Imaginings of Empowerment and the Biomedical Production of Bodies: the Story of Nonoxynol-9

Annette-Carina van der Zaag

Birkbeck, University of London, United Kingdom/a.vanderzaag@bbk.ac.uk

Abstract

In this paper, I will explore the development of vaginal microbicides (female-initiated HIV prevention methods designed as gels, films, sponges and rings women can insert vaginally before having sex to protect themselves against HIV infection) as a women's health intervention that entangles feminist ideals of empowerment with biomedical enterprise. The field of vaginal microbicide development pays heed to both the specific biological vulnerabilities of 'the female body' that are understood to make women more susceptible to HIV infection as well as the social gendered power relations that leave women at a higher risk of HIV within the power dynamics of their sexual relationships. I am particularly interested in the ambiguity that emerges between the effects of a biomedical search for facticity through clinical trial testing and advocacy promises of empowerment, which I will explore through analysing the clinical trials of Nonoxynol-9 microbicide candidates in the early 1990s – a microbicide candidate that was continuously linked to vaginal ulceration and consequently a potential increase in receptivity to HIV. Through an interrogation of clinical trial reports, advocacy documents and a social science study in which the women trial participants articulated Nonoxynol-9 as their "protector", I argue that the story of Nonoxynol-9 shows an intrinsic ambiguity between the field's feminist promise of empowerment and the effects of the biomedical search for an effective microbicide candidate. Drawing on the work of Karen Barad, I argue that agential realism is able to provide a robust analytical framework to interrogate the political and ethical effects of this ambiguity that the field's own discourse of empowerment does not sufficiently provide.

Keywords: HIV, vaginal microbicides, agential realism, global health, new materialism

Introduction

In this paper, I explore a women's health intervention that entangles feminist ideals with biomedical enterprise – the development of vaginal microbicides (female-initiated HIV prevention methods designed as gels, films, sponges and rings women can insert vaginally before having sex to protect themselves against HIV infection). In particular, I am interested in the relations and discrepancies between feminist ideals of women's empowerment and the effects of biomedical process that become apparent through clinical trial testing of microbicide candidates. At present, microbicides are being tested in clinical trials and have been since the early 1990s with mixed and at times

controversial results. Since the early 1990s eight microbicide candidates have made it to trial: Nonoxynol-9, SAVVY, Cellulose Sulphate, Carraguard, PRO 2000, Buffergel and Tenofovir gel. Currently, the new candidate with the most promise is the vaginal ring, which proved safe and effective in recent clinical trials and is currently undergoing open-label studies (Baeten 2016: 2; MTN, 2016).

The advocacy campaign for microbicides has been voiced as an explicitly feminist campaign, largely fuelled by an understanding of gender dynamics that speaks in terms of women's empowerment and aims to transform gender and sexual power relations. According to the Global Campaign for Microbicides (GCM), the largest microbicide global advocacy body, the microbicide would offer women a way to empower themselves in the context of their sexual lives, where other forms of protection, such as a condom, may not be available to them or may be problematic. The field of vaginal microbicide development pays heed to both the specific biological vulnerabilities of 'the female body' that are understood to make women more susceptible to HIV infection as well as the gendered relations that leave women at a higher risk of HIV within the power dynamics of their sexual relationships. The development of microbicide's engagement with the female body, gender dynamics, ideals of empowerment and the HIV virus places the field at a fascinating juncture, at the intersections of nature and culture, sex and gender, material real and utopic future – junctures that correspond with the aims of many STS approaches, including the work of 'feminist new materialisms'.

In this paper, I engage Karen Barad's (1998, 2003, 2007) performative onto-epistemology of agential realism and provide a reading of the development of microbicides which foregrounds the clinical trial as an apparatus of bodily production, i.e. a socio-scientific milieu constitutive of the bodies put on trial. I understand Barad's theoretical work to resonate with the aims of microbicide development as Barad both engages science and technology while paying attention to the sexual politics of scientific development. As such, Barad's work is situated on the cusp of STS and its predominant focus on the scientific production of human/nonhuman hybridity, and feminist and queer theory that foregrounds the performativity of sex(uality) and gender (Barad, 1998, 2012, 2015). As such, Barad not only celebrates human-nonhuman hybridization, but also pays heed to the processes through which the human comes into being and the potential dehumanisation such constructions might entail – "*the more or less "human", the inhuman, the humanly unthinkable*" (Butler, 1993: 8). Consequently, agential realism is not only a fruitful method for a critical analysis of science and technology, but also a theoretical engagement that lends itself to political aims of embodied resistance to gendered and sexualised power structures. Such a theoretical focus resonates with the key issue at stake in this paper – the materialisation of empowerment ideals.

In this paper, I will look at the first microbicide candidate that made it to trial, which is also the most controversial to date, Nonoxynol-9. I will analyse the Nonoxynol-9 trials as a case study that very clearly epitomises the discrepancy between the effects of a biomedical search for facticity through clinical trial testing and advocacy promises of empowerment. However, this case study is not intended to represent the entirety of the field of microbicides and several decades of candidate testing.

The argument set out in this paper is situated in a more encompassing textual research project based on a collected archive of the development of microbicides from the early 1990s until the end of the GCM in 2012 (see Van der Zaag, forthcoming). This archive consists of a collection of advocacy documents, clinical trial reports and social science studies predominantly collected through keyword searches in the PubMed database and the GCM website. This collection of texts allows me to investigate the different articulations of the development of Nonoxynol-9 and the manner in which different aims, ideals and materialities were put into discourse.

It is no coincidence that I place clinical trial reports together with social science studies and advocacy documents. I aim to show the complexity of the field of vaginal microbicides, the different meanings and materialisations that have been construed by the wide variety of actors that comprise this field – both human and nonhuman. As such, I engage in a mode of critique that shows

the frictions and relations between multiple actors in their aim to develop a technology to protect women against HIV infection while furthering ideals of women's empowerment. Indeed, I am focused on the differences and similarities between women's health advocacy documents, biomedical clinical trial reports and social science studies to show the differences in how the microbicide is articulated to intervene into women's bodies and socio-sexual lives, paying particular attention to the gendered vocabularies utilised. My approach to these articulations insists that they do not merely represent the problematic the field engages in. Rather, the multiple articulations that make up this field are constructive, they constitute what is at stake within the field of microbicide development, the microbicide as a technology and the women implicated in its intervention. I question, what happens to feminist ideals of empowerment when they materialise through biomedical process?

