



# Objectivity and orgasm: the perils of imprecise definitions

Samantha Wakil<sup>1</sup>

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## Abstract

Lloyd (The case of the female orgasm: bias in the science of evolution, Harvard University Press, Harvard, 2005) analyzes every proposed evolutionary explanation of female orgasm and argues that all but one suffers from serious evidential errors. Lloyd attributes these errors to two main biases: androcentrism and adaptationism. This paper begins by arguing that the explanation Lloyd favors—the by-product account—is guilty of the androcentrism which supposedly implicates the other explanations of female orgasm with numerous evidential discrepancies. This suggests that there is another error afflicting orgasm research in addition to the biases Lloyd identifies. I attempt to diagnose and characterize this additional error. In short, I think the error is using an imprecise definition of the trait in question. Further, Lloyd takes her analysis to support Longino's (Science as social knowledge: values and objectivity in scientific inquiry, Princeton University Press, Princeton, 1990) contextual empiricist model of scientific objectivity. I consider what implications this analysis has for contextual empiricism. Finally, I argue that theorizing about female orgasm should be done from a conceptual engineering approach.

**Keywords** Scientific objectivity · Contextual empiricism · Female orgasm · Evolutionary biology · Conceptual engineering · Carnapian explication · Biological traits

## 1 Introduction

Science is often given a special—privileged—status over other forms of inquiry. Presumably, it is the success of scientific methods which justifies the intellectual authority of the scientific community and supports the claim that science can accurately describe, discover, and underwrite knowledge about the natural world. Many have claimed it is the objective character of scientific reasoning that is responsible for its incomparable

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✉ Samantha Wakil  
Swakil@live.unc.edu

<sup>1</sup> The University of North Carolina at Chapel Hill, Chapel Hill, USA

epistemic success (Jeffrey 1956; Popper 1959, 1972; Levi 1960; Carnap 1967; Betz 2013). One way of characterizing scientific objectivity is to say that the methods and results are free of any individual or community-wide values, biases, or personal interests. But the fact that scientific research is a human activity threatens to undermine this idea and any associated concept of objectivity. Historical and recent analyses of scientific practice show that contextual values and bias can, and often do, impact both the theoretical and experimental aspects of research.<sup>1</sup> (Rudner 1953; Kuhn 1962; Longino 1990; Douglas 2009; Rollin 2015; Zahle 2018).

To save scientific objectivity, Longino (1990) defends a view that embraces contextual values within scientific practice. Aptly called ‘Contextual Empiricism’ the view is based on a social epistemology; it assumes that scientific knowledge is a social process *and* product. On this view, science is considered objective to the degree the scientific community engages in transformative criticism which requires ‘intersubjective interactions’ amongst scientists. These interactions are what facilitates the transformation of the subjective into the objective, enabling the scientific community to form a consensus on what qualifies and is incorporated into the body of scientific knowledge. Importantly, failure to adequately engage in intersubjective interactions often results in faulty science. The criteria Longino specifies for effective intersubjective interactions will be discussed in Sect. 5. But first, I will analyze one of the most well-known examples of contextual values negatively impacting scientific research: the case of the female orgasm. In particular, I will be addressing the question of how orgasm is defined.

Elizabeth Lloyd’s now-famous (2005) analysis exposed how androcentric and adaptationist biases have misled biologists investigating the evolutionary origins of human female orgasm. Out of the 21 explanations on offer, Lloyd claims only one is empirically adequate.<sup>2</sup> The explanation Lloyd favors is the by-product account originally proposed by evolutionary anthropologist Donald Symons (1979). However, an interesting historical analysis about different uses of the term ‘homology’ reveals that the by-product account, as described by Symons, is guilty of the androcentrism Lloyd criticizes other explanations for having. Section two summarizes Lloyd’s critique of research on female orgasm. Then section three demonstrates how Symons’s description of the by-product account is androcentric, according to Lloyd’s definition of androcentrism.

The outcome of section three raises an interesting question: If Symons’s by-product account is androcentric, yet it is the most empirically adequate explanation, is there something else going on in the case of the female orgasm? Sect. 4 teases apart the various ways orgasm is defined and takes this variance as the basis for furthering the analysis of research methods in investigating the origins of female orgasm. I illustrate how failing to use a precise definition of the target phenomena is correlated with theories having serious evidential discrepancies and the biases Lloyd has already

<sup>1</sup> Contextual values (also sometimes called ‘non-cognitive’ values) are moral, personal, social, political, and cultural values that supposedly conflict with the so-called ‘cognitive’ or ‘epistemic’ values typically used to characterize scientific reasoning. See chapters four and five in Longino (1990).

<sup>2</sup> Broadly construed, empirically adequate means that the content of a theory or explanation is in agreement with the data. For a more technical definition of empirical adequacy see van Fraassen (1980).

correctly identified.<sup>3</sup> This suggests that proper precisification of the trait in question is another crucial factor in producing empirically adequate science, and thus warrants more philosophical attention than has currently been given. Section 5 examines the implications of this analysis for the concept of scientific objectivity and specifically, the Contextual Empiricist model. I end by arguing that future philosophical research on female orgasm should be considered a project of conceptual engineering.

