavioural characteristics in addition to '3G-sex' (genetic, gonadal, and genital) characteristics. In the context of healthcare, sex has variously been defined as 'a multidimensional biological construct that encompasses anatomy, physiology, genes, and hormones that together create a human "package" that affects how we are labelled' (Johnson et al., 2007, p. 4), as 'one's biological attributes, including physical features, chromosomes, gene expression, hormones and anatomy' (Ballering et al., 2020, p. 1), and as 'a combination of multiply interacting things which may not fit into neat boxes, whether naturally (intersex conditions) or through human intervention (hormonal treatment for trans people)' (White, 2021). Researchers also recognise that there are people 'who are neither entirely male nor female along various dimensions, or who exhibit a mix of male and female sex-related features' (Hodson et al., 2019, p. 542). These scientific and medical subconcepts of sex are consistent with the HPC model, insofar as they acknowledge that sex classification is informed by multiple properties that are contingently related.

**Further implications**

Further to the above theoretical merits, there are implications of the HPC model which directly undermine the gender critical commentators' claims about the fixedness of biological sex. Given that the properties associated with sex occur in various combinations, the boundaries between femaleness and maleness are vague. Stone writes:

If, then, someone is female or male when they have the sufficient number of the relevant properties, being female or male is a matter of degree ... Moreover, in the case of many of these properties that are relevant to sex, having them is itself a matter of degree. (Stone, 2007, pp. 44)

According to Stone, the vague boundaries suggest that sex is not a straightforward binary but falls on a continuum. This is corroborated by the scientific and clinical literature. For example, in their research on the complexity and variability of people's sexual characteristics, Melanie Blackless and colleagues argue that femaleness and maleness are not binary categories but follow bimodal distributions on a continuous spectrum (Blackless et al., 2000). Likewise, in a primer for health research, Joy Johnson and colleagues acknowledge that 'although conceptualizing sex usually relies on the female/male binary, in reality, individuals' sex characteristics exist on a continuum' (Johnson et al., 2007, p. 4).

The above supports an approach to classifying sex that is inclusive of intersex people. However, the vagueness of sex classification has another implication which further confutes the gender critical argument. Specifically, it indicates that the boundaries of femaleness and maleness are not simply given, but have to be negotiated. Such negotiation is not only informed by the empirical data, but also by our values and interests relative to various contexts and purposes. This underscores the polysemy of sex, which I mentioned earlier. As Boyd (1999) notes, one way of classifying a collection of properties may be suited to a certain purpose but unsuited to another purpose which instead might warrant a different way of classifying the collection of properties. For example, biological taxa are often classified in different ways for the purposes of different disciplines (Novick & Doolittle, 2021). Likewise, the concept of sex is polysemous insofar as different contexts may require us to attend to different properties in the clusters.

Given that people vary along a continuum with regards to their sexual characteristics, how they are classified will depend on how many categories we want to model, which characteristics we take to be salient for our purposes, and how we decide to draw the boundaries between the categories. As Fausto-Sterling (1993) notes, there is no *a priori* reason to confine sex classification to two categories, because a continuum of properties could potentially be modelled in different ways with different numbers of categories. For example, some jurisdictions around the world now classify intersex as a third sex category (von Wahl, 2021). Depending on our purposes, many classificatory contexts warrant our modelling the categories in ways that acknowledge that trans women are female and that trans men are male. Indeed, Stone notes that 'one can be female in virtue of having all of the relevant properties, or only most of them (e.g., a woman who has had a mastectomy or a post-operative male-to-female transsexual)' (Stone, 2007, p. 44).

Although Stone specifically uses the example of a trans woman who has had gender affirmation surgery, I argue that there are also clear reasons to model sex categories so that they are inclusive of trans people who have not had gender affirming surgery. Perhaps most obviously, people's reproductive organs are simply irrelevant to most ordinary social exchanges. Rather, in our everyday social interactions with one another, the features that are usually important, practically and ethically, are people's social identities and ways of presenting in the world. Other reasons to model sex categories inclusively in other contexts include, but are not restricted to, the biological effects of hormonal treatment and the social efforts to oppose oppression based on sex.

