

## ABSTRACT

Title of Document: LIFESTYLE SEX SELECTION:  
REPRODUCTION, TRANSNATIONAL  
FLOWS, AND INEQUALITY

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This dissertation examines new practices and technologies of sex selection with a particular focus on the interrelationship between the scientific products that enable these practices; the discursive production of these practices through news media, promotional literature and self-help communication; and the institutional operations of U.S. clinics both within and across national borders.

In the late 1990s mass print and television media began heralding the emergence of new technologies as the answer to a long quest for scientifically proven methods for selecting the sex of a child. MicroSort and preimplantation genetic diagnosis gained considerable attention as methods of sex selection that diverged from earlier technologies because they do not require an abortion. Instead, both methods are applied before pregnancy and must be used in conjunction with assisted reproduction such as in-vitro fertilization. Along with the technologies appeared new discourses that make-meaning of

these practices and new institutional mechanisms that embed them within a larger phenomenon of cross-(national) border reproductive practices. Using a genealogical approach, I trace how these three processes (material, discursive and institutional) configure a new form of sex selection at the same time as they construct a stratified system of global sex selection practices, contrasting reasonable, lifestyle motivations in the West with gender-biased forms in the East.

The research uses qualitative, multi-sited modes of analysis and extends feminist STS scholarship on reproductive technologies by shifting focus to a transnational realm as manifested in what is currently conceptualized as “cross-border” reproductive practices. Against a shifting terrain of transnational reproductive practices, the study aims to displace a dichotomous framing of global sex selection practices that polarizes western from eastern practices with the more varied and complex movements that take place in cross –bordered sex selection. The study examines an emerging form of sex selection as an optic through which to theorize and reframe the meanings and interconnections among *reproduction*, *transnational*, and *inequality*, thereby generating new directions in feminist theorizing on reproduction.

LIFESTYLE SEX SELECTION: REPRODUCTION, TRANSNATIONAL FLOWS,  
AND INEQUALITY

By

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Dissertation submitted to the Faculty of the Graduate School of the  
University of Maryland, College Park, in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy  
2012

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## **Acknowledgements**

I thank my informants, who took the time out of their busy schedules to share their professional experiences. They often cared to explain technical aspects of their work in detail and with patience to ensure that I understood it properly. I appreciate their time and their contributions to this study.

I am indebted to my advisor and chair of my dissertation committee, Dr. Bonnie Thornton Dill, who in the midst of a dizzying number of exciting career shifts (a year as visiting professor at Princeton University, an appointment as president of the National Women's Studies Association and then as Dean of the College of Arts and Humanities at the University of Maryland), always managed to give me unstinting support. She not only gave generously of her time, but managed to meet me wherever I was on the journey. I thank her for her undoubting confidence in my scholarship, for stimulating discussion, for never allowing me to sweat the small stuff, and over and over again, for pushing for more clarity in my writing. I feel extraordinarily lucky to have had this mentee experience. I always left our very productive meetings with a sense of calm and renewed energy.

I am grateful for the support and mentorship from my committee members, Dr. Laura Mamo, and Dr. Michelle Rowley, who also gave generously of their time and provided critical input that continued to push me to sharpen my analysis. Dr. Carole McCann and Dr. Linda Aldoory invaluable contributed to shaping this project in its initial stages. I am also thankful for the collegiality among this group of scholars, which has been a source of inspiration.

It takes a community to raise a scholar. I am indebted to other professors within the Department of Women's Studies at the University of Maryland with whom I have had the pleasure to work with at various stages – Dr. Katie King, Dr. Deborah Rosenfelt, Dr. Claire Moses, Dr. Seung-kyung Kim, Dr. Lynn Bolles, Dr. Elsa Barkley Brown, Dr. Ruth Zambrana, and Dr. Ashwini Tambe. For financing my graduate studies and affording me the time to write I thank the University of Maryland Graduate School and the Ann G. Wylie Dissertation Fellowship. To my beloved cohort, Ana Perez, Bettina Judd, Safoura Nourbakhsh, Rachel Caidor, Amy Washburn, and Mel Lewis for your smarts and camaraderie, thank you! I also thank Barbara Boswell, Anaya McMurray, Angel Miles, and Jing Song for support and friendship.

Thriving in graduate school also takes a community. I acknowledge the love, support, companionship, good cooking and immeasurable patience of my partner, Axel Guerin, who refused to live life as a “PhD widower.” I also acknowledge my lovely children, Malvina and Milan for also making home such a wonderful and grounding place. I could not have done this without them, nor without the enduring encouragement, love, and support of my sisters, Rizie Kumar and Wizie Bhatia Eads, who stepped in to look after my children on so many occasions. Numerous other members of my family pushed and prodded me along, and I am grateful that a time nears when they will have to find something other than the (seemingly) never-ending dissertation to joke about.

## Table of Contents

<b>Acknowledgements</b> .....	ii
<b>List of Tables</b> .....	vi
<b>List of Figures</b> .....	vii
<b>List of Abbreviations</b> .....	viii
<b>Chapter 1: Introduction</b> .....	1
An introduction to the technologies – MicroSort and PGD.....	12
The MicroSort Human Clinical Trial.....	13
MicroSort and PGD – the names .....	15
MicroSort and PGD – the procedures .....	16
<b>Chapter 2: Theoretical Foundations and Methodology</b> .....	24
Diverging streams of literature and the problem of reproductive binaries .....	24
Decentering Rights: Reproductive Technology as Cultural Objects .....	26
Retaining Rights: Reproductive Technology as <i>Political</i> Objects .....	34
The Problem of Reproductive Binaries.....	45
Feminist perspectives on sex selection .....	47
The case of lifestyle sex selection and the problem of reproductive binarie .....	52
Methodology: Towards bridging the divide... ..	53
Data Sources .....	55
Multiple methods and limitations .....	59
Modes of Analysis .....	64
Self-Reflection .....	66
<b>Chapter 3: The Material Constitution and Global Situation of Lifestyle Sex Selection</b> .....	74
Material Constitution in Two Stages .....	78
The Agriculture Industry – the seedbed of sex selective ARTs.....	78
“A powerful approach to disease prevention” – the Transfer to Human Medicine .....	87
Medicalization and the anticipation of Biomedicalization .....	100
Global Situation and form of the material technologies in sex selective ART .....	105
Inhabiting a world of reproductive technology: Disassociative and Associative Meanings.....	106
Bodies, biomaterial, and information crossing borders .....	119
<b>Chapter 4: The Discursive Constitution and Global Situation of Lifestyle Sex Selection</b> .....	127
New terms disassociate with “sex selection” .....	129
Family Balancing .....	130
Gender Dreams and Disappointments .....	146
Gender vs. Sex (Selection).....	155
New Categories erase Sex Selective Abortion.....	159
New figures: the ideal gender-balanced family and the white, western woman yearning for a girl.....	164
Actual subjects of lifestyle sex selection .....	169

<b>Chapter 5: The Institutional Constitution and Global Situation of Lifestyle Sex Selection</b> .....	178
Vying for Control: The Case of GIVF .....	179
Regulatory absence and the assertion of clinic institutional control .....	180
Regulatory challenges to the clinic .....	184
Regulatory Circumvention .....	187
Intertextual relations: centering institutional control in clinic hands .....	190
Clinic/patient texts: Institutional variance .....	191
Professional association texts: devolving institutional control to individual clinics .....	193
NGO texts: raising the institutional stakes .....	201
International agency texts: disjuncture along geo-bio-political lines .....	208
Cross-Border Sex Selection: the global form and situation of lifestyle sex selection .....	211
Destination <i>to</i> U.S.: Patient crossing through clinic-to clinic institutional networks .....	213
Departure <i>from</i> U.S.: Providers crossing to satellite clinics abroad .....	219
<b>Chapter 6: Conclusion</b> .....	226
Constitution .....	229
Situation .....	231
Towards new directions in feminist theorizations of reproduction .....	233
<b>Appendix A – Interview Guides</b> .....	240
<b>Appendix B – IRB Approval</b> .....	243
<b>Bibliography</b> .....	245

## **List of Tables**

Table 1: Interviews .....	56
Table 2: Informal conversations .....	57
Table 3: Site Visits.....	58
Table 4: The Medicalization and Biomedicalization of sex selective ART .....	104

## List of Figures

Figure 1: Two-dimensional schematic of a sperm sorting flow system. ....	17
Figure 2: Three dimensional model of the sperm sorting flow system.....	19
Figure 3: Entire flow cytometer.....	20
Figure 4: Single cell embryo biopsy .....	21
Figure 5: Timeline of key events in the development of PGD and MicroSort .....	79
Figure 6: Dr. Johnson with sex preselected pig. ....	86
Figure 7: Difference in DNA content between X and Y bearing sperm in different animal species.....	94
Figure 8: “MicroSort IUI and ICSI Flowchart” .....	118
Figure 9: MicroSort Trial Information in The New York Times Sunday Styles section. .....	156
Figure 10 Sex Selection Advertisement.....	158
Figure 11: “Balanced” Family Ideal .....	165
Figure 12: “Balanced” Family Ideal .....	165
Figure 13: Multiracial “Balanced” Family Ideal .....	174
Figure 14: MicroSort International (microsort.com/en/) home page .....	175

## List of Abbreviations

ACOG	American College of Obstetricians and Gynecologists
ART	Assisted Reproductive Technology (includes drugs, devices, and procedures enrolled en route to establishing a pregnancy within a clinic)
ASRM	American Society for Reproductive Medicine, the professional society for the overlapping fields of reproductive medicine. It publishes recommended guidelines on the ethical use of reproductive technologies, but does not have the power to enforce them.
CGH	Comparative Genomic Hybridization (or microarray based CGH) is comparative to PCR and FISH, a new mode of PGD testing and analysis. It improves on FISH by allowing a simultaneous screening of all 23 pairs of chromosomes.
FDA	United States Food and Drug Administration
FIGO	International Federation of Gynecology and Obstetrics
FISH	Fluorescence In Situ Hybridization, a method that attaches probes onto DNA specific strands which fluoresce, thus allowing for the detection of chromosomes. FISH provided a simpler and more accessible means of detecting the sex of embryos than PCR in applications of PGD
GIVF	Genetics and IVF Institute, a private clinic corporation based in Fairfax, VA that sponsored the MicroSort human clinical trial in the U.S. and for 18 years held an exclusive license to commercialize the method in humans, which was patented by the USDA.
HFEA	Human Fertilisation and Embryology Authority, Britain's regulatory body that oversees embryo research and the practice of assisted reproductive medicine.
ICPD	International Conference on Population and Development (Cairo, 1994)
ICSI	Intracytoplasmic Sperm Injection, an IVF technique that micro-injects a single sperm into an egg as opposed to mixing sperm and eggs in a petri dish to allow them to spontaneously fertilize as is done in traditional IVF.
IRB	Institutional Review Board, a regulatory body that approves and monitors research conducted on human subjects to ensure they uphold principles of ethics in experimentation.
IUI	Intrauterine insemination. An insemination procedure that injects sperm directly into the uterine cavity as opposed to cervical inseminations that inject vaginally.
IVF	In Vitro Fertilization, the process of fertilizing eggs outside of the body in a laboratory to produce embryos.
OHCHR	Office of the High Commissioner for Human Rights, United Nations Human Rights
PCR	Polymerase Chain Reaction, a method that quickly amplifies or reproduces DNA in vitro, allowing for extraction of a single cell from embryos. In the first clinical application of PGD in humans, PCR was applied as a means to detect the sex of embryos.
PGD	Preimplantation Genetic Diagnosis, the umbrella term for screening and diagnostic testing of embryos conducted through a cell biopsy and various forms of analysis, involving PCR, FISH, or CGH.
PND	Prenatal Diagnostic Technologies such as amniocentesis, ultrasound, and chorionic villus sampling, conducted at various stages during pregnancy, to detect genetic or chromosomal abnormality in the developing fetus.
UN	United Nations

UNESCO IBC	United Nations Educational, Scientific, and Cultural Organization, International Bioethics Committee
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USDA	United States Department of Agriculture
USPTO	United States Patent and Trade Office
WHO	World Health Organization

## Chapter 1: Introduction

It was over fifteen years ago that Faye Ginsburg and Rayna Rapp constructed a frame of analysis, *stratified reproduction*, which offered a cutting edge conceptualization of the triangulated processes and interrelations of *reproduction*, *transnationalism*, and *inequality*. Writing just after the end of the Cold War, the editors joined their discussion on “the global politics of reproduction” to broader debates at that time about what lay beyond the old bipolarized “world order.” Since 1995, a vast offering of technological innovations and practices related to reproduction have entered the marketplace. Among these are new technologies to select the sex of babies even before pregnancy via assisted reproductive technologies (ARTs). Over this same period, economic, political, social and cultural processes have shifted the terrain of reproduction to reveal multiple, varied and overlapping worlds – new forms of reproductive activity, new transnational circuits and “connectivities” (Grewal 2005), and new forms of inequality. The overarching aim of this dissertation is to examine an emerging form of sex selection as an optic through which to theorize and potentially reframe the meanings and interconnections among *reproduction*, *transnational*, and *inequality*. Thereby, the analysis generates new directions in feminist theorizing on reproduction.

Ginsburg and Rapp’s significant work brought attention to “transnational inequalities on which reproductive practices, policies, and politics increasingly depend” (Ginsburg and Rapp 1995, 1). The contributors to the volume underlined the varied ways in which global inequalities at the time impacted human reproduction by differentially valuing the reproduction of some groups of people against others. Referring to *reproduction* as any activity related to having or not having children, they use a frame that encompasses a

broad range of technologies, each considered within particular locales across a number of world sites (abortion in Romania, ARTs in the U.K., contraception in Brazil, prenatal diagnostic screening in southern California). Today, activities related to reproduction have increasingly broadened in a way that does not directly relate to the production or care of offspring. Women may engage in reproductive practices that do not relate to having children themselves (egg donation and surrogacy), or having children at that moment (creation and storage of eggs or embryos for future use), or reproducing at all (e.g., egg donation for research). Indeed, reproductive technological practices have grown in kind if not number, so much so that the traditional notion of a reproductive right to “decide freely and responsibly the number, spacing and timing” of children, “and to have the information and means to do so,” seems almost quaint (Article 7.3, Programme of Action, International Conference on Population and Development, 1994). Even those who engage assisted reproduction in the hopes of having a child understand the odds that they are likely not to get one. Sarah Franklin’s conceptualization of IVF as a “hope technology” captures this idea (1997). In order to encompass the full meaning of reproductive technological practices, then, a frame of analysis should be able to center the process of engagement with a myriad of technological forms as an end itself, rather than a means to an end. The focus should shift from the reproduction of humans as an end to the varied activities or processes that involve reproductive bodies for different ends.

Contributors to the Ginsburg and Rapp volume counted movements of western biomedicine and labor via migration as some of the *transnational flows or circuits* impacting (local) reproductive practices. Today, certain reproductive practices

themselves such as the buying and selling of ova, surrogacy services, and other cross-border uses of ARTs such as for sex selection make up the transnational circuits. Traveling electronic communications, regulatory forms, ethical principles, clinicians, brokers, equipment, technologies, body parts, patients, and donors constitute what Ong and Collier term the new *global form* of assisted reproduction. As stated by Ong and Collier, a *global form* has “a distinctive capacity for decontextualization and recontextualization, abstractability and movement, across diverse social and cultural situations and spheres of life” (Ong and Collier, 2005, 11, see also Hamra and Knecht, 2008; Ryan 2009). Although some aspects of this global form such as the buying and selling of Eastern European women’s eggs or “renting wombs” from Indian women provide fodder for media spectacle, more mundane activities fall outside the radar of news and popular media. These include the technicalities of transnational clinic networks or the invention and solicitation of visas that grant access to a country (e.g., to India) specifically for the purpose of purchasing medical services.

Finally, Rapp and Ginsburg develop the idea of global *inequality* in reproduction through *stratified reproduction*, a concept that has become a boundary object – that is, robust enough to traverse a number of disciplines while flexibly adapting to their specific and locally developed goals and projects (Bowker and Star 1999, 297). Ginsburg and Rapp define *stratified reproduction* as “power relations by which some categories of people are empowered to nurture and reproduce, while others are disempowered,” and “arrangements by which some reproductive futures are valued while others are despised” (Ginsburg and Rapp 1995, 3). That which is stratified or valued differently is the

reproduction of different groups of people relative to one another. In her encyclopedic entry on the term, Amy Agigian clarifies,

Some children are considered highly worthy of being born, and considerable resources are used to enable their births (e.g., through in vitro fertilization made available to affluent, predominantly white heterosexual couples), while others are strongly discouraged (e.g., through welfare policies that impose “family caps” limiting the subsistence income of poor mothers who have children). (Agigian 4828)

Further, Agigian explains, “Reproduction can be, and is, stratified along multiple axes of social status and exclusion. Relevant inequalities include gender, race, class, nation, sexual orientation, age, health and disability status, and legal status” (4827). As Agigian points out, the categories of valued and despised reproduction do relate to markers of social difference, yet the process of pinning such markers to our understanding of these categories has both directly and inadvertently reinforced a number of *reproductive binaries*: despised- /valued reproduction, (over)fertility/(in)fertility, antinatalism/pronatalism, developing/developed, irrational/rational, modern/postmodern, and population control/individual control. The category of valued, for example, does not simply correlate to a whole category of people (such as those that are wealthy or racialized white, etc.), or to a set of (conceptive) technologies, or to a world region (e.g. global West). There are multiple ways in which reproductive processes are stratified and what is valued or not (and how) configures contingent upon the situated context of reproductive activities.

The Ginsburg and Rapp anthology associates particular technologies with nationally or culturally bound sites, leaving much out of focus today as current activities, especially those related to cross-border reproduction, take place in increasingly enmeshed

transnational and/or biopolitical contexts, along with their related technologies and subjects. *Stratified reproduction* strongly captures the idea of inequality across a number of local/global divides. Yet, the term no longer fully captures the diversity in types of reproductive activity and stratifications that result in the contemporary context of transnational circuits working to produce what public health and human rights scholar, George Annas, calls, “the global baby” (2011). Cross-border practices such as those involving sex selective ART represent a new type of reproductive activity that confounds existing theoretical frameworks and demonstrates a need for new concepts.

### **The case for examining sex selective ART:**

The U.S. plays a very significant role in the science and practice of new forms of sex selection. In the mid to late 1990s two new technologies, MicroSort and preimplantation genetic diagnosis (PGD) began to be applied for sex selection in humans for purposes other than disease avoidance on U.S. turf, where the practice is not illegal. Developed at the U.S. Department of Agriculture (USDA), MicroSort, involves sorting sperm based on the chromosomes determinative of sex and using the sorted samples either with in-vitro fertilization (IVF) or intrauterine insemination (IUI). Having undergone a human clinical trial in the U.S. for over 15 years, investigators of MicroSort currently await a determination on its safety and efficacy by the U.S. Food and Drug Administration (FDA). Second, PGD is a diagnostic technology that involves testing embryos produced through IVF for the characteristic of sex and then pre-selecting embryos for implantation based on sex preference. Since both are applied before pregnancy in conjunction with ART, they can circumvent the politically contentious abortion issue. The importance of this feature in the U.S. context, where the legalization of abortion in 1973 elicited a

strong backlash and the formation of an anti-abortion stronghold in U.S. political-cultural life, cannot be overstated.

Mass print and television media in the U.S. began heralding the emergence of these technologies as the answer to a long quest for scientifically proven methods for selecting the sex of a child. At the same time, prospective consumers of sex selection increasingly found each other on the internet, developing a collective identity based on their desire for a child of a particular sex. Patient/consumer activism via the internet provides sympathetic, self-help spaces that allow individuals to express their intention to preselect offspring's sex or their disappointment at bearing or birthing a child of the "wrong sex." Taken together, these developments signal a new era in which the desire to choose having a boy or girl baby has been "biomedicalized," or increasingly normalized as an *indication* to intervene medically for sex selection. The dissertation explores this process of biomedicalization and the interconnections of local and global, as a new sex selection practice gets constituted in contrast to a preexisting one.

Understandings of sex selection stemming from experiences in Asian regions tie the practice to population measures, family planning, abortion, son preference, missing girls, gender inequality, and even political instability (Oomman and Ganatra 2002, Gupta 2005, Hudson and Den Boer 2004). Yet, a preliminary look at discourse stemming from the U.S. on sex selection reveals contrasting ideas such as gender equality, family balancing, daughter preference, designer babies, playing god, and gender disappointment. The newer discourse formed in opposition to an established discourse corresponding to binary ways of thinking about the contexts of reproductive technology use across global and local divides: (over)fertility/(in)fertility, contraception/conception, developing/developed,

and population control/individual control. This framework categorizes women too simply as either population subjects seeking sex selective abortion in a global East context or as autonomous individuals seeking preconception gender selection in the U.S.

This contemporary form of sex selection via ART (which I refer to as lifestyle sex selection) manifests characteristic elements of new reproductive situations that have emerged around the mid-1990s, thus providing a productive topical area to reexamine the interconnections between *reproduction*, *transnational movements* and *inequalities*. For example, sex selection introduces more complex sets of desires into *reproduction* beyond the choice to have or not have a child. Secondly, due to a permissive regulatory climate within the U.S., ART clinics market sex selection to international users to tap larger potential sources of demand and users outside the U.S. travel here to engage a more legitimate and legal practice. U.S.-based ART clinics increasingly collaborate with clinics outside the U.S. in order to extend their markets. Clinic networks pave another route into the *transnational* reproductive economy. Therefore, multiple biopolitical and cultural influences come into contact with one another to both reinforce existing inequality related to reproduction and to form new kinds of inequalities.

In sum, the purpose of analyzing the formation of a new practice of sex selection via ART is to reveal its viability as a theoretical case for illuminating new meanings of and interconnections between reproduction, transnational, and inequality. The local and global forms and assemblages<sup>1</sup> that accompany emergent reproductive activity such as lifestyle sex selection transgress existing frames of analysis within feminist theorizations of *stratified reproduction*. Therefore, the case provides a productive topical area from

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<sup>1</sup> Ong and Collier use *assemblage* in connection to *global*, as an idea referring to that which is “heterogeneous, contingent, unstable, partial, and situated” (Ong and Collier 2005, 12).

which to build upon the concept in light of changing economic, social, political and cultural processes.

In forthcoming chapters I argue that lifestyle sex selection formed in part because of a convergence that took place between practices involving MicroSort and PGD – as sex selective ART – in opposition to those involving sex selective abortion. This split took place along the same line that separates a broader set of *reproductive binaries*.

Specifically, the assemblage of associated valued elements in *stratified reproduction* (white, well-off, global West, ARTs) produced a valued set of sex selection practices: western, individually determined, unbiased, producing desired babies via ART and “family balance” in sex ratio. These formed in relation to a less valued form: eastern, culturally determined, gender biased, aborting undesired babies, and causing population imbalance in sex ratio. In this way, the existence of *stratified reproduction*, and the meanings tied to the reproduction of different groups of people around the globe, helped to produce *stratified sex selection*. My contribution to the field of women’s studies lies in defining a new frame of analysis I call *reproductive stratifications*, which apprehends reproduction as a set of shifting processes in and around which stratifications of various kinds occur.

As a multi-sited and multi-method qualitative inquiry into a new set of sex selection practices, the research design is guided by the following question:

How is lifestyle sex selection materially, discursively, and institutionally constituted and how does the practice situate globally?

Since the research design starts with the science and technology of sex selection as located in two technologies, MicroSort and PGD, the research begins with the *material*

constitution and global situation of sex selective ART. It then moves to the *discursive* formations that accompanied the emergent practice and finally, the *institutional* structure that supported it. To answer the research question, sex selective ART is understood not as a single site, but as multiple material, discursive, and institutional processes.

**Materially**, sex selective ART includes material technologies and bodies. As such the very meaning and use of technologies will be foregrounded and analyzed for the ways humans and things actively and mutually shape the “object” of study. Second, sex selective ART practices are **discursively** produced through clinic communications in print materials, websites, and through interaction with popular and public news media and social media such as self-help books and blogs. Finally, sex selective ART practices are **institutionally** produced through the regulatory and deregulatory work done by the clinics themselves, regulatory authorities, professional and non-governmental organizations. Since I utilize a methodological strategy that organizes material, discursive, and institutional domains separately, locating each in its own chapter, a break occurs between, for example, what I identify as material or discursive that in reality is not so sharp. Rather, these processes should be understood as a set of overlapping, co-constituted meanings guided conceptually through understandings of material-semiotics in which the material is simultaneously semiotic (constituted through the work of translation, negotiation and compromise) and the semiotic always qualified by or constituted in relation to matter (e.g., made bodies) (Haraway 1991, Butler 1993).

Data is drawn from three main sources: 1) in-depth interviews with clinic personnel and authors of self-help books and blogs, and informal participant observation at clinic site visits, 2) discursive materials collected at and about these clinic sites in newspapers,

advertising, websites, self-help books and blogs, and 3) organizational documents that coordinate institutional activity. The methodology is described more fully in chapter two.

The study primarily focuses on providers of sex selective ART who I purposively selected for their active role in constituting sex selective ART for lifestyle purposes through development of material technologies, the production of informational and promotional websites, and/or for their mention in news and popular media on the topic. Therefore, the study is limited by the lack of examination into providers who have more quietly begun to offer sex selective ART without high stakes in its promotion. It is also limited in that it does not examine the voices of end users of the technology, the men and women who have successfully or not sought technoscientific interventions to choose a boy or girl baby. Some gaps in the data I had to fill with secondary source material. For example, while I gained access to interviews with individuals involved in the history of MicroSort that covered the earliest years (1992 and before) and the latest decade (2002 and onwards), I was unable to interview anyone involved in the clinical trial from the mid to late 1990s. I also struggled to balance uneven types of data on each technology – while I could rely on some primary sources on the history of MicroSort, I had to turn to secondary sources on the history of PGD. On the other hand, I was able to observe PGD in practice, and not MicroSort. Some of these limitations arose unexpectedly (e.g., self-help authors who refused to engage in formal interviews but belatedly agreed to informal conversation), while others through the boundaries I drew on the case (e.g., exclusion of the subjective experiences of end users).