## 2 Bias and female orgasm: adaptationism and androcentrism

Lloyd argues that adaptationism is the most destructive bias in evolutionary accounts of female orgasm and it is the most prominent shared assumption across the proposed explanations. Adaptationist explanations assume the presence of the female orgasm trait is due to its being naturally selected for. The most common type of adaptationist explanations are ‘pair-bonding’ accounts; 11 out of the 21 proposed evolutionary explanations take this form. The hypothesis is that orgasm helps ensure a monogamous relationship with a sexual partner. Monogamy could—theoretically—provide many reproductive advantages like ensuring bi-parental care and securing scarce resources. Consequently, these explanations claim orgasm helps create pair-bonds which in turn motivates individuals to have intercourse with the same person.

The evidential discrepancy with pair-bonding accounts is the significant gap between the occurrence of intercourse and the occurrence of orgasm.<sup>4</sup> An average of 37 studies examining the frequency between intercourse and orgasm indicates only 20% of women reliably orgasm with intercourse (Lloyd 2005, 2015). Orgasm is much more common during self-masturbation and homosexual sex acts making its adaptive value for reproductive sex dubious (Garcia et al. 2014).

In response to the negative frequency between intercourse and orgasm, several sperm competition explanations have been proposed. Most notably is the ‘up-suck’ hypothesis which claims that orgasm creates a sucking mechanism within the uterus that helps propel sperm into the reproductive tract, which supposedly increases the chance of fertilization. There are several problems with the up-suck hypothesis. First, there is no evidence that orgasm increases the probability of conceiving and there is no association between orgasm and number of offspring (Zietsch and Santtila 2013). Second, the evidence that there is a sucking-like mechanism is at best equivocal. The up-suck hypothesis predicts that there would be an increase in pressure in the uterus, but some studies have recorded a reduction in uterine pressure after orgasm (See chapter seven in Lloyd 2005). Finally, while fertility is necessary for reproductive success, reproductive success depends on more than merely the ability to get pregnant.<sup>5</sup> Trade-offs between the number and quality of offspring, and between adult reproductive

<sup>3</sup> An evidential discrepancy is an incompatibility between the theory or explanation and the data.

<sup>4</sup> Of course, a present gap between orgasm and intercourse does not establish that there was a gap in the evolutionary past when the adaptation supposedly evolved. Adaptations are a historical concept, not to be confused with current utility. A selective history might account for a trait’s existence in the population without being currently adaptive. (Sober 2000, 85–86).

<sup>5</sup> While I agree with Lloyd on this conceptual point, the latter (reproductive success) necessarily depends on the former. Therefore, the focus on *fertility* specifically wouldn’t appear to be a baseless starting point.

effort and mortality, are constantly occurring. Additionally, the costs and benefits of such trade-offs are not fixed and vary significantly in response to changing environmental factors. The sperm competition explanations on offer fail to even consider these ecological and evolutionary complexities.

The other bias that Lloyd argues has beset biologists is androcentrism. Following Longino (1990), Lloyd defines androcentrism as viewing things from an exclusively male perspective. Androcentrism is exemplified in two ways regarding female orgasm research. First, that female sexuality is analogous to male sexuality. This means assuming males and females have the same physiological and psychological sexual responses. Second, that female sexuality is tied to reproduction. In other words, that procreative—i.e. heterosexual vaginal intercourse—is the only evolutionarily significant type of sex. Lloyd argues that both these assumptions should be rejected (See chapter eight in Lloyd 2005). Unsurprisingly, the adaptationist and androcentric biases often appear together. For example, one hypothesis suggested that the function of female orgasm is to communicate sexual satisfaction to a male. The male's ability to identify female orgasm stems from female orgasm resembling male orgasm, and the communication of sexual satisfaction is supposedly adaptive because it could protect the female from violent retaliation of her male partner who suspected infidelity: "Men had to be sure that their females were going to be faithful to them when they left them alone to go hunting." (Morris 1967, p. 64).

This explanation flies in the face of the available evidence. Compared to females who do not show any or much sexual excitement, females who show more excitement or orgasm easier tend to have a statistically significant greater number of sexual partners (Wolfe 1979). Additionally, several studies report large success in women faking orgasms, calling into question males' ability to recognize when females orgasm (Hamilton 1929; Thornhill et al. 1995). Finally, cross-cultural studies indicate that most men are not concerned with female sexual satisfaction at all (Davenport 1977).

### 3 The by-product account

According to Lloyd, the by-product account is the most evidentially supported evolutionary explanation of female orgasm. Originally proposed by Donald Symons (1969), this account posits that females have the potential to orgasm because of the strong selection on males to orgasm and their shared embryologic origins. Orgasm is necessary for male reproductive success as the contractile pulses serve as the sperm-delivery system. Thus, there is strong selective pressure for the materials needed in male orgasm development. Interestingly, the tissues and muscle fibers associated with orgasm develop in the embryo before the respective sex organs gain their distinctive features. During the first 8 weeks of development male and female embryos have no differentiating characteristics except for the chromosomes. If the embryo is male, after 8 weeks of gestation there is a release of hormones that triggers the development of male sexual apparatuses and female sexual organs develop otherwise.<sup>6</sup>

<sup>6</sup> The male nipple is a well-known and analogous example. There is a strong selection pressure for female nipples in mammals due to its reproductive necessity in feeding offspring and male mammals acquire nipples through the same early embryological form with females. (See Symons 1979).