With regards to the biological effects of hormonal treatment, gender affirming hormones produce profound and systemic changes in people's physiological, metabolic, and secondary sexual characteristics (Fabris et al., 2015). Some classificatory contexts warrant our lending more weight to these physiological, metabolic, and secondary sexual characteristics in the clusters than to genitals, gonads, or chromosomes. For example, trans women who take oestrogen exhibit changes in their overall bodily compositions and develop breast tissue that is histologically the same as that of cis women (Parikh et al., 2020). Due to these characteristics, cis women and trans women have significantly higher risks of breast cancer than men. Hence, in the clinical context pertaining to this condition, trans women would appropriately be classified as female alongside cis women (de Blok et al., 2019). Indeed, as Margaret White notes, 'trans women on hormonal treatment will develop natural breast tissue, and should attend breast screening in the same way as any other woman, so getting that automated invite is entirely appropriate for them' (White, 2021). Similarly, due to the physiological and metabolic effects of testosterone, trans men who take testosterone develop many of the same haematological features as cis men, especially with regards to their haemoglobin, haematocrit, and erythrocyte parameters. Accordingly, in the clinical context pertaining to blood test analysis, it has been recommended that trans men should appropriately be classified as male alongside cis men (Antun et al., 2020).

Regarding the social efforts to address oppression based on sex, Julia Serano (2007) notes that trans women, like cis women, commonly suffer abuses which specifically target their female characteristics, including sexual objectification, sexual harassment, and sexual violence. Hence, if the social and legal efforts to oppose oppression, discrimination, and violence based on sex are to represent the group of people affected by such oppression, then trans women would appropriately be classified as female alongside cis women. As Lori Watson notes, 'a women's movement ... can't occur while marginalizing, refusing to recognize, and denying the existence of our trans sisters' (Watson, 2016, p. 251). Moreover, given that the above issues affect trans women at various stages of their transitions, these social and legal purposes may be much better informed by properties that pertain to social recognition and gender identity than by any specific anatomical properties.

At this point, it is worth addressing the objection that the anatomical and physiological properties possessed by trans people are less relevant to sex classification than the analogous anatomical and physiological properties possessed by cis people because the former are exogenously produced while the latter are endogenously produced. This objection is raised by Kathleen Stock (2021), who writes:

... I said that characteristics relevant to maleness and femaleness are 'endogenous': i.e., self-developed within the organism and not artificially put there. In the context of medicine, we see the importance of this condition. Endogenous features count as an important baseline in specifications of human health ... by considering what features tend to self-develop in an organism at various stages and averaging them, we get one useful source of information about what's statistically 'normal' at each stage. (Stock, 2021, pp. 80–81).

Interestingly, the above passage supports a cluster approach to sex classification. Nonetheless, it suggests that only endogenously produced properties should be considered taxonomically relevant.<sup>1</sup>

I have three responses to this objection. First, the context of medicine is much more complex than suggested in the cited passage. As shown by the examples of breast cancer screening and blood test analysis, some medical purposes warrant our classifying people's

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<sup>1</sup> Stock's work has also been criticised for failing to engage with the extensive literature on trans philosophy that already addresses many of the issues that she raises. For such a criticism, see Bettcher's (2018) guest post on the *Daily Nous*.

sexes according to their identified genders rather than to their assigned sexes at birth. Second, restricting the properties that are taxonomically relevant to only those that are endogenously produced would count against some cis people being classified in the sex categories to which they are usually allocated. For example, girls with vaginal atresia are born without vaginas, cervixes, and uteruses, and so are often treated by having vaginas surgically constructed. Likewise, girls with ovarian dysgenesis often do not produce sufficient levels of oestrogen and progesterone to initiate puberty, and so are often treated with exogenous oestrogen and progesterone to enable them to develop secondary sexual characteristics. In these cases, the sexual characteristics are exogenously produced. Hence, restricting the taxonomically relevant properties to those that are endogenously produced generates a serious problem. The criterion used to exclude trans people from being classified in certain sex categories also counts against cis people with such conditions as mentioned. Third, the above objection equivocates between a generic claim and a universal claim. By considering endogenous features, we may yield a generic generalisation about what features are statistically typical for members of a given sex category, but to then interpret this as a universal generalisation about what features all members of the sex category possess would be wrong. The fact that the statistical majority of women have sexual characteristics that are endogenously produced does not entail that all women must have sexual characteristics that are endogenously produced.

