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Testosterone Rex: Unshackling communities from a gendered mindset

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An address on gender equality by

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About the address:

Testosterone Rex is that familiar story that tells us that risk-taking, competitive, promiscuous masculinity evolved in males to increase their reproductive success, and is therefore built into the male brain and fuelled by testosterone. This belief that “boys will be boys” can (subtly or otherwise) encourage, excuse or exculpate behavior and patterns that impede progress to healthier communities. But Testosterone Rex is based on outdated science, Cordelia Fine argues. As *The Guardian* put it, this “is a debunking rumble that ought to inspire a roar”.

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Cordelia Fine

Thank you very much for that lovely and generous introduction, and it's a very great pleasure and honour to have been invited to speak at this conference, so thank you.

We all know Testosterone Rex. It's that familiar and compelling set of interconnected beliefs that tells us that risk-taking, competitive, status-seeking masculinity has evolved more strongly in males because it enhances their reproductive success, and is therefore wired into the male brain, and fueled by testosterone. Now the "Testosterone Rex" view of course doesn't deny that environment, culture, and gender socialisation make a difference. But it assumes that predispositions towards behaviour that would have been especially adaptive for men in our ancestral past, back in the Stone Age, are passed on through biological inheritance, generation after generation. Boys will be boys, because they've evolved that way.

Now why does Testosterone Rex as a scientific idea matter for our communities, and for those who are trying to make them stronger, fairer and healthier? Now I certainly don't want to reinforce a seductive but misleading view that scientific claims about sex and gender can tell us about how our society ought to be, or how we ought to behave. The principle of equal opportunity doesn't depend on any particular theory, or on their being no significant differences between the sexes. Needless to say, we shouldn't of course condone male aggression or rape, because a scientist tells us that it's natural or adaptive, and I should say that no scientist has ever held that view.

However, scientific claims do set constraints, or can set constraints, or seem to set constraints on to what kind of society it's reasonable or realistic to aspire to. As many of you may know firsthand from your work, Testosterone Rex is often the voice of skepticism when it comes to efforts to increase gender equality. What if, thanks to the hand of evolution, and implemented by testosterone, it's typically only in male nature to want to work in particular kinds of occupations and roles and to be willing to make the sacrifices of family life and take the necessary risks to get to the top. What if women, on average, just aren't as willing to lean in?

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Scientific claims also tell us how we can best *achieve* social goals. If we want more collaborative, responsible, compassionate organisations, is the answer to build that? Do the hard work of building that into the formal and informal ethical systems, through incentives, norms, narratives, heroes, and rituals? And expect those qualities of all our leaders and followers, regardless of sex? Or, is the answer to send in the women, whose complementary values and skills will offset those of men?

Scientific ideas also give us a particular perspective on social issues and debates. A few months ago the *Economist* magazine published an article discussing the demise of the diamond engagement ring. Now the article was about troubles in the diamond industry, but along the way, the journalist equated the marketing-inspired tradition of the diamond engagement ring with the strutting peacock's extravagant tail supposedly both evolved courtship rituals that signal a male's superiority as a mate. So in the human case, the diamond ring enables a man to show off his resources and signal his commitment to the woman.

Now, we're all, I think, familiar with the evolutionary story that starts with cheap sperm and ends with an explanation of why it is that a man has no need for a woman to provide a signal of *her* resources and commitment. The Economist article states, to quote:

Greater equality for women might seem to render male courtship displays redundant, but mating preferences evolve over millennia, and will not change quickly.

How does the gender pay gap look through the lens of a scientific world view in which a woman, caring about a potential partner's material resources, is evolved and therefore timeless and inevitable?

Or consider how University of Glasgow psychologist Gijsbert Stoet explained to the *Huffington Post* a few years ago the persistence of the gender gap in the science, technology, engineering and mathematics, or STEM fields.

He said:



People are often guided by their unconscious desires. In the Stone Age, it was useful for men to be hunters and women to look after babies. And nature has helped, by encoding some of these skills in the hardware of our brain. That still influences how we think today.