Before ending with background information related to the technologies in this study, I briefly define my use of key terms that arise in the study. These include:

**Contemporary** – here defined as 1995 to the present. 1995 is the year that the MicroSort trial expands the human clinical trial on MicroSort to *family balancing*, jumpstarting lifestyle applications of sex selective ART. 1995 is also the year that MicroSort is first introduced to the scientific community as an “adjunct” to PGD for the purpose of sex preselection of offspring. The year marks the convergence of second-generation, pre-pregnancy methods of medicalized sex selection that coincide with related emergent forms of local/global, social relations, and inequalities.

**Lifestyle Sex Selection** – Sex selection refers to interventions into reproductive practices in order to prevent or cause the birth of a child based on preferences for or against particular sex characteristics. *Lifestyle sex selection* is a term that I define as the specific practice of sex selection that has evolved around a use of MicroSort and/or PGD in combination with assisted reproductive technologies. It is comparable to *social* sex selection or *non-medical* sex selection or *family balancing* all terms used to indicate practices of sex selection that are not applied towards the end of disease prevention or avoidance. I use it in lieu of the comparable terms in order to denote a specific iteration of sex selection practice that runs parallel to other processes of biomedicalization that have since 1985 expanded medical jurisdiction to lifestyle wishes. Motivated by imaginings of one’s future self and family that are contingent upon the sex of future offspring, *lifestyle sex selection* denotes a practice of trying to realize that dream using technoscientific means to get pregnant with sex-specific babies. The practice has been constituted as valued and devoid of gender-bias in a hierarchy of global sex selection practices.

**Biopolitical** – refers to how the lives of individuals or groups of individuals are turned into elements of political and economic calculation, categorization, and regulation. (Foucault 1990, 139-140). At times, when I wish to stress the spatial dimensions of the “biopolitical” (that range local to global) I refer to “geo-bio-political.”

**Biomedicalization** – expanding on Irving Zola’s critique of medicine as an institution of social control (medicalization), biomedicalization refers to “a second ‘transformation’ of American medicine” since around 1985 revealed through new social forms and major changes in the organization and practices of contemporary medicine brought about by technoscientific innovations (Clarke et al. 2003, 161).

**Global East/West** – the East/West divide is a hierarchical division of global regions based on political and socio-economic development status (rather than simply geography). It runs parallel to global North/South differentiation, and to a very large extent the references I make to the global East can be easily replaced by global South, and global West by global North.

## An introduction to the technologies – MicroSort and PGD

This dissertation starts with the scientific products, MicroSort and PGD, and basic information about the two technologies such as fundamental characteristics of their design and procedures are essential not only to understanding data from my informants but also to grasping analysis of shifts taking place in transnational reproductive processes. What follows is a detailed explanation of how these technologies work and other essential information crucial to discerning how these technologies signal changes occurring in a global political-economy of reproduction.

As a set of technologies constitutive of lifestyle sex selection, the similarities between PGD and MicroSort outweigh their differences. They are both examples of “high” science and technology, which are applied before pregnancy. They both associate with ART and disassociate with abortion. Even their differences tend to reinforce their material, discursive, and institutional convergence as a set of alternative sex selection technologies. PGD is highly accurate at identifying the sex of embryos. MicroSort is less accurate in differentiating X- from Y-bearing sperm, aiming at best to alter probabilities, shifting sperm populations from the normal 50:50 ratio to a higher proportion of sex-desired sperm. Yet, neither can guarantee the birth of a specifically sexed baby. PGD sexes embryos prior to implantation, while MicroSort sexes sperm before conception, yet both are applied before pregnancy and both involve the rigorous processes of ART. MicroSort can be applied using intra-uterine insemination, while PGD necessitates IVF. Thus, MicroSort sidesteps abortion-related politics more than PGD, which must contend with the morally and ethically contentious issue of producing and disposing of human embryos that do not get transferred for pregnancy. Yet, in their

initial invocation within human medicine to avoid genetic disease scientists touted both technologies for their ability to avoid repeat pregnancy terminations associated with prenatal diagnostic test results that reveal afflicted fetuses. As fundamentally a cross-use, multi-purpose technology, PGD maintains an anchor to the larger medicalized context of clinical genetics, while MicroSort clinically widened the ambit of indications for sex selection by defining a non-medical use, *family balancing*. Thus, the push and pull of these various factors, their comparative association with ART and disassociation with both sex selective abortion and “pseudoscientific” methods, reinforces convergence of PGD and MicroSort into a set of alternative, “high-tech” lifestyle sex selection technologies.

### **The MicroSort Human Clinical Trial**

It is pertinent to this dissertation that, unlike PGD, MicroSort has been part of a human clinical trial in the U.S. since 1993. Sponsored by the Genetics and IVF Institute (GIVF), a private clinic corporation based in Fairfax, Virginia, the trial began after the USDA granted GIVF an exclusive license to commercialize the method for human use. The USDA had developed the method originally for use in the livestock industry. In 1993, the Institutional Review Board (IRB) at Inova Fairfax Hospital approved the trial only for the indication of sex-linked disease. Two years later, GIVF had established its own in-house IRB, which took over oversight of the trial, and approved the extension of MicroSort applications to the *indication of family balancing*, that is for those couples who desire a child of specific sex that will balance the sex ratio of their current offspring (Wadman 2001, 178).

Although not sought and at first challenged by GIVF, the U.S. FDA in the late 1990s extended its authority over the clinical trial – to oversee the trial process and make the ultimate determination on MicroSort safety and efficacy (the latter of which has not occurred at the time of this writing). The institutional mechanism by which the trial came under FDA purview was the FDA Investigational Device Exemption (IDE) dated 2000. The trial history, thus, among those working at MicroSort is often distinguished between pre- IDE (1993-2000) and post-IDE (2000- today) periods, corresponding to when the trial operated outside of and within the bounds of FDA authority (Interview series, MicroSort scientific director, December 2010).

In the middle of 2008 the trial officially concluded when it reached its sample size limit of 1,050 babies. Since then, MicroSort continued to enroll subjects under an FDA policy of “continued access” for which GIVF had to reapply every six months. In the summer of 2010, in response to GIVF’s fifth application for “continued access,” the FDA denied it specifically for the *indication of family balancing*. At the time of this writing, MicroSort is available in the U.S. for the medical indication of avoiding X-linked disease only, and the FDA has not yet made a determination on its safety and efficacy (Interview series, MicroSort scientific director, December 2010).

In 2009, MicroSort opened MicroSort International with new labs outside of FDA jurisdiction in Mexico. Thus, the dissertation refers at times to the investigational U.S. and commercialized international (outside the U.S.) contexts of use.

## **MicroSort and PGD – the names**

The USDA developed and patented their method of sperm sexing under the name, the Beltsville Sperm Sexing Technology. GIVF renamed its human application complete with a registered trademark signifier, “MicroSort®.” In scientific literature the method is identified as “flow cytometric separation of DNA-based X or Y enriched sperm samples.” It differs and should not be confused with other methods of sperm separation such as the Ericsson method or those that involve sperm spinning. I use the trade name “MicroSort” in this dissertation not only for the sake of simplicity, but also because my data all stems from MicroSort providers. Although the method as of 2010 is no longer under exclusive use license, I did not in the field encounter the method under different name or provided by any other entity other than GIVF or GIVF recognized ART providers who transact with GIVF owned labs for sperm sorting. GIVF refers to these ART providers as “collaborating physicians” within the GIVF sponsored, U.S.-based, human clinical trial, or as “participating physicians” internationally.

In the scientific literature, a distinction is sometimes made between preimplantation *screening* (PGS) and preimplantation genetic *diagnosis* (PGD). Screening refers to both sex selection and aneuploidy (abnormal chromosome number) screening protocols that do not technically diagnose a disease. However, among lay publics such as online self-help communities, in news and popular media, and even many providers appear to drop this distinction and refer to all applications as “PGD,” and thus, I also refer to PGD as the umbrella term.

## MicroSort and PGD – the procedures

Although the most important instrument involved in the MicroSort process is the *flow cytometer*, MicroSort should not be understood as an instrument or machine itself, but rather a process or series of steps that act on the raw material of human sperm. Often contrasted to their earlier kin, the microscope, which permits analysis of a single cell or particle, flow cytometers use a system of cells flowing in a liquid in single file past an optical analysis point, in order to measure and collect information on a whole population of cells. Howard M. Shapiro, author of *Practical Flow Cytometry*, describes the basic function of flow cytometers thus: “At the most basic level, a cytometer might be considered to be a ‘black box’ with cells as ‘inputs’ and numbers as ‘outputs;’ the outputs of a cell sorter would include both numbers and cells” (Shapiro 2003, 1).

Starting with a raw semen sample, lab technicians begin a multi-step process of *sperm preparation*, to first evaluate “common semen quality traits: volume, sperm concentration, the percentage of motile sperm, and the percentage of sperm that are viable,” and then “wash” or “process” the sample in order to remove “non-sperm components of the ejaculate – seminal plasma, cellular debris, that kind of thing,” and finally reevaluate sperm volume, concentration, motility and viability before the “specimen is handed off” for staining and sorting (Interview series, MicroSort scientific director, December 2010). The information collected in the evaluation of the specimen during preparation informs the next major step in the process: *staining*. A very specific ratio of stain amount to sperm cell number must be maintained in order to ensure that each cell is exposed to the same amount of stain. The Hoechst 33342 stain binds to the

DNA in the sperm. Finally, after an hour for staining, the sperm sample is ready for sorting.

The schematic for the *sorting procedure* is illustrated in figure 1 in a two-dimensional diagram prepared by USDA scientists. The “input” sample (washed and stained sperm) flows through the cytometer, hits a laser beam, which causes the dye to fluoresce. A detector oriented at 90° to the laser beam reads the amount of fluorescence at the sperm’s edge to determine if the sperm is oriented correctly. Most are not oriented correctly, and therefore do not get read and are wasted (see middle droplet labeled “waste” in the diagram). Therefore the sorting process results in far fewer sperm numbers (200-400,000) than in the original unsorted sample (20-40 million).

## Schematic of a Sperm Sorter

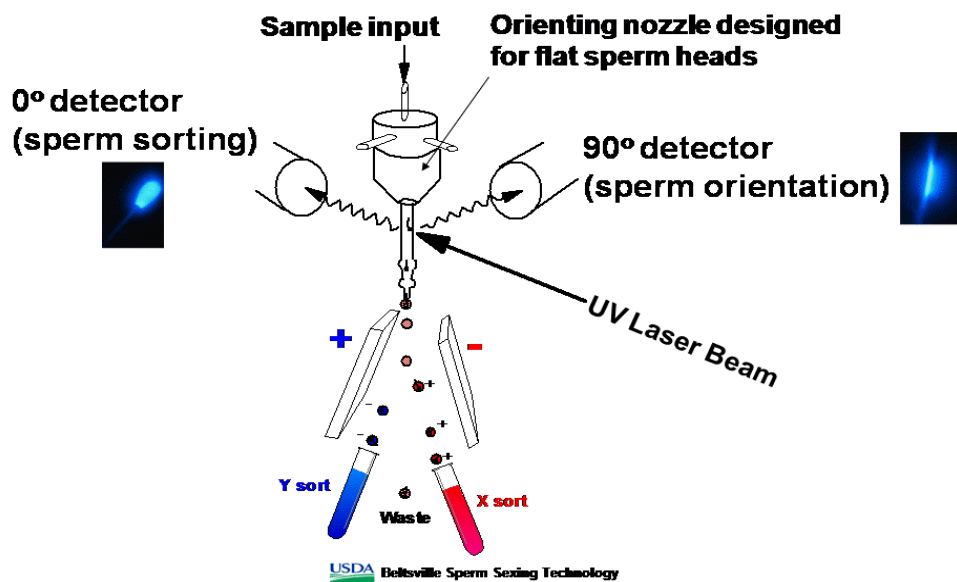


Figure 1: Two-dimensional schematic of a sperm sorting flow system.<sup>2</sup>

<sup>2</sup> I thank H. David Guthrie of the USDA for the use of this PowerPoint slide from his presentation, “Animal Biosciences and Biotechnology Laboratory ‘Gender Preselection.’” (n.d.).

If oriented correctly, another detector at 0° reads the fluorescence intensity of the face of the sperm head. The information provided by the readings of the 0° detector are used to determine the relative differences in intensity of X and Y sperm. This is called the analysis point. One of the most delicate aspects of the process, which must be monitored continuously by the cytometrist, is the timing between the analysis point, and the point at which a droplet (containing a single cell) breaks off from the stream. Depending on the amount of glow or fluorescence intensity determined at the analysis point, each droplet that then breaks off is given either a positive or negative charge. For example, as shown in figure 1, sperm cells with higher intensity fluorescence are given a positive charge and then deflected by a negatively charged plate to the “X sort” tube (Schulman and Karabinus 2005, 112; field notes, USDA site visit, Sept.10, 2010).

To translate this process to visitors, USDA scientists prepared a three dimensional model of the sorting flow system, which is pictured in figure 2<sup>3</sup>. The spherical bubbles correspond to flowing droplets, each containing one sperm cell. Y-bearing cells are deflected to the left, labeled in this diagram with the male symbol, ♂. X-bearing cells are deflected to the right, labeled with the female symbol, ♀. Most droplets fall in the middle and are “wasted.”

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<sup>3</sup> I took this photograph with permission during my site visit to the USDA lab (September 10, 2010)



**Figure 2: Three dimensional model of the sperm sorting flow system.**

The illustrations of figures 1 and 2 that depict the flow and sorting system are difficult to see on an actual flow cytometer, pictured in figure 3<sup>4</sup>. Figure 3 depicts the entire cell sorting flow cytometer. Note that the two schematics in figures 1 and 2, which depict the actual flow system, correspond to a very small portion, the center section of the big “black box” on the right. This structure contains the laser beam and the optical detectors. On the left lies the corresponding computational equipment. This model, called a Mo Flo was used at the USDA in the late 1990s. It is not the model that GIVF has used in the MicroSort trial.

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<sup>4</sup> I thank H. David Guthrie of the USDA for the use of this image from his presentation, “Animal Biosciences and Biotechnology Laboratory ‘Gender Preselection.’”(n.d.). I altered the image to indicate location of key parts.



**Figure 3: Entire flow cytometer.**

PGD is a subset of processes within IVF, taking place after the creation of embryos in laboratory and before transfer of those embryos back to the women intending to get pregnant. PGD testing often combines sex selection applications with those used to identify some of the main aberrations in chromosome numbers (aneuploidy screening), other kinds of chromosome disorders, or single gene disorders (genetic diagnosis). PGD involves two major sets of procedures. First developed in the late 1960s the first procedure is an embryo biopsy, which involves removing a cell from each of the embryos created in the IVF cycle. Figure 4 illustrates the procedure from what appears to be an embryo with 8 cells. While in the field, I was able to observe this process.



**Figure 4: Single cell embryo biopsy<sup>5</sup>**

The second procedure applies a test used to analyze the chromosomal and genetic information contained in the nucleus of the removed cell. There are currently three tests that yield information from the cell nuclei removed via embryo biopsy. Two of them, polymerase chain reaction (PCR) and fluorescence in-situ hybridization (FISH) were both developed during the 1980s. The first clinical application of PGD occurred with PCR, but FISH has served as the test of choice in basic sex selection protocols. Only since 2009 has a new, third type of screening procedure, microarray or array comparative genomic hybridization (CGH), which tests all 23 chromosome pairs, emerged (Fishel et al. 2009).

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<sup>5</sup> Image source: <http://www.advancedcell.com/images/34.jpg>, accessed on May 25, 2011.

Inside the cell nucleus, chromosomes are the larger packages that hold DNA. The genetic “code” that resides on two twisting strands known as “the double helix,” is made up of sequences of molecules. FISH involves first developing a *probe*, which is a small, unique subsection of DNA molecules that fluoresces, and then allowing that fluorescent probe to bind to its counterpart on a DNA strand that has been unraveled from the helix. In this way, scientists can detect using fluorescence microscopy information about the number and location of chromosomes or gene sequences. Simple chromosomal sex differentiation via FISH requires only two probes, and FISH appears to be well suited to this relatively easy task. Yet, based on the information provided by clinic personnel for this study, sex selection is often enveloped within larger “aneuploidy screening” protocols that check for some of the more common aberrations (either too few or too many) in normal 23 pair chromosome numbers, which may compromise the chances of establishing a pregnancy or lead to birth defects.

When presented with a wider range of what PGD can do, typically sex selection patients opt for a larger set of probes. Genetic labs sell convenient 2-probe, 5-probe, or 9- and 10-probe kits to ART clinics that have the laboratories and expertise to conduct FISH in-house. A five probe kit, for example, screens not only for the two sex chromosomes, X and Y, but for chromosomes 13, 18, and 21 because the presence of more than the normal pair or *too many* of these chromosomes represent some of the most common “birth defects.” Trisomy is the condition of having three rather than the normal pair of chromosomes. Trisomy 21, for example, means that there are three rather than the normal pair of chromosome 21 present, which results in the condition known as Down Syndrome. On the other hand, cells can contain *too few* of the normal number of

chromosomes. The next most typically screened chromosomes in a 9-probe kit look for the most common chromosome deletions. A limitation of FISH is that only a small number of chromosomes can be tested at any one time. The process requires applying one set of probes, washing them off, and then applying another set to avoid too many colors mixing, which can appear white under the microscope (Interview, Clinic Director, August 24, 2010). Today, microarray CGH has improved on some of limitations of FISH, by allowing a simultaneous screening of all 23 chromosome pairs. However, this complex procedure appears to be only conducted at genetics laboratories rather than in-house at IVF clinics. One of the clinics I investigated had removed intermediary probe number options, giving PGD patients the choice between the simple 2-probe by FISH for sex selection only or the more comprehensive CGH conducted by a genetics “reference” lab, or an outside laboratory to which biopsied cells are overnighted for rapid testing and analysis. Screening information on cells biopsied on a three-day old embryo must return promptly so that decisions can be made about which embryos to transfer. Embryo transfers take place on day five after the day of egg retrieval and fertilization. These basic procedural and design aspects of the technologies are essential to an understanding of the data and analysis encountered in later chapters. In the next chapter, I proceed to a discussion on the theoretical underpinnings of this study.

## Chapter 2: Theoretical Foundations and Methodology

In this chapter I take a closer look at the conceptual framework for this study through a review of feminist theorizations of reproduction and I introduce the problem of reproductive binaries that result from gaps in that literature. I consider the case of lifestyle sex selection in relation to that broader literature and also, in relation to specific feminist theorizations that address the issue of sex selection. In the latter section of the chapter, I turn to the study's methodology as I consider how the theoretical frame informs the questions and methodological approach I take.

### Diverging streams of literature and the problem of reproductive binaries

The issue of lifestyle sex selection rests on the foundational feminist theorizing on reproductive technologies, inclusive of their related critiques of technoscientific interests in fertility and reproduction. This chapter maps a set of divergences in that literature – a conceptual divide that constructs essentially different kinds of biopolitical subjects that become particular kinds of reproductive technology users. For example, on one end there is a subject cast as an affluent individual in a rich, post-industrial country such as the U.K. or U.S. She has a number of technological options open to her, and is generally supported in fulfilling her desires. If facing infertility, she may actively seek and undergo IVF (in-vitro fertilization). On the other end is a poor, fertile woman without choices, a number in a population from a developing country such as Haiti or Puerto Rico, who is the object of programs to reduce the number of children she bears within population control programs. In their depth and detail the literature often troubles these extreme binaried representations with illustrations of women exercising choice and agency in the

face of multiple constraints in the so-called developing regions (López 2008, Maternowska 2006, Unnithan-Kumar 2004). The literature also portrays ambivalent, often anxiety-ridden decision-making around technology use in richer countries (Edwards et al. 1999, Franklin 1997, Thompson 2005). Still, on the whole, critical feminist analyses of reproductive technologies tends to address either contraception and sterilization associated with a population subject in a global East context, or conception and reproductive genetic technologies associated with an individual subject in Euro-American regions. Not only are these sets of literature divided by topic, but also often in approach. Though both streams belong to a continuum of literature and do not represent opposing camps – rather different streams of thought – their net effects reinforce reproductive binaries.

During the 1970s and 1980s theoretical discourse on reproductive rights emerged in classics such as *Our Bodies, Ourselves* (The Boston Women's Health Book Collective 1973), *Woman's Body, Woman's Right* (Gordon 1976), and *Abortion and Woman's Choice* (Petchesky 1990). Their collective assertions of “choice,” “control,” “self-determination,” “freedom,” and “rights” in relation to reproductive technology became the foundational feminist discourse known as reproductive rights. All of them point to a central tension within the framework, between what Petchesky names the individual and social dimensions of reproduction.

Beginning in the 1990s, I trace the beginning of two diverging approaches to the study of women, reproduction and technology. Each addresses the central dilemma between the individual and social arising from theoretical discourse on reproductive rights during the preceding two decades differently. One stream of literature, which I will call

*decentering rights* focused on reproductive technological practices as a means to understanding social and cultural life. In this way, *decentering rights* structured the story away from rights-based issues and claims, or violations. *Retaining rights* literature, on the other hand, continued to approach such practices as political phenomena, in order to refine or expand on the meaning of reproductive rights. Their names, *decentering* or *retaining rights*, reflect a different orientation to the scholarship on reproductive rights emerging in prior feminist theorizations. This divergence in the literature ultimately reinforces what I refer to as *reproductive binaries* – ARTS/contraceptives, valued /despised reproduction, individual/population, (in)fertility/(over)fertility, and pro-natalism/anti-natalism – since each stream largely deals with one side of these opposed elements.

### **Decentering Rights: Reproductive Technology as Cultural Objects**

Ginsburg and Rapp, in their introduction to *Conceiving the New World Order*, spell out the theoretical basis for a new approach to reproductive technology: “reproduction in its biological and social senses, is inextricably bound up with the production of culture,” (Ginsburg and Rapp 1995, 2) and consequently, “technologies are cultural objects enmeshed in social, political, and economic systems” (5). Sarah Franklin, in the same volume, welcomes this new approach because of increasing challenges to the politics of “choice” and “reproductive rights” from “fathers, fetuses, and embryos” and most problematically for feminists, from other women (Franklin uses the Baby M surrogacy controversy entailing a clash of two women’s choices as an example). Therefore, she argues, “that an appreciation of the specifically cultural dimensions of the changing

construction of reproduction is critical to the maintenance of effective feminist challenges. Anthropology has a particular role to play...” (Franklin in Ginsburg and Rapp 2005, 325). If this was a call to action in 1995, Inhorn and Birenbaum-Carmeli confirm in their recent review article that anthropologists have stepped up to that task. They document the work of over fifty anthropologists studying “ARTs and culture change” (Inhorn and Birnbaum-Carmeli 2008). Feminist anthropologists’ “fascination with the new reproductive technologies”<sup>6</sup> that Lock and Kauffert admit in their 1998 anthology, *Pragmatic Women and Body Politics*, has clearly endured (1998, 3). On the whole, *decentering rights* scholarship illuminated reproduction as a social and cultural process involving multiple subjects and interests rather than an individual act, choice, or right.

### ***Disciplinary orientation***

Anthropologist engagement with matters of reproduction opened many new questions and lines of inquiry (Martin 1992, Strathern 1992, Ragoné 1994, Inhorn 1994, Ginsburg and Rapp 1995, Ragoné and Franklin 1998, Rapp 1999). Emily Martin’s “cultural analysis of reproduction” broke ground in its innovative textual analysis of metaphors in medical textbooks – treating science as the “exotic” that needs to be made “familiar.” Many of these authors, as younger anthropologists, fulfilled a disciplinary duty of studying people often less privileged than themselves in foreign (“exotic”) settings. Their scholarly interests must be read against the discernible contextual background of their field – cultural anthropology’s period of intensive reflexivity in the 1980s and 1990s

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<sup>6</sup> Today, scholars overwhelmingly refer to these technologies as ARTs, rather than NRTs (new reproductive technologies), a more common usage in the 1980s and 1990s. Using “new” as a referent has become increasingly impractical given a proliferation of even newer technologies and a recognition of a variety of both distinct and overlapping reproductive domains to which both “new” and “old” technologies pertain (such as conception, genetic screening, or contraception).

brought on by postcolonial and feminist critiques. In response to this “crisis,” scholars pursued innovative ethnographies at local sites back “home” such as Baltimore, MD (Martin 1992) and New York City (Rapp 1999). Writing of her experience doing fieldwork at the Prenatal Diagnosis Laboratory (PDL) in New York City, Rapp recalls,

The laboratory staff was more than tolerant during the two months that I imposed a maverick internship upon them, learning to spin and culture fluids, focus a microscope, and cut chromosomes into karyotypes. They must often have wondered why I thought science was exotic, when I could have gone to more traditional anthropological locations. (Rapp 1999, 6)

In this case, the site was untraditional on two counts – first because of its location in the west, and secondly because it subjected the *scientific* laboratory to a *cultural* anthropological gaze. The latter unconventionality had a remarkable theoretical consequence, which in footstep with co-emerging science and technology studies (STS) began to study science as a *cultural* enterprise.

Marilyn Strathern was among the first to revive a traditional anthropological area of study on kinship, offering insights to the ways ARTs both undermine and reinforce traditional categories related to kinning such as the biological and social. A number of scholars continued to explore the kinship line of inquiry, a frame, which because of its simultaneous disassociation with preceding overt feminist critiques of science and technology, likely improved their chances to gain access to both clinical and non-clinical settings related to high-tech reproduction (Strathern 1992, Ragoné 1994, Edwards et al. 1999, Thompson 2005). Ragoné, for example, describes a context in 1988, when she began her research on surrogacy, in which surrogacy programs faced “anti-surrogacy organizations” and overwhelmingly negative portrayals in the media. Consequently, “distrustful” surrogacy program directors viewed granting access to researchers as “a

calculated risk.” In this climate, Ragoné recalls, “The fact that I was an anthropologist and interested in kinship boded well,” suggesting the intentioned promotion of a less antagonizing field (Ragoné 1994, 3-4). Indeed, gaining access to sites of study including clinics, labs, the offices of genetic counselors, etc. became a growing methodological imperative within this stream in tandem with the cross-fertilizing field of science and technology studies.