Women's empowerment as a vehicle of inclusion

According to UNAIDS statistics, worldwide there are around 37 million people living with HIV (UNAIDS, 2016: 1), of which women and girls make up more than half (UNAIDS, 2016: 8). Globally, the number of women living with HIV has been on the rise since the early 1990s. This increase is shown to be more prominent in some parts of the world than others, such as in Sub-Saharan Africa (UNAIDS, 2016: 8). Moreover, the UNAIDS 2010 report states that in Sub-Saharan Africa young women are eight times more likely to be HIV positive than men their age (UNAIDS, 2010: 10). This increasing feminisation of the HIV epidemic constitutes the need for and has been the backdrop to the development of vaginal microbicides.

The development of microbicides commenced in the early 1990s when women were only just becoming visible as a group at risk of HIV. During this time, the concept of 'empowerment' functioned as a vehicle for women's inclusion into global HIV prevention discourse (WHO, 1990, 1992, 1993, 1994, 1995). Within global health discourse women at risk of HIV were articulated as subject to a lack of power in their gendered lives and this distribution of power was understood to fuel their vulnerability to HIV infection. Subsequently, 'empowerment' was understood as alleviating this particular vulnerability, brought about either through behavioural change or biomedical intervention. However, although the need for female initiated HIV prevention was recognised in early 1990s global health discourse, most attention was given to women's socio-economic empowerment initiatives and condom logistics. This is the point where the development of vaginal microbicides critically set its own direction, as it took up biomedicine as a way to transform women's vulnerability to HIV infection and expand an understanding of women's empowerment towards biomedical intervention into the female body.

From its initial conceptualisation, the vaginal microbicide has been understood as an explicitly sexual technology potentially transformative of both gender dynamics and HIV susceptibility, as the epidemiologist Zena Stein argued in 1990:

> At present, the sole physical barrier promoted for the prevention of sexual transmission of human immunodeficiency virus (HIV) infection from men to women is the condom. With condoms, active male cooperation is crucial. The proposition of this paper is that the empowerment of women is crucial for the HIV transmission to women. It follows that prophylaxis must include procedures that rely on the woman and are under her control (Stein, 1990: 460).

Stein put female controlled prophylaxes forward as devices that might very well be less efficacious than a condom, but more effective as they are tailored to meet women's specific needs. As female-controlled prophylaxes were aimed at protecting women's bodies against HIV and simultaneously further women's empowerment, Stein articulated an intimate relation between social dimensions of power and scientific interventions into the female body. The promise of vaginal microbicides entangles the biological susceptibility to the HIV virus with the transformation of socio-sexual power relations. As Catherine Montgomery writes, "[t]he fusing of women's biological vulnerability to HIV with their social vulnerability to infection seamlessly led to the medicalisation of powerlessness

and the search for a medical solution to it" (Montgomery, 2012: 928).

The idea of a vaginal microbicide as a female-initiated HIV prevention method was soon taken up by Lori Heise (Elias and Heise, 1994), the former director of the GCM. The GCM remained the prime advocacy body in microbicide development before it disbanded in 2012. This campaign was officially launched at the twelfth AIDS Conference in Geneva in 1998 (GCM, 2009a). Although the GCM's headquarters were based in the U.S., they described themselves as a – "broad-based, international coalition of organisations working to accelerate access to new HIV prevention options" (GCM, 2012a). Their main goal was "to focus world attention on the critical need for new HIV prevention options, especially for women" (GCM, 2007a, 2010c). The Campaign represented women's need for a microbicide, how a microbicide will intervene in women's lives and, importantly, how the microbicide will function as an empowering technology. What is significant of the GCM is that they both engaged with an understanding of women's vulnerability to HIV as a social problematic as well as the specific vulnerability of the female body, thereby simultaneously engaging the social and the biological without reinstating a sex/gender, nature/culture dichotomy. This entanglement of physical and social aspects of HIV infection becomes visible in their articulation of women's risk, an articulation of vulnerability that is consistently repeated throughout their campaign discourse. They claim that the biological factors that contribute to women's risk of HIV consists of the following:

> Biological factors contributing to women's risk of HIV:
>
> -Women are more likely than men to contract HIV at a single exposure.
> -The cervix is a site of particular vulnerability.
> -Younger women are at even greater risk, since the cervix is physiologically less mature and therefore more vulnerable to infection.
> -Women with asymptomatic STIs may not seek treatment, which can result in serious long-term consequences such as infertility, pelvic inflammatory disease, ectopic pregnancy, infant mortality, and cervical cancer.
>
> Social and economic inequities also contribute to women's risk:
>
> -The vast majority of women with HIV were infected during heterosexual sex – many by their husbands or boyfriends.
> -Women may influence but do not control the sexual and/or drug-using behaviour of their male partners.
> -Violence, coercion, and economic dependency in many women's relationships make it difficult to "negotiate" condom use or to leave a partnership that puts them at risk.
> -In many societies, women and girls are discouraged from learning about their bodies and about sex in general.
> -Often, women are socialised to leave sexual decision-making to men.
> -Gender-based social norms often encourage men to seek multiple partners, while women bare the shame and stigma of disease.
> -Growing economic inequality and eroding social support have driven many women into commercial sex work to support their families (GCM, 2009b).

For the GCM, a vaginal microbicide promises to provide women with a HIV prevention method that would protect their bodies against HIV which women would be able to incorporate into their socio-sexual lives. The specific aim of the GCM was to provide women with a tool they could control and that would answer to women's different needs. Importantly, the GCM worked in close collaboration with biomedical efforts of microbicide development and its large-scale roll out of trials, to ensure that the trials themselves would be spaces of empowerment and that women's vulnerability would not be increased through biomedical process (GCM, 2007b). However, I argue, it is in this meeting of feminist ideals and politics and biomedical enterprise where problems arise, particularly in terms of women's vulnerability to HIV infection within clinical trials.

The clinical trials

Women's vulnerability to HIV, physically, socially, sexually and economically, is a key controversy within the microbicide Randomised Controlled Trials (RCTs) and the field of microbicide development is very much aware of these complexities. To address these, a symposium was organised in

1997 in Washington D.C. which highlighted key concerns and ethical deliberations that are still in effect in the field. This symposium was convened by WHAM (Women's Health Advocates on Microbicides, the main advocacy body preceding the GCM) and the Population Council (the initial biomedical collaborator in the microbicide field), to discuss ethical and practical dilemmas of microbicide testing. It brought together 55 experts in clinical, biological and social science and activists, biomedical ethicists from 15 countries in Africa, Asia, Latin America, Europe, and the U.S. The symposium took place when the concept of a topical microbicide was just taking shape, when boundaries between science and women's health activism were starting to become less rigid and the first Nonoxynol-9 based candidates were entering human clinical trials. Importantly, as the below excerpt of the symposium report indicates, the symposium situated the clinical trial as embedded and active in power dynamics.