Now, both of these examples – the engagement rings and the explanation of the STEM gender gap, are quite liberally crammed with assumptions that don't necessarily hold up to close scrutiny. So, for example, the idea that competition and resources are unimportant for the reproductive success of female mammals, that a monogamous man is missing out on dozens and dozens of offspring that his promiscuous counterpart could effortlessly produce, or that in some deep primal fashion doing sex, science, technology, engineering or mathematics is like hunting a bush pig with a spear.

But since I know from bitter first-hand experience that it's not possible to bring down the entire scientific patriarchy in a 30-minute talk, I'm going to focus here instead on the common assumption that evolved behaviours reliably develop generation after generation, because they are grounded in genetic inheritance, in nature, as Stoet put it.

The genes that are the basis of our mating preference, the *Economist* article assumes, have been honed over the course of millennia and therefore can only be re-honed in response to a changed, more egalitarian environment on a similarly glacial time scale.

This is a common kind of assumption, however, there is now widespread acknowledgment within evolutionary biology that animals reliably inherit not just genes, but an entire developmental system, as it's known. An ecological legacy of place, of physical environment, of structures.

So if you're a bee, that might be a beehive, if you're a beaver it will be a dam, if you're a primate it might be a forest filled with a particular kind of fruit trees, or things to eat. And we also inherit a social legacy, of parents, of relatives, of peers, and others. And what we now understand in evolutionary biology is that this non-genetic legacy can play a vital role in the development of evolved and adaptive behaviours, things that are useful for survival and reproduction.

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So for example, when a Mallard duckling hatches, it immediately has a preference for the call of a mother of its own species rather than another species of bird, like a chicken.

Now for a precocial species in which young are very quickly independently mobile, it's obviously highly adaptive for a freshly hatched Mallard duck to be already orienting towards its mother, and this characteristic of Mallard ducks was at first assumed to be instinctual, in other words, built into genetic inheritance.

But as painstaking research by [Gilbert Gottlieb](#) demonstrated, this evolved adaptive trait depends in part on auditory stimulation, while inside the egg. So when he put unhatched ducks into auditory isolation, so he removed them from other little ducklings, from the mother, so they weren't getting any auditory stimulation from outside, and also, even went to the lengths of paralysing the vocal cords of the unhatched ducks so that early noises that the pre-hatched duckling was making couldn't be heard by the duck itself, he found that those ducklings don't show the same robust preference for their own species' call, although they quickly learn it.

The point here is that a Mallard duck of course reliably inherits its genes, but it also reliably inherits an early auditory environment that includes the vocalisations of its mother, its siblings, and itself. And all of this can contribute to the construction of the development of adaptive evolved behaviour.

Another fascinating example is the anti-predator responses of moose when they encounter the sound or smells of their predators; wolves or bears. So moose become vigilant, they display aggressive response, they stop eating, and they will abandon a particular feeding site where they smelt or heard the signs of their predators. It's a highly adaptive behaviour, and you might suppose again that it's genetically based, to ensure that this highly valuable anti-predator instinct is passed on to each generation.

However, human hunting, that has obliterated many of these predators has led to an opportunity for scientists to test this assumption in some populations of moose.

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And it turns out that after just a handful of generations, living predator-free, moose show a striking reduction of this evolved adaptive anti-predator behaviour. But, if recolonisation by predators takes place, mothers whose infants have been killed, quickly learn to become astute and wary around the sounds and smells of predators, and they transmit this wariness to their young.

So what might be assumed to be provided by the genes appears in fact to reliably develop through learning, so long as the environment contains predators, as of course through evolutionary time it normally would have, and of course mothers, which again are something that are reliably inherited, by every baby moose.

Now, this isn't how we're used to thinking about the development of evolved behaviour. But it actually makes sense.

Just as car engineers don't bother to design miniature crude oil distillers into cars, since petrol stations are readily available to motorists, genes are unlikely to supply what is readily and reliably available elsewhere.

The philosopher of biology, Paul Griffiths, provides an example – the fact that primates have lost the ability to synthesise vitamin C, since vitamin C is readily available on the fruit trees that are part of the ecology that primates inherit, along with their genes. As he puts it:

The constructive role of environmental factors in the development of evolved traits should come as no surprise. Selection cannot favour a trait that compensates for the loss of a developmental input that is, as a matter of fact, readily available. Evolution does not anticipate future contingencies.