STS, an interdisciplinary field still emerging and under definition, and its feminist variant, are later outgrowths of science studies. One of the main differences between science studies and STS is a retreat by STS from casting science and society, or nature and culture against one another. The field aims to reveal the “deep interdependence,” or mutual constitution of nature and society (Thompson 2005, 31). STS scholars of ARTs within the *decentering rights* stream exhibit this predilection in their fascination with the various ways in which “artificial” reproduction via ARTs upended notions of the “natural” or “biological facts” of reproduction (Strathern 1992, Ragoné and Franklin 1998, Thompson 2005). Charis Thompson, as a feminist STS scholar, and Inhorn and Birenbaum-Carmeli, as anthropologists, mutually recognize the strong interdisciplinarity of their fields on the topic of ARTs. According to Thompson, anthropology’s methods allowed STS scholars to explore nature and society’s interdependence, because “anthropologists had worked out ways of examining different culture’s beliefs about nature without presupposing that those beliefs simply reflected the state of nature” (Thompson 2005, 37). In their recent review of anthropological literature on ARTs, Inhorn and Birenbaum-Carmeli refer to anthropology’s “millennial intersection” with

STS as the “medical anthropology-STS nexus” (Inhorn and Birenbaum-Carmeli 2008, 178). This interdisciplinarity characterizes *decentering rights* literature.

### ***Retreating from technological determinism***

STS scholars avoid readings of technologies as deterministic in their influence on society, or potentially dangerous and unsafe in and of themselves. Rather, technologies are understood as “socio-technical products, which are shaped by human and nonhuman factors” (Inhorn and Birenbaum-Carmeli 2008, 178). As a result, *decentering rights* perspectives on ARTs, accord technology a far less negatively deterministic role in their effects on society than in general feminist science studies critiques. As Charis Thompson describes, feminists engaged STS methodology to produce new feminist perspectives on ARTs that “granted the technologies a much less monolithic, oppositional, and inhuman role and a much more mediating and active role than their predecessors had” (Thompson 2005, 70). In fact, *decentering rights* scholars on ARTs actively distanced themselves from the “polemical” and “speculative” dystopian classic feminist theoretical accounts of “NRTs” or “new reproductive technologies” stemming from the 1980s and early 1990s (Inhorn and Van Balen 2002, 6). These include works such as *Test-Tube Women* by Arditti et al. (1984), *Man-Made Women* (1985) by Corea et al., Gena Corea’s *The Mother Machine* (1985), and arriving later in the early 1990s, Robyn Rowland’s *Living Laboratories* (1992) and Janice Raymond’s *Women as Wombs* (1993). It is tempting to group these selections together because they appear at first glance to share a dystopian characterization and remarkably coherent critique against an array of reproductive technologies, particularly “new” ones, which at the time counted IVF and prenatal diagnostics. As a collection they produce a metanarrative about reproductive

technologies functioning as instruments of male power through medicine, science, and the state. “Reproductive technology is a product of the male reality. The values expressed in the technology – objectification, domination – are typical of the male culture. The technology is male-generated and buttresses male power over women” (Corea 1986, 3-4). In conversation with one another, the authors produce and share neologisms such as “techno-patriarchy,” (Mies in FINRRAGE-UBINIG 1991), “reproductive brothel,” “pharmacrats,” (Corea 1986) and “living laboratories” (Rowland 1992). Many identify as members of FINRRAGE (Feminist International Network of Resistance to Reproductive and Genetic Engineering), or its precursor, FINRRET (Feminist International Network on New Reproductive Technologies), both organizations that emerged from international conferences held respectively in Sweden (1985) and in the Netherlands (1984) (FINRRAGE-UBINIG 1991).

*Decentering rights* scholars distanced themselves from such characterizations because of the particular ways in which STS makes meaning of technology, but also by principles that require its practitioners to treat accepted and alternative truth claims in the same way, since neither claim could be viewed as “uniquely true to nature” (Thompson 2005, 39). Rapp, in *Testing Women, Testing the Fetus*, describes how her own experiences and those of the women she interviewed defied dystopian theorizations on NRTs, which “often spoke as if women’s interests in reproductive technologies were both clear-cut and unified.” In contrast, Rapp recalls “feeling both grateful for and critical of the technology,” a perspective echoed by her informants, and therefore she presents “a case for the complexity, diversity, and contradictory nature of the impact of reproductive technology” (Rapp 1999, 4-5). Lock and Kaufert make a similar contribution by

privileging the “ethnographic method in which due attention is paid to both local practices and local knowledge” in their selection of essays affirming a complex relationship between women and technologies marked by “ambivalence coupled with pragmatism” (Lock and Kaufert 1998, 2). In this way, this stream of literature retreats from a technological determinism that would treat (reproductive) technologies as a priori progressive or regressive (Lock and Kaufert 1998, Rapp 1999, Franklin 1997, Thompson 2005).

Ethnography as well as other modes of cultural analyses stemming from a variety of disciplinary locations and involving a range of objects – media representations, documentaries, fictional films and literature – became important new “texts” to feminist scholars within this stream. Indicative of the reach to diversified methods taking place in *decentering rights*, Kaplan and Squier foreground analyses of cultural objects such as fiction (a short story) and an NBC Sunday movie, *Cloned* (1999). Indeed, many scholars drew on women’s studies, cultural studies, history and other locations not only to shape innovative, interdisciplinary analyses, but also to enact a breach of the science/culture divide. In the 1990s, Sarah Franklin studied the cultural “naturalization” of IVF technologies in a BBC docudrama; Donna Haraway provided an interpretation of “the fetus” as cultural icon through readings of comics and advertisements; and Barbara Duden employed historical female patient protocols to understand the “fetus” as a particularly modern construction and to study how women’s perceptions of their bodies, embodiments and dis embodiments have changed over time (Franklin in Ginsburg and Rapp 2005, Haraway 1997, Duden 1993). Today, this work continues exemplified in Lisa Jean Moore’s innovative analysis of representations of sperm in such diverse

cultural objects as children's books and sex crime entertainment in popular television, as well as Souter's study of fiction and autobiography with themes, plots, and characters enacting women's experiences with technologically assisted pregnancies (Moore 2007, Souter 2008).

On the whole though, *decentering rights* utilized both traditional research methods from anthropology such as participant observation and ethnography alongside less conventional ones. Multi-sited explorations allowed researchers to illuminate multiple meanings of a technology. For example, Franklin and Roberts in their study of preimplantation genetic diagnosis (PGD) employ cultural studies approaches to analyze popular media representations of PGD along with clinic fieldwork in order to show how PGD functions both as a medical and discursive technology (Franklin and Roberts 2006, 92-93). Motivation to use qualitative empiricism, often an expectation of the scholars' own disciplines, also stemmed from two sources outside: 1) the scholars' intention to ground their analysis with voices of technology users, producers, and practitioners in order to distance themselves from earlier dystopian critiques of the technologies, and 2) the interdisciplinary connections to STS that compelled immersion into and translation of the sites and practices of science-in-the-making such as clinics and laboratories. Often, but not always, the methodological orientation involved "studying up" (including such powerful composites as "Western science," or the relatively affluent worlds of IVF technologies). Several studies reveal a commitment to the STS methodologies that emphasize the materiality of science practices by incorporating the nonhuman within networks of study (Oudshoorn 1994, Clarke 1998, Thompson 2005).

Strengths of this approach include adept interdisciplinary handling of often cutting edge subject matter that ensured richness in theory and method variety. The stream was attentive to multiple actors, institutions, sites, and networks within a specific locale, and it produced nuanced meanings and questions about the technologies. Limitations include the stream's lack of insight on the global (given its penchant for the local) and a certain detachment with political practice as its name, *decentering rights*, might suggest. The studies more often did not engage contexts of subordination, and sometimes lacked historical grounding for the “cutting edge” technologies under consideration.

Recent work has begun to take on the study of ARTs outside typical Euro-American settings (Aditya Bharadwaj , Elizabeth Roberts and Michal Nahman in Gibbon and Novas 2008, Inhorn and Van Balen 2002) or typical users – infertile, heterosexual couples. For example, in documenting lesbian practices that employ ARTs in the pursuit of “becoming parents and constructing families” Mamo finds that these processes both “‘trouble the normal’ and reinforce the normalization of traditional gender, sexuality, and family constructs” (Mamo 2007, 6). Mamo builds on feminist poststructural and technoscientific dimensions characteristic of this literature, in which “the meeting of bodies with technological and scientific practices” take place inside rather than outside “culture and power” (10).

### **Retaining Rights: Reproductive Technology as Political Objects**

In contrast to *decentering rights*, *retaining rights* literature takes a significantly different approach to reproductive technologies, interpreting them primarily as political objects that are instrumentalized as a means to individual or social control. Having a proclivity for the “global,” this stream of literature conceptually engages “population”

and “development.” It foregrounds and problematizes the contexts of primarily abortion and contraception technology use often by women in the global East or by women of color in the West. It applies political-economic analysis to the contexts of reproductive technology use, utilizing human rights and social justice discourses to question, refine and/or elaborate on concepts stemming from foundational feminist theorizations such as “choice,” “control,” “freedom,” and “rights.”

### ***Disciplinary orientation***

Betsy Hartmann’s *Reproductive Rights & Wrongs* (1995), Ruth Dixon-Mueller’s *Population Policy and Women’s Rights* (1993), and Sen, et al.’s *Population Policies Reconsidered* (1994) either stem from or converse with the broad population science and policy fields. These contributions focus mainly on the “applied” side of population sciences – policy aims and implementation, and in some cases their ideological bases (Hartmann 1995, Bandarage 1997, SAMA 2005, Dixon-Mueller 1993, Sen et al. 1994). Hartmann’s critique of population control, for example, brought to light the numerous ways in which “the global politics of population control” prohibited a realization of reproductive rights. Hartmann provides case studies of coercive contraceptive and sterilization practices from Kenya, Indonesia, China and Bangladesh among others. She describes the complex “population establishment” made up of multiple institutions as well as changes afoot in population discourses that precipitated and accompanied the International Conference on Population and Development (ICPD) in Cairo, 1994 (Hartmann 1995). Feminist demographer, Dixon-Mueller, and Sen, et al. acknowledge the gravity of women’s health and rights grievances related to population control, yet put forth forceful arguments for reforming population policies. Instead of narrowly

conceived fertility decline measures, the authors call for a centering of “health, empowerment and human rights” (Sen et al. 1994) or “sexual and reproductive health and women’s rights” (Dixon-Mueller 1993) in state and international population policies. In anticipation of the ICPD, these contributions gave conceptual backing to a formidable presence of representatives from international women’s networks advocating for reform. Notable among these were the International Women’s Health Coalition (IWHC) and DAWN (Development Alternatives with Women for a New Era) (Connelly 2008).

Originally founded by the Population Crisis Committee, the IWHC came into being in 1984 to distribute abortion kits in the wake of a loss of U.S. funds to services abroad either providing abortion services or making abortion referrals (361). This policy, also known as “the global gag rule” was first announced by the U.S. delegation to the decennial U.N. International Conference on Population (Mexico City, 1984). It reflected not only the rise and influence but also international impact of anti-abortion, neo-conservatism within the U.S. A decade later, led by Joan Dunlop (then president) and Adrienne Germain, the IWHC played a pivotal role in constructing policy recommendations that ultimately made their way into the ICPD Programme of Action. Adrienne Germain contributed to the conceptual works by Dixon-Mueller and Sen et al., both aimed at reforming international population policy. Members of DAWN, a network of feminist scholars and activists from the global South, such as Gita Sen, Sônia Correa, Srilatha Batliwala, Carmen Barrosso, and Peggy Antrobus also participated in driving this shift within population circles – both conceptually and “on the ground” in advocacy work both “inside and outside” various ICPD meetings and processes (Sen et al. 1994, Connelly 2008, 360).

In the process of convincing population institutions to rethink means and ends, Rosalind Petchesky in *Global Prescriptions* takes account of what transnational women's engagement around the ICPD conceptually achieved in rights discourses. Southern feminists, such as those in DAWN, infused "social needs" and development discourses into a reconceptualization of reproductive rights. Working together with Northern feminists, they challenged the divide between civil and political rights (posed as "negative," meaning that they position the state as a potential violator), and economic, social and cultural rights (posed as "positive," meaning they position the state as guarantor) (Petchesky 2003, 17). This entailed a questioning of the dichotomy between rights and needs, *and* between the individual and social. Concretely, feminists active in the ICPD process proposed policy that would foster the "enabling conditions" intrinsic to rights, but refused to rank needs as somehow more fundamental than rights (Corrêa and Petchesky in Sen et al. 1994). In particular, Dixon-Mueller (1993) and Sen et al. (1994) directed their claims to a host of population and development scholars and professionals poised to influence international population policy-making at the United Nations.

Some *retaining rights* theorizations questioned whether population policies could be reformed at all based on feminist principles. Renate Klein and Asoka Bandarage, for example, contest the compatibility of the principles of feminism and population, viewing a "feminist population policy" (as put forth by Dixon-Mueller) a contradiction in terms. The question they pose on a conceptual level related directly to political strategy as they feared ICPD engagement could sever unified feminist resistance to population control, coopting the rhetoric and activists of an emerging international women's health movement (Klein 2008, 163; Bandarage 1997, 7). Against the heady and mainstreaming

discourse on “reproductive and sexual health and rights” stemming from the ICPD, the question of what one compromised by defining feminist health and rights goals within a population framework focused on human numbers became the kernel of that debate.

Collective resistance to population control, both Hartmann and Petchesky recall, was voiced at the 1984 International Women and Health Meeting in Amsterdam, in which participants built an agenda to encompass reproduction within a larger women’s health framework (Hartmann 1995, 305, Petchesky 2003, 4). Recognizing what was at stake then, Hartmann and Petchesky attempt to answer the question posed by Klein and Bandarage. Hartmann argues for “a strategy of principled pragmatism.” She recognizes the political necessity at times to engage “the establishment,” yet feels that the international women’s health movement need not accept “the population framework.” In her response, Petchesky complicates depictions of structural power and draws on text from Pheng Cheah’s analysis on human rights to support the women who worked within UN circles to reform population policy goals:

To become legitimized and, indeed, realized as actors within the UN system, transnational women’s NGOs have had to learn and in many ways internalize the rules and procedures of that system....To misname this process ‘cooptation’ is simply to reduce all power to a zero-sum game and therefore to misconstrue the nature of power...If our ideas and ‘points of resistance’ (reproductive and sexual rights, sustainable development, gender equality) are continually being ‘reinscribed into the text of global capitalism,’ those same ideas and resistance points, framed as human rights, also have the power to change existing historical conditions and power relations. (Petchesky 2003, 26)

For Petchesky and the scholars with whom she conversed, the question of whether to resist or reform population policy related directly to political methodology and goals.

Theorizing within the *retaining rights* stream exhibited this general, politicized tendency

as it cross-fertilized with reproductive rights and women's health political activism and movement impulses.

Another set of critiques on the disciplinary evolution and nature of "pure" demography and the population sciences illuminates the disciplinary gaps that helped to produce diverging streams of feminist theorizing increasingly non-conversant with one another. Susan Greenhalgh, Nancy Riley, and James McCarthy, for example, all critique demography's lack of theory, reflexivity, and engagement with neighboring disciplines. All discuss the discipline's enduring fixation on modernization theory (in revisions of demographic transition theory) long critiqued in other social, historical and humanistic disciplines (Greenhalgh 1996, Riley and McCarthy 2003). Riley, for example, critically assesses the discipline's narrow understanding and handling of gender as an isolated individual attribute and its use of feminist empiricism to "add women" by way of new variables used to measure "women's status" (Riley 1999, 371-373). Riley and McCarthy argue that demography ought to borrow postmodern theoretical and methodological insights from anthropology, gender studies and other disciplinary locations that use qualitative methods to more complexly account for the social structural dimensions of gender and other systems of inequality. Thus, the gap in my account between *decentering rights* and *retaining rights* theorizations exists, in part, because of the disciplinary gap between anthropology and demography as exposed by these scholars. As Riley and McCarthy explain, a vast disparity in approaches taken by demographers and feminist theorists of "NRTs" exists, although they handle not dissimilar subject matter:

And, indeed, the literature on NRTs is nearly completely separate from that of demography, and, at times, appears to be dealing with a completely

different area of focus. While it is true that some of the focuses in NRT literature are not easily or immediately of use or interest to demographers, it is also the case that the focus of a substantial amount of this body of work is related to demography, as it deals with birth, motherhood, family, and the processes surrounding them. With a radically different assumption than that behind survey methodology, NRT literature and research views concepts we take for granted – such as motherhood, pregnancy, birth, and fertility – not as fixed and stable but as sites of enormous complexity and shifting meaning. (Riley and McCarthy 2003, 148)

Feminist critiques of demography that reveal the nature of that discipline – its academic isolation from other humanities and social sciences, theoretical stagnation, and overwhelming reliance on quantitative methods – thereby assist in explaining the divergence between *decentering rights* (more closely oriented towards anthropology) and *retaining rights* (which adapted its critique to demography’s “applied” side).

In addition, retaining rights literature cross-fertilized with feminist science studies emerging in the late 1970s and 1980s with early contributions from Ruth Hubbard, Ruth Bleier, Evelyn Fox Keller, Donna Haraway and Sandra Harding among others. Alongside subdisciplines in other fields such as the sociology of scientific knowledge, the history of science and medicine, and the philosophy of science, feminist science studies contributed to perspectives that discredited the prevailing notion of science as objective and scientist as impartial. Many scientists themselves, these women uncovered the tacit androcentrism of science and the particular ways in which it subordinated women, especially but not only in terms of biology, and within biology especially with respect to reproduction. Refuting the supposed biological basis for women’s ways of being, doing, and knowing (biological determinism) was a more general feminist project clearly manifested in feminist critiques of biology (Hubbard et al. 1979, Hubbard 1990,

Bleier 1984). The realization of pervasive male bias in science allowed feminist philosophers to make specific contributions to critiques of positivism, including theorizations about the nature of knowledge as value-ridden rather than value-free and contingent upon the social, cultural and historical factors rather than universal and unchanging. Feminist critiques of science influenced, in turn, readings of its technoscientific products.

### ***Technologies not inherently progressive***

For some scholars, androcentric sciences were thought to lead to the production of anti-women technologies they identified as “NRTs.” The domination inherent in these structures and objects of science foreclosed the possibility of any kind of liberatory engagement with them. Therefore, some scholars asked women to resist the “NRTs,” arguing that implicit in their design and promotion is the idea that women must become biological mothers. In a recent retrospective of twenty-five years of FINRRAGE, Klein continues to cast the possibility of a “truly non-violent women-centered science and politics,” only within the conditions of a “post-patriarchy” (Klein 2008, 161). However, the implications of androcentric sciences (esp. medicine) also inspired the creation and promotion of self-help knowledges (such as in *Our Bodies, Ourselves*) and ethical principles as a way to negotiate and resist practices deemed anti-women. On the question of technologies, feminist perspectives from the *retaining rights* stream minimally questioned the assumption that new technologies automatically spell progress or an enhancement of choice for women as presumed by dominant liberal views of science (Hartmann 1995, Roberts 1997, Silliman et al. 2002, Silliman et al. 2004).

In addition to uncovering violations of medical ethics in sterilization research (Mulay 2000, Saheli Women's Resource Centre 1997), authors in this stream provide in-depth, risk-benefit analyses that combine both the biomedical and social. Richter's incorporation of "potential for abuse" in thinking about the schema of the immunological contraceptive's design and delivery broadens the definition of what can be counted as "safe" (Richter 1996). Sathyamala emphasizes the particular limitations of the long-acting, injectable hormonal contraceptive, Depo Provera's use in a global South context of health provision and care (Sathyamala 2000). These studies engage with calls for a reorientation of contraceptive research and definitions of safety that stem from feminist critiques of birth/population control methods.

U.S. women of color perspectives make a strong entrance into *retaining rights* theorizations in Marlene Fried's 1990 edited volume, which aims to expand a movement narrowly focused on abortion rights to a broad agenda for "reproductive freedom." The volume gives voice to concerns and desires of women of color, women with disabilities, and LGBT communities (Fried 1990). To the list of coercive contraception and sterilization practices, Silliman et al. add new issues faced by U.S. women of color such as the criminalization of pregnant, drug-using women, welfare and immigration controls, which they interpret as permutations of population control (Silliman et al. 2002).

Dorothy Roberts' *Killing the Black Body*, stands out as a pillar among women of color theorizations. Centering Black women's reproductive histories and representations, Roberts calls for "a social justice approach to liberty." Elaborations on this notion of "reproductive justice" continue to emerge in writings by women of color scholars of reproduction (Silliman et al. 2004). Roberts' work stands out within this entire stream for

grappling with infertility, race, and “the new reproduction.” She gives due recognition to the infertility issues faced by Black women, but goes beyond calling for their improved access to fertility technologies.

Racial injustice infects the use of new reproductive technologies no less than it infects the use of birth control. While too much fertility is seen as a Black woman’s problem to be curbed through welfare policy, too little fertility is seen as a white woman’s problem to be cured through high-tech interventions. The new reproduction is designed for the creation of white babies. (Roberts 1997, 292)

Indicative of the effect of the literature dualism I describe in this chapter, Robert’s reading pins antifertility technologies to women of color and ARTs to wealthy, white women. This interpretation reinforces the *reproductive binaries*, which elide how the globalization of ARTs increasingly brings women of color into its fold. In recent work, Roberts rethinks this relationship. “In the last several years...I have come to reconsider once again the opposition of white women and women of color in the reproductive caste system,” she writes. “A reproductive dystopia for the twenty-first century could no longer exclude women of color from the market for high-tech reprogenetics. Rather, it would take place in a society in which racial and economic divisions are reinforced by the genetic testing extended to them” (Roberts 2009, 785,799). As Roberts suggests, a conceptual frame on contemporary reproductive technology practices must account for the growing inclusions of women of color in a range of ART and “reprogenetic” practices.

In sum, political-economy approaches predominate among *retaining rights* literature. Scholars examine social, economic, and political structures and systems; the histories, ideologies, and philosophies that ground them; and their current policies, implementation practices and interests. Methods include rhetorical and discourse analysis, archival

research, and selective, investigative interviewing of institutional representatives (Gupta 2000, Hartmann 1995, Bandarage 1997). Highlighting mechanisms of power, control, and hierarchy, scholars examine the political structures and discourses of “the population establishment,” “the medical industrial complex,” pharmaceutical companies, international development regimes such as the IMF and Worldbank, welfare and prison systems, and state juridico-legal, and medical-ethical review boards and systems. They also examine social movement histories of birth control, eugenics or neo-Malthusianism. Disciplinary backgrounds of scholars stem from political science, law, philosophy, women’s studies, demography, sociology, and history.

Strengths of the stream include an attention to the global, to contexts of historic subordination, a close attachment with political action (women’s health, population policy reform, reproductive rights and justice movements), and a keen sense of dynamics of power, inequality, and stratifying mechanisms. The stream produced conversations and questions about the nature of rights, choices, science, and ethics. The studies, however, sometimes play into a victim producing discourse by depicting “the poor,” “women of color,” or “the criminalized” as objects or targets of oppressive forces, without including accounts of individual desires among these groups or the social and relational fields of their negotiation, action, and constraint. Some recent scholarship has begun to embrace ethnographic methods, serving as a corrective both to this issue as well as to the reductive, quantitative accounts of “autonomy,” and “women’s status” stemming from demography (López 2008, Maternowska 2006, Krause 2005, Madhok in Unnithan-Kumar 2004).

## The Problem of Reproductive Binaries

This chapter assists in understanding why feminist theorizations that have traditionally covered the reproductive issues of marginalized groups or “devalued reproducers,” do not generally engage individual subjectivities or ARTs. It also explains why feminist theory focused on ARTs remains largely blind to the biopolitical dimensions of antinatalism, even when ARTs increasingly unfold in contexts overwhelmingly defined by it. Current, transnational reproductive activity that spans across national borders pose a further dilemma revealing the inadequacies of a literature methodologically oriented towards producing rich ethnographic accounts of locals or political-economic analysis of a preexisting global – the international population order wedded to development regimes, which is now undergoing structural neoliberalization (Greenhalgh and Winckler 2005; Rao and Sexton 2010).

A conversation between sociologists, Jyotsna Gupta and Michal Nahman, in the *European Journal of Women’s Studies* demonstrates the incompatibility of the diverging streams. In light of transnational commerce in reproductive body parts and services, Gupta raises concerns about the “fragmentation” and “dehumanization” of egg donors and surrogates. She sees “an urgent need” for a feminist bioethics based on “the protection of women’s self-respect and human dignity” (Gupta 2006, 35). Directly addressing Gupta’s piece, Nahman cautions against “strange bedfellows” – feminists alongside anti-choice advocates, who depict egg donors as “brutalized victims.” She prioritizes ethnographic modes of study and her interviews of Romanian egg “sellers” (as she prefers to call them) reveal that “some of the women...were exercising a desire for participation in a neoliberal culture – selling something to get ‘stuff’ and money”

(Nahman 2008, 23). She questions “dignity” as a principle with a “fraught history” and doubts the utility of human rights discourses (66). While both Gupta and Nahman acknowledge a need for some kind of transnational feminist response and both question the inadequacies of pro-choice individualism, their debate reveals little further common ground.