> Although women need and deserve a technology they control, microbicide research should not be allowed to deflect attention from the underlying power inequities that put women at risk.
> Microbicide research must be seen as part of an overall program of STI/HIV prevention that includes efforts to empower women and to improve the detection and management of STIs among women, especially in resource poor settings. (Heise et al., 1998: VII).

What the clinical trial was understood to do, entailed more than testing for mere efficacy. Rather the efficacy of the microbicide candidate became intimately related with power dynamics. This is a manner of understanding biomedical engagement that remained with the GCM throughout its later advocacy efforts (GCM, 2010a). However, through the manner in which power is understood and the authority ascribed to biomedical knowledge seeking practices, the clinical testing of microbicides is almost instantly separated from these more encompassing relations and power dynamics. This has remained intrinsic to, and one of the key complexities in, the development of vaginal microbicides. Although the clinical trial is put forward as an active component in women's gendered power dynamics and protection against the HIV virus, it is simultaneously understood as 'the gold standard' of microbicide testing (Heise et al., 1998: 10; see also Rosengarten and Michael, 2013).

The RCT as the gold standard for microbicide testing is directly related to the demands of regulatory institutions (the United States Food and Drug Administration being the most prominent) by which the candidate needs to be approved before it can be produced for large scale distribution, should the candidate prove efficacious. Although the FDA does not explicitly articulate the RCT as the gold standard for the testing of new drugs, their guidelines are interpreted as such that the field endeavours to answer to their requirements through the RCT (AVAC, 2015; GCM, 2015; FDA, 2015; see also Will, 2007). The manner in which this tension between the RCT as an empowering space and the RCT as the gold standard of microbicide testing plays out is through women's (vulnerability to) HIV infection. On the one hand every effort is taken to decrease HIV infections within the clinical trial, specifically by providing STI testing, promoting the use of condoms and providing safe sex counselling. However, the manner in which data is sourced means that, despite the trial's preventative measures, women's HIV infection is anticipated.

The efficacy clinical trials are only conducted on HIV negative women. The data of these trials is readable through women's seroconversions (to HIV infections) as the number of HIV infections in the placebo arm shows how efficacious the microbicide candidate in the product arm is. "The higher the incidence of HIV in the host community, the smaller the number of participants necessary to detect a difference between a microbicide and a placebo. As incidence declines, the number of women necessary to detect an effect rises rapidly, making trials among low-incidence populations extremely cumbersome and expensive" (Heise et al., 1998: 18). The RCTs need to be conducted on populations with a high prevalence of HIV infections in order to gather enough data for statistically significant analysis, which for the phase III trials (human trials testing efficacy) would mean a multi-site population. If the data is not statistically significant the measured efficacy of a microbicide candidate could have been due to chance.

In other words, statistical significance provides 'objective' data concerning the effect of the microbicide candidate on the HIV virus within the female body. Statistical significance remains *the* core method for the success of a clinical trial in biomedical terms, as its success is understood as providing proof of the efficacy of the microbicide candidate, which is called 'proof of concept'.

Because of the need for statistical significance to show the efficacy of the microbicide candidate, the population the microbicide is tested on is selected according to HIV incidence (the number of HIV infections across the potential trial population) and women's specific risk of HIV infection within their sexual relations (as opposed to for instance drug injection). These criteria are aimed at ensuring that the trialists know whether seroconversions occurred during vaginal sex and therefore, consequently, the measure of protection is due to the efficacy of the microbicide. This need of HIV infection leads trialists to enrol groups of women into the RCT who are highly vulnerable to HIV infection in specific ways. In particular, female sex workers and women who have difficulty negotiating condom use. In other words, precisely those women who are understood to be in need of a microbicide, because of what advocates indicate as, their socio-sexual vulnerability, are desirable participants of the RCT because their specific vulnerability will make the RCT more likely to produce a statistically significant result. "This reality helps ensure that despite the best efforts of trial sponsors to actively promote condom use in both trial groups, there will be some women who are unable to do so (making it easier to evaluate a potential microbicide)" (Heise et al., 1998: IX).

Although biomedical development is inherent to the advocacy promise of empowerment, the manner in which women's vulnerability to HIV infection is anticipated in light of the trial's success is not easily reconcilable with the advocacy efforts to diminish this vulnerability through centralising women's needs, protection and empowerment. There is a clear discrepancy between the advocacy promise of women's empowerment and the biomedical development of microbicides that hinges on women's HIV infections within the trial. However, although ideals and materialities stand in ambiguous relation, they are not mutually exclusive. Thus, in order to explicate what is at stake in the development of microbicides, I concur with Jungar and Oinas' statement that "[a]nalyses of potentially helpful interventions into the epidemic as a discursive-material reality become crucial" (Jungar and Oinas, 2010: 179). Textual analysis of the development of microbicides allows me to bring biomedical articulations of the female body, microbicide candidates and virus, social science articulations of women's experience and advocacy ideals of women's empowerment within the same performative frame. In doing so, I am interested in how differences, such as the aforementioned ambiguity, are negotiated and how such negotiations come to bear on the microbicides potential user and thus the empowerment a microbicide is able to promise. As such, my work resonates with Nelly Oudshoorn's research into clinical trials where "…the development phase of a technology becomes an intriguing location for understanding the co-construction of users and technologies" (Oudshoorn, 2003a: 213; see also Oudshoorn, 2003b).

Furthermore, this study makes a significant contribution to social science in HIV and in particular social science studies of the development of vaginal microbicides which engage the experiences of trial participants (for instance the work of Saethre and Stadler, 2010, 2011), but often leave the workings of a trial unexamined (Will, 2007: 85) and present their findings as representative of women's experience. In critical contrast, and aided by my textual point of entry into the microbicide field, I do not claim direct access to women trial participants' experience. Although my own work is in conversation with these studies, what I am interested in is the ways in which these experiences and voices come to be articulated through social science and as such become part of the apparatus of bodily production of microbicide development. Such a performative scope is in line with an emerging body of HIV research that explicitly foregrounds the materialities of HIV, bodies and prevention technologies and biomedicine's constitutive role herein (see for instance Rosengarten, 2009; Race, 2009; Montgomery, 2012; McKnight and Van der Zaag, 2015). That is to say, I am interested in how bodies come to

matter in microbicide development as a material-discursive performative process that includes the articulations of materiality, experiences and ideals.