Evolution doesn't anticipate the experimenter who reduces the auditory environment or the hunters, who take away the predators from the environment. So despite the strong conceptual link in our minds between evolved and genetic, the development of evolved behaviours can depend on specific environmental resources that are stably reproduced generation after generation. Now what does all this have to do with Testosterone Rex or sex differences?



Well, decades ago, in what turned out to be incredibly prescient work, a psychobiologist Celia Moore conducted a series of studies that pointed to the very same principle, even when it comes to evolved sex differences in brain and behaviour that the non-genetic developmental system plays a critical role.

So mother rats in the early years of mothering spend a lot of time as part of the care of the young, grooming the ano-genital region of their baby rats. And Moore noticed that the male rats received a lot more of this attention than did the females. And this turns out to be because the females are attracted to the higher levels of testosterone in the urine of male rats, than female newborn rats. And this extra licking, she found out through experimentation, actually stimulates the development of sex differences in brain regions that underlie basic male mating behaviour.

So males, whose mothers didn't provide this extra quota of licking through experimentation, grew up to be less adept at masculine mating behaviour. In other words, the mother's behaviour is an integral part of how male rats' brains and behaviour develop differently from females.

Now this actually seems amazing. Mother rats are a critical part of evolution strategy for creating something as fundamental, so much part of the core business of reproduction, as male sexual behaviour. We usually assume that something so elemental must surely be in the portfolio of the genes, because it's so important. But to my knowledge, Moore's research was the very first demonstration of the role of predictable, reliable, unexceptional stimulation from the environment – the mother – that every newborn rat reliably inherits along with its genes, in the development of sex differences in brain and behaviour.

Here's an even more striking example of the same principle. It turns out that if you cross-foster a male lamb to a goat mother, or a baby goat with a sheep mother, the males grow up to show robust and persistent sexual preferences for mates of their foster mother species, rather than their other own biological species. Now clearly, having sex with the right species is really, really important for reproductive success.



Yet in these species, this mating preference isn't determined by the genes, but depends in part on completely unexceptional social experience – time with mum. Change that experience, or any other relevant part of the developmental system, and the evolved behaviour changes with it, in this case, turns into something really quite different.

Now as a caveat, it's important not to generalise from one species to another. But we can extract general principles. And there are two reasons to take the non-genetic developmental system particularly seriously when it comes to ourselves – humans.

The first is our unique capacity as humans for social learning. From the tender age of just two years of age, we conform to the behaviour of our peers. Notably, even the apes don't ape each other in the same way that humans do. And in particular, we're geared towards learning from those who are prestigious, who are successful, or who are similar to us in some important regard, with whom we come to identify, and from whom we learn, internalise, and gain our understanding of norms.

Now gender is, of course, a very prominent social divide. Something that children learn very early. By just three years of age, when children are presented with other children, endorsing novel gender-neutral activities and objects, they already show a clear preference for those that are promoted by kids of the same gender as themselves.

The second reason to take the non-genetic developmental system particularly seriously in understanding our own gender relations, is its sheer richness. Every newborn human inherits gender constructions as an obligatory part of their developmental system. Gender stereotypes, gender ideology, gender roles, gender norms, and the hierarchy that is built into gender are passed on by: parents, toys, peers, teachers, clothing, language, media, role models, organisations, schools, institutions, social inequalities, and so on.

Now we've seen that the frugal process of natural selection makes use of mother rats and moose's care of their young, it even makes use of little squeaks that Mallard ducks make inside their eggs.



And it would be curious indeed if this frugal process squandered the pervasive cultural phenomenon of gender that starts at birth at the pronouncement that it's a boy, or it's a girl, and that persists throughout life. And from this perspective, to try to change gender patterns of behaviour isn't to try to overcome nature — as we often think of it — but the no less daunting task of rearranging the developmental system.