In moments of reflexivity, scholars of each stream seem to acknowledge the presence of a gap between their approaches. For example, Charis Thompson, whose work I categorized among *decentering rights* contemplates:

Given the faltering moral certainty that came to dominate..., injustice and inequality might be expected to have taken a back seat to the cultural and ontological arguments that were preoccupying theorists. To some extent, this was true. Some work exhibits the ethnographic version of neutrality. Other work emphasizes “horizontal” difference (things like race and sexuality) because they are easier to conceptualize in ... cultural poststructuralist terms ...and disproportionately ignores “vertical” stratification (primarily social and economic class) because it smacks too much of structure and ... moral certainty. (Thompson 2005, 71)

On the other hand, in a study by SAMA-Resource Group for Women and Health on ARTs in India, the group asked activists who had long raised concerns about coercive population policies about the lack of “systematic engagement by members of progressive social movement groups” in India with ARTs. One informant reflexively responded,

Our movement has been efficient in conversing in the language of violence, discrimination and victimhood. But it has somewhat failed to handle more nuanced complex dilemmas...It has been difficult apparently to find a victim in this scenario which is crafted in the language of choice... (SAMA 2008, 324)

Taken together, these comments indicate the problem with reproductive binaries. They can lead to *binary capture*<sup>7</sup> when the cumulative effect of divergent literatures, in this case between *decentering rights* and *retaining rights*, ultimately reinforce reproductive binaries: ARTs/contraceptives, valued /despised reproduction, individual/population, (in)fertility/(over)fertility, and pro-natalism/anti-natalism. These function alongside other kinds of dualisms such as affluent/impoverished, postindustrial/postcolonial and postmodern/modern. The overall effect of these divided frames of theorizing largely pigeonhole categories of women technology end users into particular reproductive strata that correlate to specific technological practices and biopolitical contexts

### **Feminist perspectives on sex selection**

Interestingly, feminist perspectives on sex selection enter academic literature in the 1980s in connection to discussion on “new reproductive technologies” and as part of the collection that theorists (especially within the *decentering rights* stream) would later critique as far too speculative and dystopian. Janice Raymond, author of *Women as Wombs*, leads one of the earliest discussions stemming from a conference held as early as 1979 at Hampshire College (Raymond in Holmes et al. 1981). In 1985, Gena Corea’s *Man-Made Women*, a collection of writings that stem from an international meeting in the Netherlands in 1984 (where FINNRET - Feminist International Network on the New Reproductive Technologies was founded), devotes four out of seven chapters to the topic. Theorists view preconception forms of sperm separation and prenatal diagnostic

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<sup>7</sup> I borrow and reinterpret Dorothy Smith’s concept of “institutional capture,” to think about the net effect of the divergence I trace. “Institutional capture” refers to researchers “converting informants’ accounts of their experience into the terms of an institutional discourse that constitutes people and their activities as the objects of professional or managerial knowledge” (Smith 2006, 25, 110).

technologies and their potential use for selective abortion alongside IVF as “new” technological practices that portend the increasing medicalization of women’s reproduction, loss of control by women in reproductive technological processes, and loss of women themselves. As Raymond recalls from the 1979 sessions on the topic,

Women had listened to several days of how we have been victimized by a whole spectrum of reproductive technologies, from contraception to sterilization abuse. Yet the impinging reality of sex preselection moved our discussion of manipulative medical technologies into the realm of *previctimization*, i.e., the spectre of women being destroyed and sacrificed before even being born. (Raymond in Holmes et al. 1981, 177)

These scholars’ pairing of prenatal diagnostic technologies with IVF as “new” reproductive technologies gets ruptured through the constitution of lifestyle sex selection, which, as I will argue, creates a new “old/new” divide between selective abortion via PND (now old) and selective ART via MicroSort or PGD (the new).

Also in 1985, Mary Anne Warren’s book *Gendercide: The Implications of Sex Selection* arrived. Significantly, the timing of these early works precedes the coming to light of widescale use of selective abortion of female fetuses taking place in countries such as Korea, India and China. Although the authors do have knowledge of the prevalence of son preference in many societies (they do not foreclose the U.S. context), they could not have known the scale of practices that were only just unfolding at the time. India’s campaign to expose and address sex selective abortion, for example, began to organize in 1985 itself, and the first official recognition of sex selection as a problem leading to imbalanced child sex ratios on a national scale occurred about ten years later through the passage of laws banning the practice in India (1994) and in China (1995).

Warren's entrée into the issue steered the direction of another set of writings that relied on philosophical concepts on ethics, weighing arguments in favor or that condemn sex selection on consequentialist (potential to cause harm) or non-consequentialist (principled) grounds. Although Warren sees no difference on moral grounds between "early sex-selective abortion" and "preconceptive sex selection," a fissure between the two does emerge through the constitution of lifestyle sex selection. Warren's liberal position views as "rational" or "altruistic" even those sex selective decisions made under the constraints of structural dimensions of patriarchy, e.g., choosing sons because they could inherit or because it will avoid their child facing gender-based discrimination (83-85). Canadian feminist philosopher, Christine Overall, disagrees, countering,

Granted, it may be kinder on an individual basis to avoid producing daughters who will suffer grievous injury through nutritional deprivation, genital mutilation, sexual abuse, exploitative labour, and dangerous procreation. But choosing sons for that reason is still a way of saying yes, however obscurely or reluctantly, to patriarchal power and the oppression of women. (Overall 1987, 687)

This philosophical debate continued in a spate of writings published in a special issue of *Hypatia: A Journal of Feminist Philosophy*. Critiquing the presumed "autonomous moral agent" in Warren's work, Gail Weiss applies a framework that will account for the embeddedness of sex selective choices within familial and community relationships (Weiss 1995, 212-213).

While these North-American writers contested the ethics of sex selection (with the benefit of very little empirical study of the growing practice), most agreed that outright prohibitions of the practice might unduly impinge upon civil liberties, specifically the right to abortion (Warren 1985, Wertz and Fletcher in Holmes and Purdy 1992, Holmes in Callahan 1995). Self-referring to their own perspectives as "feminist," and in

conversation with one another, their work reveals the central tension in classic theorizations of reproduction between the individual and the social.

A highly significant theoretical contribution to literature on sex selection stems from the work of Susan Greenhalgh and Jiali Li, which stands apart from the rest. The combination of the authors' disciplinary backgrounds from anthropology (Greenhalgh) and the population sciences (Li) provides a rare interdisciplinary approach, which produces both in depth political-economic and also cultural analyses that draw on qualitative, ethnographic *and* demographic data from three villages in China. Published in *Signs: Journal of Women in Culture and Society* in 1995 the authors begin by pointing out the "remarkably few feminist scholars" who write on "the problem of China's missing girls," which results in demographers defining "the terms in which the issue is understood" (Greenhalgh and Li 1995, 601-602). As a result, understandings of the problem resort to limited understandings of "gender" and "culture" which demographers treat as apolitical and ahistorical "residual variables" (603). They interweave the complex interaction between "peasant culture" and the "party-state" in the political negotiation of China's one-child policy to describe what they call the "engenderment" or "male bias" in "reproductive practice" (634).

We see the gender dimensions of reproductive values not as contemporary manifestations of traditional culture but as something newly constructed out of the residues of the past and the exigencies of contemporary life. Thus, politics, the state, and history, which are missing from the demographic account, take center stage in ours. (606)

Several feminist scholars continued to underscore the link between the phenomenon of "missing girls" and contemporary population and economic policies. They often point to upwardly mobile class and newly forming consumerist cultures as opposed to ahistorical

notions of “traditional” culture as drivers of sex selective abortion practice (Croll 2000; Mallik 2003; SAMA 2005). In the tradition of *retaining rights* literature, recent scholarship from the global South brings to light largely social, political, and economic dimensions of sex selective abortion in India that highlight structural issues (Contractor et al. 2003; Patel 2007).

In her 2011 book, *Unnatural Selection*, journalist Mara Hvistendahl, like Nicholas Kristoff before her, presents an alarming view of the consequences of widespread sex selective abortion. Arguing that sex selection is an international (rather than local, national or regional) phenomenon, Hvistendahl provides evidence for a practice that is growing beyond the borders of Asian settings to Eastern Europe. She ties the onset of increased sex selective abortion historically to interests and politics within the international population order, and devotes several chapters to transnational impacts of imbalanced adult sex ratios including trafficking of brides and sex workers across borders. Although she cannot wholly ignore the current presence of sex selective ART (Hvistendahl devotes an epilogue to MicroSort and sex selective PGD use in the U.S.) she handles these practices separately, highlighting the regionally-specific aspects rather than the ways in which they confound the “international.”

Few feminist theorists, have addressed the contemporary phenomenon of sex selective ART. Feminist, scholar-activist, Marcy Darnovsky critiqued the increasing commercialization of sex selective ART in conjunction with other developments related to recently emerging human biotechnologies. Unlike Warren, who dismissed as unlikely the potentiality that sex selection could lead along a “slippery slope” to other eugenic selection practices, Darnovsky reignites the potentiality of “high-tech eugenics” in light

of an expanding biotech industry in general, and uses of PGD in particular (Darnovsky 2004). In contrast, Van Balen and Inhorn (2003) take a different, less alarmist, view, even as they assess the “‘new’ new reproductive technologies” in light of known sex selective abortion and son preference in non-western parts of the world. Playing into an east/west divide, they claim that PGD and MicroSort “may ultimately change Western sex-preference practices in dramatic ways,” but are not likely to impact non-western regions because they will either remain inaccessible (especially PGD) or they will not as effectively produce what the East desires – i.e., mainly sons (MicroSort). Their analysis, which was echoed by important professional bioethical discourse at the time (Ethics Committee of the ASRM 2001), presumes that MicroSort will not be used with IVF, and will therefore remain, “less invasive, less technically demanding, and less expensive than PGD” (Van Halen and Inhorn 2003, 244). On the whole, feminist theorizing on sex selection in many ways reflects and reinforces reproductive binaries on east/west lines. Only very recently have, especially Asian-American scholars begun to incorporate discussion of both sex selective ART and abortion within a single frame by centering the experiences of Indian or Asian immigrants living in the U.S. (Puri 2011; Generations Ahead et al. 2009) and revealing the relational (and differential) meanings assigned to global practices divided along an East/West binary (Bhatia 2010).

### **The case of lifestyle sex selection and the problem of reproductive binaries**

Lifestyle sex selection transgresses existing frames of feminist theory on reproductive technology. As already mentioned in chapter one, understandings of sex selection stemming from the global East tie the practice to abortion, son preference, missing girls, and gender inequality, whereas “western” practices associate with gender equality, family

balancing, daughter preference, and designer babies. Each group of discourses forms a composite set that corresponds to binary ways of thinking about the contexts of reproductive technology use across global and local divides as noted above. This framework effaces a number of biopolitical subjects as women get categorized too simply as either population subjects seeking sex selective abortion in a global East context or as autonomous individuals seeking preconception gender selection in the U.S. Sex selective abortion gets subsumed within a population framework in discussion of population sex ratios, while sex selective ART gets subsumed within emerging scholarship on the high technology and cultural forms related to human biotech enterprise.

#### Methodology: Towards bridging the divide...

Beginning with a local “western” and U.S. framed set of sex selective ART, my approach shows how this seemingly *discrete, bounded national practice* is shaped by contrast to other sites of sex selection, especially in the global East. As such, the U.S. is conceptualized as a *continuously global site*. The tight interconnection between the local and global stays in focus as I explore how a new set of material, discursive, and institutional practices gets constructed in relation to something “other.” This qualitative inquiry is concerned with how a new set of sex selection practice formed, and how it situates globally. Methodologically, this is a genealogy of practices, which interrogates the truth and knowledge claims that have arisen in relation to those practices. Since sex selective ART practices emerge not in any single site, but in multiple material, discursive, and institutional forms, the research design is guided by the following **research question:**

How is lifestyle sex selection materially, discursively, and institutionally constituted and how does the practice situate globally?

The dissertation research design starts with the science and technology of sex selection as located in two *technologies*: MicroSort and PGD. The research follows these two technologies as they form a set of related sex selection practices in their material, discursive and institutional travels both within and across national borders. As sites of practice, ART clinics serve as central sources of data for this multi-sited qualitative analysis. The study compiles data from both the virtual (on-line) and real spaces of these clinics, and where that activity merges into the spaces of other social and institutional worlds such as in self-help literature or professional societies. Drawing on aspects of Adele Clarke's situational analysis (2005), George Marcus' multi-sited ethnography (1995), and Dorothy Smith's institutional ethnography (2006), the study combines inquiry into multiple social worlds, real and virtual sites and texts, all as they relate to the institutional center of practice in the ART clinic. In particular, the methodologies of feminist STS scholars such as Adele Clarke and Sarah Franklin that combine grounded analysis of material, discursive and institutional formations have been employed.

The study segments data sources and analysis into three areas: the material, discursive, and institutional. **Materially**, sex selective ART includes material technologies and bodies. As such the very meaning and use of technologies will be foregrounded and analyzed for the ways humans and things actively and mutually shape the "object" of study. Second, sex selective ART practices are **discursively** produced through clinic communications in print materials, websites, and through popular and public news media and social media such as self-help books and blogs. Finally, sex selective ART practices are **institutionally** produced through the regulatory and de-regulatory work done by the

clinics themselves, regulatory authorities, professional and non-governmental organizations. These three processes will be analyzed as a set of co-constituted meanings. Each artificially segmented area in the analysis will then be returned to its complex and overlapping web in the theorizations of *stratified reproduction* vis-à-vis *reproductive stratifications* in a final discussion.

The data gathering period spanned over the course of one year from May 2010 until June 2011, with the most intensive phase taking place in the fall of 2010 through winter 2011. As providers of both MicroSort and PGD, the two U.S. ART clinics that served as sites of primary data collection through site visits and interviews with clinic personnel were chosen purposively due to their active roles in the constitution of sex selective ART both locally and transnationally. This included high visibility in public news media and/or involvement in the production of self-help spaces and materials. Data collected at these sites inquired about the technology design and application processes; discourse stemming from both clinic (websites, brochures) and non-clinic sources such as self-help books, internet forums and news media; and institutional activities or arrangements vis-à-vis other clinics, professional organizations, and regulatory bodies. The Genetics and IVF Institute (GIVF) did not serve as study site. Nonetheless, as the clinic sponsor of the MicroSort trial, GIVF is pursued in the study as a significant “case” providing important historical and current data related to the material, discursive, and institutional practice of sex selective ART.

### **Data Sources**

This research has drawn on three main data sources: interviews, site visits, and both primary and secondary source texts of various kinds. Below I elaborate on these sources.

## ***Interviews***

I conducted in-depth, semi-structured interviews with 15 people, the majority conducted by phone. Most interviews ranged from one to two hours in length, though some were as short as a half hour, and some took place over several sessions. The longest and most in-depth interview took place over 10 hours and in 7 sessions by phone with the MicroSort Scientific Director at GIVF. He and the lead scientist at the USDA who developed the method agreed to be identified in this study.

**Table 1: Interviews**

<b>Institution or Social World</b>	<b>Job Title</b>	<b>Interview Type</b>
U.S. ART Clinic I	Director	Initial: Phone Follow-up: Face to Face
	Nurse	Face to Face
	Embryologist I	Face to Face
	Embryologist II	Face to Face
U.S. ART Clinic II	Director	Initial: Phone Follow-up: Face to Face
	Nurse	Phone
	Embryologist	Face to Face
USDA	Retired Scientist credited with the invention of the “Beltsville Sperm Sexing Technology” (precursor to MicroSort)	Face to Face Follow-up: Email
Genetics and IVF Institute, ART Clinic and Sponsor of the MicroSort Trial	MicroSort Scientific Director	7 Sessions by Phone Follow-up: Email and Phone
	MicroSort Lab Technician based in Mexico	Phone
Nigerian ART Clinic	Director	Phone
Mexican ART Clinic	Director	2 Sessions by Phone
U.S. NGO	Executive Director	2 Sessions by Phone
	Consultant	Phone
Self-Help	Book Author	Phone

I also held informal conversations with two people because they did not agree to a formal interview and would not sign informed consent forms. Significantly, these informants were producers of self-help materials and end users of the technology. One

had attempted MicroSort for a girl and the other PGD for a boy. Although my questions to them exclusively pertained to their experience as producers of self-help materials, at times in conversation they shared their experiences as end users of the technologies.

**Table 2: Informal conversations**

<b>Institution or Social World</b>	<b>Job Title</b>	<b>Conversation</b>
Self-Help	Book Author	Phone
	Website Author	Phone

### *Site Visits*

Data also stems from site visits, in which I had a chance to observe, conduct formal interviews, but also to converse informally with people present at those sites. At the U.S.D.A., for example, I spoke at length with two scientists, one of whom had worked directly with the lead scientist developing the “Beltsville Sperm Sexing Technology” (precursor to MicroSort). At the nurses roundtable luncheon on *Gender Selection* at the annual meeting of the American Society for Reproductive Medicine I had a chance to speak informally with the other nine attendees, which included nurses, embryologists, and other clinic and non-clinic personnel interested in the issue/practice. I spent one day each at two U.S. ART clinics in which I conducted some face-to-face interviews, and shadowed directors (reproductive endocrinologists) in clinical situations that involved women in various stages of the process: one initial phone consultation with an African-American woman, one monitoring of ovulation by ultrasound of a Nigerian woman, and one egg retrieval of a South Asian woman. All of these sex selection clients were attempting sex selective PGD for a boy. Additionally, I observed a second egg retrieval

and an embryo transfer for couples not explicitly seeking sex selection.<sup>8</sup> Finally, I observed various procedures in the laboratories related to IVF and PGD including egg cleaning, sperm retrieval for ICSI after aspiration and embryo biopsy, and was shown various equipment and procedures used in the application of FISH (fluorescence in situ hybridization) to identify sex chromosomes of an extracted embryonic cell, though I did not see this in action.

**Table 3: Site Visits**

<b>Institution or Social World</b>	<b>Site</b>
U.S.D.A.	laboratory where “Beltsville Sperm Sexing Technology” (precursor to MicroSort) developed
U.S. ART Clinic I	<ul style="list-style-type: none"> <li>• IVF and PGD laboratory</li> <li>• Clinical Exam Rooms</li> </ul>
U.S. Art Clinic II	<ul style="list-style-type: none"> <li>• IVF and PGD laboratory (only for embryo biopsy)</li> <li>• Clinical Exam and Recovery Rooms</li> </ul>
American Society for Reproductive Medicine Annual Meeting October 23-27, 2010 Denver, CO	<ul style="list-style-type: none"> <li>• Nurses Roundtable: <i>Gender Selection</i></li> <li>• Interactive Session: <i>How Might We Think About Sex Selection? Case Studies and Perspectives on a Current Controversy</i></li> </ul>

### ***Texts***

Furthermore, data included various kinds of primary source “texts.” From the clinic site visits, I procured product informational or promotional materials such as brochures, informed consent forms or service contracts related to sex selection technologies and procedures. Some texts were available online such as informed consent forms used in the

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<sup>8</sup> The race/ethnicity of the couples going for sex selection as well as their desire for a girl or boy were relayed to me by their reproductive endocrinologists. Although I asked about race/ethnicity of end users in general terms, I did not ask about these markers in relation to specific patients encountered in the clinic, and therefore do not have the information for all patients (especially those that were not seeking sex selection).

MicroSort trial (revisions dated 2003 and 2007), FDA warning letters to MicroSort personnel, and a package of forms (case report, medical history and registration) that collaborating physicians use in the MicroSort trial, which aided in understanding the trial structure and data collection procedures. Self-help books and websites served as primary sources along with clinic and/or technology websites and U.S. news and popular media articles featured on these websites. I expanded on clinic endorsed news and popular media texts mentioned on their own websites by identifying twelve further articles on the topic through a search conducted in the database, “Ethnic Newswatch.” I consulted the database, which collects newspaper and magazine articles published in “ethnic and minority press” in the U.S. and Canada ([http://www.proquest.com/en-US/catalogs/databases/detail/ethnic\\_newswatch.shtml](http://www.proquest.com/en-US/catalogs/databases/detail/ethnic_newswatch.shtml), accessed January 5, 2012), as a means to access less mainstream representations of the topic that are more likely to view the U.S. as a continuously global space. In my search I applied the terms, “sex selection” or “gender selection” or “MicroSort” or “PGD” for articles published from 1995. Finally, I also utilized a number of organizational documents stemming from NGOs, professional organizations, and UN agencies as primary sources. A number of secondary sources such as scientific journal articles supplemented the inquiry, especially into the material elements and history of the technologies. Secondary data in both academic and professional journal articles on “reproductive tourism” or “cross-border reproductive care” provided a basis from which to continue exploration and analysis.

### **Multiple methods and limitations**

Applying both multiple sites and methods of inquiry, I adapted qualitative approaches to my topic, interweaving non-participant observation of clinical and laboratory practice,

participant observation in a professional institutional setting, field notes, a reflexive journal, in-depth, semi-structured interviews, and interpretive analysis of texts. The interview data gathering process involved first contact by letter, followed up by email or phone. Initial phone interviews were scheduled and conducted with clinic directors, whereupon I requested and secured site visits and permission to approach other clinic personnel for interviews. Most of these interviews were conducted face to face during site visits. Based on grounded, on-going analysis of the data, other informants were identified, who participated in cross-border connections to U.S. clinics or in the overlapping spheres of institutional and self-help work related to the practice. The proximity of my own institution to Beltsville, MD, where sperm sexing via flow cytometry (MicroSort) was developed in U.S.D.A. labs, allowed me to access primary data on the history of the technology and technoscience-in-the-making through a site visit, conversations and an interview with scientists involved in that research. Thus, the data generated all stems from purposive sampling: the informants all had explicit stakes in either the provision or growing practice of sex selective ART, and had actively intervened (materially, discursively, or institutionally) in its constitution. Their voices cannot be interpreted as representative, for example, of ART, self-help, or NGO communities at-large.

The timing of research influenced the kinds of data I gathered. As I began to collect data in late spring of 2010, the website of Jennifer Merrill Thompson, a self-help book author and early MicroSort user, suddenly went off-line, and the book she had co-written with Dr. Daniel Potter, announced as forthcoming in 2009 (complete with cover design) by Prometheus Books did not appear. Then, over the summer and fall I learned that the

FDA prohibited MicroSort from enrolling new subjects into the trial for the *indication* of *family balancing* while they decide on the technology's safety and efficacy. MicroSort only made this information public in spring 2011. MicroSort did not show up to fill their reserved booth space in the exhibition hall of the ASRM annual meeting in October 2010 as they had in previous years. By the end of my data gathering period, the clinical sites of the MicroSort trial had revamped or launched new websites that were now centering PGD instead of MicroSort for "family balancing." Changes seemed underway and part of the research challenge was placing these within recent historical context. My overall impression was that MicroSort seemed to be strategically lowering its profile as it awaits an FDA determination, receding in the real and virtual spaces of U.S. ART, just as its international presence began to take off.

It was very difficult to find a MicroSort representative willing to participate in the study. Seven months after initial communication, I was able to secure a lengthy seven session interview with the scientific director of MicroSort focusing primarily on the U.S. based clinical trial and the technological process of MicroSort. Hired in 2002, the director could provide information related to trial history in the latest decade. Although I was not able to interview anyone about the history especially before FDA intervention in the late 1990s, I did get confirmation of some of the historical details via email from a MicroSort authority unwilling to be identified. Finally, due to the stated reason of "proprietary information" I was not allowed to view the flow cytometry labs attached to ART clinics. However, I did see a model used at the U.S.D.A.

On the other hand, I did gain access with relative ease to clinic spaces. This may in part be explained by the fact that journalists were no longer knocking at their doors.

Clinic directors confirmed what I perceived as waning news and popular media interest in the issue, which had been well publicized in the early to mid -2000s. I did not have to compete for attention, though I did have to follow-up and reschedule all but one of the initial phone appointments with clinic directors, sometimes several times, due to their extremely busy schedules.

Furthermore, both clinics I approached were among the earliest providers of sex selective ART in the U.S., and as such, their directors participated in the constitution of a newly forming practice. They clearly felt comfortable serving as spokespersons for the controversies surrounding the practice that fed news and popular media frenzy, at least for a while. I did not seek out the voices of the increasing number of ART clinicians who have more quietly begun to take on a few cases with limited if any marketing. However, I did encounter them at the ASRM sessions, and their voices would be crucial to understanding why providers feel increasingly compelled within the competitive U.S. ART market to offer new sex selection technologies against professional guidelines. Furthermore, as a genealogy of a set practices, this study is further limited by its main focus on supply side information and perspectives. A study into the subjective experiences of the women and men who attempt technoscientific methods for having a girl or boy child are crucial to its constitution, not to mention an important study into the cross-cutting relationships between parental, gendered and familial identity formations. Although I would very much be interested in pursuing that work, it requires a level of depth and attention that I could not pursue within this study's frame. I did approach three end users of the technology for this study to interview them in their capacity as producers of self-help material (books or websites). One of the three never responded to my

multiple attempts to reach her by email and Facebook. Indeed, self-help authors were far more difficult to approach than I had first assumed. Introducing my dissertation research in a formal letter to solicit their invaluable input (which worked fine with clinicians and scientists), did not bode well with self-help authors. An informal approach was far more effective. After the first author I approached declined my request for an interview, we proceeded to communicate more casually by Facebook at various points during the year, and then finally had a more extensive phone conversation in June of 2011. A website author, who created and launched the site during the course of my data collection in the winter of 2011 agreed to a phone conversation, but not to a formal interview. She wanted to remain anonymous even to me to protect her family's privacy, but was willing to share her experience with sex selective PGD as well as with the production of the website.

### ***The problem of data balance***

Since this research undertakes the study of the confluence of two technologies into a set of practices, part of the challenge was reconciling that I could not access the same types of data for each technology. As a clinical trial, MicroSort made up a neatly bounded case study, with clearly defined boundaries of purpose and practice (at least within U.S. federal jurisdiction). PGD did not. With MicroSort, I was able to access some primary sources of data on its history, but I had to rely on secondary sources for PGD history. On the other hand, since the FDA had put MicroSort out of commission for the purpose of “family balancing” while the regulatory authority deliberates on the method's safety and efficacy, all of my observations of clinical practice related to PGD. Yet, since both technologies are essential to this study, I continued to struggle during data collection and analysis with how to pull together comparable data for each technology.

## **Modes of Analysis**

Overall, this study followed a grounded theory approach in which any collection of data informed subsequent sites and processes of data collection. In this way, analysis was an on-going activity. Utilizing the assistance of *Atlas ti*, qualitative data analysis software, I coded interview transcripts and other texts initially based on codes gleaned from the data itself (e.g., “needy patients”) or from literature. Something as general as “cross-border” would grow to a level of specification through sub-codes (“monitoring,” “test results,” “communication from clinic to clinic”) and then merged into categories (“departure site preliminary treatment”). My process of extracting themes usually began with a writing process that was at first heavily descriptive of data. Through processes of reflection and rewriting, I began to draw relationships between codes and categories and identify larger themes (e.g. “technological convergence”). With input from other readers into these processes, I began to move to a greater level of analytical abstraction and argument.

I designed basic interview guides for each type of informant appropriate to the nature of work in which they engaged (see basic guides for clinic director, embryologist, nurse, self-help author in the appendix). These were tailored with greater specificity depending on research already conducted and the overlapping fields of work in which the informant participated (e.g., a reproductive endocrinologist with both clinical and media or self-help communications experience would be posed questions about all of those domains). Questions inquired into the examination of “things,” like material technologies, discourses, and institutional texts, and into the “work” done in relation to those “things.”