Agential realism

Karen Barad's work is embedded within so-called feminist new materialism, currently gaining rapid momentum within feminist theory. In correspondence with STS agendas, these new materialisms are concerned with the breakdown of the dichotomous oppositions between biology and society, nature and culture, human and nonhuman and are characterised by paying significant attention to nonhuman actors, especially within the scientifically focused strands of this multifarious body of work. Here, a wide array of theoretical interventions and trajectories is encompassed, including engagements with matter's literacy (Kirby, 1997, 2011), engagements with sexual difference and its futurity (Grosz, 2005, 2011; Braidotti, 2011a), the constitutive role of the sciences (Haraway, 1997; Barad, 2007) and more ecological investigations (Haraway, 2016; Alaimo, 2010). Many feminist new materialisms, including the work of Barad, are pitched against the so-called cultural turn and its focus on cultural processes of signification and identity in the theorisation of sex(uality) (Hemmings, 2011). In particular, Judith Butler's notion of materiality is often invoked as failing to engage with the materiality of the body (Cheah, 1996; Kerin, 1999; Kirby, 1999, 2011; Fraser, 2002; Barad, 1998, 2003, 2007).

What is at stake here are the various materialities these theories engage with and thus the multiplicity of materiality that ensues. Sari Irni (2013) has coined this 'the politics of materiality' which constitutes a certain disciplinary hierarchy of value where engagements with the natural sciences (or 'capital S science' (Willy, 2016: 4)) are understood to be the primary site where materiality is to be found[1]. Attention to such politics of materiality is often articulated through the conceptualisation of this relatively nascent field of theory. Should we speak of new materialisms (Coole and Frost, 2010), material feminisms (Alaimo and Hekman, 2008), neo-materialism (Braidotti, 2000)? These questions are not so much attempts to canonise the field, as they are questions of politics phrased through scholarly genealogical trajectories. Here, it is important to state that these materialisms are not necessarily new, but rather are enabled by a wide range of past feminist theories on materiality including Simone de Beauvoir's (1997[1949]) engagement with biology, Shulamith Firestone's (1970) feminist revolution through technology, Emily Martin's (1989) discourse analysis of the reproductive system, Sandra Harding (1986, 1991) postcolonial critique of science and of course, Donna Haraway's (1976, 1978) critique of the distinction between nature and culture. In other words, and to speak with Sara Ahmed (2008), new materialisms can often be seen to enact a 'founding gesture' - a certain neglect of past feminist theory on materiality, articulated through a 'return to matter' (Hemmings, 2011), that comes to substantiate the 'new' of this multifarious body of work. However, such a gesture has direct methodological and political implications problematic for new materialism as a feminist project. Barad has a complex position within these feminist critiques. On the one hand, she repeats the same founding gesture by setting her theory up against Butler's performative notion of materiality and thus enacting a 'return to matter'. On the other hand, her agential realism explicitly allows for theorisations of sex(uality) and dehumanisation, even if Barad rarely engages such materialities herself.

Karen Barad's approach (1998, 2003, 2007, 2012, 2015) is both deeply embedded in Haraway's socialist feminist theory (historical materialism) as well as Judith Butler's performative materialism (even if in critical relation). Such embeddedness makes clear that Barad's agential realism is indeed materialist, but not necessarily new. Furthermore, the multifarious genealogy of Barad's agential realism, already illuminates that she engages, or at least opens up a theoretical space to engage, a multiplicity of materiality. What I am particularly interested in is Barad's interest in non/human hybridization and science, while a methodological and political emphasis on lived reality (Haraway) and the performativity of sex/gender and (de) humanisation (Butler) remain at stake. Therefore, I utilise Barad's agential realism, not because of the specific science (quantum physics) she engages. Rather, I am interested in the manner in which

Barad engages science as a field of operations through which bodies come to matter. Thus, I would coin Barad's approach, as well as my own, neomaterialist in an effort to both articulate its trajectory through historical and performative materialisms, while paying heed to the contemporaneity of the current feminist materialist debates.

Karen Barad takes Judith Butler's notion of materiality and performativity (Butler, 1993) and its concern with processes of (de)humanisation and rearticulates this theory to account for scientific practice. Karen Barad's point of departure (1998, 2003, 2007, 2012, 2015) is the practices constitutive of the "human" and "nonhuman", these entities do not pre-exist the material-discursive apparatuses through which they come into being (Fraser, 2002: 617). Indeed, who gets to count as human within human/nonhuman hybridizations is contingent on the specific apparatuses through which these entities are constructed. Barad understands scientific practice as performative, the objects and bodies under scientific investigation, their very ontology, is an effect of performative practice. However, agency, for Barad, is not a human prerogative, rather, she develops a performative account of materialisation that is open to intra-action with nonhuman entities, thereby paving the way for an analysis of embodiment that is indiscrete in matters of bodily contours and postanthropocentric in its consistency. In this understanding of performativity, Barad (2007) emphasizes intra-action as opposed to interaction as there are no pre-existing entities to interact with one another. It is within *phenomena* that bodies and objects come to be, through the performative onto-epistemology of intra-action. As such, within scientific development there are no pre-existing bodies, subjects and technologies for scientific knowledge-seeking practices to discover and describe, rather, it is through performative practices that these entities emerge, in intra-action with one another. As an important consequence, especially in light of an analysis of the field of microbicide development, the boundaries between bodies, apparatuses of scientific development and technology evaporate: "...bodies are material-discursive phenomena that materialize in intra-action with (and, by definition, are indissociable from) the particular apparatuses of bodily production through which they come to matter (in both senses of the word)" (Barad, 2007: 209).

Within an onto-epistemology of agential realism (scientific) apparatuses have a central place. Because boundaries between the component entities of the phenomenon are determined through the apparatus, they do not pre-exist. Out of a context of indeterminacy, apparatuses construct the components of/within a phenomenon (such as for instance HIV, microbicide and woman) by temporarily determining them as such. According to Barad (1998, 2007), an apparatus is not purely scientific, but a more complex and encompassing setup consisting of myriad systems of meaning and materialisation. Reading the RCT as an apparatus of bodily production allows me to 'open the RCT up' as not only a scientific space of facticity and objectivity (Epstein, 1996; Michael and Rosengarten, 2013; Latour, 1993; Will, 2007), but rather as a complex site where facts, ideals, bodies, virus, microbicide candidates, sexual practices materialise and become meaningful in intimate, co-constitutive, relation - intra-action. Thus, to get ahead of my argument, reading the RCT as an apparatus of bodily production allows me to interrogate the field's ideals of empowerment and the effects of biomedical knowledge-seeking practices (here vaginal ulceration specifically) not as a mutually exclusive contradiction, but as an ambiguous relation constitutive of the woman/microbicide phenomenon on trial.