One piece of evidence supporting this explanation is that the penis and clitoris appear to be homologous organs. There is a shared organ between male and female embryos that only develops into the respective sex organs after the dose of hormones it receives at the 8-week gestation period. The clitoris and penis have the same erectile tissue, nervous tissue, and muscle fibers which are involved in sensing sexual excitement and producing genital contractions. Lloyd also points out that the by-product account fits with data regarding masturbation techniques amongst women (which rarely includes penetration) and the infrequency of orgasm with heterosexual intercourse. As mentioned before, this same data seems to be inconsistent with evolutionary explanations that assume female orgasm is related to the potentially reproductive aspect of heterosexual intercourse.

Furthermore, it follows from adaptive accounts that males should be incentivized to choose females who can easily orgasm or prioritize making their mate orgasm. But cross-cultural evidence suggests that in typical communities “men take the initiative and, without extended foreplay, proceed vigorously towards climax without much regard for achieving synchrony with the women’s orgasm...coitus is primarily completed in terms of the man’s passions and pleasures, with scant attention paid to women’s response. If women do experience orgasm, they do so passively.” (Davenport 1977, p. 149; quoted in Lloyd 2005). Finally, of the few nonhuman primate species that appear to orgasm, the orgasms most frequently occur during self-masturbatory or homosexual sex acts. Thus, no evidence suggests orgasm has a reproductive role in female primates.<sup>7</sup>

According to Lloyd, the upshot is that the byproduct account does not share the background assumptions which seem to have implicated the other accounts with serious evidential problems. It does not assume the female orgasm is an adaptation, leading scientists to generate procreative hypotheses. Nor does it assume androcentrism, motivating hypotheses based on the false idea that female sexual response is completely analogous to male sexual response. Out of all 21 evolutionary explanations for the female orgasm, Lloyd claims the by-product account is the most empirically supported; it fits with the individual behavioral and cross-cultural evidence in humans and the nonhuman evidence available. Lloyd concludes that:

There is a direct tie between making these background assumptions and making the specific evidential errors that I have detailed...when it comes to explanations of female orgasm. (2005, p. 256)

Despite the depth of Lloyd’s analysis and my agreement that the by-product account is the most empirically adequate explanation, there is a potential discrepancy. Lloyd defends a developmental biology version of the by-product account originally proposed by Donald Symons (1967). But, as the next section will show, Symons’s by-product explanation seems to possess the same androcentric bias that is partially responsible for the evidential errors of the competing theories that Lloyd rejects.

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<sup>7</sup> See chapter five in Lloyd 2005 for a complete presentation of the evidence supporting the by-product account.

### 3.1 Two definitions of homology

The by-product account of female orgasm is based on the concept of homology. The standard notion of homology in evolutionary biology refers to the divergent development of structures or processes from a common origin. It is clear Lloyd has this developmental definition in mind. In support of the by-product account, she says “The penis and clitoris have the same embryological origins and are thus called ‘homologous’ organs.” (Lloyd 2005, p. 108). But there is a different way of defining homology. Crucially, this alternative definition is the one operative in Symons’s (1967) by-product explanation which Lloyd explicates and defends.

An interesting historical analysis by Lee (2013) reveals that Symons used a non-developmental concept of homology based on congruence between genetic sex and behavioral sex. According to which there are distinct male and female sexual behavior patterns. For example, “mounting” is supposedly a male-specific behavior. On Symons’s view, behaviors that match the genetic sex of the individual displaying it are “homologous” while behaviors that match the opposite genetic sex are “heterologous”. These two definitions of homology lend themselves to radically different interpretations of the potential for females to orgasm. On the developmental reading, it merely refers to the shared prenatal tissues that develop into either a penis or clitoris, supplying females with the physiological materials required for orgasm. But, on Symons’s idiosyncratic definition it refers to the potential for an individual to have both male and female behavior patterns.<sup>8</sup> According to Symons, the adaptiveness of male orgasm makes it a specifically male sexual behavior. As Lee explains, for Symons

Orgasm is an adaptive part of the male response, and so is a typically male trait. This trait is based on a mechanism in the brain. As with mating patterns, this mechanism is wired into the brains of individuals of both sexes. Whereas the expression of the mechanism in males is ‘homologous’ ... because the behavior matches the genotypic sex, in females it is ‘heterologous’, because it does not match. (Lee 2013, p. 1025)

So, on Symons’s view orgasm is considered a distinctively male behavior, and thus females who orgasm are behaving like a male. Lee concludes that according to Symons

A female experiencing an orgasm during heterosexual intercourse is exhibiting ‘bisexuality’, because her mating response to a male is a female behavior, whereas her orgasm is a male behavior. Her behavior is male and female at the same time. (Lee 2013, p. 1025)

Symons’s definition of homology—by claiming orgasm is a distinctly male trait and using male orgasm as the proxy for characterizing female orgasm—is dripping with the androcentrism Lloyd defines as “not treating female sexuality as autonomous from male sexuality or male reproduction.” (2005, p. 236) and “assuming females’ response is like male’s response” (2005, p. 237). Of course, there is new evidence available that demonstrates how Symons’s androcentric characterization is not empirically adequate. Here are just a few ways in which female orgasm is distinct physiologically and

<sup>8</sup> For the details of Symons’s argument see pages 92–94 in Symons (1979).

psychologically from males: First, females have the capacity for multiple orgasms (Tuana 2004). Second, females' variability in their ability to orgasm is anatomically distinct from males. The distance between a female's clitoris and the urethral meatus is correlated with the reliability of orgasm through intercourse; the shorter the distance the higher the likelihood of orgasm (Wallen and Lloyd 2011). Finally, female orgasm varies by sexual orientation. Compared to heterosexual and bisexual women, lesbian women have a significantly higher probability of experiencing orgasm. This correlation between orgasm and sexual orientation is not present in males (Garcia et al. 2014).