And this perspective on the evolution of human sex differences in behaviour is also particularly helpful in light of various difficulties, often glossed over, in drawing on testosterone to explain masculine behaviour, and therefore differences between the sexes.

So first of all, consider the differences in behaviour we often draw on testosterone to explain. What is it that we say, “Oh, it's the testosterone” about? Now, while often differences between women and men certainly do exist on average, these differences are typically much smaller than the differences that you see in circulating levels of testosterone, which are actually really quite large, with not that much overlap. Or when we think of what we tend to consider quintessentially masculine traits like physical aggression or interest in casual sex, it turns out that in some populations at least, the majority of men are like women — so to speak — in not being physically aggressive, or being quite happy with being monogamous, despite having more testosterone (on average, quite a lot more) than women.

And this already tells us that there's no simple “more testosterone equals more masculinity” equation that applies across the sexes. Or consider current research interest in the role of testosterone and financial risk taking, which is of growing interest in behavioural economics, which in some cases is explicitly motivated by the assumption that financial risk-taking, life risk-taking in general, is an evolved masculine trait.

Wouldn't it therefore make sense, the thinking goes, that testosterone, the hormone that does indeed make men physically masculine, is also endowed them with masculine psychological characteristics, such as being irresistibly drawn to complex credit derivatives and junk subprime mortgages?



Now, this is a research programme that has on occasion given rise to newspaper headlines such as – this one’s from the *Independent* in 2011, in the UK – “Testosterone to blame for banking crash, says Tory MPs” or *Wired* 2012 – “Testosterone is to blame for financial market crashes says neuroscientist”, or the *Daily Mail* in 2015 – “Was the banking crisis caused by too much TESTOSTERONE”.

Yet when the economist Julie Nelson carefully looked at the often-stated claim that there is a fundamental difference between the sexes in their taste for financial risk, she found that in fact, when you base your assessment on large, more reliable samples, sex differences and financial risk-taking are actually very small. Again, much much smaller than sex differences and testosterone.

What’s more, whether or not researchers even find sex differences in financial risk-taking seems to depend on factors that shouldn’t be important for a timeless essential masculine trait. It depends on factors like: which population are you looking at; what’s the size of the stakes; what’s the task that you’re using; and what’s the social context?

And these details matter a lot for the kinds of explanations that we reach for. So if we say that men are financial risk-takers and women are financially risk-averse, then men’s higher testosterone exposure looks like a plausible cause of that difference.

But when we say it instead: more accurately, “On some financial tasks but not others, some men, from some cultures, in some contexts, with some payoffs, are more financially risk-taking than some women,” men’s higher levels of testosterone no longer seem like such a satisfying explanation.

Now these difficult questions proliferate when we consider risk-taking more generally, and the relatively recent insight the people are domain-specific in the kinds of risks that they’re willing to take. So, for example, someone who likes to invest in high risk stocks is no more likely than someone who prefers safer government bonds, say, to go sky diving or even, as it turns out, to gamble.



And this turns out to be explained by individual differences in people's subjective perception of the material and reputational benefits versus costs that a risk offers, rather than individual differences in risk attitude, per se.

Now this creates a problem for the idea that higher testosterone makes some people, ie. men, more risk-taking. What kind of risk taker do we expect a high-testosterone individual to be? Do we expect him to be a skydiver, or an entrepreneur? Do we expect him to be a poker player, or a horse rider? Nor can the idea that more testosterone equals more risk taking explain more female-typical forms of risk taking that occur quite commonly.

What about cheer leading, or horse riding, or cosmetic surgery. What about the risk of sexual harassment that women take on when they pursue a traditionally masculine occupation, or when they write an outspoken feminist blog? What about the risk to a career of taking time off work to have a baby? What about the risk to future economic security, or even to life, of leaving a marriage or relationship?

Women take risks all the time.

And these awkward questions proliferate again, when we zoom out to masculine traits in general. So for many decades, as researchers assumed that masculinity and femininity are polar ends of a single dimension, one dimension as we know ends up in Mars, the other one ends up in Venus.

So the idea here is that someone who's high in masculinity is therefore necessarily low in femininity and vice versa. And in fact, this assumption was built into the very design of the first systematic attempt to measure masculinity and femininity back in the 1950s.