The story of Nonoxynol-9

Nonoxynol-9 based spermicides were the first agents to be considered for microbicide development. Their testing commenced in the late 1980s as spermicides that might protect against HIV (see Kreiss, 1992) even before the concept of a 'microbicide' was articulated. Nonoxynol-9 was understood to be a promising candidate by both the advocacy and biomedical field because at the level of in vitro research Nonoxynol-9 showed to be potentially efficacious against several STDs and HIV. Furthermore, since Nonoxynol-9 based spermicides were already being manufactured, they were viewed as a potential microbicide that

would be relatively cheap and easy to produce (Roddy et al., 1998; Cook et al., 1998). Specifically, Nonoxynol-9 was a detergent that functioned by breaking down cell membranes. However, it raised concerns that it did not only break down cell membranes of the virus, but also of vaginal skin and the cervix. Eventually, Nonoxynol-9 based microbicides were shown to increase women's susceptibility to HIV infection due to causing vaginal ulceration.

Nonoxynol-9 had been the active ingredient in spermicides since the 1950s and was approved for distribution before the FDA demanded any rigorous clinical trial testing. As a result, Nonoxynol-9 based spermicides were already available for use, but no one knew exactly how efficacious these spermicides were and, importantly, how safe they were. Advocates understood the uncertainty of Nonoxynol-9's safety and efficacy against STDs including HIV to be exasperated by public rumours that Nonoxynol-9 would be effective against HIV infection. Consequently, women and gay men were already using Nonoxynol-9 lubricated condoms for extra protection and Nonoxynol-9 sexual lubricants (in addition to its use as a spermicide). As a knock on effect, manufacturers put Nonoxynol-9 on condoms and in lubricants to tailor to the needs of those using Nonoxynol-9 based lubricants (Heise et al., 1998: 10).

The context in which microbicides containing Nonoxynol-9 entered the human clinical trials during the late 1980s and were trialled for over 10 years, was marked by a high variety of candidates, trial designs and Nonoxynol-9 formulations. Different trial designs were used, not all of the trials were randomised controlled clinical trials, the amount of Nonoxynol-9 differed from compound to compound (as much as from 50 mg to 1000 mg) and the suppositories differed, as some tested rings, some foams, some films etc. (Martin et al., 1997; Van Damme et al., 2002; Forbes and Heise, 2000). Furthermore, the data produced by the safety trials as well as the efficacy trials was conflictual and is still incredibly difficult to compare. Some small scale observational studies reported promising results and called for more studies in large scale randomised controlled trials to validate their findings (for instance Zekeng, 1993). Other studies suggested the heightened risk increase of genital ulcers (for instance Niruthisard, 1991; Kreiss ,1992). Uncertainty within the scientific and advocacy field emerged around these safety issues, the association with vaginal ulcers and, importantly, the association of vaginal ulcers and HIV infection. This uncertainty provoked a dedication in the field for more and more research, despite Nonoxynol-9's potential side-effects.

The safety trials

The development of Nonoxynol-9 based microbicide candidates had continuously been marked by a worrying safety profile, in particular a concern for its association with vaginal ulcers, which could facilitate HIV virus in semen to enter a woman's body. Consequently, the use of Nonoxynol-9 based compounds would in fact increase women's susceptibility to HIV infection instead of providing protection and inflict harm on the women participating in the trials. A good example of this is the safety study of Niruthisard et al., published in 1991. In a context of uncertainty about the safety of Nonoxynol-9, its possible future, rumours about its effect on the HIV virus and the fact that people were already using it as an HIV preventative gel, this study sought to determine facts about Nonoxynol-9's safety. The study was supported in part by Family Health International and the U.S. Agency for International Development, although (as the report states) the study does not necessarily reflect FHI and AID policy (Niruthisard et al., 1991: 176). The Niruthisard safety study was a small scale observational study conducted on a small number of women at low risk of infection recruited from a family-planning clinic in Bangkok, Thailand. The women participants were asked to insert the compound once per hour, for four consecutive hours daily for a period of two weeks. This study showed that Nonoxynol-9 had harmful effects, as the report states:

> Six of the women or 43% (...) had physical findings that included disruption of the epithelium and/or bleeding. None of the women receiving placebo had abnormal physical findings. The break in the epithelium on the cervical squamous epithelium of four women appeared to be the result of a thin layer of cells sloughing; in some cases the

> layer of cells could be seen still partially attached. The epithelial sloughing appeared on the cervix in the area adjacent to the fornices and was not over the transformation zone. One woman had a severe reaction on the cervix that appeared similar to the strawberry cervix seen with trichomonas infection, but it was more severe and was bleeding and edematous. (...) One woman had physical findings that included bleeding and sloughing of the vaginal mucosa, which also occurred in the fornices. All of the symptoms and findings of the women resolved within 1 week of stopping N-9 use. None of the symptomatic reports were considered severe enough by the women to cause them to stop using the suppositories (Niruthisard, 1991: 177).

The damage this statement describes appears to be severe, involving the skin lining women's vaginas and cervix shedding (sloughing) in certain places and bleeding. A 'strawberry cervix' refers to a cervix that is damaged as such that is has a punctuated appearance, making it look like the skin of a strawberry. This strawberry cervix was oedematous, meaning it was swollen with fluid retention and shown to be bleeding. However, as the report articulates, none of these side-effects were considered severe enough by the women participants themselves to stop using the compounds. This trial report raises questions about the particular local context within which such adverse events are experienced and given meaning by women trial participants - experiences and meanings that might very well differ from biomedical protocol and bioethical considerations (Crane, 2010; Kingori, 2013). Why did the women in this study not think these side effects were severe enough? To what extent did the clinical trial context itself impact on this articulation? Did the trial participants and scientists share the same understanding of what constituted a severe side effect? However, what the wider context of this consideration was, is absent from the clinical trial report. It is not the woman within a wider context or her socio-economic situation, her sexual relation(s) and her body that is on trial here. Rather, this social, sexual and material context is reduced to only one fragment: the vagina/cervix and in particular Nonoxynol-9's effects upon it.

I argue that the clinical trial report is a powerful writing technology (Haraway, 1997: 26) that articulates the objective truth, here, of a scientific object and the body on trial. This articulation enacts an agential cut that separates women's vaginas from the body they are a part of, from the sexual relations in which they act and the economic currency they have (which becomes especially relevant in relation to the efficacy trials below). Barad (Barad, 2007: 148) writes that "apparatuses are the material conditions of possibility and impossibility of mattering; they enact what matters and what is excluded from mattering". In particular, an agential cut necessarily implies particular material-discursive exclusions that remain intimately related to the phenomenon produced by the apparatus, as what Barad has coined an exteriority-within – an effort to pay attention to the productive effects of exclusion inspired by Butler's constitutive outside. As such, the particular agential cut under analysis here does not produce a mere objective truth about the effect on Nonoxynol-9 on the female body, here the vagina and cervix specifically. Rather this agential cut constructs and fragments women's bodies within the story of Nonoxynol-9 as vaginas whose meaning is tied to their degree of ulceration, and in the same move excludes the wider social and material context through which these bodies emerge.