The undergirding methodological approach draws on feminist STS in which technologies are understood as socio-cultural artifacts just as much as they are technical. Thus, the chapter on material constitution of sex selective ART attends to the historical networking and collaborative arrangements between scientists and across various institutions that fostered the development of the technologies that comprise it (MicroSort and PGD) and to the globally situated meanings assigned to scientific and material practices. The discursive constitution of the practice (chapter four) moves into another realm – news and popular media as well as self-help materials. There I draw on critical Foucauldian discourse and narrative analysis in order to interpret how discourses produce particular geo-bio-political subjectivities and particular kinds of power/knowledges about sex selective ART through the construction of new terms, categories and figurative language. The chapter pays close attention to both the inclusion and exclusion of identities especially by nationality/ethnicity and global region as those endowed (or not) with the power to represent the emerging practice (Foucault 1972, 1980). It further draws on theories of affect in analysis of the way discourses work to shift emotive atmospheres and constitute anticipatory affects (Ahmed 2010; Adams, Murphy and Clarke 2009). Chapter five on the institutional constitution of sex selective ART utilizes another mix of analytical approaches. It begins with a case history centering on the institutional practices of the Genetics and IVF Institute vis-à-vis sex selective ART, a mapping of institutional positions on ethical questions in relation to sex selective ART in addition to a meta-analysis of institutional texts in relation to one another. I use intertextual relations of texts arranged from most local to global to illustrate how the prevention of state regulation consists of active (not just a lack of) institutional work (Clarke 2005; Smith

2006). In total, the modes of analyses used in this research are multiple but all interpretive and inductive, characteristic of the study's core qualitative approach.

### **Self-Reflection**

Committed to a feminist research praxis that not only acknowledges but also accounts for my own subjectivity, values and position in this research, I scrutinize here not only how I came to this topic, but how I moved through the research process. I offer the reader my standpoint as a means to interpret my own necessarily partial perspective and to lay bare my own personal stakes in this work (Charmaz 2007, Harding 1991, Harstock 1998, Smith 1999).

My entrée into the issue of sex selection took place in India in the mid-1990s, when I interned briefly as a student and activist at the organization, Forum for Women's Health (FFWH) in Mumbai. The history of engagement by FFWH activists in a movement against sex selection in India strongly affected my own feminist framing of the issue. While sex selection did not top the list of FFWH's advocacy work and activism during my study period in India, I read documents stemming from the decade-old campaign and listened to first-hand accounts and campaign experiences.

Some founding members of FFWH had in 1985 become alarmed by increasing evidence of what they defined as a "misuse" of prenatal diagnostic technologies, such as amniocentesis or ultrasound scanning, for sex selection. Son preference motivated the alarming growth in the practice of sex selective abortion of female fetuses. Women's movements in India quickly took up the issue because they viewed sex selection as a form of violence against women and girls, threatening their very survival. Together with other activists from people's science, health, human rights and legal action organizations

and movements, they formed the Forum Against Sex Determination and Sex Pre-Selection (FASDSP). Significantly, FASDSP formulated its primary objective, not in terms of passing judgment on the technologies themselves, but in terms of their broader opposition to all forms of discrimination against girls and women (Contractor 2003, 9). On a practical level, FASDSP had to find a way of stemming the practice without curbing the legal right to abortion.

The history of engagement by FFWH activists in a movement against sex selection in India strongly affected my own understanding of the issue. Like them, I came to view sex selection as a form of violence against women and girls and a misuse of prenatal diagnostic technologies. In a fact-sheet on sex selection that I co-authored for distribution at *Aarohan 2003*, a national conference of South Asian organizations and community members in the U.S. dedicated to ending violence against women, we described sex selection as a form of gender-based violence:

Son-preference is a by-product of the ubiquitous patriarchal social system. Unfortunately, this favoring is hardly a harmless idiosyncrasy, as the valuing of male children is generally accompanied by the contrasting neglect and mistreatment of daughters. Historically, this degradation of girls has been expressed in various ways, from female infanticide, to denial of nutrition and health care after birth, to withholding education and empowerment opportunities to girls and women while they are growing up. With the advancement in reproductive technology, pre-natal diagnostics followed by sex selective abortion was added to this list of abuses. (Bhatia et al. 2003)

Thus, I have viewed sex selection as a feminist concern.

My first encounters with the issue of sex selection in the U.S. took place in early fall of 2001, when two articles on sex selection appeared nearly back-to-back in the *New York Times*: “Clinics’ Pitch to Indian Émigrés” (August 15, 2001) and “Fertility Ethics Authority Approves Sex Selection” (September 28, 2001). The first piece covered the

targeting of sex selection advertisements to South Asian communities in newspapers such as the North American editions of *India Abroad* and *Indian Express*. The second announced the approval of sex selection via PGD by the Ethics Committee of the American Society of Reproductive Medicine (ASRM). It was my own juxtaposition of these two articles that caught my attention and moved me into an advocacy mode, jumpstarted through a protest letter campaign I initiated along with five other individuals from nonprofit, nongovernmental organizations. Later we wrote position papers, factsheets, and a webpage. We secured organizational alliances on the issue, and presented at various conferences. We called this work, “the campaign to end sex selection,” a name that lays bare my own partialities.

Prior to this moment though, I had been involved mainly in advocacy work on unethical testing of contraceptive or sterilization technologies and coercive contraception practices. It was the topic of sex selection more than anything else that catapulted my work into the area of assisted reproductive technologies, where I began to experience first-hand the divide I discussed in the first part of this chapter – the divide between the reproductive binaries.

As I began to watch as the issue unfolded in the U.S., I found it baffling to make sense of the news media, the advertisements, and the blogs, information that campaign members kept a watchful eye out for and we circulated amongst ourselves. I had taken up the issue without realizing at first that apart from the usual challenges of activism, we would face a number of unsettling, conceptual challenges as well. We had to delve more into the new technologies without losing sight of the old ones. We had to rethink how to frame a critique as we confronted a range of new and unfamiliar discourses emerging

with the practice. We had to take stock of an institutional world of assisted reproductive technologies with which some of us (including myself) were not familiar.

In 2005, when I joined the academy as a graduate student, my engagement with the issue of sex selection began to change. Without the pressure to organize and advocate with clearly articulated positions and agendas, I began to learn how to ask questions and design ways of trying to answer them. However, even in this scholarly pursuit, clearly my politics will have played some part in the questions I raise as well as my selection of methodological strategies. Although years had passed since my activism “against” sex selection, some of the position statements I wrote in that period would come up first through a simple Google search of my name. At the start of data-gathering I was intensely preoccupied with how my informants would read me and my former activism. I worried that the combination of my gender and South-Asian identity alone would immediately peg me as a skeptic rather than a genuinely curious researcher. As it turns out, I need not have worried. There were plenty of South Asian women in the field whom I later encountered, some quite vested as users or providers of the practice, not naysayers.

After a self-help author declined an interview early in my data gathering, I decided to disclose to her my former activism (I figured I had nothing to lose), and ask if this had factored into her decision. I also made it clear how my engagement with the issue had changed on so many levels, not least because of my encounter with materials written by women for other women. My activism in reproductive rights, health, and justice always held strong affinity ties with the self-help community in general, and I could not help but recognize the courage and intensity of purpose it must have taken to share experience in

this way. The author replied: no, she had no idea of my former activism, and after years of being approached with questions by journalists, she was simply fatigued, and as I slowly gathered also put off by my initial, cold, academic, and formal approach. In the same reply she answered other questions I had on her book projects and thus we began an off and on informal exchange. I learned a lot through this initial interaction, which helped me to move more assertively into the field. From there, the levels of anguish I had first experienced in approaching informants slowly dissipated as I learned how to talk about my former and current interests in the matter, one as a stepping stone to the other. It did not always come up in later requests for interviews, but if it did, I was prepared with an answer.

Throughout the year there were a few jarring moments that forced me to self-reflect apart from the on-going entries in my reflexive journal. A clinic director I shadowed in practice made an off-hand, sarcastic comment about the South Asian couple undergoing PGD for a boy we had just encountered. He said, “They don’t look so evil, do they?” I immediately responded, “Of course, not!” Did I think they were evil? Did I somehow convey that I thought they were evil? Or, did I just somehow come on the receiving end of his quest to demonstrate the ordinary humanness of his patients? Feminist condemnations of the practice (with which I had identified) never questioned the integrity of any individual woman’s decision to pursue sex selection within their own situated context. This, however, did not mean that there are no other questions to be asked.

Another moment occurred when I spoke by phone to a self-help website author, a woman who had also undergone PGD for a boy. An initial casual exchange led to my “off the cuff” disclosure that I had a girl and a boy. Later in the course of our

conversation she insisted, which I did not deny, that I could then not possibly understand the longing she and other women had experienced for a child of specific gender, because I had without striving for it what many of them so dearly wanted: the ideal, “complete” and “balanced” family.

How could I reconcile this reading of my family make-up, with my experience being the third daughter in an Indian family without sons? No one hid the fact that my parents planned a third child hoping for a boy. Before sex selective ART, and sex selective abortion, having another child was a form of testing the odds of getting a child of desired sex. Only as an adult, have I pondered the moment of my birth often relayed to me casually. Apparently, my parents, who had been well prepared with a boy’s name, were so disappointed that I was a girl, they could not name me. It was the well-timed intervention of an aunty friend visiting the hospital who had a name handy, “If not Rajan (king),” she said referring to the name they had in store, “she will be Rajani (night - though according to my father, the meaning of ‘Rajani’ is also a nascent dawn).” Even though I was never made to feel unwanted, I have begun to look back and wonder at the consequence of my birth, which connected as it was with “tying the knot” (tubal ligation) immediately thereafter, definitively ascribed my family of origin as sonless. Is this partly why my Buas (father’s sisters) treated my mother so poorly? Is this why my mother had my hair cut so short while my sisters wore braids and pony tails? Delving into how my own personal experiences and family make-up may affect my views on the issue and motivation to pursue this topic only reveals the connection between the personal and political. Perhaps it is the incomprehensible knowing that I might never have been that

drives my search for answers about these practices, especially in all of their cross-cultural, transnational complexity.

As a scholar who identifies with feminist STS, I must also admit that pursuing the technological and scientific aspects of the topic fascinated me, and at the same time I sometimes worried if I was delving too much into the science – because it was a convenient and comfortable topic of conversation, allowing me to maintain good rapport with some of my informants. Was the science preventing me from getting to other important aspects of the practice? I began to understand scientist enthusiasm for what they had undertaken and I also learned how to spot misrepresentations of material or clinical practices in news, popular, and self-help media that frustrated them so. I was riveted by the activities of their world, yet much of that detail and what I would collect in secondary sources such as textbooks on flow cytometry or DNA microarrays did not make their way into this dissertation, sometimes not even as a footnote. I am certain, however, that my level of engagement with the science has also played a role in defining my perspective, influencing my interpretations.

In recognition of myself as an integral part of this project, my standpoint has shifted in interesting ways from the perspective of a critical outsider looking in to a passing visitor and (extremely) modest witness from the inside. The study is at once both an inquiry into an emerging biomedical practice as it is an assertion of my transnational and STS feminisms. The research maintains focus on the transnational realm as manifested in what is currently conceptualized as “cross-border” reproductive practices. In order to displace East/West binaried constructions of global sex selection practices, the research begins to expose some of the major routes of cross-border sex selection that traverse the

U.S., originating and landing in varied parts of the globe. I explore what flows across these routes, and clinic networks created to maintain them. This information will be used to theorize the ways transnational practices shape and influence the very meaning of sex selection in multiple locations.

Chapters three to five expound on the material, discursive, and institutional constitution and global situation of lifestyle sex selection. In chapter six I combine analysis of these segmented areas to theorize and define a new frame of analysis I call *reproductive stratifications*, an inversion of *stratified reproduction* that can, I hope, begin to apprehend the economic, political, cultural and social shifts that have taken place during the last fifteen years within a global politics of reproduction.

## Chapter 3: The Material Constitution and Global Situation of Lifestyle Sex Selection

This chapter focuses on the *material* constitution of contemporary lifestyle sex selection through its embeddedness within *Fertility, Inc.* (Kolata 2002; Mamo 2010) or *The Baby Business* (Spar 2006), terms that signify the competitive, for-profit, and relatively unregulated market of assisted reproductive technology, especially as it manifests in the U.S. At the beginning of the 21<sup>st</sup> century *Fertility, Inc.* seemed to grow exponentially through an ever-expanding array of services and markets (Mamo 2010), among them sex selection. Sex selective ART is produced through overlapping *material*, *discursive* and *institutional* knowledges and practices. This chapter focuses on the material base, the “tool kit” of assembled technologies, deployed in laboratories and clinic examination rooms that make up sex selective ART.

Sex selective ART comprises a set of technologies, MicroSort and PGD, which developed historically on distinct paths, but began to converge as a set of related practices through two major historic turns. The first turn occurred as the technologies crossed from their development within agricultural industry research in the U.K. and U.S. into the realm of human medicine in the early to mid-1990s. The potential for human applications could not sustain the development of these technologies initially, and in this transfer to human medicine both technologies underwent a process of redefinition – transforming from the end point of sex selection (specifically for the industrially valued female livestock) to a means of avoiding sex-linked disease. PGD led this transformation and MicroSort piggybacked onto this process of *medicalization*, defining itself as an

adjunct technology to PGD to increase the production of medically needed female human embryos, which may carry but do not express X-linked genetic disease.

A short while later the technologies underwent another process of redefinition as they moved from therapeutic to lifestyle medicine. Defined by Gilbert et al. (2000), lifestyle medicine treats “non-health problems” or “conditions that lie at the boundary between a health need and a lifestyle wish” (1341). In this second transformation, Microsort led the way by first defining *family balancing*, the desire for a boy or girl to offset an imbalance in the sex of offspring, as an *indication* for its use. As the technologies shifted from serving as diagnostic tools fulfilling medical needs to elective interventions, their meanings had to stabilize. Together, they became “high tech gender selection,” and formed a new more valued set of sex selection practices defined against a less valued set (i.e., sex selective abortion). In the first part of this chapter, I trace the technoscientific history that led to lifestyle applications of sex selective ART through two successive turns and convergences of MicroSort and PGD. While the first turn constituted a process of *medicalization*, the second exemplifies *biomedicalization*, which refers to “a second major transformation of American medicine” taking place “since around 1985,” and marked by “dramatic and especially technoscientific changes in the constitution, organization, and practices of contemporary biomedicine” (Clarke et al. 2010, 1). Drawing on five analytic processes, Clarke et al. further define the shift to biomedicalization:

Medicalization practices typically emphasize exercising *control over* medical phenomena – diseases, illnesses, injuries, bodily malfunctions. In contrast, biomedicalization practices emphasize *transformations of* such medical phenomena and of bodies, largely through sooner-rather-than-later

technoscientific interventions not only for treatment but also increasingly for enhancement (2)

I draw on this definition as a means of situating the practice of lifestyle sex selection among other case studies of contemporary medical practice, which increasingly utilize technoscientific means to address consumer lifestyle issues. I do not, however, methodologically trace the five analytic processes of biomedicalization as outlined by Clarke et al. as they relate to the case of sex selection. Instead, I apply their definition to mark the material assemblage of these technologies temporally against the background of major historical shifts taking place in the social forms associated with biomedicine.

In the second major section of chapter three, through an analysis of material meanings and materiality, I situate sex selective ART within a dichotomous world of reproductive technology, and explore its global form. Originating within dominant western sciences and inhabiting high-technology reproductive medicine, the practice latches on to sites of meaning associated with valued reproduction in the global West, privilege, and individual choice, which contrast with the global East, despised reproduction, (over)fertility, and population control. I explore the material meanings of MicroSort and PGD in relation or in contrast to other technoscientific practices. With attention to the materiality and use processes involved in the interaction between human bodies and the technologies, I explore how the practice has increasingly globalized. In spite of their relative immobility and inaccessibility, the complex and lengthy processes involved in lifestyle sex selection can be broken up into moveable parts that cross borders. Vectors of bodies, biomaterial, and information flow between laboratory and clinical sites of lifestyle sex selection creating a web of transnational transaction.

Paul Rabinow's ethnographic study of polymerase chain reaction (PCR), one of the scientific techniques that appears in this story as a mode of detecting sex via PGD, describes it as "a tool that has the power to create new situations for its use and new subjects to use it" (Rabinow 1996, 7). One of the situations that emerged through a use of PCR is contemporary lifestyle sex selection. The *material assemblage* of each technology to sex sperm (MicroSort) or sex embryos (PGD) took place for reasons other than human lifestyle sex selection. Yet, their parallel development and medicalization set the stage for their later convergence into a set of material tools for lifestyle medicine. Through successive historical turns, the technologies became entwined in processes of first classic medicalization and then biomedicalization. **Materially situated** within the overlapping "western" worlds of high-tech reproductive medicine and clinical genetics, the tools of lifestyle sex selection get charged by the "promissory capital" and "hope and hype" of fast-paced change in biotechnology (Thompson 2005; Adams et al. 2009, 252). Their global form arises from a divisible practice constituted by moving bodies, biomaterial, and information that can cross national borders on their way to and between clinics and laboratories.

This chapter combines both data from interviews with a synthetic review of multiple histories of science in relation to PGD and MicroSort. Data types are not always evenly distributed for each technology. For example, I could rely on primary sources of historical data for MicroSort (given my proximity to USDA labs where it was developed). On the other hand, I had a closer look into the use processes of PGD through observation during clinic site visits. I have tried to compensate with secondary sources

such as scientific journal articles in order to balance the amount of data on each technology that informs my interpretation here.

## Material Constitution in Two Stages

In the early 1990s human clinical trials of both MicroSort and PGD had begun with the first PGD baby born in 1990 to the first MicroSort baby born in 1995. Both “firsts” involved couples selecting girls to avoid genetic conditions that only affect males (i.e., to avoid X-linked disease). Both trajectories emerged as a means to a medical rather than a lifestyle end. MicroSort and PGD arose and advanced in the animal reproductive sector, where clear industry interest drove the research. By the mid-1980s, both technologies were conceptually anticipated and initial laboratory studies in non-human mammals proved by the end of that decade that they could successfully identify the sex of non-human embryos or sperm. Both were first experimentally demonstrated on rabbits and faced considerable technical obstacles in the move towards human application. This section traces the historical development of the technologies through two turns: the transition from agriculture to human medicine, a process of medicalization which served as a stepping stone to the second turn; an expression of biomedicalization as the technologies oriented towards consumer lifestyle issues.

### **The Agriculture Industry – the seedbed of sex selective ARTs**

Just as the agricultural livestock industry provided the seedbed to all ARTs, so did it spur the development of sex selective ARTs (Clarke 1998). In the U.K. PGD for humans was conceptually envisioned and publicly championed as a reproductive genetic technology, yet its first experimental demonstrations and clinical application were

technically geared to select for sex. In fact, early references in the scientific literature refer to PGD as “embryo sexing” (Theodosiou and Johnson 2011, 2). “Sexing” refers to sex identification, a term used in scientific literature both in relation to embryos and sperm. PGD’s first experimental demonstration came as early as 1968 when Robert Edwards, today recognized with a nobel prize for advancing infertility medicine through the development of IVF, and Richard Gardner successfully biopsied cells from 119 rabbit embryos, sexed the embryos, and then transferred them back to rabbit does, which produced 18 offspring all correctly sexed. Lawrence Johnson’s first experimental demonstration of the Beltsville Sperm Sexing Technology (precursor to MicroSort), also on rabbits, occurred in 1989, 21 years later. Yet, this gap closes considerably when comparing the first clinical application in humans of the two technologies, which occurred in 1990 for PGD, and 1995 for MicroSort as illustrated in Figure 5.



**Figure 5: Timeline of key events in the development of PGD and MicroSort**

Theodosiou and Johnson explain the longer period between first experimental demonstration and first clinical application of PGD by a lack of explicit motivation to develop the method in humans.

Although the early experimental development history of PGD is intertwined with that of IVF, IVF moved into the human clinical realm much earlier. Those in the U.K., most famously Robert Edwards and Patrick Steptoe, who were involved with the advent of

IVF, never envisioned IVF technology to only address infertility. In the experimental stages of IVF, long before the birth of the first IVF baby, Louise Brown in 1978, Edwards and Gardner among others simultaneously developed the technique of embryo biopsy used in PGD. As Edwards has emphasized in retrospective accounts of his work, PGD was *conceptualized* along with the possibility of fertilizing eggs outside of the womb (Franklin and Roberts 2006, 42-43). Robert Edwards, for example, applied for research funds to develop PGD in 1971, seven years before IVF was even successfully shown in humans. In the grant application Edwards proposed that a first potential application of PGD in humans could control “sex-linked mutant genes in man” (cited in Theodosiou and Johnson 2011, 5). Yet, the U.K. Medical Research Council rejected the proposal, and it was not until fifteen years later that U.K. scientists formed PROGRESS, a lobby to advocate for the realization of PGD successfully drumming up public support. Thus, PGD development during the 1970s through the mid-1980s remained relegated to the animal agricultural sector.

The ability to control for sex in the production of farm animals, especially cattle, swine, and sheep has long been recognized as having the ability to bring an economic boon to commercial agriculture (Johnson and Welch 1997, 337, Theodosiou and Johnson 2011, 3). This industry drove the development of both embryo and sperm sexing technologies during the 1970s and 1980s, whose manifestations in human medicine today are known as PGD and MicroSort respectively. David Karabinus, scientific director of MicroSort, whose background also stems from the field of animal reproduction explains:

Dr. Johnson [USDA scientist, Lawrence Johnson, who developed the sperm sexing technology used by MicroSort] developed the application in livestock, because male cattle don’t give milk, females do. Male cattle don’t bear more

young, females do. So, you don't need as many males as you do females to keep the line going to make babies. Female livestock are easier to manage. Males are more physical, bigger, and tend to be more aggressive. (Interview, December 6, 2010)

In their history of the commercialization of sperm sexing technologies within the cattle industry, Seidel and Garner also underline the long-standing industry interest in sex selection. Even though laws of 50:50 probability in the absence of sperm sexing would not make it unlikely for dairy farmers to get several male cattle in a row, the authors describe how farmers in the past interpret such an occurrence as bad luck, resorting to “folkloric” (read unscientific) ways to explain them (Garner and Seidel 2008, 886-887). Thus, dairy and meat farmers have sought ways to reliably control the sex of their cattle and the long-standing economic value of females in livestock reproduction spurred the development of both PGD and MicroSort. However, of the two technologies, MicroSort (or more accurately, its precursor, the Beltsville Sperm Sexing Technology) remains the preferred method within the industry because it can be applied with “artificial insemination.”<sup>9</sup> PGD, on the other hand, requires IVF, a relatively complicated procedure, which cannot easily be applied en masse. Optimizing sex selection for livestock reproduction must contend with industry standards that involve inseminating many cows at one time with the sperm of just one superior bull. Although PGD's design does not fit with that standard, the industry nonetheless remained interested in its development, in part because the experimental demonstration of sexing sperm took place much later (Theodosiou and Johnson 2011; personal communication with Larry Johnson, March 24, 2011).

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<sup>9</sup> The term “artificial insemination” (AI) remains current in animal reproductive sectors, even when it seems to have fallen out of favor in human reproduction.

During the 1970s and 1980s, then, research on PGD advanced within the realm of animal reproduction. PGD was demonstrated for sexing of sheep in 1975 and cattle in 1976. The timing of biopsy (stage of embryo development when cells are removed) and mode of analysis used to identify sex varied in these studies, none of which pointed to a potential application in humans. Similarly, the research that led to the development of MicroSort became technologically viable under the helm of the U.S. Department of Agriculture, though the method was first conceptualized in a weapons laboratory through research funded by the U.S. Department of Energy.

Scientists working at the Lawrence Livermore National Laboratory, a weapons lab in California and the Max Planck Institute for Biochemistry in München among other institutions first theorized the potential of sperm sexing via flow cytometry (Van Dilla, et al. 1977). MicroSort is an example of a cell sorting application of the flow cytometer, which make up a small proportion of the total range of applications of the instrument (Givan 2001, 159).

Supported by the United States Energy Research and Development Administration, a central aim of the research was to study the reproductive effects of radiation on humans (Van Dilla et al. 1977; Garner et al. 2008; Pinkel et al. 1982). The Livermore team described the purpose of the research thus:

The increasing presence of potentially hazardous substances in the environment makes it prudent to develop both tests for their genetic activity and methods to screen people for the effects of exposure. Reproductive effects are a major concern...*Because the presence of sperm with abnormal DNA content is a direct indication of genetic effects of exposure, we have explored the application of flow cytometric DNA content measurements to sperm.* (Pinkel et al. 1982, emphasis added)

However, distinguishing between X and Y chromosome bearing sperm appears to have been an evident secondary goal, and byproduct of their work. Scientists during the 1970s anticipated, but were not yet able to distinguish between the relative DNA content difference between X and Y bearing sperm, and they certainly did not articulate a medical purpose to sexing human sperm, which only first appeared in the literature in the early 1990s.

In 1977, a team of German and U.S.-American scientists published an article that described some specific problems in trying to measure sperm DNA content. By the early 1980s, the Livermore scientists detected relative DNA content differences between X and Y sperm populations based on fluorescence intensity after applying a DNA binding fluorescing dye to tailless sperm. In 1982 they published their success in using flow cytometry to distinguish between X and Y sperm from bulls, rams, rabbits and boars (Pinkel et al. 1982). Yet, these experiments did not yield live sorted sperm viable for reproduction as the tails of the sperm had to be removed in order to get them to smoothly pass through the cytometer. Furthermore, the research on sexing sperm may have ended altogether had it not been subsequently taken up and funded by the USDA prompted by a research proposal submitted by one of the Livermore scientists to the USDA while on sabbatical (Garner and Seidel 2008). While the Livermore lab had the advantage of being able to tinker and improve various aspects of instrumentation (the USDA did not initially own a flow cytometer), the USDA had a clearer vested interest in pursuing research on sexing sperm because, as I have already described, the method was “important to farmers” to improve livestock production (Interview, Lawrence Johnson,

September 14, 2010). Lawrence Johnson, lead scientist who helped move the endeavor forward in the 1980s recalls:

So, I and Pinkel from Lawrence Livermore, which was a weapons laboratory, well, it still is, they had done some work with DNA and sperm, and they had demonstrated that if you stain the tailless sperm, the nuclei, what we call the heads, or whatever you want to call them, that you could demonstrate a DNA difference. And, so, but they had to get out of the business. They're Department of Energy, and they were looking initially at the effect of nuclear weapons on human sperm. So, that was the focus of their research when they got into the animals...(Interview, September 14, 2010)

Thus, the Department of Energy, would likely not have sustained on-going research on sperm sorting for sexing purposes.