Although there is evidence that could help adjudicate Symons' androcentric definition from the standard one the crucial point remains: if we hold fixed what is common between the two interpretations, then intervening on the androcentric bias won't have any effect on the core hypothesis that females have the potential to orgasm in virtue of selection for male orgasm. That is, the available evidence supports the by-product *explanation* whether it appeals to the standard developmental characterization of homology or Symons's androcentric definition. So, is there something else going on in the case of female orgasm in addition to the biases Lloyd's identified?

Early in the book Lloyd makes a passing claim which, I think, contains a potential answer, "...orgasm is a significant and crudely quantifiable aspect of sexual response that has caught the attention of evolutionists." (Lloyd 2005, p. 23). It is the 'crudely quantifiable' bit that I think has understated importance. I hypothesize that the lack of a precise definition of 'orgasm' has been (and still is) a primary obstacle for this research domain. I also suspect that there is a connection between this error and the biases Lloyd has uncovered. The plausibility of this hypothesis is what we will consider next.

It is important to clarify before moving on that when I refer to the definition of orgasm, I am not making any claims about what the ordinary everyday notion of orgasm is, means, or refers to. The concern here is with the way statements about the explanandum are characterized. The starting place for any evolutionary inquiry requires getting as clear as possible on what exactly it is we are trying to explain, and for the sake of generating testable hypotheses and critical predictions, this must involve specifying measurable features of the trait in question (Sober 1999). Lloyd appears to agree with this point, stating that for her purposes she will "stick to the relatively reductionistic biological descriptions...the evolution of the reflex loop described and its physiological aspects...[because] it is the most useful for cross-comparison of evolutionary explanations, many of which focus on the orgasm under its narrow biological description, especially in nonhuman primates." (Lloyd 2005, p. 23). The problem is that the ordinary concept of orgasm is too elusive to meet these criteria, yet it has been featured in many of the prominent scientific accounts of female orgasm that Lloyd criticizes. The next section will illustrate the different ways orgasm has been defined and show how more precise characterizations of the trait have contributed to recent progress in orgasm research.

## 4 What *exactly* is an orgasm?

Canvassing the relevant literature immediately reveals the obvious lack of an explicit definition.<sup>9</sup> What exists is a mishmash of physiological, behavioral, and phenomenological descriptors: "the mounting of tension and peak of sexual response." (Bancroft 1989 p. 81); a "Climax of intense feeling followed by a feeling of relief and relaxation." (Wallin 1960); "Reflexive clonic contractions of pelvic/abdominal muscle groups." (Mould 1980); a "Stretchreflex release of genitopelvic muscular vasocongestion" (Sherfey 1973); and my favorite "a capacity to surrender to the flow of biological energy." (Reich 1973)<sup>10</sup> Despite the staggering multitude of characterizations, I think the various definitions of female orgasm can be taxonomized under two broad categories: classificatory and quantitative. I am borrowing this terminology from Carnap's classification scheme for the explication of empirical concepts.<sup>11</sup> Explication is a tool for transforming or replacing imprecise concepts with new more exact concepts. There are three categories: classificatory, comparative, and quantitative. Quantitative is the most precise, classificatory the least (Carnap 1950).

Classificatory definitions identify orgasm as a particular point during sexual activity. The most widely used model of the sexual response cycle is Masters and Johnson's four-stage model (1966). The four stages are excitement, plateau, orgasm, and resolution. Orgasm is a classificatory concept on this model because it merely picks out a specific stage in the sex cycle. The classificatory notion can easily be contrasted with a quantitative concept of orgasm. By using an insertable device that combines photoplethysmograph (blood-flow sensor) and electromyography (muscle activity sensor) researchers can directly measure the pressure, pattern, and duration of pelvic and genital contractions during sexual activity (Prause 2012). Additionally, the levels of various hormones like prolactin can be measured and used to characterize orgasm (Pavlicev and Wagner 2016; Pavličev et al. 2019).

The distinction between classificatory and quantitative definitions is important because it reveals a new aspect of the case study that was otherwise undetectable. Curiously, there seems to be a strong correlation between the explanations Lloyd critiques and the type of definition of orgasm used: the most empirically inadequate theories use a classificatory definition while the most empirically supported appeal to a more precise—partially quantified—definition. This trend is easily seen by looking at the table Lloyd provides to summarize the results of her analysis (see Fig. 1).

More specifically, all of the studies that have 4 or more of the problems Lloyd identifies either do not define orgasm at all or appeal to the Masters and Johnson

<sup>9</sup> There are two potential problems here. First is the plurality of definitions and second the imprecision of the various definitions. I am only identifying the latter as a potential problem. It's also worth noting that precision should not be misconstrued with accuracy. As the conceptual engineering conclusion will make clear, the purpose of precision is not to accurately describe a natural kind (if one thinks of biological traits as natural kinds).

<sup>10</sup> For more definitions of orgasm see Mah and Binik (2001); Meston et al (2004); and Komisaruk et al (2006). Notably, Mah and Binik document almost 30 different definitions of orgasm.

<sup>11</sup> The use of explication for concept determination in the philosophy of science has been advocated for before by Justus (2012).