In contrast to the biomedical articulations of their investment in the development of vaginal microbicides, I argue that the scientific objectification of Nonoxynol-9's effect on the vagina/cervix does not merely construe facticity, but constitutes a specific manner in which women's bodies are made to matter in this particular biomedical enterprise. In other words, the entity of trial is not 'the female body' assumed to pre-exist biomedical knowledge seeking practices. Rather, this entity emerges *through* these practices, here, in an arguably problematic way. Furthermore, this entity emerges here as a human/nonhuman hybrid, a microbicide/woman relationality that brings to mind the feminist critiques on STS and in particular Actor Network Theory (ANT) spearheaded by Bruno Latour (see for instance 1993, 2004) for its lack of engagement questions pertaining to the social and cultural processes

inherent to scientific practice through which 'the human' is differentially constituted (see for instance, Star, 1991; Haraway, 1997; Van der Ploeg, 2004; Braidotti, 2013). These feminist scholars critique STS and ANT for its focus on human/nonhuman mingling, to the neglect on social and cultural processes through which the human comes to matter within human/nonhuman hybridisation. Indeed, the woman/microbicide entities at stake here are not hybrids to celebrate. What is particularly problematic is the fragmentation through which the human is offered up in relation to the microbicide candidate: the vagina/cervix that is separated from the body that it is a part of, and the socio-materiality this body exists in, especially with regard to sexual relations and gender dynamics. The manner in which women's bodies are made to matter here hinges on the exclusion of their wider socio-material relationality.

It is tempting to provide a reading of the development of Nonoxynol-9 based microbicides as a critique against science, that foregrounds the manner in which women's bodies are objectified through biomedical endeavours and technological development - a mode of critique characteristic of the versatile field of feminist science studies (Harding, 1986, 1991; Fox Keller and Longino 1996[1982]; Martin, 1989, 1996) and which has a particularly rich history in the feminist critiques of reproduction science (for a generous overview see Thompson, 2005). Such a critique would also resonate with arguments against large scale outsourcing of drug trials and the profit making machine of Big Pharma that Petryna (2009) engages in her writings on the exploitation of bodies for profit. However, such a critique against science is also not able to fully articulate what is at stake here, as it would discard the feminist inhabitation of biomedicine that characterises the field of microbicide development and thus the effort inherent in the testing of Nonoxynol-9. Furthermore, the development of vaginal microbicides has a history of struggling for funding and has mostly been funded by the public sector and philanthropic organisations (Weber et al., 2005), thus as an enterprise it is not so much part of the exploitation of bodies for pharmaceutical profit that Petryna describes.

Within a context of high HIV prevalence, constrained access to healthcare and a wider socio-economic environment that drives women's risk of HIV infection, the development Nonoxynol-9 based microbicides can be considered both ethical and unethical, politically desirable and problematic. This complexity resonates with the ethical and political ambiguity that Johanna Crane (2010) highlights in her critical reading of what constitutes 'ethical science' with regards to RCT testing of HIV treatment and prevention within resource poor settings. As she writes, "the debate is not merely about what is 'right' and 'wrong', but also about how science travels, and about how to forge useful and humane scientific knowledge across terrains of difference and inequality" (Crane, 2010: 861). What agential realism provides is an analytical framework in which this ambiguity (Montgomery, 2015) becomes visible, as apparent ethical and political contradictions do not rule one another out, but rather depend on one another in and for the woman/microbicide phenomenon.

The human efficacy trials

Between 1992 and 2002 three efficacy trials were conducted. These tested the effect of Nonoxynol-9 on women's vaginal cells as well as its effect of dismantling the HIV virus. The first was a study by Kreiss testing a vaginal sponge containing Nonoxynol-9. This trial was conducted amongst 138 female sex workers in Nairobi, between January 1987 and June 1990 (Kreiss, 1992: 479). The trial showed a significant increase in vaginal ulcers in the Nonoxynol-9 arm of the trial and was prematurely halted following the recommendations of the Data Safety and Monitoring Committee in July 1990 (Kreiss, 1992: 479). The report continues to warn that

> [i]t is possible that prolonged and intensive exposure to nonoxynol 9 results in compromising the vaginal and vulvar epithelial integrity (...). Alternatively, nonoxynol 9 sponge use may directly cause genital ulceration as a result of chemical toxicity or mechanical irritation. Reactivation of genital herpes simplex virus infection is another possibility that was not excluded. These findings are of particular concern because genital ulceration in women and men has been implicated as an important risk factor for HIV infection in both

> American and African populations (Kreiss, 1992: 481).

In 1998, the results of another efficacy trial were published, this time testing a vaginal film containing Nonoxynol-9 on just over 1000 female sex workers in Cameroon (see Roddy et al., 1998). In line with the Kreiss study, this efficacy trial again showed an increase in vaginal ulceration. However, the trial did not show that vaginal ulcers in turn increased women's susceptibility to HIV infection. Regardless of its findings that the product increased vaginal ulceration the trial report ends with a call for more research (Roddy et al., 1998: 509). Finally, in 2002, the Van Damme UNAIDS sponsored research on the vaginal gel COL-1492, also called Advantage-S, resulted in significantly more women's seroconversion in the active arm than in the placebo arm of the trial and associated Nonoxynol-9 with an increase in vaginal lesions and ulcers (although based on a safety trial that showed no harm (van Damme et al., 2002: 975)). In other words, this study showed that frequent use of Nonoxynol-9 based vaginal gel increased, rather than decreased, women's vulnerability to HIV infection.

This Phase III trial was conducted between September 1996 and June 2000. The population included female sex workers in South Africa, Thailand, Benin and Côte d'Ivoire. Across the sites 892 sex workers were enrolled, 104 women became infected with HIV during the trial, 59 of whom in the Nonoxynol-9 arm. The higher prevalence of HIV infection in the product arm was possibly due to the vaginal ulcers and lesions most likely resulting from the use of Nonoxynol-9. The level of vaginal ulcers increased with the frequency of use. As the report states:

> Our results show that nonoxynol-9 increased risk of HIV-1 infection compared with placebo. Risk was especially high in women who used the study drug gel more than 3.5 times per day and who also had a high incidence of lesions with epithelial disruption. This finding suggests that nonoxynol-9 has an adverse effect on vaginal integrity when used frequently, thus increasing women's susceptibility to HIV-1 infection. At low frequency use, nonoxynol-9 had no effect, either positive or negative, on HIV-1 infection (van Damme, 2002: 975).