Several major technological developments in the 1980s shaped the practice:

- flow cytometry was demonstrably used to not only distinguish X and Y chromosome bearing sperm in a number of different non-human mammal species, but also to separate X from Y sperm populations (Pinkel et al. 1982, Johnson 1992),
- the instrumentation of flow cytometry was successfully perfected for use on sperm (Pinkel et al. 1982, Johnson and Pinkel 1986),
- a staining process that could allow sperm to go through the sorting process intact and remain viable for reproduction was found (Johnson et al. 1987), and
- flow cytometrically sorted sperm populations were combined with assisted reproductive methods to produce sexed offspring of non-human animals. The method was named the Beltsville Sperm Sexing Technology (Johnson et al. 1989).

Among the many technical obstacles was the standard cylindrical shaped needle at the flow opening of the cytometer better suited to the round shape of blood cells, rather than the flat shaped heads of mammalian sperm. Scientists at first tried to imitate that shape by removing the sperm tails, which meant the sperm had no prospect for remaining viable

for reproduction. In 1986, Lawrence Johnson of the USDA and David Pinkel from the Livermore Lab described two major mechanical adjustments to standard flow cytometers, whose design had to be adapted for use with sperm cells.<sup>10</sup> These changes were ultimately incorporated into commercially available flow cytometers intended for use with sperm (Johnson and Welch 1997, 345).

Alongside tinkering with mechanical elements related to the cytometer design, scientists sought ways to use in-tact sperm (sperm with their tails) and to change staining protocols because the dyes used in the early 1980s also compromised the viability of the sperm. As Lawrence Johnson recalls,

So, I said to Mary actually. Mary Look. She was working for me at that time. This was about 1986. I said we need to just try it with in-tact sperm. I got ahead of myself. The stain we were using in the heads was detrimental to living sperm. So, I found another stain, and that's the Hoechst 33342 that's still used. It's the only one that works. (Interview, September 14, 2010)

Once Dr. Johnson's team succeeded in separating X from Y bearing viable sperm, they surgically inseminated that sperm in litter bearing animals such as rabbits and pigs that rapidly produce a large number of offspring. The resulting proportions of sexed baby animals, they argued, could thereby prove that the method worked. Figure 6 depicts Dr. Lawrence Johnson of the USDA with a pig born using sorted sperm and IVF.<sup>11</sup> In 1989,

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<sup>10</sup> Scientists replaced the cylindrical needle at the flow opening with a beveled needle directing the stream of sperm cells to flow in a thin ribbon allowing sperm to orient correctly in the stream. Then, they added a second fluorescence detector at 0° position relative to the laser beam to the standard 90° fluorescence detector. The addition of a second fluorescence detector to the system provided a way to ensure that only properly oriented sperm (as detected by the 90° detector reading the fluorescence intensity of the cell's edge) would then be read for fluorescence intensity by the 0° detector (reading the intensity of the cell's face) (Pinkel et al. 1982).

<sup>11</sup> Reprinted from *Agricultural Research Magazine* (Weaver-Missick May 1999). Photograph by Keith Weller (K8409-9).

Dr. Johnson and two of his colleagues, put forth the results of a rabbit study in a paper headlined, “Exceptional Paper – Rapid Publication.” This paper reported that rabbit does



**Figure 6: Dr. Johnson with sex preselected pig.**

inseminated with X-bearing sperm samples had a litter that was 94% female, and those inseminated with Y-bearing sperm had a litter that was 81% male (Johnson et al. 1989).

The paper “made waves” Johnson recalls. “It was a scientific breakthrough of considerable proportion because it had never been done

before” (Interview, September 14, 2010). As a postdoctoral student at South Dakota State University, working in a flow cytometry lab, David Karabinus, today the scientific director of MicroSort, remembers his advisor first bringing Johnson’s rabbit study to his attention, “To me that represented the epitome of science. It was a well thought out, well based study, and the results were good, credible results. I just thought it was, as I told my postdoc advisor, I thought it was a landmark paper” (Interview, December 13, 2010).

The paper also caught the attention of scientists working in human genetics, especially Edward Fugger at Genetics and IVF Institute (GIVF), whose background also stemmed from animal reproduction. Fugger took the initiative to approach Johnson along with his colleagues, Joseph Schulman and Andrew Dorfman about the prospects of applying the method in humans. Reaction to the paper thus unleashed the kernels of a new collaboration between the USDA and GIVF, which would lead to the transfer of the method to human medicine. Scientific collaboration of concern in the history of MicroSort shifted from Livermore and the USDA to the USDA and GIVF. The purpose

of the research shifted along with these institutional changes. Therefore, by the end of the 1980s both PGD and MicroSort's antecedent in agriculture had been successfully shown to sex non-human mammals, and both technologies were poised to enter human medicine.

### **“A powerful approach to disease prevention” – the Transfer to Human Medicine**

In Britain, the birth of PGD coincided with the birth of the U.K.'s (and the world's) first state authority to regulate embryo research and the practice of assisted reproductive medicine. In their ethnographic study of PGD, Sarah Franklin and Celia Roberts trace a critical period (1984-1991) in the intertwined histories of the technology and the national regulatory body. The authors draw attention to the “role of PGD in focusing and clarifying public attitudes toward reproductive biomedicine” during that period, stressing PGD's very public form due to a multiplicity of representations in media or in parliamentary debates (Franklin and Roberts 2006, 92, 39). Similarly, Theodosiou and Johnson, in their historical study of the motivations to achieve PGD also pinpoint 1986-1987 as the year “pivotal” to “clinically oriented PGD interest,” driven in part by changing attitudes to prenatal diagnostic technologies (PND) and IVF but significantly “stimulated” by a charged political climate in which embryo research came under attack by an anti-abortion bloc of parliamentarians (2011, 11). Both studies highlight how technological development takes place not only in the lab, but is highly social and political.

The drive to develop PGD among scientists arose in part as a means of demonstrating the medical importance of embryo research beyond the treatment of infertility. Within

the situated context of mid-1980s Britain, proposed anti-abortion legislation began to widen its ambit from debates about shortening the timing of legal abortion during pregnancy to banning embryo research and IVF practice. Alarmed by what was at stake, U.K. scientists and clinicians organized to defend a publicly made case to support the clinical practice of IVF as well as the development of IVF dependent technologies, including PGD. They recommended that research should be supported and proceed within the bounds of a responsible governing authority (what became Britain's highly acclaimed Human Fertilisation and Embryology Authority - HFEA), which would ensure their "proper" use. Therefore, scientists and clinicians took pains to associate PGD foremost with its medical indication (i.e., its application in the realm of clinical genetics as a preventive/therapeutic intervention), and avoid any relation of the technology to controversial and commercial uses, including as a means of improving IVF success rates much less as a means of lifestyle sex selection. In their historical account of PGD, Franklin and Roberts explain,

Britain's place in the wider global context of PGD can thus be described as medically and scientifically progressive, but cautious in relation to uses of PGD that could be seen as too commercial – including the "boutique" choice of sex preselection and the high-priced niche market in aneuploidy detection [i.e. checking chromosome numbers as a means of reducing IVF failure]. Although Britain is not the largest provider of PGD in global terms, its scientific contributions to the technique have continued to be distinguished since PGD's first successful implementation in London in 1990. This is in part because the medical-scientific community in Britain has sought to protect the image of PGD by minimizing its association with fertility enhancement and emphasizing its "original" role as a branch of clinical genetics. (2006, 98-99)

As Britain's scientists defined "proper" uses of PGD as a means of "minimizing public 'discomfort'" with the new technology, it also, in making the medical argument for PGD, highlighted the technology's ability to obviate abortion in reproductive genetics.

Scientists, who pursued the development of PGD publicly and in active, direct response to anti-abortion legislation which threatened embryo research, emphasized the technology's ability to avoid repeat and late-term abortions associated with a positive amniocentesis result.

Within mid-1980s Britain, then, the normalization of prenatal diagnostic technologies (PND) and IVF on the one hand, and the encroachment of anti-abortion forces on embryology and IVF practice on the other, formed the contextual backdrop to public debates in which scientists articulated a need to pursue the development of PGD. In June 1985, an anti-abortion bill put forth by conservative MP, Enoch Powell would have ended research on embryos in Britain if not for a narrow defeat. Members of the lobby called PROGRESS organized to defeat the bill began to persuasively advocate for PGD as an urgent need for inheritable genetic disease patients who have to contend with the “fear and anxiety” associated with pregnancies that get terminated after positive PND results. In a 1987 assessment of prospects for PGD, McLaren and Penketh highlight not the relative simplicity of PND vis-à-vis PGD as McLaren had done just two years earlier, but PND's associated “high physical and emotional price” necessitating tentative pregnancies and possible repeat abortions (Penketh and McLaren 1987, 747, cited in Franklin and Roberts 2006, 56; Rothman 1986). The UK parliamentary debate on timing of abortion and research on embryos thus helped to spur the first articulations of a medically justifiable need for PGD – a clearly spelled out *medical* problem (early childhood death and disease affliction) requiring a *medical* solution. As it turned out, this motivation served not only the development of PGD by instigating an increased pace in

research, but set the stage for MicroSort's entrée into human medicine just a few years later.

The work done by some U.K. scientists to *publicly* safeguard not only the practice of IVF but also a political climate supportive of their research on PGD against a growing threat from anti-abortion interests is highly significant. It imbued the technology with a social validity and paved the way for *disassociation* with abortion, which contemporary lifestyle sex selection has further underlined. Thus, for PGD, it was after 1986-87, that researchers, using techniques developed on animals, began to direct their efforts explicitly towards application in humans. The stated reason was medical: to avoid X-linked genetic disease with an eventual expansion to screen against other genetic conditions.

Initial technical obstacles facing PGD research for humans resolved over time through the concurrent development of requisite in vitro technologies such as IVF and PCR (polymerase chain reaction). IVF produced the raw material - human embryos, and PCR provided the initial diagnostic means to identify sex because it could quickly amplify (or reproduce) DNA, thus requiring only the removal of a single cell from the embryos. The first clinical application of PGD took place in 1990 by Alan Handyside and Robert Winston. Using PCR to amplify Y chromosome specific DNA strands, the clinicians isolated female embryos for transfer. Once again, sex selection took place in this initial clinical instantiation as a means of avoiding the birth of male children, because females can carry but do not express the disease trait.

Although the first human application of PGD provided the *explicit* scientific proof that PGD could be useful in clinical genetics, it *implicitly* and simultaneously proved itself as a viable new human sexing technology at the same time. U.K. scientists, Penketh and McLaren, made their points in support of PGD development with specific reference to beta-thalassemia, which is not a sex-linked disease, but much of the experimental research studies into PGD taking place between 1986 and 1990 (a period of vibrant and fast-paced experimentation in the U.K.) focused on attempts to sex embryos in order to avoid sex-linked genetic disease (Franklin and Roberts 2006, 52; Theodosiou and Johnson 2011, 6). The majority of sex-linked diseases (examples are hemophilia and Duchenne muscular dystrophy) are X-linked, meaning that the disease only expresses itself in male children and selecting for a girl avoids the 25 percent chance of having an affected child. Used in this way PGD does not actually screen for the genetic mutation itself, rather it screens for the presence of the Y chromosome – in effect the process involves sex selection. I make this point not to question sex selective PGD as a tool of genetic medicine, but to highlight that, in material-technological terms, that first human clinical instantiation of PGD in 1990 demonstrated the technology as viable for human sex selection in general, including and beyond its medically therapeutic intent. The combination of wider genetic screening potential and actual technical ability to sex embryos made PGD a potent tool for lifestyle sex selection, one that at once supplied a medical justification to pursue and also an effective material-technical capability to screen for sex.

Today, the method of using sex selective PGD to screen against sex linked diseases appears somewhat crude, as advances in the technology allow PGD to identify more of

the specific disease mutations in DNA that happen to also be sex-linked. In this way PGD use can actually prevent the implantation of a diseased embryo rather than a male embryo that has a fifty percent chance of being affected by the disease. Around 15 years after PGD's first clinical application in humans, scientific review articles began to reassess that initial protocol.

X-linked diseases...were among the first for which PGD was undertaken. With a simple technique, the sex of the embryos is ascertained and all male embryos disposed of. A drawback of this approach is that half of the discarded male embryos are healthy and half of the female embryos transferred are carriers of the condition. For more and more X-linked diseases, the specific genetic defect has now been identified, however, allowing a specific DNA diagnosis...Ethically, for X-linked recessive diseases, most would agree that to transfer non-carrier girls and healthy boys is preferable than to transfer carrier girls. (Sermon et al. 2004, 1635)

Ogilvie et al. (2005) describe new developments in PGD leading to “very robust” methods to detect chromosomal sex that minimize chances of misdiagnosis. Yet, they too question sex selective protocols designed to avoid sex-linked disease. They state, “...sex determination for sex-linked disease is not ideal, because 50% of male embryos will be unaffected by the disorder. As specific protocols for mutation detection are developed...it is likely that the need for sex selection in this context will decline” (257). In fact, the PGD Consortium of the European Society of Human Reproduction and Embryology (ESHRE) reported in 2002 a drop in the number of PGD cases involving sexing to avoid X-linked disease (2002, 243-244).

Twenty years after its first clinical use, the scope of PGD applications have broadened considerably. Although in the very first clinical application of PGD, PCR was used for embryo sex identification, in practice, fluorescence in situ hybridization (FISH) soon replaced PCR as the “diagnostic” technique of choice because it provided a simpler

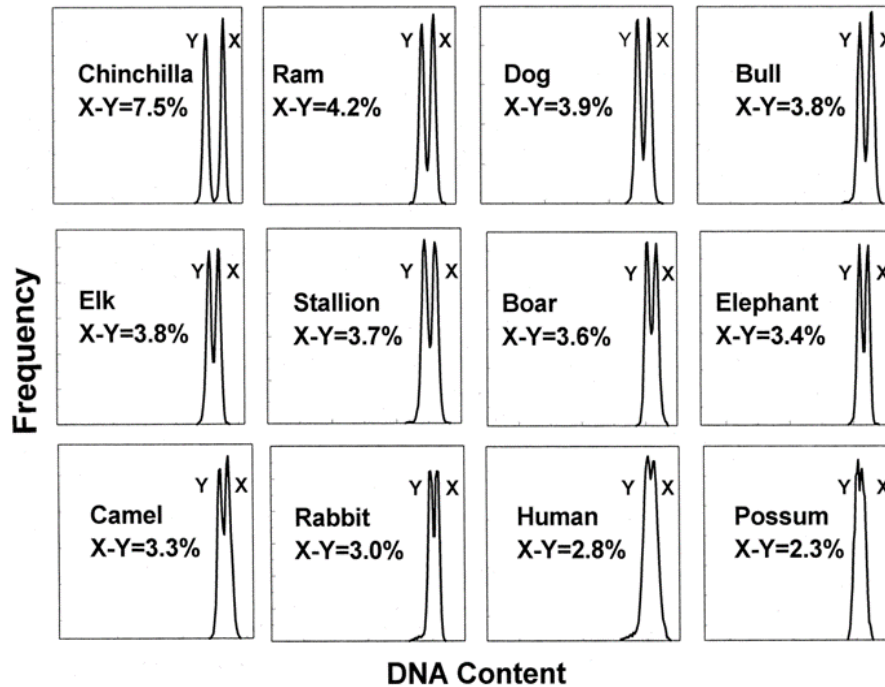
means to test for basic chromosomal characteristics of the embryo, such as sex, and was also well-suited to checking chromosome numbers (Sermon et al. 2004, 1633). A method for detecting and mapping sequences of genes within chromosomes that came into being during the 1980s, FISH was among a number of new techniques that revolutionized the field of molecular genetics, providing an important diagnostic tool to check for chromosomal abnormalities and genetic mutations (Levsky and Singer 2003). FISH was already well integrated as a PND tool of analysis when its utility for PGD and MicroSort was first realized. While the utility of FISH allowed PGD sex and aneuploidy screening to become more widespread and accessible, the method, it turns out, also provided a critical key to the overall development of MicroSort, which has narrowly remained a sexing technology performer.<sup>12</sup> GIVF scientists who pursued an application of the Beltsville Sperm Sexing Technology in humans told Johnson that they were interested in the method's potential to avoid sex-linked genetic disease in human babies (Interview, September 14, 2010). Johnson anticipated initial technical challenges. First, relative to other mammals, humans have a small difference in DNA content between X and Y bearing sperm (see figure 7)<sup>13</sup>. Initial experiments to sort X from Y bearing sperm were conducted on mammals with more easily distinguishable, large differences in the DNA content of their sex chromosomes such as in a vole (9%) or chinchilla (7.5%) as compared to bulls (3.8%) or humans (2.8%).

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<sup>12</sup> Even though scientists have speculated that MicroSort potentially reduces the risk of birth defects because the process may screen out sperm that have an aneuploid (or abnormal) amount of DNA (Schulman and Karabinus 2005), this use has not been clinically demonstrated.

<sup>13</sup> I thank H. David Guthrie of the USDA for the use of this chart in his PowerPoint slide presentation, "Animal Biosciences and Biotechnology Laboratory 'Gender Preselection'" (n.d.).

**Figure 7: Difference in DNA content between X and Y bearing sperm in different animal species.**



Moreover, this smaller difference in DNA content between human sex chromosomes compromised the utility of Johnson's own method of determining sort purity (through a reanalysis of the sorted sperm populations which involved putting them again through the flow cytometer). The GIVF team had a solution to offer: FISH.

Founded by Joseph Schulman in 1984, GIVF uniquely provided under one institutional roof an IVF clinical facility, a molecular genetics lab that provided prenatal diagnostic services to pregnant women, and one of the largest sperm banks in the U.S. FISH was one technique already in use in GIVF's genetic laboratory as a means to analyze fetal and placental tissues, and according to GIVF's website, Shulman realized its potential to serve as a reliable test of purity of the sorted sperm samples. Furthermore, GIVF through its sperm cryobank could readily supply the raw material needed for the

experiments. While the USDA now had the flow cytometer and the expertise with the instrumentation needed to make adaptations for human sperm, GIVF supplied the human sperm itself and the test needed to check the proportions of X or Y sperm populations. The proximity of the two institutions (about 25 miles distance between Fairfax, VA and Beltsville, MD) likely simplified the effort. Since the research was mainly conducted at the USDA lab, a USDA restriction that prohibited using the sperm for fertilization of human eggs effectively limited the study to determining only whether the Beltsville technology could reliably distinguish and separate X from Y viable human sperm.<sup>14</sup>

In 1993 the USDA-GIVF collaboration published their findings. The article proposes the development of human sperm sexing as “a powerful approach to disease prevention” (Johnson et al. 1993, 1733) that “could in time reduce or eliminate the use of selective abortion as a means of decreasing the incidence of X-linked genetic disorders” (1738). The collaborators make no mention of sex selection as a lifestyle option, highlighting instead a medical purpose and a disassociation with selective abortion.

FISH results revealed enriched samples of X and Y sperm populations with an average 82 and 75 percent rate of purity respectively as opposed to their normal 50 percent presence in unsorted semen. Yet, the results stress the challenges posed by human sperm in comparison to livestock sperm, including their different morphology – more angular heads (rather than paddle-shaped as with bull sperm), smaller difference in DNA content as already mentioned, and sperm heterogeneity (lack of uniformity among sperm from a

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<sup>14</sup> In contrast, Garner and Seidel document the first “heroic experiment” conducted to determine whether the Beltsville Sperm Sexing Technology could work effectively in the cattle industry. Involving travel over 1,790 miles by both plane and car, bovine sperm was collected in Lancaster, PA during the early morning, driven to the USDA in Beltsville, MD, where it was sorted in five hours and then frozen en route by flight to Denver, CO with the final destination being Fort Collins, CO. Around midnight the sorted samples were used to inseminate 29 cows (Garner and Seidel 2008, 890).

single individual and between individuals) (Johnson et al. 1993, 1735). These complicating material factors compromised the number of sperm retrieved after sorting and the sort sample purities.

For some at the USDA, the material-technological challenges of morphology and DNA difference seemed daunting. By 1993 the USDA had gained ample experience with sperm sorting for livestock varieties (especially bull and swine), which could potentially move from the experimental to the commercial realm. Yet, Glenn Welch, a USDA scientist, working in the 1990s in the USDA-GIVF collaboration recalls having a “negative attitude” to the prospects for commercialization of the Beltsville Sperm Sexing Technology. Welch thought the method was too expensive and labor-intensive to work well in the cattle industry, and the relatively smaller difference between X and Y DNA content in human sperm meant there would always be a greater amount of overlap in X and Y subpopulations compromising sort purity. In addition, Welch explained why MicroSort typically produces purer X sorts, effectively biasing the technology towards the production of girls. Since the process relies on measuring the relative strength of fluorescence of a dye that binds to DNA, and Y sperm have less DNA than X sperm, he said you simply cannot fluoresce what is not there. Therefore, Y sperm are unlikely to over-fluoresce, falling into the X tube. Issues with stain process perhaps impacted by the “quality” of the sperm, might, however, allow an X sperm to fluoresce less than it otherwise could, and therefore be read falsely by the cytometer as a Y. Bovine sperm sorting, on the other hand, has been reported to produce far less disparity in sort purity between X and Y samples, with both ranging from 90 to 95% (field notes, September 10, 2010; Gosálvez 2011).

In addition to the disparity in average rates of purity between X and Y human sperm samples, purity rates vary between individuals. Fugger et al. point out the challenge of heterogeneity both within the sperm of one individual, and between individuals (1998, 2369). Although Lawrence Johnson and Glenn Welch of the USDA asserted in 1997 that it would be “essential” to “prevalidate” sort purity *before* using sorted sperm with ARTs in human reproduction, in clinical use this has proved logistically difficult. Due to the additional time necessary to conduct purity tests<sup>15</sup> clinicians and their patients who wish to utilize fresh samples directly post sorting will not know the results of the purity of their individual sample. The scientific director explained that the 88 percent average purity rate for an X-Sort noted on MicroSort informational materials is sometimes misinterpreted as guaranteed:

We’ve had an X-sort as high as 99%, and we’ve had X-sorts down in the 60% range. That’s one of the things that patients don’t think about. It’s an average, and an average is just that. It’s the high ones and the low ones added together and divided by the number of sorts. It gives you an average so you have a range.

Human sperm heterogeneity within one individual sample also posed a challenge for developers of MicroSort. Reproductive scientists interpret such heterogeneity, which they say results from a lack of selective breeding, as a marker of poor sperm “quality.”

The scientific director of MicroSort explained:

...so in the livestock species males and females both have been selected for reproductive performance, and on the male side, a big factor in reproductive performance is not only sperm numbers but sperm quality. By and large bulls, boars, rams, produce sperm that look like they’ve been cut out of cookie cutters – very, very uniform. Humans have not been selected for reproductive performance. Compared to bull sperm, humans produce really, really crappy sperm. (Interview series, December 2010)

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<sup>15</sup> A rushed, same-day purity test was at one point in the clinical trial offered to subjects for an additional fee, but was discontinued due to the logistical difficulties of providing rapid results. (Interview, Clinical Director, September 9, 2010; Interview series, MicroSort Scientific Director, December 2010; Weiss 2007)

Lawrence Johnson, inventor of the technology, made a similar comparison while explaining the impact of human sperm heterogeneity.

Interesting in animals there's been a lot more selection because the use of livestock obviously for procreating, improvement, and this sort of thing, whereas the human population that is not the case. Human sperm, their DNA is quite, if you can visualize a sperm head, and there are pockets that are less dense with DNA. They call it vacuoles a lot of times. So, you have a lot more of them in the human sperm. In livestock sperm you have very little of that. They're very uniform. And part of the staining process is uniformity of the stain to get your stain into the sperm uniformly at a level where you have a minimum of variable. (Interview, September 14, 2010)

The heterogenic form of human sperm – lack of uniformity as a result of a lack of selective breeding – actually forms a kind of material resistance to the process in general. Furthermore, the relatively low numbers of sperm that human males produce combined with cultural practices that disallow the insemination of many women with just one man's sperm additionally defy the use of sperm sexing on a massive scale as occur among bovine.

In spite of Welch's doubts, the commercialization of bovine sperm sorting has led to the establishment of multiple sorter sites (14 for just one company called Sexing Technologies), each outfitted with multiple flow cytometers. Some individual sorting sites even have ten flow cytometers running side by side for 14 hours a day (Interview, Lawrence Johnson, September 14, 2010; <http://www.sexingtechnologies.com/articles/history>, accessed May 27, 2011). Yet, this scale does not translate to human reproduction due to both *material* characteristics of human sperm and also the social and cultural practices of human reproduction. Indeed, the transition from livestock to human reproduction requires *institutional* as well as

*material* translation. Waldby and Cooper describe a similar translation with respect to IVF,

The technology of human IVF emerged from the livestock industry although in institutional and economic terms it was never organized along the same lines of mass reproduction that reigned in the livestock industry. Human reproductive IVF does not involve reordering the developmental biology of cells...The process is organized precisely to *preserve* the ontogenic and teleological potentials of the germinal cells. (Waldby and Cooper 2011, 15)

Relative to livestock reproduction, then, the social and cultural practices of human reproduction combined with the material conditions of human sperm morphology, heterogeneity, and lower DNA difference between human X and Y sperm has impacted the sex sorting process in a way that defies mass use and does not as effectively produce boys. While the precursor to MicroSort (the Beltsville Sperm Sexing Technology) has the design potential to be applied en masse through artificial insemination, its human application does not. In the meaning-making shift to human medicine, however, such material impediments dissolve, as the purpose of the technology shifts from mass production of female livestock to reducing the likelihood of X-linked disease expression in human babies.

Although the GIVF-USDA collaboration proved that the method could work in theory, in practice the safety and efficacy of the method ultimately to produce human babies of desired sex still had to be shown. *Institutionally*, the locus of research had to shift once more. In 1992, GIVF took over the task. The Office of Technology Transfer of the Agricultural Research Services of the USDA granted GIVF a 17 year exclusive license to develop the Beltsville Sperm Sexing Technology for commercial use in

humans. Johnson claims to have at least in one aspect significant influence on that process:

One impact that I did have early on was the technology transfer. They wanted to put one license across the board animals and humans and not have any distinction. Absolutely not in my view. And they did take my advice at that time to separate them, so that you have a separate license for humans. Because you got different people dealing with it. You've got people trained in medicine, human medicine, that need to be working with humans. That's indeed where their clientele is. Whereas the whole animal world is a whole different set of circumstances. (Interview, September 14, 2010)

In this way, this history of sperm sexing divided, with a boundary between human and non-human development sharply drawn. GIVF purchased two flow cytometers, secured institutional review board (IRB) approval from Inova Fairfax Hospital (Wadman 2001) and in 1993 the human clinical trial was underway. GIVF named the human application, "MicroSort."