This survey yielded a single score that placed every individual who took the test on a single masculinity/femininity continuum. So, for example, if you felt that the word "tender" went most naturally with the word "loving" or "kind", then you lost a point — naturally — for being feminine. But by contrast, if your mind leapt unsentimentally from "tender" to "meat", then you may have had trouble getting second dates, but you did at least gain a point for being masculine.

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A few decades later, in the psychological community, it was realised that people could actually have both masculine and feminine qualities, so being confident, for example, doesn't prevent you from being warm.

But even this two-dimensional model of gender, which is still in use in psychological research today, is now known to be too simple. Correlations among masculine traits and among feminine ones are often weak or non-existent. Having one masculine trait doesn't imply that you have another, and likewise for feminine traits.

For instance, the neuroscientist Daphna Joel and colleagues found that even restricting attention to behaviours with at least moderate sex differences – and many sex differences are extremely small in size – the majority of people have an idiosyncratic mix of masculine and feminine traits. Fewer than one percent of people, she found, have only masculine or only feminine characteristics.

Now this, I think, probably resonates with our own experience of ourselves and the kind of complex, interesting people who we know, none of whom are walking stereotypes. But it also raises an interesting question. Which of the many combinations of characteristics that males display should be considered “male nature”? It is a profile of pure masculinity that appears to barely exist in reality? Except perhaps in the White House. What does it mean to say that “boys will be boys”? Which boys are we referring to?

Now these findings of gender mosaics are also awkward for those who want to argue that the sexes naturally segregate into different occupations and roles, because of their different natures or because of a slight advantage of one sex over the other, on average, on a particular trait.

Job performance, paid or unpaid, depends on a suite of different skills, values, interests, and so on. People simply don't develop a successful career doing one thing really well, like identifying facial expressions of emotion, being sympathetic, or being able to bang a fist on a boardroom table in a highly effective way. What's more, for most jobs there simply isn't one single ideal combination of characteristics, skills and motivations, but a range that could all fit the bill equally nicely.



And that's why not everyone at your level, in your role, in your occupation, is just like you.

So if you want to trot out the argument that women are just psychologically better suited to taking care of children or to nursing, or make converse arguments about traditionally masculine occupations, then you're committing yourself to the claim that women's hugely variable gender mosaics of characteristics far more often match the many possible mosaics for caring for children, or nursing, or other kinds of female dominated roles, than do men's hugely variable gender mosaics, similarly for masculine jobs.

Now I don't say this kind of argument can't be successfully made. But if someone wants to make it, I would personally ask to see the working out.

And finally, this mosaic pattern of sex differences and similarities doesn't show the neat divergence we would expect, if testosterone had the powerful effect on brain and behaviour that many seem to assume that it does. Now to be clear, testosterone certainly does affect the brain. We don't have asexual brains. But the circulating level of testosterone is just one variable in a highly complex system.

Potentially, other parts of the system such as the sensitivity of the receptors to testosterone and other hormones in the brain, may also differ between the sexes, in ways that to some degree counter balance men's higher average circulating levels. Different species, by the way, might tweak the system dials in different ways. What we see in one species may not be what we see in another.

One way of thinking about this idea that one sex difference in circulating level might be compensated for by another, for example in receptor sensitivity, is actually a different way of thinking about sex differences in biology. We tend to think that they add up, and up, and up, to create sex differences in behaviour, but another way of thinking about it is this.

That we're all humans. We all have roughly similar kinds of things that we have to achieve, and we have to achieve that in the biologically different bodies that we have.



And so the idea is that instead of always looking to see how does this particular sex difference create a sex difference in behaviour, we can look at the possibility that some sex differences in biology may compensate or counteract for other sex differences in biology, and there are actually some very interesting examples of that in other species.

Testosterone is also just one of the many factors that feeds into decision making. Even in some non-human animals, social context and experience can override its influence on behaviour, or stand in for testosterone's absence. And although we're used to thinking of behaviour as "testosterone fuelled", testosterone levels can be responsive to our subjective perception of a situation and to behaviour itself.