Author	Female orgasm only in intercourse	Intercourse = orgasm	Conflict/ no support sex research	Female response like male's	Ancestral response dictated by hormones	Conflicts with evidence in nonhuman primates	Orgasm = adaptation
Morris	✓	✓	✓	✓	✓	✓	✓
Gallup and Suarez	✓	(✓)	✓	✓		✓	✓
Pugh	✓	(✓)					✓
Crook	✓	✓				✓	✓
Newton	✓	✓					✓
Eibl-Eibesfeldt	✓	(✓)			(✓)		✓
Barash	✓	✓			✓	✓	✓
Campbell	✓	✓	✓		✓	✓	✓
Beach	✓	✓	✓		✓	✓	✓
Hamburg	✓					✓	✓
Rancour-Laferriere	✓				✓		✓
Alcock	✓		✓				✓
Allen and Lemmon	✓	✓	✓				✓
Bernds and Barash	✓		✓				✓
Alexander and Noonan	✓	✓	✓	✓			✓
Diamond	✓						✓
Sherfey	✓	✓	✓				✓
Hrdy	✓		✓				✓

Fig. 1 Originally printed in Lloyd (2005, p. 104). The (✓) indicate arguable cases

classificatory notion.<sup>12</sup> Ironically one of these studies explicitly acknowledges a problem with the definition of the trait, “rapidly increasing precision and sophistication in endocrinological and neuroendocrinological techniques have *not been accompanied by comparable advances in the definition and measurement* of behavioral variables.” (Beach 1976, p. 105; my emphasis). This correlation suggests there might be a connection between the biases Lloyd has identified and the type of definition (or lack thereof) used. How exactly these biases and the definition of orgasm could interact is

<sup>12</sup> For the reader’s ease, here is the list of those in the table that do not define orgasm or use Masters and Johnson’s model: Morris, Gallup and Suarez, Crook, Eibl-Eibesfeldt, Barash, Campbell, Beach, Allen and Lemmon, Alexander and Noonan, and Sherfey. That is 11 out of the 18 accounts listed in the chart.

an interesting question. There are several possibilities. First, it could be that having an imprecise definition is what enables certain biases to infiltrate a research area. Or, perhaps it is the biases that are responsible for researchers failing to precisely define the target phenomena. Another option is that the two are not related at all. It could be that the presence of bias and an imprecise definition are joint effects of a different feature that all severely empirically inadequate explanations share.

My hypothesis is a fourth possibility, that the interaction goes both ways. That is, there is a reciprocal relationship between the biases and type of definition used in scientific theorizing.<sup>13</sup> It's plausible that how a trait is defined might influence the presence or absence of biases in the proposed explanations of the respective trait. If we begin by defining orgasm in a distinctly female way, then perhaps researchers will be less likely to assume that male and female sexual responses are analogous. For example, conceptualizing orgasm by a surge of prolactin might mitigate the development of androcentric explanations because of the known reproductive function of prolactin in females that is absent in males.

Similarly, the presence of bias could influence how the trait itself is characterized. Take for example Gallup and Suarez's (1983) explanation for female orgasm. Based on the intuitive (but false) idea that the ability for sperm to reach the cervix would be threatened by gravity if a female were positioned upright, they proposed that the function of female orgasm is to keep them lying down after a male ejaculates to increase the probability of conceiving. Their explanation is predicated on an observed 'sedative effect' following orgasm, and their reference for this phenomenon is Masters and Johnson's work on the sexual cycle. Recall that on this model orgasm is a classificatory (i.e. imprecise) concept. Crucially, Gallup and Suarez argue that their explanation is supported by data showing that "the average individual requires about five minutes of repose before returning to a normal state after orgasm." (1983, p. 195) However, Lloyd points out that the citation for this statistic is Kinsey et al (1948), a study that contained trials *only* on males' post-orgasm response. This makes it clear Gallup and Suarez assumed female orgasm response is the same as males, which in turn influenced how they characterized female orgasm by the supposed sedative effect it produces.<sup>14</sup>

I take these two examples to demonstrate *prima facie* plausibility to the idea that there is a relationship between the biases picked out by Lloyd and the error I am identifying. Further investigation into this connection could provide new insights about scientific practice and methodology, which suggests a promising new avenue for future research. Accordingly, it's worth noting why imprecise concepts can be problematic, and thus how failing to use a precise concept could constitute a methodological error.<sup>15</sup>

<sup>13</sup> The idea of reciprocal causation is also found in recent literature on scientific progress. For example, in a paper about the pure vs applied science dichotomy Douglas (2014, 62) explains that "The history of science reveals attempts at application as providing theoretical breakthroughs and theoretical work as providing new modes of application. The linear model has been decisively rejected as descriptively inaccurate."

<sup>14</sup> In fact, women are typically in a higher state of arousal and restlessness directly after orgasm. Women are also more likely to orgasm when 'on top', regardless of when or if their partner orgasms. (See chapter three in Lloyd 2005).

<sup>15</sup> Enhancing precision is usually beneficial in empirical sciences (see Sect. 4.1). But it is worth noting that increases in precision are not always fruitful. Sometimes even a decrease in precision may be warranted depending on the field of inquiry and the phenomena being studied. For examples, see Carnap (1950) and Justus (2012).