After the Van Damme trial showed a higher amount of HIV infections in the Nonoxynol-9 arm of the trial, the World Health Organization released a statement in 2002 that Nonoxynol-9 is ineffective against HIV and might increase women's vulnerability to HIV infection. "Spermicides containing nonoxynol-9 do not protect against HIV infection and may even increase the risk of HIV infection in women using these products frequently" (WHO, 2002, 1). This statement marked the end of the development of Nonoxynol-9 based microbicides after over 10 years of testing.

It is important to note that the Van Damme trial also showed that women's vulnerability to HIV infection increased with sexual activity and that Nonoxynol-9's effect was therefore related to how women used the microbicide candidate. After the Van Damme trial finished, a social research study was conducted that supports this suggestion. This research was conducted at one of the sites of the Van Damme trial, amongst a group of HIV negative sex workers who worked at truck stops in Durban, South Africa. The primary aim of this study was to show the manner in which these women understood the gel's (placebo or Nonoxynol-9) effectiveness. This research articulates women's belief and hope that they were using the Nonoxynol-9 gel instead of placebo and that the gel was effective, regardless of understanding the RCT's aims and protocol. The study explains:

> The gel took on added significance as a protective device in light of the fact that many women reported that some of their clients and partners did not want to use condoms. Some women were concerned about the condom's effectiveness and viewed the gel as providing better protection. Others believed that in the case of condom breakage, the gel would protect them: "Even if [the condom] bursts, we don't have any problems. We have our protector."
>
> At trial baseline, only 17% of the women reported that they were protected by condoms in more than 50% of the sex acts they engaged in. One woman told her clients who refused to use condoms that she was using the gel; she indicated that these men felt protected by the gel.

> Belief in the gel's efficacy was further reinforced by the economic pressures on the women and their concerns about losing clients:
>
> "You try to force a person to use a condom but when you see this person really doesn't want to use it and is going to the next person who will sleep with him without a condom, and the money he has a lot, you just think that you have your gel, and you take the money" (Mantell et al., 2006: 1075).

The differences between the manner in which these women articulated their use of Nonoxynol-9 as 'their protector' is in striking contrast to the clinical trial report of the aforementioned safety study, the Van Damme trial report and the WHO statement. The use of Nonoxynol-9 is embedded within women's vulnerability to HIV infection, their specific sex work economies and the hope they have for an effective tool to protect themselves, where the power to demand condom use is scarce. The candidate as a nonhuman 'protector' articulates a specific scenario in which women participants struggled to negotiate condom use, namely the specific power relations between sex worker and client which put these women at risk of HIV infection. Moreover, it is exactly this use of Nonoxynol-9 without a condom that would further the extent to which trialists are able to show the candidates efficacy, as this is based on women's HIV infections. The women participants' use of a microbicide candidate in a context where they are unable to negotiate condom use and are as such vulnerable to HIV infection is anticipated in the trial's design and the central place it affords to statistically significant sero-conversions. Furthermore, taking into account a history of struggling for funding, women trial participants' vulnerability to HIV infection also makes the trialing of microbicides more affordable and thus realizable. In other words, this Nonoxynol-9 candidate as women's protector and as an (in)efficacious compound were mutually constitutive. But this specific woman/microbicide hybrid as a human/nonhuman relation is vastly removed from the field's promise of empowerment.

Women's vulnerability to HIV infection in the Van Damme trial is compounded by the bioethical decision that the women who seroconverted in the Van Damme Advantage-S trial, possibly due to the use of Nonoxynol-9 and the resulting vaginal lesions and ulcers, were not given access to anti-retroviral (ARV) treatment. At the time, ARV treatment was not available in the countries participating in the study. Making this treatment available for the women in the trial would therefore, in line with bioethical standards of care, be coercive (Van Damme et al., 2002: 976). In other words, making treatment accessible for the women who were infected with HIV possibly due to Nonoxynol-9 induced ulcers was considered unethical according to the bioethical logic of the time. In the clinical trials after Nonoxynol-9 as ARV treatment slowly became more accessible globally, to some extent, this ethical standard has been changed and women in the trials now do have access to ARVs when they seroconvert (UNAIDS and WHO., 2000; Heise et al., 2008; McGrory et al., 2010). However, the Nonoxynol-9 trials do raise major ethical and political questions regarding the role of women trial participants and their specific vulnerability to HIV infection.

The advocacy response

After the van Damme trial, the GCM made an effort to explain the complexity of the trial results and focused on the removal of Nonoxynol-9 lubricated condoms and sexual lubricants. The GCM did not publicly engage with the protocol that failed to provide ARVs to the women who seroconverted in the trial. Rather, the GCM's point of focus was the extent to which the trial was harmful to women. As such, Heise and Forbes (2000) published an article in Reproductive Health Matters entitled *What's Up With Nonoxynol-9?* and the GCM website devoted a page to Nonoxynol-9 in which they disseminated information. Both the GCM website and the article by Heise and Forbes (2000) situate the difficulty of the trial results within a larger HIV epidemic. Specifically, they make a statement that the RCT in itself does not increase women's risk:

> It should be noted, however, that the incidence of new HIV infections in both study groups was lower than that seen in the wider population of sex workers from whom the women were recruited. This contradicts the fear expressed by some AIDS activists that participation in microbicide trials may

> in itself, increase women's HIV risk. The challenges associated with designing ethical prevention trials are complex, given the fact that some sero-conversion among participants is likely to occur despite condom promotion and other safeguards. But they are not insoluble (GCM, 2010c; Forbes and Heise, 2000).

The extent to which the RCTs increase women's vulnerability to HIV infection, was the GCM's primary engagement with the biomedical field (see for instance GCM, 2007b). However, the statement above shows that the GCM's ethical deliberations did not focus on the biomedical process of testing microbicide candidates through the RCT or, specifically, the set of relations this type of testing invites, such as the need for women's HIV infection, the specificities of women's high risk behavior and the role that the microbicide candidate necessarily plays (and in part is anticipated to play) herein. Thus, the role that women's vulnerability to HIV infection plays in the clinical trial is not placed under scrutiny, and with this the constitutive power of biomedical trialling practices is not placed under interrogation.