Another implication of the HPC model is that it suggests that sex is mutable. Recall that the homeostatic causal mechanisms that hold properties together in clusters are dynamic and contingent. Accordingly, the clusters of properties can change if these mechanisms are modified. For example, the medical practice of altering the sexual characteristics of intersex infants to assign them male or female sexes depends on these clusters of properties being mutable (Lee et al., 2006). This is a contentious practice that has been criticised for violating the rights of intersex people to make decisions about their own bodies and for reinforcing heteronormative assumptions about what gendered characteristics are deemed acceptable or unacceptable in society (Clune-Taylor, 2019). Nonetheless, the practice does underscore the ways in which the clusters of properties associated with sex are contingent and mutable, as it shows how people can, through medical interventions, acquire sexual characteristics that they would not have otherwise acquired.

The effects of gender affirming treatment for trans people also demonstrate such contingency and mutability. Hormonal interventions result in profound changes in the homeostatic causal mechanisms that hold various physiological and anatomical properties together, which in turn bring about substantial changes in these clusters of properties. Accordingly, as noted above, trans women develop many of the same anatomical, physiological, metabolic properties as cis women, and trans men develop many of the same anatomical, physiological, metabolic properties as cis men (Antun et al., 2020; Fabris et al., 2015; Parikh et al., 2020; White, 2021). Gender affirmation surgery is also often guided by considerations about conserving the embryonic equivalents between female and male genitals, and so to some extent draws on the developmental mutability of the external reproductive system (Gupta, 2018).

And so, the HPC theory offers a philosophical model that accommodates the complexity of classifying biological sex across different contexts. To be clear, the purpose here is not to supply a theory of trans identity. As noted earlier, I wholly agree with Bettcher (2009) that whether one is a man, a woman, or nonbinary is ultimately determined by one's first-person authority over one's gender identity, rather than by a set of biological criteria. Hence, the properties in the clusters should not be taken to define manhood or womanhood. Rather, the purpose of the HPC cluster model here is to underscore how the complexity of sex classification discredits the gender critical commentators' claims about biological sex. For example, the implications of vagueness, complexity, polysemy, and mutability show that the claims about sex being exclusively binary and immutable are false.

Given the issues of vagueness and polysemy, the HPC model itself does not prescribe how many categories we should model, which characteristics we should take to be salient, or how we should draw the boundaries between the categories. These need to be negotiated relative to our purposes. Nonetheless, by recognising that sex classification is interest relative, the HPC model paves the way for further ameliorative inquiry into which features of sex are relevant to our aims (Haslanger, 2012). This is especially significant in the current political context, where the concept of biological sex is frequently invoked in debates and policies about the social and legal rights of trans people (Pearce *et al.*, 2020). Furthermore, the HPC model is wholly compatible with realism regarding sex, insofar as it recognises that the properties relevant to sex classification are genuine properties possessed by people. However, it also acknowledges that the ways in which we model these properties are informed by our values, interests, and purposes. Therefore, acknowledging the inadequacy of the essentialist model does not amount to an ‘outright denial of biological sex’ (Wright & Hilton, 2020).

### **Conclusion**

Gender critical commentators often suggest that whether a person is a woman or a man is determined by an essentialist conception of biological sex. In recent political discourse, this line of argument has been weaponised to oppose gender affirmation for trans people, as shown by the backlash against the proposed reform of the Gender Recognition Act 2004 in the United Kingdom. Herein, I have showed that the gender critical argument is unsound because the essentialist model of sex classification it assumes is untenable beyond a very restricted technical domain. Instead, I have showed that the complexity of sex classification is more accurately captured by a HPC model, which underscores the contingency, vagueness, polysemy, and mutability of sex categories.

Indeed, it is doubtful whether the discussion about gender affirmation should hinge on a theoretical account of biological sex rather than on basic respect for one’s autonomy over one’s gender identity. Such a focus on ontology tends to distract from the ethical and political issues that are truly relevant, while also having the further consequence of excluding intersex people. Despite this, however, gender critical commentators continue to centre their criticisms of gender affirmation around an essentialist model of biological sex. Given that these criticisms have not been confined to the intellectual sphere but have influenced social policy, public attitudes, and media narratives concerning trans people, there is a need to challenge them directly. Accordingly, the philosophical analysis I have provided offers a resource to debunk the claims of gender critical commentators. It illustrates that a scientifically informed understanding of biological sex does not in any way undermine gender affirmation for trans people.

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