## 4.1 The perils of imprecision

The concern with imprecise concepts is their poor track record in the production of successful scientific theories. The history of science indicates that vague concepts like ‘germ’, ‘life’, ‘substance’, ‘essence’, ‘aura’, and ‘life-force’ are rarely components of substantive well-confirmed generalizations. (Justus 2012) On the other hand, enhancing precision typically facilitates “increasing experimental testability, measurability in the field, theoretical unification, mathematical rigor, etc.” (Justus 2012, p. 162). This seems especially true in the case of orgasm research. Prause (2012) highlights the limitations of what I’m calling a classificatory definition of orgasm. Most studies she notes “commonly describe orgasm as a ‘peak sensation of intense pleasure’ without citation...which should be attributed to a lack of evidence to cite.” (Ibid. 7) Further, the limited data collected from studies which use a classificatory definition rely on self-reports, but “self-reports are of unusually limited utility in the study of female orgasm... many women are unsure whether they even experience orgasms... it also appears difficult or impossible for women to identify sites of orgasm stimulation reliably.” (Ibid., 8) Given these limitations, Prause (Ibid., 8) reasonably concludes that

Studies should include other measures of orgasm in addition to self-report whenever possible... studying physiological responses warrants inclusion of physiological measures... A number of methods are available...It is surprising these have not been used.

In addition to the general concern about empirical tractability, a focus on precision seems warranted given that studies which made some increase in precision are partially responsible for establishing the assumption that male and female sexual responses are *completely* analogous is indefensible. For example, by using fMRI techniques Wise et al. (2017) were able to definitively illustrate differences in brain activity of females during orgasm compared to males (See also Stoleru et al. 2012). Finally, and complementary to this last point, there is a new theory about the origin of female orgasm which begins by emphasizing how vague definitions of the trait have confounded researchers. Importantly, their theory (which while tentative seems to have positive evidential support) uses a very precise and measurable conception of orgasm.

Pavlicev and Wagner (2016) propose a new explanation about the evolution of female orgasm and they start by making a targeted criticism against the current explanations on offer, including the by-product account. They complain that the competing explanations all appeal to evidence from current human biology and that this evidence is relevant to the modification of the trait, not its evolutionary origin. Tracing the evolutionary history of the trait requires identifying its homolog in other species and researchers investigating human female orgasm have failed to do so thus far. Crucially, they note a problem with the way orgasm is usually defined. “Human orgasm is often described as a climax, followed by a sudden discharge of sexual arousal. Defined this way, the presence of female orgasm is hard to establish with certainty beyond primates, and hence little has been found about its distribution.” (2016, p. 327).

Instead, they propose to describe orgasm specifically by a neuroendocrine discharge, in particular, a surge of prolactin. Pavlicev and Wagner argue that this surge

may reveal the homolog of human female orgasm as it occurs in many other mammals and is a measurable trait across species. They reason that

The surge serves a range of important but variable reproductive functions across mammals, [and] may have become modified to what we understand as female orgasm in humans, as its ancestral reproductive function became less important or obsolete. (2016, p. 327).

More specifically, they hypothesize that the ancestral reproductive role preceding human female orgasm was that orgasm would induce ovulation. This is in fact what the phylogenetic evidence and comparative anatomy suggest. Not only is spontaneous ovulation derived within placental mammals post the evolution of copulation and environmentally induced ovulation, but the evolution of spontaneous ovulation is correlated with an increasing distance of the clitoris from the vaginal canal across mammal species. Furthermore, the ovulatory homolog hypothesis makes certain testable predictions. For example, the model predicts that medications that affect human orgasm should affect the ovulation of other mammals with copulation-induced orgasms. This prediction has been borne out in recent experimental tests (Pavličev et al. 2019). It's important to note that this new explanation is not an alternative to the by-product account, which pertains to human females specifically. Viewing the ovulatory homolog hypothesis as incompatible with the by-product account would be to confuse two distinct questions: (1) what is the origin of a trait? And (2) what explains its continued existence? (Sober 2000) Pavlicev and Wagner's explanation pertains to the evolution of female orgasm in human's ancestors; the by-product account explains the continued existence and variation of the orgasm trait in female humans.<sup>16</sup> By conceptualizing female orgasm endocrinologically using hormonal measures, Pavlicev and Wagner were able to study orgasm in a way that has potentially provided a more comprehensive understanding of the phenomena and its origins. The takeaway here is that tremendous epistemic progress has been made in this research domain by precisifying the trait's characterization. Accordingly, though the hypothesized connection between the type of definition and the biases Lloyd identified remains speculative, the considerations of this last section establish independent reasons for giving more philosophical attention towards the variety of ways biological traits can be characterized.

## 5 Contextual empiricism

As mentioned in the introduction, Lloyd takes the case of the female orgasm to support the Contextual Empiricist model of scientific objectivity. Lloyd claims her analysis supports Contextual Empiricism in two ways. The first is descriptive, as Lloyd explains how she utilized Contextual Empiricism as a diagnostic tool for analyzing what went wrong in the female orgasm case study. The second is normative, Lloyd claims that researchers *should* have used Longino's model, and she speculates that it was less likely researchers would have made so many errors had they adhered to

<sup>16</sup> This also suggests that Pavlicev and Wagner should not include the by-product account in their general critique; as it is a current stabilizing selection explanation, not an explanation about the ancient evolutionary past. Thanks to an anonymous reviewer for highlighting this implication.

the Contextual Empiricist approach. In light of the close connection between Lloyd and Longino's views, it is worth considering what implications this analysis has for Contextual Empiricism.