### **Medicalization and the anticipation of Biomedicalization**

In a 1995 report of the first achieved MicroSort pregnancy published in the scientific journal *Human Reproduction* of the European Society of Human Reproduction and Embryology (ESHRE), trial scientists propose a material linkage between the two technologies in which MicroSort would serve as an "adjunct" to PGD "for the prevention of X-linked disease" (Levinson et al. 1995, 979). The combination, the authors contend, raises the chance of pregnancy by increasing the number of female embryos (as identified by PGD) from which to choose for transfer. Further, they suggest MicroSort combined with PGD would simultaneously minimize the number of male embryos, the production

of which pose a “dilemma” for patients as some may be unaffected by disease<sup>16</sup> (979). In fact, the first human clinical instantiations of MicroSort did the reverse, by utilizing PGD as an adjunct of sorts, a backup and further test of validation – “purely a necessary precaution to check the sex ratio and to identify the rare male embryos conceived by the few Y spermatozoa which escaped X-sorting” (Edwards and Beard 2005, 978). In this way, at the very moment MicroSort is introduced to scientists in the field as a viable, sex selective technology in human reproduction, the parallel histories of MicroSort and PGD converge within the framework of scientific discussions of sexing for medical purposes.

A directly preceding editorial co-authored by reproductive scientists, Robert Edwards and Helen K. Beard, reinforces that frame, while also anticipating the leap to lifestyle sex selection. Entitled, “Sexing human spermatozoa to control sex ratios at birth is now a reality,” the editorial first grants MicroSort a high level of scientific recognition – another form of validation – coming from some of Europe’s most esteemed scientists in the field. This editorial highlight granted to MicroSort’s first pregnancy may in no small part have been influenced by the enduring friendship and growing affinity between GIVF’s Schulman and Robert Edwards, which first began while Schulman attended Cambridge in the mid-1970s where he had the opportunity to observe early (unsuccessful) attempts to clinically apply IVF (Schulman 2010). Secondly, the editorial seals the material convergence of MicroSort and PGD as sexing technology alternatives (if not adjuncts) by discussing the two in relation to one another. The authors suggest:

Sperm sorting will be a valuable adjunct to other forms of very early prenatal diagnosis. It could well replace the use of preimplantation diagnosis which

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<sup>16</sup> The authors are suggesting that for patients trying to avoid having children afflicted with disease, the dilemma arises because the process may involve the destruction of healthy embryos.

utilizes marker genes on the X and Y chromosomes for sexing. Preimplantation diagnosis offers a high degree of success, perhaps equal to or greater than sperm sorting, but it is an expensive approach to diagnosis. Its great advantage is avoiding or reducing the need for abortion, but it involves an operation on the wife, IVF, and the rejection of the afflicted embryos (Edwards and Beard 1995, 977-78).

Here, as in subsequent comparative assessments of the technologies, the authors not only presume heteronormative applications of both technologies, but that MicroSort will most likely be combined with insemination procedures (unlike PGD, which necessitates IVF). Finally and most significantly, Edwards and Beard, foreshadow the immediately forthcoming move made by MicroSort to expand to non-medical uses. They condition the acceptability of using MicroSort for “sex choice” with its inherent capability (unlike PGD) to be combined with “artificial insemination.” They state, “The introduction of sex choice *using artificial insemination* with sorted spermatozoa would make the method highly acceptable for sexing for social purposes. Indeed, such an approach may be imminent” (978, emphasis mine). In fact, the USDA license that extended MicroSort indications to what today is described as *family balancing* was deliberated and approved that very year. Edwards and Beard continue, “This prospect will rattle the skeletons in the cupboard for some observers as they contemplate the ethics of a further example of a rapidly advancing biotechnology” (978). The anticipated move to lifestyle sex selection found even earlier expression in an opinion piece published in 1993 by GIVF founder, Joseph D. Schulman.

At the moment of its very inception into human medicine, even as MicroSort’s *medical* purpose was still being mobilized and the technology’s viability for human applications underwent its earliest testing, developers not only envisioned future human lifestyle applications, but began to disassociate both MicroSort and PGD from abortion

technologies. Schulman's piece foreshadows the "family balancing" policy later operationalized within GIVF.

The *initial* applications of human sperm sorting are likely to be limited, and to achieve broad ethical acceptance....It will be applied prior to medical fertilization in families at high risk of bearing children with serious X-linked diseases...In this application, the sorting would achieve the laudable goals of reducing the incidence of X-linked diseases *and decreasing the frequency of pregnancy terminations after prenatal diagnosis*. The only available alternative for achieving both of these goals, IVF with preimplantation genetic testing, is complex, difficult, expensive, and necessitates the destruction of embryos.

...What carefully defined conditions would permit more ethically acceptable gender preselection of healthy girls or boys? The 'balancing' of sex ratios in families is certain to attract considerable discussion in this regard. Consider a family with its only children being three healthy boys. If a fourth child is desired, and a girl is preferred by the parents, why would sperm sorting to enhance the odds of a female not be ethical?

...In my opinion, many people will conclude that ethically acceptable guidelines for family balancing can and should be developed. One position to be considered might simply be that it is ethical to perform balancing to increase the less represented gender in any family that already has at least one child. (emphases mine, Schulman 1993, 1541)

Schulman's assertion of a medical need for MicroSort simultaneously looks ahead to the potential for lifestyle uses, long before such applications would also envelope PGD. His language asserting a lifestyle iteration of sex selection within ART is enabled by material aspects of MicroSort's design, e.g., its bias towards the more effective production of girls (Schulman's hypothetical family of three boys would likely not have been randomly chosen), and its relative simplicity and lower risk profile than PGD (assumed as it was to be applied with IUI instead of IVF).

To summarize the parallels, PGD and MicroSort developed on distinct pathways with significant technical obstacles to overcome during the 1970s and 1980s in the research realm of animal agriculture where each technology was prized for its capability to

produce female livestock. The potential for human applications could not sustain the development of these technologies initially, and in their eventual transfer to human medicine both technologies underwent a process of redefinition transforming from the end of sex selection to a means of avoiding sex-linked disease. Therefore, the emergence of the technologies alone could not preclude or determine the construction of lifestyle sex selection.

Initial human trials demonstrated foremost in material terms their viability as sexing technologies, even when this function was applied as a means to the end of avoiding disease. These development pathways converged materially as scientists framed the arrival of MicroSort in connection to PGD, as adjunct or alternative technology within the larger clinical worlds of fertility and reproductive genetic medicine. The coincident timing of arrival of MicroSort and PGD paved the way for their combination into a new set of “high tech” human sex selection practices. Their first convergence took place within highly integrated scientific and clinical spheres of molecular genetics and reproductive medicine, in which information and technologies fused towards their *medicalization* with PGD leading the way. This process served as a stepping stone to their subsequent *biomedicalization*, as they became a set of alternative technoscientific interventions designed to fulfill, as first asserted by MicroSort, consumer lifestyle desires.

**Table 4: The Medicalization and Biomedicalization of sex selective ART**

<b>Medicalization</b>	<b>Biomedicalization</b>
MicroSort and PGD = medical intervention	MicroSort and PGD = lifestyle intervention
Need linked to risk of disease affliction and based on professional diagnosis	Need based on desire
Control over pregnancy and reproduction	Enhancement through transformation of parental and family identity and constitution

Table 4 illustrates the shifts in meaning that accompanied both processes. Discursive developments further punctuate the process of biomedicalization as will be discussed in chapter four.

## Global Situation and form of the material technologies in sex selective ART

The overlapping domains in which PGD and MicroSort embed, ART and reproductive genetics, strongly associate with “high”<sup>17</sup> science, the pioneering field of human biotechnology, and wealthy world regions, even when ART proliferates increasingly beyond those (western) locations. Not only does ART provide PGD and MicroSort with an *institutional* home, but also associative meaning. As ART embedded technologies, PGD and MicroSort gain definition through belonging and situation on the privileged side in a dichotomized world of reproductive technologies alongside valued reproduction, conceptive technologies, and rational individual choice.

However, the question of how contemporary lifestyle sex selection situates globally in material terms is not only answered by their dwelling in the realms of “modern Western science” and Fertility, Inc. The material design that the technologies take – their relatively immobile but fragmentary form – leads to a porous, figuratively “western,” high-tech practice, in which the U.S. has figured as a significant destination node of global flows of information, bodies, and biomaterials. Unlike technologies designed for mass use, dissemination, and transfer from developed to developing regions (such as in

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<sup>17</sup> As with “high culture,” I use “high” as a referent of taken-for-granted status indicating a more cultivated, advanced, complex, or developed form of science, whose truth and knowledge claims are generally less scrutinized.

the global form of population control), MicroSort and PGD are comparatively immobile. However, their technological processes can be broken down in a way that allows provision to take place across multiple local sites through border-crossing movement of bodies, biomaterial, and information.

### **Inhabiting a world of reproductive technology: Disassociative and Associative**

#### **Meanings**

Boundaries drawn between ART and abortion, partially in response to local politics in their western contexts of origin, initially drove a wedge between selective abortion and selective ART in the realm of reproductive genetics. This wedge extends further into lifestyle applications, situating sex selective ART against sex selective abortion. While the longer standing practice of sex selective abortion can be historically traced to world regions associated with the imposition of population control such as in South and East Asia (Hvistendahl 2011), sex selective ART situates in the opposed regions of the “developed” global North or West. The material-technological tools of contemporary lifestyle sex selection disassociate from the opposed reproductive biopolitical context of population control, its related technoscientific practices, such as sex selective abortion, and world regions.

Developed within the dominant position of “modern Western sciences,” (Harding 2006, 1) MicroSort and PGD also disassociate with “unscientific” sex selection practices. In particular, the assertion of scientific validity in relation to other methods of preconception sex selection helped to justify a medical application of MicroSort. Boundaries of disassociation significantly define sex selective ART against “other”

practices of sex selection (such as those involving abortion, “low” tech or “unscientific” interventions).

Associative technologies in the practice of lifestyle sex selection include IUI, IVF, and ICSI, “high” technologies which merge in the realm of assisted reproduction, a globalizing “western” technoscientific medical practice marked by privilege and inaccessibility (Roberts 1997; Inhorn and van Balen 2002; Ryan 2009). As they stake out their own meanings in relation to these technologies, both PGD and MicroSort significantly entangle in processes of technological normalization, routinization, and escalation occurring in these sites.

### ***Abortion and the “Pseudoscience” of preconception methods***

The meaning-making transitions that have accompanied the technologies of lifestyle sex selection in human medicine disassociate with abortion. They stress that applications of PGD and MicroSort can avoid abortion by establishing desired pregnancies based on characteristics in the resulting child. As already described, British reproductive scientists vested in the development of PGD, highlighted this feature to politically counter an anti-abortion bill that would have stopped research on embryos. Similarly, the importance of this feature in the U.S. context, where the legalization of abortion in 1973 elicited a strong backlash and the formation of an anti-abortion stronghold in political-cultural life, cannot be overstated. In both the U.K. and U.S., scientists emphasized that development of each technology could prevent abortion in addition to early childhood death and disease. The *discursive* development of lifestyle sex selection, which I will discuss in chapter four, fortifies that boundary, with explicit distancing of “western” sex selective

ART from “eastern” sex selective abortion. *Not* abortion is a central feature of the material definition of both technologies.

Further, both technologies define as *scientific*. They *really* work, unlike a number of methods that falsely make the claim to sway the odds of getting a boy or girl. The website, [mygenderselection.com](http://mygenderselection.com), for example, contrasts MicroSort and PGD with the “pseudoscience” of Shettles and Ericsson, both preconceptions methods of sex selection that became popular in the 1970s (<http://mygenderselection.com/the-pseudoscience>, accessed March 16, 2012). Especially MicroSort had the added charge of demonstrating scientific validity in the face of similar methods whose legitimacy had come under question. Named after their founders, Landrum B. Shettles and Ronald Ericsson, both claimed to be scientific because their basis of action relied on codified knowledge existing since the early 20<sup>th</sup> century that it is the sex chromosome of the sperm, which fertilizes an egg that contributes to human sex differentiation.<sup>18</sup> Both Shettles and Ericsson theorize that Y sperm swim faster than X sperm and based their methods of intervention on this difference. Shettles proposed that timing intercourse several days before ovulation for a girl and closer to ovulation for a boy could influence the chances that the egg would get fertilized with the desired X-sperm in the first case, or Y-sperm in the latter. Similar to MicroSort, the Ericsson method also involves the manipulation of

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<sup>18</sup> Knowledge of the human chromosomal sex determination system is an artifact of modern scientific history first articulated in 1905. Both MicroSort and PGD hinge upon the basic knowledge that human sperm, like eggs, are gametes or reproductive cells that normally contain 23 or half the number of a full set of chromosomes. Chromosomes are carriers of genetic material. When sperm combine with egg cells through fertilization, their 23 chromosomes get paired with the same number from the egg to make a full set of 46 pairs. One particular pair known as the sex chromosomes is one biological indicator of sex (female or male) of the developing embryo. Individually identified as either X or Y, sex chromosomes, when paired as XX are defined as female, and XY as male. Since human egg cells always contribute a sex chromosome identified as X, but sperm bring either an X- or Y- bearing chromosome to the pair, scientists have known since the early 20<sup>th</sup> century that it is the sex chromosome of the sperm, which fertilizes an egg that contributes to human sex differentiation.

semen samples outside the male body to separate enriched samples of X- or Y-bearing sperm. Ericsson places sperm in a test tube filled with a thick albumin substance. Those sperm that reach the bottom faster are isolated for an insemination to produce a boy.

Competing scientists dismissed the claims made by Shettles and Ericsson since the Shettles method did not pass the basic scientific principle of repeatability, and the sought after enriched X- or Y-bearing populations of sperm produced via the Ericsson method could not be independently verified on a consistent basis (Claassens et al. 1995, Flaherty, et al. 1997, Rose and Wong 1998; Fugger et al. 1998).

The motivation to undo the potential harm of pre-conception methods that made false claims partially propelled the research for a viable, scientifically based method of sperm sexing forward. USDA scientist, Lawrence Johnson described to me his own contention with what he called “schisters,” those, “who were in the field to try to make a buck, with little concern for scientific merit or for the farmers they swindled. I probably analyzed 500 samples from 40 or so similar 'schisters' with 50:50 results [i.e., after sorting the proportions of X and Y sperm were still 50:50]” (personal communication, March 11, 2011). In one of their few articles written on the application of the Beltsville Sperm Sexing Technology in humans, Lawrence Johnson and Glenn Welch cite a number of studies that discredit the Ericsson method and present their own method as one that “enhances the credibility” though it does not “still the controversy” surrounding its use in humans (1997, 338). As Johnson asserts, “anyone can run a sperm through a cell sorter, but if you cannot verify what you have done, it has no merit” (personal communication, March 11, 2011). In his description of how he became a provider of

MicroSort and PGD, one clinic director told me that it was precisely his concern that patients were given false information about the potential of an Ericsson-like method he observed in use<sup>19</sup> that prompted him to look into newer methods.

...we were also starting to do PGD at that point, and so on several patients that were doing PGD they had these gradient heightened procedure done on the sperm (a method similar to Ericsson), and then we looked at the outcome to see what the gender of the embryos were, and it was 50:50, you know. So, it didn't do anything. And, we also did internal examinations where we did FISH on sperm that was either prepared in our gender selection method or just the way we always do it, and found no difference in the ratios, so at that point, I stopped doing it, and I got in touch with MicroSort... I'm a patient advocate, and that's what led me to look into gender selection in the first place, because I thought we were potentially providing people with false hope, and I don't like to do that. (Interview, September 9, 2010)

Thus, researchers and later providers had a stake in maintaining a sharp boundary between their own and other preconceptions methods they deemed “unscientific.” In this way, they could harness recognition, legitimacy and other types of value associated with high science.

### ***Prenatal Diagnostic Technologies (PND)***

From amniocentesis to ultrasound technologies to chorionic villus sampling – a range of PND since the 1970s became routine aspects of prenatal care. These technologies were enrolled in broader processes that pathologize and medicalize pregnancy. When combined with abortion technologies, PND provided a means to avoid having children with chromosomal disorders or genetic mutations resulting in disease. In this sense, the precedence of PND provided a context of *association* for PGD, not to mention common material-technological modes of analysis (e.g., FISH for the detection of specific

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<sup>19</sup> Owned by Gametrics, LTD, the Ericsson method can only be used by fertility clinics who pay a licensing fee to Gametrics (their website lists 11 centers in the U.S., 2 in Pakistan, and 1 each in Nigeria, Panama, Colombia, and Egypt), but unlicensed clinics can and do use their own version of the method (accessed on February 23, 2011, <http://www.childselect.com>).

chromosomes). At the time when reproductive scientists first considered the prospect of a *preimplantation* form of genetic diagnosis, they did not draw a sharp boundary between technologies applied before or during pregnancy, considering them on a continuum of access points where diagnostic results have varying implications. Yet, when the very prospect of developing PGD rested on public advocacy highlighting its ability to avoid abortion, a wedge was driven between genetic selective abortion and genetic selective ART. In so far as PND raises the potential of abortion depending on results, PND represents a context of *disassociation* for the technologies of lifestyle sex selection.

### ***IUI/IVF/ICSI***

Associative technologies to MicroSort and PGD include IUI, IVF, and ICSI, technologies that can be applied en route to establishing a pregnancy. Both PGD and MicroSort preclude the simplest method – vaginal insemination that can be applied by a user at home, since PGD requires IVF, and the MicroSort processes decrease sperm numbers to an extent that renders vaginal insemination ineffective. An intrauterine (as opposed to vaginal) insemination can improve the chance of establishing a pregnancy when sperm numbers are low, but IUI requires professional assistance in most cases since the catheter that releases the sperm must breach a woman’s cervix. In the hands of ART providers and within the walls of *Fertility, Inc.*, both MicroSort and PGD have been swept up in processes that normalize, routinize and ratchet up technological interventions in order to optimize the chance of pregnancy (Thompson 2005; Mamo 2007, 165).

By the time MicroSort and PGD entered human medicine in the 1990s, IVF had moved from a highly controversial technology to one that was beginning to normalize. IVF bears material-technological significance because it produces the embryos, the “raw

material” required to conduct PGD. Moreover, the context of IVF normalization provided lifestyle sex selection technologies with an associative “home” in fertility clinics. Cussins’ ethnographic account of practices in U.S. fertility clinics describes the techniques by which the strangeness and novelty of IVF practice became “natural,” “normal,” and “routine” (Cussins in Ragone and Franklin 1998, 67). Indeed, as Franklin and Roberts argue, the push for PGD itself in the U.K., in which IVF functioned as a requisite technology, “helped to establish its (IVFs) social and political legitimacy” (Franklin and Roberts 2006, 60). As IVF proceeded to normalize, its meanings as a tool towards family building, pregnancy making (rather than terminating) and as a “hope technology” deepened its associations with valued reproduction (Franklin 1997). MicroSort and PGD latch onto these sites of meaning.

Emerging in the 1990s, Intracytoplasmic Sperm Injection (ICSI) is an IVF process to fertilize eggs that physically microinjects a single sperm into an egg rather than rely on spontaneous fertilization after placing eggs and sperm together in a petri dish as in traditional IVF. Traditional IVF sometimes results in some eggs remaining unfertilized. Originally, reproductive scientists developed ICSI to address male factor infertility marked by low sperm count, impaired sperm motility or morphology (Sherins et al. 1995). Yet, at both clinics I visited, ICSI is today routinely applied with IVF in order to ensure that all available eggs become fertilized. All providers I spoke to in the field confirmed this trend both inside and outside the U.S. Significantly, the original meaning of ICSI as a technology to address male factor infertility can be linked to socio-cultural processes that have led to changing definitions of manhood in some settings (see Inhorn 2012 on Arab masculinities). Yet, routine use of ICSI with IVF has the potential to erase

both the medically defined problem of male infertility (for which it has served as a medical solution) and concomitant socio-cultural negotiations. For MicroSort, which induces low sperm counts especially when combined with sperm freezing, ICSI is a highly significant addition to sex selective ART. Discussing the compounding stresses that sperm undergo through freeze-thaw cycles in conjunction with MicroSort, the scientific director of the trial pointed out the compensatory function of ICSI, “The good news is for an ICSI cycle, you don’t need really vigorously motile sperm, because they’re going to inject the sperm anyway. All they need to be is twitching” (Interview series, December 2010). Thus, in the quest for IVF success optimization, which involves a ratcheting up of technologies, today’s routine use of ICSI (with IVF) counteracts compromised reproductive viability in sperm as induced by MicroSort combined with freeze-thaw processes.

### ***PGD and MicroSort - Staking Out a Position in Fertility, Inc.***

As a *post-conception* technology, PGD is inextricably bound to IVF, but is most often defined as a reproductive genetic technology. Fundamentally a cross-use, multi-purpose technology, PGD’s boundaries flex and blend into the contours of ART and clinical genetics. Sex determination of embryos is one of the most basic applications of PGD, but its inherently expandable form, in terms of the list of conditions and characteristics for which it can screen, means that sex selection patients can “cross-over” to other simultaneous applications of PGD for aneuploidy screening or genetic diagnosis, and vice versa. As one clinic director explained,

Once you offer the ability to look at the genetics of an embryo, we don’t just say we can do boy or girl, we have to sort of let them know everything that we can do and we can do quite a bit, and so as we go through those dialogues with them.

They'll say well gosh it would be good to know this also, and we don't argue with them. We do Down Syndrome, Patau, Edwards, a lot of the most common heritable aneuploid genetic diseases along with gender selection at the patient's request. (Interview, August 24, 2010)

Later at his clinic, I observed this "cross-over" phenomenon close up. Listening in on an initial phone consultation with an African-American patient with two girls seeking twin boys, the director offered the patient sickle cell screening after learning through the intake forms and by directly asking that both she and one of her daughters were carriers of the disease. Though the patient did not explicitly request on paper a sickle cell screening and presented herself to the clinic for sex selection, the director offered the PGD sickle cell screening "add-on," which the patient accepted, thereby *crossing over* from sex selection to genetic disease marker detection.

PGD also embeds within general fertility services as an accessory technology, either to improve IVF success rates (a highly contested claim), or for sex selection. A nurse recounted situations in which infertility patients cross-over to sex selection when offered a simple and relatively inexpensive form of PGD testing (via 2-probe FISH):

We offer the testing, and so they're like why not pay the \$2400 and find out what the sex of the embryos are....before we put them in, so if we come back and have a second kid and we already put back a female and we have males frozen, we can come back and choose the sex....We give them an option. We tell everything that we offer, so that they don't come back and say well we didn't know we could do that, you didn't tell us. (Interview, July 26, 2010)

PGD blends lifestyle sex selection practices within other medically designated functions of the technology, in the above cases for a genetic diagnosis, or as an adjunct to an infertility treatment.

As a piece of information resulting from a comprehensive chromosome screening test (microarray CGH), sex identification of embryos arrives as a nugget of data, routinely conveyed to the ART clinic by genetic laboratories after conducting PGD microarray CGH screening of all 24 pairs of human chromosomes. As one embryologist explained,

24 chromosome analysis...the microarray stuff – you always know what the sex is going to be because they [the reference lab] give you the XY or XX, whatever it's going to be, we know....They have all that information together, so when we get a report back from [the genetic lab] it'll have the embryos that are safe, the ones that are carriers, and the ones that have the disorder, but each one of those would be either a boy or a girl, so we would know that... (Interview, January 24, 2010)

The future of sex selective PGD may therefore have more to do with information disclosure procedures within ART rather than testing and screening procedures in a genetics lab. Since sex selection does not add on a separate screening procedure in PGD conducted via microarray (as opposed to FISH or PCR), any application of PGD could potentially cross-over to sex selection.

As a *pre-conception* technology, MicroSort, can begin somewhat removed from ART technologies and processes (though not entirely). The MicroSort scientific director insisted that MicroSort stays “out of the minutia of the medical management of [a] patient's cycle,” which remains, “under the purview of the physician that's actually managing the cycle” (Interview series, December 2010). Similarly, a MicroSort lab technician stressed she works on sperm samples rather than patients, suggesting that MicroSort positions itself as a supplier to ART physicians (Interview, October 22, 2010). Yet, the question about where MicroSort processes end – with the production of successfully sorted sperm, or in the intricacies of its use in ART – remains vexed. In a discussion on how effectiveness is measured in the MicroSort clinical trial, the scientific

director asserted at first, “Effectiveness does not have to do with ability to create a pregnancy. Effectiveness is strictly the ability of the process to result in a shift in the X-Y ratio of the sperm....The fertility potential of those sperm is a separate question” (Interview Series, December 2010). An elaboration, however, revealed that the question of efficacy was more muddled than he at first presented.

From a practical standpoint, you’re right, we do take into account its impact on sperm survival, sperm functionality. ...We do present fertilization, cleavage, pregnancy and birth results to the FDA as part of the clinical trial data. Again, it would be ridiculous to do a clinical trial with sperm that weren’t usable for reproduction. It would end up being some esoteric investigation. (Interview Series, December 2010).

Use processes of MicroSort must contend with decisions, practices and technologies in the ART realm and vice versa. Actual sorting procedures depend on ART specifications and ART specifications, when MicroSort is utilized, must heed to the limitations of utilizing sorted sperm. MicroSort requires that original semen samples have a minimum of 70 million motile sperm for an ICSI cycle, and 140 million sperm for an IUI cycle, because only about 30 percent of those sperm will be recovered after sorting. A very stringent gating procedure takes place before the process even begins. Not every man will produce the minimum number of motile sperm required (even for an ICSI cycle), and in those cases the scientific director suggests PGD as a possible “alternative treatment.” Some may not produce enough to enable their partners to choose an IUI cycle (Interview series, MicroSort Scientific Director, December 2010). In these ways, ratcheting up takes place from MicroSort to PGD or from IUI to IVF/ICSI.

The convoluted relationship between MicroSort and ART procedures is illustrated in the following flow chart presented to potential consumers of the English version of

MicroSort International at [microsort.com/en/](http://microsort.com/en/).<sup>20</sup> A close reading of the flowchart reveals some of the contingencies imposed on ART processes, in order to compensate for high rates of attrition of sperm induced by MicroSort and the sometimes added process of freezing sperm.