For instance, young men's social background or their developmental history seems to influence both the aggressiveness of their response to a provoking event, and the reactivity of their testosterone level to it. Meanwhile, intimate fatherhood seems to lower testosterone levels. Testosterone isn't a stable, purely biological factor.

And this fits with a new scientific conception of hormones as helping animals to modulate behaviour to the situations in which they find themselves — competitive versus nurturant. And, while there's been much less of this kind of research with women, broadly speaking there seem to be similar patterns: women's testosterone levels rising in competitive contexts, and lowering in nurturant ones.

As sociologist Lisa Wade puts it, hormones are "a dynamic part of our biology designed to give us the ability to respond to the physical, social and cultural environment".

What we think of that difference, makes the difference. Psychological studies have found that in subtle ways, within individual minds, the belief that "men are from Mars, women are from Venus", or that "boys will be boys", is associated with a host of attitudes and behaviours that serve to reinforce the status quo.

People who think about the sexes in this kind of way are more likely to endorse the gender stereotypes that are the foundation of intended and unintended discrimination in the workplace.

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They're more likely to allocate child-care in a traditional way. They're more likely to prefer that the husband earns more in a heterosexual marriage and to expect to make traditional work/care tradeoffs.

Women encouraged to take a “men are from Mars, women are from Venus” view of gender, become more vulnerable to stereotype threat, the reduction in performance and interest in traditionally masculine domains triggered by negative stereotypes about women. “Boys will be boys” thinking makes men evaluate sexual aggression more leniently, attributing less control and responsibility to the perpetrator. Telling people that science shows that males and females are fundamentally different makes people less supportive of progressive gender policies, and to feel more comfortable with the status quo. That's why Testosterone Rex, as a scientific idea, matters for our communities, and for those who are trying to make them stronger, fairer, and healthier.

Now people have different reasons for wanting greater equality between the sexes. Some people want fewer women assaulted, or killed by their partners. Some want to close the yawning gap in retirement savings that puts disproportionate numbers of women, particularly from some backgrounds, in poverty in their senior years. Some want greater sex equality in their organisations because of research suggesting beneficial effects for productivity and profit.

Some people want mothers and fathers to share more equally in caring for children so that the next generation reaps the benefits of involved caring fathers and happier parents. Some people want an easier journey for loved ones with identities, bodies or both, that fall in between the two neat male versus female binary. Some want it to become easier for people to pursue and fulfil counter-stereotypic ambitions.

Others want to stem the leak of talented, highly educated, and expensively trained women lost in professional pipelines. Some want to see households headed by single mothers lifted out of hardship or poverty.

Some want more equal political representation so that girls and women's interests are more equally served in government policy.



Some people are also for sex equality because of an important suite of benefits for boys and men, from lessening of pressure to live up to demanding and sometimes physically or emotionally dangerous hyper-masculine norms, to an easing of the burden and stresses of being the primary breadwinner.

Some hope it will bring a liberating expansion of the definition of male success into the parts of human existence beyond work, wealth, and sexual conquest. Some go even further and hope that thinking of qualities, roles and responsibilities as human rather than feminine or masculine will transform the world of work to the benefit of everyone.

Others think that greater sex equality is probably a bit of a mixed bag for men, but that we should try for it anyhow, because it's just fairer and nicer, when power, wealth and status are more equally shared.

And some people think that sex equality is a lovely idea in principle, but that Testosterone Rex fiercely blocks the path to this better place. Why? Because “men are from Mars, and women are from Venus”, “a woman can't be like a man”, and “boys will be boys”.

But I've never heard anyone admit to holding the following view. “Look! I agree, it's not very fair, nor is it decreed by nature, so we could change things a lot if we wanted. We've had sex inequality for thousands of years, and I kind of like it. So, how about we just keep things as they are?”

So apparently we're all for sexual equality, so what now? Now you all have your own answers to this question, which is one for our values rather than our science. Of course science can help us understand better how to achieve our values. But the evolving science is showing that one time-honoured option is no longer available to us.

It's time to stop blaming Testosterone Rex, because that king is dead.

Thank you.

ENDS