Longino critiques other models of objectivity—like Kuhn 1962; Kitcher 1993; Soloman 1995, 2001; Alvin Goldman 1995—for ignoring the very process that generates scientific knowledge (Longino 1990, 2002). Longino claims that science can be considered objective “to the degree that it permits transformative criticism.” (1990, p. 76). Transformative criticism is achieved through intersubjective interactions and Longino specifies four evaluative criteria for such interactions (1990, p. 76):

- 1 *Avenues of criticism* public forums to criticize evidence, methods, assumptions, and reasoning.
- 2 *Uptake of criticism* theories and beliefs must change over time as a result of critical discourse.
- 3 *Shared standards* publicly recognized standards used to evaluate theories, observations, and hypotheses.
- 4 *Equality of intellectual authority* The consensus of the community must result from critical dialogue where all relevant perspectives are represented.

There have been several criticisms made against Contextual Empiricism, and it appears that these various critiques all find their grip because the four criteria are underspecified. For instance, Reiss and Sprenger complain that “The condition of equality of intellectual requires only ‘qualified’ practitioners to equally share authority—but who qualifies as ‘qualified’?” (2017, p. 16). Relatedly, Solomon and Richardson claim Contextual Empiricism lacks a naturalistic justification, “Longino rests with presenting her standards as ‘intuitively reasonable’ which is unsatisfactory because of intuitions’ poor track record in philosophy of science.” (2005, p. 213). Finally, Kitcher contends that we are left with an unjustifiably strong pluralism, “Longino goes beyond the modest view that the bits of nature we try to represent accurately are a function of us, our capacities and our interests... she wants to allow for the acceptability of representations that are ‘hard to reconcile’—presumably in ways that the adequacy of different maps [] are not. Utter mystery descends at this point.” (2002, p. 555).

I won't attempt a full defense of Contextual Empiricism against each of these objections.<sup>17</sup> But I want to suggest that the analysis presented here helps alleviate some of these concerns by providing *some* of the wanting specifications. To see how, focus on the third requirement of shared standards. This requirement is particularly important because it appears to be in tension with the requirements of ‘uptake of criticism’ and ‘equality of intellectual authority’, making the model susceptible to the charge of relativism (Intemann 2008; Kourany 2005). Relativism is a particularly crucial objection because it suggests that the shared standards will be dogmatically adopted and defended (Crasnow 2003). Admittedly, on Contextual Empiricism's original formulation what exactly should constitute the shared standards is unclear. Longino introduces this criterion the following way:

In order for criticism to be relevant to a position it must appeal to something accepted by those who hold the position criticized. Similarly, alternative theories

<sup>17</sup> See Rollin (2011) for a complete defense against these objections.

must be perceived to have some bearing on the concerns of a scientific community in order to obtain a hearing. This cannot occur at the whim of individual but must be a function of public standards or criteria to which members of the scientific community are to feel themselves bound. These standards can include both substantive principles and epistemic, as well as social, values. (1990, p. 77)

Longino further explains that the shared standards are supposed to serve as ideals that regulate normative discourse: “Participants in a dialogue must share some referring terms, some principles of inference, and some value or aims to be served by the shared activity of discursive interaction.” (Longino 2002, p. 130). Previously, Longino took the traditional Kuhnian theoretical virtues like simplicity, unification, and explanatory power, as obviously belonging to the set of shared standards. However, Longino (1996) later denies these cognitive values typically thought to be part of the shared standards are always reliably truth conducive. Through a series of compelling examples, Longino demonstrates how in certain contexts other values like novelty, ontological heterogeneity, mutuality of interaction, diffusion of power, and applicability to human needs are more truth conducive than the Kuhnian alternatives. She concludes by proposing to add the aforementioned values to the list of shared standards so that they can be contextually adopted.

As the critiques mentioned before correctly highlight, such a radical pluralism *might* leave the view normatively impotent. Although Longino is a card-carrying empiricist, the flexibility at the heart of her view leaves those seeking a more robust and stringent account unsatisfied. Even when it comes to empirical adequacy Longino says “this requirement may be temporarily waived and is subject to interpretation.” (1990, p. 77). Is there any universal standard we can appeal to combat these worries? Early in *Science as Social Knowledge* Longino clarifies how any inquiry “must characterize its subject matter at the outset in ways that make certain kinds of explanation appropriate and other inappropriate. This characterization occurs in the very framing of questions.” (1990, p. 98).<sup>18</sup> Crucially, what the analysis presented here reveals is that there is something prior to the framing of questions—precisely defining the phenomena we generate questions about! Contextual Empiricism and all other accounts of scientific objectivity Longino criticizes for that matter, have paid little attention to this vital component of scientific practice.<sup>19</sup>

So, this is my conjecture: having a precise characterization of the research target ought to be a *universal* shared standard. Of course, the level of precision required to generate a testable hypothesis about a phenomenon might vary across scientific domains. For instance, quantifying microphysical properties to characterize subatomic particles might be necessary for quantum mechanics; but such a fine-grained description of most biological and psychological phenomena would be superfluous and likely lead us to mix different levels of analysis (Fodor 1974; Hull 1972; Keller 2002). Notice that this kind of contextualism is not the objectionable radical pluralism that Contextual Empiricism has been charged with. The pluralism here is occurring at the level of implementing the standard, not in the standard itself. Given the variety of subject

<sup>18</sup> This idea is paralleled in Lloyd’s more recent analysis of the logic of research questions (2015).