The women participating in the trials are sought out on a global scale because of their vulnerability to HIV infection which, as advocates tell us, is understood as related to their lack of resources and diminishment of power that renders them vulnerable to HIV infection. Despite its preventative (empowering) measures, the trial depends on this vulnerability for its scientific validity and anticipates this vulnerability in the central role it affords to statistically significant sero-conversion. Although the advocacy aim was to create a feminist science, where the trial would be a site of empowerment, the GCMs response to the Nonoxynol-9 trials, their comparison between the inside and the outside of the trial, maintains the trial as a scientific space cut off from processes of power. Thereby they reiterate the 'gold standardness' of the RCT and facilitate the exclusion of the GCM's own social concerns from the RCTs they conducted. Consequently, the ethical and political ambiguity between ideals of empowerment and biomedical knowledge-seeking practices, intrinsic to microbicide testing, is not addressed. As Mike Michael and Marsha Rosengarten (2012: 40) write, "the RCT entails its own necessity, as it were – not least because of the exclusion of the very conditions that give rise, for instance, to infections". I suggest that the ability to question the extent to which biomedical process is constitutive of women's vulnerability to HIV within the trials is of vital importance to be able to engage the full ethical complexity inherent to the testing of vaginal microbicides through a biomedical process that centralises women's HIV infections and anticipates women's inability to protect themselves from HIV.

Of course, the field has had awareness of the ethical controversies of the trials, but the biomedical process inherent to the clinical trials and its specific practices through which the facts emerge is not seen as part of what makes these RCTs potentially controversial. The materiality of the female body and the efficacy of the microbicide to prevent the HIV virus from entering this body is understood as the only materiality at stake in the development of microbicides. Furthermore, biomedical knowledge seeking practices are understood as the only manner in which to gain access to this materiality. An agential realist conception of the RCT as an apparatus of bodily production, a socio-scientific milieu through which bodies come to matter, neither understands biomedical matter to be the only materiality at stake, nor does it gives sole authority to biomedicine to determine and describe this materiality. Rather, agential realism enables an analysis of the multiplicity of materialities enacted in and through the clinical trials, pertinent for an ethical and political assessment of how women's bodies come to matter in the trials, including their socio-sexual risk of HIV infection and in accordance to feminist ideals.

Concluding remarks: multiple materialities

In this paper, I have argued that agential realism is able to provide a robust analytical framework to interrogate the political and ethical effects of this ambiguity that the field's own discourse of empowerment does not sufficiently provide. In particular, it shows the need to take social science research seriously within the trialling of vaginal microbicides (and HIV prevention in a

more encompassing sense) instead of being either a secondary exercise or an afterthought, for instance in case of the Van Damme trial. Times have changed since the Nonoxynol-9 trials and microbicide clinical trials now often include a social research arm, which I indeed understand to be imperative. However, if we do not come to a multiple understanding of materiality, where biomedical knowledge-seeking practices and social science are understood to be of equal value and authority to determine what matters in the development of microbicides (and HIV prevention technologies more broadly defined), social science analyses run the risk of remaining secondary, or indeed complicit. Consequently, the power mechanisms in play within and through the RCT will remain obscured in such a hierarchy of value. This is what I understand to be one of the crucial contributions STS is able to make within the field of global health - it elucidates the constitutive power of science and technology and thereby engages the politics and ethics of how bodies come to matter under the rubric of 'global health'.

In the beginning of this paper, I asked: what happens to feminist ideals of empowerment when they materialise through biomedical practice? The concept of empowerment has functioned as a vehicle of entry for women's specific vulnerability and receptivity to the HIV virus to play a major role in HIV global health discourse. It has functioned, and still functions, as a driving force behind the development of vaginal microbicides. It has brought women's health advocacy and biomedicine in productive relation with each other. The promise of vaginal microbicides is indeed a promise that entangles the biological vulnerability of the female body to HIV and women's social risk of infection – a particular medicalisation of powerlessness and its promised transformation through the scientific development of a technology that is envisioned to transform the body and sexual power relations. However, this feminist inhabitation of science and the aim to materialise a feminist ideal through biomedical process is where an intrinsic ambiguity emerges between the promise of empowerment and the effects of a biomedical search for facticity through clinical trial testing – here women's HIV infections within the RCTs and vaginal ulceration specifically.

But how does this feminist ideal of empowerment stand in relation to neomaterialist feminist work? Empowerment as a concept emerging out of the second wave feminisms of the 1960s and 1970s stands in awkward relation to neomaterialist theory (although I appreciate Rosi Braidotti's (2011b) unapologetic use of the concept), in particular with regards to underlying understandings of power as predominantly a social force - gender (although there are of course exceptions to such understandings of power as second wave feminism is not a singular field, see Van der Zaag, forthcoming). I do not wish to end this paper with a call towards empowerment, or an argument that hinges on a 'return' to such discourses and ideals, but I do argue that there is purchase for paying serious attention to the politics of materiality and the various exclusions that might be enacted if we fail to do so. Although feminist neomaterialisms encompass a rich multifarious posthuman landscape, increasingly the breach of nature/culture dichotomies have come to stand in for feminist analysis, a certain immanent politics that runs the risk of neglecting attention to specific problems pertaining to sex(uality) and gender (Squier and Littlefield, 2004; Hinton and Van der Tuin, 2014), including matters of postcolonialism and race (Willey, 2016; Leong, 2016). Such an understanding has direct impact on which problems are understood to be significant for analysis and the discourses available to articulate such an analysis. If what is at stake in feminist neomaterialisms is only understood as biomatter, i.e. systems of meaning prevalent in the natural sciences, materialities of sex(uality) as a lived and gendered project of survival (Bell, 2008) as those foregrounded by Judith Butler (1990, 1993) run the risk of being neglected if not fully excluded. This exclusion, I argue, is problematic in terms of feminist theory as a political project.

In particular relation to STS and its predominant focus on the celebration of human/nonhuman hybridity, Nonoxynol-9 shows that a celebration of human/nonhuman mingling does not substitute a political analysis. The human/nonhuman relations in the story of Nonoxynol-9 do not only matter as biomateriality, but also within the articulated lived experiences of women in the HIV epidemic - biomedical bodies are not the only materialities

at stake. What the story of Nonoxynol-9 shows is the importance of a feminist neomaterialism that is focused not merely on Science as the privileged zone of materiality, but on multiple materialities: the materiality of lived reality, sex work economies, HIV infection, (in)efficacious microbicide candidates, the vulnerability of bodies, vaginal ulceration and the potential materiality of a different future less tainted by HIV. Such a focus on multiplicity is indeed a 'politics of materiality', and ethics, I would add, that invites a pertinent critical self-reflection regarding the worlds we bring into being and those we exclude from mattering as feminist theorists located in the scenes of STS.

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NOTES

1 A thorough discussion of these theoretical debates is beyond the scope of this paper, for a more elaborate discussion see Van der Zaag forthcoming.