<sup>19</sup> Of course, sometimes a precise definition of the phenomena is the aim of scientific inquiry. See Anderson (2004) who begins exploring the topic of defining phenomena.

matters that are of interest to scientists, this is a fruitful feature of the conjecture. Take the case of orgasm again. Lloyd's analysis and mine both pertain to evolutionary explanations of the origin of the trait. But that is not the only research question about female orgasm and other research goals might require a different kind of definition. For example,

Levin, Wagner, and Ottesen (1981) tabled some 13 definitions [of orgasm] by authors from a variety of backgrounds, and 20 years later Mah and Binik (2001) repeated the exercise with a doubling of the author definitions. They divided them into three groups: those with primarily a biological perspective, those with a psychological perspective, and those with an integrated biopsychological perspective. The authors still had to conclude that a satisfactory universal definition of orgasm could not be accomplished. (Meston et al 2004)

Unsurprisingly, it seems unlikely that the prolactin characterization of orgasm which helped progress research in evolutionary biology would be suitable for other research agendas in social science domains like psychology and sociology.<sup>20</sup> That said, recall that the biases Lloyd connected to various evidential errors appear to be correlated with the type of definition of orgasm used in the hypothesized explanations. So, even though the endocrinological characterization of female orgasm might not be suitable outside of evolutionary biology, it may turn out that a general emphasis on precision could potentially guard against the sociopolitical factors that can poison epistemic success. Investigating the relationship between pernicious biases and varying levels of trait precisification could provide new insights about scientific methodology and is a project left for future research.

## 6 Conclusion

This analysis began by highlighting a potential gap in Lloyd's critique by uncovering the androcentrism latent in Symons's characterization of female orgasm. This motivated the suspicion that there was something else going on in this case study, in addition to androcentrism and adaptationism. Then through Carnapian lenses, I noticed a correlation between the way orgasm is defined and the number of evidential errors in the studies Lloyd identified. There are many hypotheses one could generate based on this correlation. I have suggested that the biases and type of definition interact reciprocally. Finally, I argued that there are independent reasons to think precision considerations are particularly important in characterizing scientific phenomena and that these considerations should be incorporated into Contextual Empiricism. I'd like to conclude by drawing out some general implications that follow from what's been presented.

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<sup>20</sup> It should be noted that while Pavlicev and Wagner's definition is very precise and made some important advances it would be a mistake to think that human female orgasm = prolactin release. Their definition does not include what is widely taken as typical markers of orgasm in humans like muscle spasms, reflexes, and pleasure. This raises an important question, often discussed in the context of philosophical methodology, as to when a new definition has "changed the subject". (Prinzling 2018).

One thing this analysis has made clear is that there are many ways of defining orgasm. What is also apparent is that there are different research interests and topics related to orgasm. A particularly striking issue presents itself upon further consideration of Prause's (2012) overview of orgasm research. Recall, in her critique of experimental methods Prause (2012, p. 8) states that

Self-reports are of unusually limited utility in the study of female orgasm. Although it is important to understand women's subjective experience of orgasm, many women are unsure whether they even experience orgasms... it also appears difficult or impossible for women to identify sites of orgasm stimulation reliably.

This is also echoed in Meston et al. (2004, p. 179) who claim:

Orgasm is a subjective experience accompanied by a number of physiological body changes. The degree to which these changes vary among individuals is not known... An objective indicator(s) that an orgasm has occurred to confirm or to inform any subjective report would be of real clinical and therapeutic value. [T]he indicator must involve a body change that is unique to orgasm [but] it is unclear whether orgasm should be defined as starting when the woman first mentally perceives it, or whether it starts when the first physical manifestation occurs. (ibid. 180)

The trade-off between a subjective self-report and a desire for an objective measure further complicates the situation. Who should decide what an orgasm is? An individual experiencer or the scientist? Some studies suggest that people conceive and describe orgasm in psychological terms, not physiological (See Vance and Wagner 1976). If a woman reports having orgasmed in the absence of certain vaginal contractions does that mean she hasn't *really* orgasmed? I do not have a ready answer to these questions, but I want to suggest how we ought to go about answering them. I take the variety and complexity of research questions related to orgasm to indicate that the concept 'orgasm' be considered a project of conceptual engineering (CE).

Conceptual Engineers primary goal is to evaluate and suggest ways to improve our concepts (Plunkett and Cappelen 2020). The Carnapian line about precision presented here is complementary to recent analyses of the role of Explication in CE (Olsson 2015; Burn 2016; Koch 2019). In particular, Dutilh Novaes (2018) provides an insightful comparison between Explication and a different CE methodology: Ameliorative Analysis (Haslanger 2000, 2006, 2012). Dutilh Novaes (2018, p. 17) notes that precision "has no immediate counterpart in Haslanger's framework." and that "practitioners of the ameliorative method may benefit from engagement with the techniques employed by Carnapian explicators." It seems to me that the concept of female orgasm is an excellent candidate for examining the interplay between the two approaches. Not only is orgasm a scientific concept (the usual target of Explication) but it also has clear social-political salience (the target of Ameliorative Analysis).

Normative topics regarding how we evaluate healthy sexual relationships, sexual identity (especially for trans and nonbinary persons), the value of sex, and in particular, the role orgasm plays in valuing female sexual pleasure, may require a concept of female orgasm that departs from the biological concept proposed for the goals of evolutionary biology. These social, political, and ethical questions are no less significant

than the scientific ones. This suggests that ‘orgasm’ is a concept salient for feminist philosophy, ethics, philosophy of sex, and philosophy of biology and psychology. For those interested in theorizing further about female orgasm, the takeaway here is to begin by asking what we want a concept of orgasm to do, and then start engineering concepts of orgasm that might fulfill those functions.

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