MicroSort and PGD reside in *Fertility, Inc.*, where they get inscribed with associative meanings attached to technologies used in these sites en route to pregnancy. Locally and globally, ART clinics situate within the worlds of high science and technology, wealthy world regions or cosmopolitan sites. Even when MicroSort and PGD uproot from their actual western sites of origin they remain tethered to a so-called First World of reproductive technology use on the valued side in a dichotomized world of reproductive technologies.

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<sup>20</sup> [http://www.microsort.com/en/en/forms/Microsort\\_IUI\\_&\\_ICSI\\_flow\\_chart.pdf](http://www.microsort.com/en/en/forms/Microsort_IUI_&_ICSI_flow_chart.pdf), accessed April 19, 2011

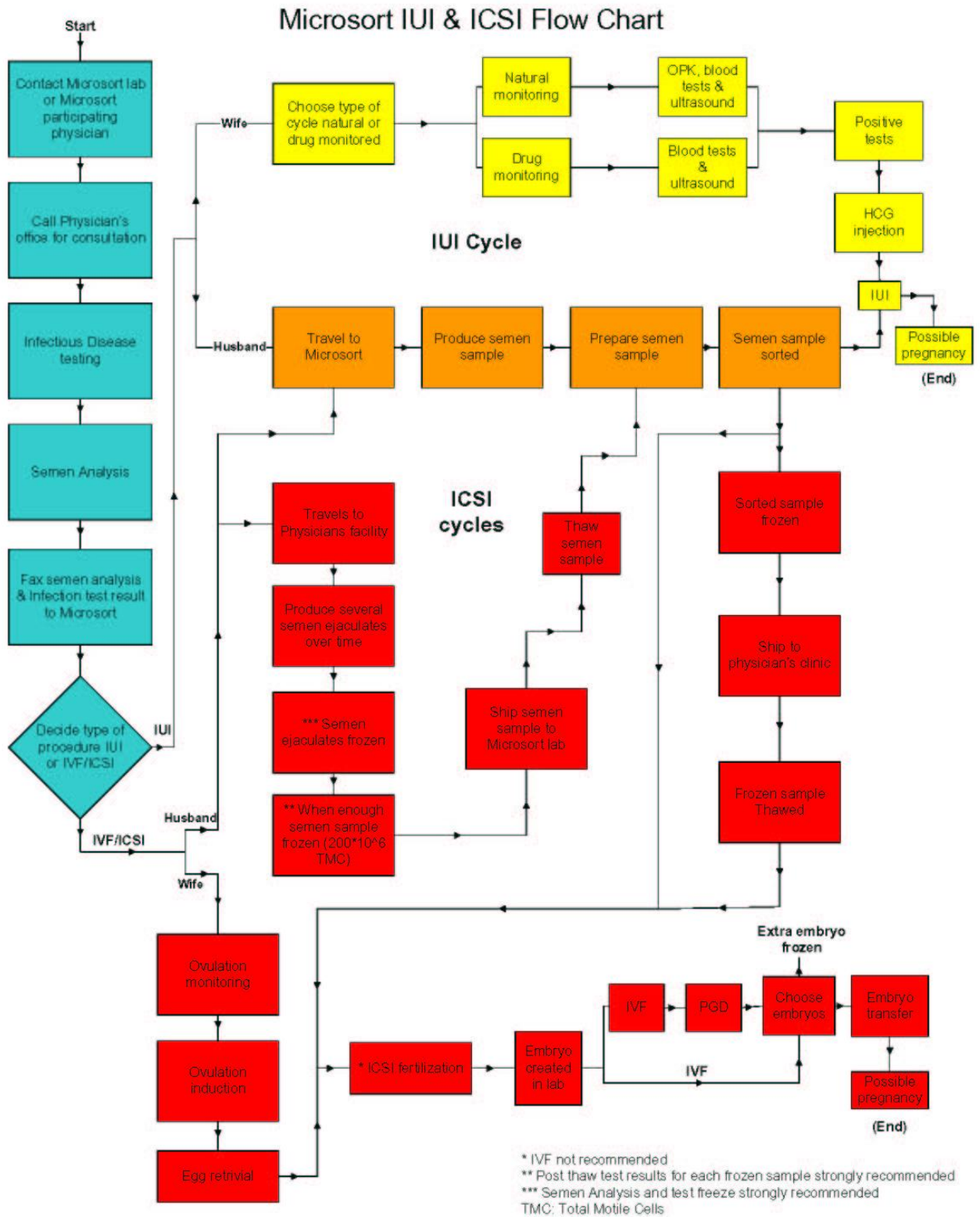


Figure 8: “MicroSort IUI and ICSI Flowchart”

## **Bodies, biomaterial, and information crossing borders**

The global situation of lifestyle sex selection rests on design aspects of MicroSort, PGD, and ART that defy standardization and mass dissemination. Both technologies require a high degree of expertise, specialized instrumentation and complex procedures to perform, which compromises the accessibility (and mobility) of each technology. On the other hand, the divisibility of the lengthy processes involved means that certain aspects of sex selective ART can take place in different locations or countries. The beginning, middle or end of the process can be broken up. A single application can thus cross borders involving more than one clinic and lab, and more than one nation-state. In this way, contemporary lifestyle sex selection situates within a web of inter-clinical and -laboratory practice that can span across nation-states. Within this web, the U.S. becomes a destination site, a node within a broader set of cross-border ART practices.

### ***(Im)mobility***

Material-technological aspects of the MicroSort process and human sperm delimit the technology's mobility in a way that until recently drove global flows of consumer-patients to its sites in the U.S. rather than the other way around. Although theoretically MicroSort-IVF cycles may take place entirely at a local physician's ART facility without travel to a MicroSort lab, this would require freezing the semen sample twice, first for shipment to MicroSort, and then after the sorting procedure for shipment back to the local IVF clinic. Although relative to other species, human sperm survive a freeze-thaw process well, still only half of the sperm in the original sample will survive (Interview series, MicroSort Scientific Director, December 2010). Freezing-sorting-refreezing processes take such a toll on the material output of MicroSort that suppliers recommend

gating measures such as a semen analysis and test freeze to ensure that the sample is strong enough to withstand it. They also recommend that male partners travel to a MicroSort facility to provide raw unfrozen samples for sorting so as to avoid freezing and thawing more than once.

By and large, sperm don't survive two freeze-thaw cycles very well.... what we really don't like is for patients to go to the time and expense of freezing multiple specimens, and shipping them here, and for us to thaw them and find a sub-optimal post-thaw survival, and then during processing or sorting, we see too few surviving sperm to make it worth their while....

...What we generally tell patients. We recommend that they come here to provide fresh semen for sorting, because they'll probably end up spending as much money collecting, freezing, and sending multiple specimens as they would for a plane ticket here. (Interview series, December 2010)

Therefore, while freezing allows for an application of MicroSort beyond the local vicinity of its laboratory, the compounding stresses the process puts on the functionality of the sperm elicits patient flows to MicroSort sites.

Further, the flow cytometers used by MicroSort are not very portable or simple to set up or operate, requiring skilled technicians. Cytometry textbook author, Alice Givan, describes the instrument as “complex,” “unwieldy,” “expensive,” “unstable and therefore difficult to operate and maintain” (Givan 2001, 11). Only three cytometers served the U.S.-based MicroSort clinical trial. One new lab site that opened in Mexico in 2009 is equipped with one cytometer and staffed with two technicians. It took three months after obtaining the facility to receive shipped equipment, test the equipment, and get the laboratory fully certified before it was ready to run its first sort (Interview with lab technician, October 22, 2010).

**“It’s not running by itself.”**

As to staffing the laboratory, the director put it this way, “You just can’t pull a MicroSort lab staff person off the shelf and plug them in and say okay start the sort. It doesn’t work that way.” The flow system is fragile, and sorting requires constant monitoring by an experienced, trained cytometrist. Glenn Welch at the USDA recalls having to remain vigilant during the technology’s pre-clinical trial, experimental stages, in order to adjust for any changes that could impact the efficacy of the sort. Lasers and the detectors may shift throughout the process and need to be realigned. Even small changes, such as in heat or pressure could change the distance from the point of analysis of the cell in the flow chamber and the point at which it breaks off into a droplet. Without adjusting for these changes, the flow cytometer may appear as though it is working fine, but actually collect empty droplets without cells in the collection tubes (Field notes USDA site visit, September 10, 2010). MicroSort’s scientific director insists that technicians must never walk away from the process. As one lab technician put it,

And, we have to be looking at the screen the whole time. It’s not running by itself. The thing is, it’s a flow, it’s a liquid going through, anything can happen...If you get distracted, you could actually ruin the purity of the sample, and you will have to start all over again. (Interview, October 22, 2010)

Her account of a typical work day, included tasks such as “prepping,” staining, sorting, and sometimes freezing sperm samples as well as paperwork. Adding a second sample for sorting on the same day required careful management of the procedural timetable in order to incorporate lengthy cleaning procedures and the physical separation of workstations to avoid sample mixing. Two samples in one day seemed to max out their current capacity of one cytometer and two technicians in the lab (which she indicated was

outfitted to expand). Nevertheless, these current procedures hardly constitute mass scale use. In human reproduction, the complex and unwieldy form of MicroSort prevents easy dissemination and mass scale use of the technology, and thus it orients towards niche markets typical of lifestyle medicine.

**“This is an art in here. It’s not as much science as you think.”**

Access to PGD is likewise compromised by the lack and expense of highly skilled labor and laboratory facilities to conduct embryo biopsies and the chromosomal and genetic tests. In some parts of the world, PGD remains inaccessible. For example, a Nigerian couple I encountered during a site visit had a referral letter (shown to me by the clinic director sans personal identifying information) from a Nigerian physician, which stated that the patients had no access to a PGD facility. A clinic director from a fertility center in Nigeria explained to me in a phone interview for this study that he refers his sex selective PGD patients to South Africa and sometimes to the U.K. and U.S. for the same reason. A physician participating in a roundtable discussion on “gender selection” at the annual meeting of the American Society for Reproductive Medicine (ASRM) 2010 from Nigeria likewise referred patients to the U.S. and sought a PGD trained embryologist willing to relocate to his clinic (Fieldnotes, ASRM Participant Observation, October 25, 2010). Even an ART clinic equipped with a PGD laboratory in the U.S. had to shuffle experts and cells back and forth from satellite to main clinic locations, because the smaller number of cases handled at satellites did not justify the expense of replicating the lab. As one clinic director explained,

I mean these are highly skilled, labor intensive things that go on. So, to maintain...I go to [different city in the U.S.] every five weeks. I fly in, I do a

bunch of patients, I fly out, and that's it. Same thing with [city in Mexico]. I fly in, I'll do 30 patients, I fly out. The time that I'm not there, I can't have somebody – a highly skilled scientist twiddling their thumbs. So, what I do is I bring the genetics team down with me, they do the biopsy and they send it back up here to maintain the laboratory. Because the laboratories aren't....I mean one lab can handle thousands, and thousands, and thousands of slides. (Interview, January 24, 2010)

PGD labs as well as the skilled embryologists and geneticists that go along with them, remain relatively limited and inaccessible. Describing the process of removing cells from early embryos and fixing them to slides, one embryologist I interviewed emphasized that not all embryologists have the requisite skill and experience to perform these minute procedures.

This is an art in here. It's not as much science as you think. It's an art. Some people are really good at it and some people aren't. We've got a guy that does it well now, but it's really an art to it. (Interview, January 24, 2010)

During a clinic site visit, I observed in the lab one embryologist remove one at a time, a single cell from each of 36 embryos. All embryos were created three days earlier using eggs from one “super” egg donor. A second embryologist assisted the first by delivering to her batches of four embryos at a time. Removed from the incubator, the embryos awaiting biopsy were placed on a table with a heated metal surface under a funnel that had a tube attached to a bubbling bottle that I was told provided them with CO<sub>2</sub>. Using a 3 micron laser operated by a foot pedal, the embryologist would look in the embryo for a cell with a clearly presenting nucleus, and then make an incision into the outside surface of the embryo near that cell. Both hands worked to operate a micro pipette and a syringe with oil used to remove the cell. The oil, she explained, helped her to control the process so that no more than one cell gets removed. Before moving on to the next embryo, the embryologist had to keep track of where she placed the biopsied cell and embryo (for me

an invisible part of the process) and then using simple pen and paper she graded the embryo in terms of “stage” (number of cells), “type” or quality as indicated by the amount of fragmentation and cell size, and any other “remarks.” Even with all of these steps, it would take her only about one minute per embryo, and she managed to carry out a conversation with one of the physicians at the same time. In my field notes, I described the process as “highly skilled,” “precise,” and, “hyper meticulous.”

Thus, both MicroSort and PGD have complex, ART embedded forms in common, not designed for standardization, mass production or dissemination in the same way as reproductive technologies such as a handheld ultrasound device, the contraceptive pill or IUD. The form and design of MicroSort and PGD defy the modernist design criteria defined by Clarke to facilitate mass production and distribution (1998, 10). According to the scientific director of MicroSort, “It is a very complex set of circumstances, the trial, the procedures, the whole shebang, this is not take a pink pill, or take a blue pill.” His comments bring forth the contrasting form of the “modern” contraceptive pill. Indeed, MicroSort and PGD are not easily comparable to contraceptive technologies designed to be discrete even to intimate sexual partners or for easy application and mass distribution to fulfill the design criteria of population control. The highly complex set of processes involved in lifestyle sex selection, which involves specialized labor and equipment render the process relatively immobile. Instead, they propel movements of bodies, biomaterials, and information to and between their own clinic and laboratory work sites.

### *Divisibility*

Since the lengthy processes involved in ART can be broken up into parts, contemporary lifestyle sex selection has developed into a practice that can span across

clinics, laboratories, and nation-states. These movements form a web of transactions that is increasingly global. Border-crossing patients who undergo sex selective PGD in the U.S., for example, begin their treatment in clinics located in their departure countries. Only after mandatory testing, starting on fertility drugs, and getting monitored for ovulation, is it necessary for them to travel to the U.S. for egg retrieval, IVF, PGD, and then embryo transfer. I explore the *institutional* elements of such transactions between clinics in chapter five. In these cases, information such as a patient test and ultrasound monitoring results flow prior to the patients themselves.

Biomaterials also flow. MicroSort IUIs require *fresh* sorted sperm because *frozen* sorted sperm depletes the already reduced numbers of sorted sperm. Therefore, MicroSort IUIs can only take place in close proximity to a MicroSort lab, which situate either in or very close to ART clinics willing to utilize the method. However, the combination of cryopreservation (freezing) of sperm and ICSI (which requires only one sperm cell to fertilize an egg) enable a practice that stretch beyond the local site. Cryopreserved sperm flows from MicroSort to ART clinics, and sometimes the other way around.

In addition to sperm, embryonic cells (biopsied for PGD) move from clinics to labs. ART clinics remove and affix cells from embryos to slides (for FISH) or place them in capsules (for microarray CGH), in order to ship them to genetic labs that conduct PGD analysis. In return, those labs send information about the embryos that informs which ones get transferred. While embryos return to the incubator to continue developing after biopsy, their removed cells become movable parts that will never return to the embryo. In the words of one clinic director, “All we want is the information from the nucleus of

that one cell. So, you can ship it anywhere” (Interview, January 24, 2011), so long as the combined, shipment, testing, analysis, and return of information time does not extend beyond the critical five day period post egg retrieval after which embryos must be transferred. Cells move from clinics to genetic labs, and information about them returns along those same routes.

Thus, the fragmentary form of ART fosters a web of transaction between labs and clinics that has increasingly globalized where sex selective ART can begin and end in various parts of the world. On the one hand, the complex forms of the technologies, which require a high degree of specialty expertise and equipment to perform, disallow easy dissemination of the technological processes on the whole. On the other, the divisibility of those processes fosters movements of bodies, biomaterial, and information to and from lab and clinic work sites within *Fertility, Inc.* This web of transnational transaction constitutes the global form of contemporary lifestyle sex selection.

In this chapter, I have described a process of material constitution of lifestyle sex selection in two stages via the regimes of medicalization and biomedicalization. I also illustrated how MicroSort and PGD latch onto sites of valued reproduction through association with material-technological forms that reside in *Fertility, Inc.* Not only did these processes assemble a “toolkit” for lifestyle sex selection, but they harnessed one valued element in a reproductive binary – technologies that assist conception, fertility, and births, which have strong associations with wealthy world regions or the global West. As products of high, western technoscience, these technologies developed through travels along established transatlantic, Euro-American channels, itself representing a preexisting global form of science-in-the-making.

## Chapter 4: The Discursive Constitution and Global Situation of Lifestyle Sex Selection

In chapter three I traced the history of MicroSort and PGD as these technologies shifted from their origins in livestock reproduction to diagnostic tools fulfilling human medical needs and then to elective interventions of lifestyle sex selection. I also analyzed the material meanings of the technologies deployed in lifestyle sex selection as they relate to one side of a dichotomy – technoscientific practices that assist reproduction as opposed to those that prevent it. In this chapter, I highlight processes that channel yet another valued element in a second reproductive binary – namely biopolitical subjects racialized white, nationalized western and yearning for a girl. These processes constructed a discourse, i.e., new terms, categories, figurative language and visuals that produce meaning of sex selection in the public imagination as practiced via ART. I examine the discourse that arose and the meanings that had to stabilize in the transition to lifestyle sex selection.

STS scholars refer to material-semiotics in technoscientific processes to point out the inextricability of material and conceptual things (Haraway 1997; Law 2008). In this same way, *material*, *discursive*, and *institutional* developments that constitute lifestyle sex selection are highly interconnected. Yet, this chapter draws attention to the ways in which sex selection takes on a new form through *discursive* means. In particular, I explore how new terms, categories and figures formed to signify a different kind of sex selection and what that discourse accomplishes. I conduct analysis of data from various sources prepared for lay publics and circulated to widespread popular audiences.

Lifestyle sex selection acquires meaning through new terms, categories, and figurative language and visuals that arise and travel within texts such as 1) clinic websites and print informational materials; 2) the mainstream news and popular media that clinics link to on their websites in sections headlined “news articles,” and “our sex selection program in the news”, and 3) self-help literature and on-line forums. I also draw on the voices of clinic personnel and self-help authors as relayed to me in interviews or personal communication. Finally, I augmented the news and popular media “endorsed” by clinics through mention on their websites with a search of articles on the topic stemming from the database, “Ethnic Newswatch,” which collects newspaper and magazine articles published in “ethnic and minority press” in the U.S. and Canada ([http://www.proquest.com/en-US/catalogs/databases/detail/ethnic\\_newswatch.shtml](http://www.proquest.com/en-US/catalogs/databases/detail/ethnic_newswatch.shtml), accessed January 5, 2012). Applying the terms, “sex selection” or “gender selection” or “MicroSort” or “PGD” for articles published from 1995, my search yielded twelve further textual sources.

The discourse that constitutes lifestyle sex selection works to distinguish sex selective ART overall as a “western” practice, situated globally apart from “other” forms of sex selection. This differentiation occurs through strategies of distancing that rename the practice while infusing it with new meaning as rational or even morally good; through erasure of sex selective abortion in new systems of categorization that range “high tech” (MicroSort and PGD) to “low tech” (timing of intercourse, dietary interventions, etc.); and finally by recasting the biopolitical subject who engages in the practice as a liberated, western woman yearning for a daughter. For the popular imagination, these produce a figurative western frame around sex selective ART, purging it of associations of

discrimination, bias, and immorality that simultaneously bind to the othered, non-western practices. As lifestyle sex selection increasingly goes “international” and “global,” that western frame travels.

### New terms disassociate with “sex selection”

In 1990, economist Amartya Sen coined the term “missing women,” which brought attention to uneven sex ratios present in the population of Asian countries and in 1991, *New York Times* journalist, Nicholas D. Kristof began to publicize to popular audiences the phenomenon that tied sex selection, “missing women,” and Asia (Sen 1990; Kristoff 1991). By the mid-1990s, the issue of *sex selection* understood as gender discrimination began to enter world stages through events associated with the International Conference on Population and Development (Cairo 1994) and the Fourth World Conference on Women (Beijing 1995). Several countries began to legislate against and implement policy to curb sex selection (for example, India and China in 1994 and the U.K. in 1995). Against this background, the U.S.-based clinic corporation, GIVF, sought to develop MicroSort and to promote a different way of thinking about sex selection, one that could disassociate from negative ideas such as unethical or illegal medical and gender discriminatory practice. To that end, GIVF contributed a powerful new term (in addition to a new technology). *Family balancing* from the outset signified often more clearly what it was not rather than what it was. Other stakeholders joined and elaborated on GIVF’s initial meaning making practices and together this set of associated terms, categories, and figures formed a new discourse on sex selection.

## Family Balancing

Feminist theorist of reproductive technology, Charis Thompson, reflects (as paraphrased and quoted by Kara Platoni) on the power behind the term:

the genius of the term "family balancing" [according to Charis Thompson] lies in its ability to transform a social anxiety (desire for a boy or a girl) into a clinical diagnosis with a recommended medical solution. She compares it to recently developed ideas about body shape "proportionality" that have become accepted as rationales for plastic surgery. "So if you have a too-small bust for a ratio to your hips, it's now a 'bodily imbalance,'" she says. "It's a medical concept -- it's not that you're vain. That seems to me very similar to the rationale in 'family balancing.'" (Platoni, 2004)

"Family balancing" lies at the crux of the processes of biomedicalization that have taken place in lifestyle sex selection. Not only does the term not refer to a condition (medical or social), it refers to a positive action, a "balancing," holding implicit the subject of that action – the one who technoscientifically takes action to correct an imbalance. In the same way that "family planning" became a synonym for contraceptive use that called on a modern subject to *control* her fertility for the sake of her health, her liberation, the betterment of her race (eugenics), or her nation's development (especially in global South countries); family balancing calls on a postmodern, western or more recently (trans)western-global subject to *transform* her family for the sake of an individual desire, dream, or ideal. For the rest of this section of the chapter, I will first sketch the evolution of the term as it shed its initial strangeness and its meaning began to stabilize. Then, I explore two tensions blackboxed from view during this process in the claim that *family balancing* is "sex neutral" and an "indication" for a medical treatment.

*From strangeness to taken-for-granted usage*

Today, *family balancing* has come into wide circulation even making its way into the 10<sup>th</sup> edition of the Collins English Dictionary (2009), which defines,

**family balancing**

--*n*

(US) the choosing of the sex of a future child on the basis of how many children of each sex a family already has

(Dictionary.com. *Collins English Dictionary - Complete & Unabridged 10th Edition*. HarperCollins Publishers. [http://dictionary.reference.com/browse/family balancing](http://dictionary.reference.com/browse/family%20balancing); accessed July 15, 2011).

Yet this was not always so. Conceived within the context of MicroSort clinical trial in its earliest years, the term has circulated only for a decade and a half. Paul McFriedies author of *Word Spy: The World Lover's Guide to Modern Culture*, traces the origins of recently coined terms on his website, wordspy.com. He finds the earliest citation of family balancing in a *Fortune Magazine* article from 1994 that focuses on infertility rather than sex selection (Caminiti 1994; <http://wordspy.com/words/familybalancing.asp>, accessed June 24, 2011; Darnovsky 2003). A quote from GIVF's founder and director, Schulman towards the end of the article throws the idea of *family balancing* in the mix of options a patient may begin to encounter at a fertility clinic, but the article does not even mention MicroSort. Engulfed by the overwhelming issue of infertility at the time, and prior to the birth of the first MicroSort baby, that introduction of *family balancing* did not yet garner much attention.

In 1993 the USDA granted GIVF an exclusive license to develop the USDA's patented Beltsville Sperm Sexing Technology for use in humans solely for the purpose of preventing X-linked disease. In 1995, GIVF presented the USDA with the term in a bid

to expand development of the technology to the *indication of family balancing*. Dr. Larry Johnson, scientist from the USDA who developed the technology, recalls this moment.

One of their reasoning on it was, as I remember, it was that they couldn't keep the business going based on sex-linked diseases. In other words, there wasn't enough call for those type of situations that they could maintain a business. They had to add family balancing. (Interview, September 14, 2010)

A commercial intent drove GIVF's pursuit of the technology in the first place, and a commercial plan helped fulfill the criteria for GIVF's initial successful application for an exclusive license from the USDA. Yet, as a treatment to prevent sex linked disease alone, MicroSort was not very viable commercially. The scientific director of MicroSort explains, "...the incidence of sex-linked and sex-limited disease is not that high....we figured that the overall average incidence of all sex linked/limited diseases [X- or Y-linked] is about 1 in a 1,000" (Interview Series, December 2010). Furthermore, from a commercial point of view PGD held a competitive advantage for the prevention of X-linked disease since it could more accurately than MicroSort select sex before pregnancy. Thus, *family balancing* not only provided a means to expand the market for MicroSort but to keep it alive as a potentially viable commercial product. The USDA was likely not unsympathetic to this objective. From a statistical point of view, *family balancing* would allow the clinical trial to increase the numbers of subjects in order to more powerfully demonstrate safety and efficacy. Indeed, *family balancing* patients have made up over 90% of the total enrolled subjects (Karabinus 2009, 77).

Nonetheless, the idea of *family balancing* was still strange, and Johnson did not expect the initial reception by the USDA to be favorable to GIVF's request. Once again, Johnson looks back on that moment:

I was pessimistic. I didn't really have a position on it other than I didn't think the USDA would agree to it....Dean Plowman. He was the administrator of ARS [Agricultural Research Service] at that time and he made the decision. I remember the person who was handling it from the Office of Technology Transfer at that time. He told me, he said, he's not going to approve this. That was his view, but he was wrong. (Interview, September 14, 2010)

June Blalock at the USDA OTT (Office of Technology Transfer), which handles all licensing for ARS, USDA, recalled the decision-making. She clarified that the field of use on the license for genetic disease reduction was not extended specifically to *family balancing*. Rather, it was extended to all physician-approved, human uses, because the USDA did not feel that they should make decisions on medical ethics for human applications, rather that question should be deferred to medical ethicists (informal conversation, December 21, 2010). Thus, the USDA in 1995 opened the door to the possibility of expanded indications for MicroSort while ceding institutional authority over the specific question of *family balancing* to the “overseers” of the clinical trial within human medicine, which at the time was only an institutional review board (IRB), not yet the FDA. Even though the USDA did not give *family balancing* specifically a stamp of approval, GIVF likely interpreted the USDA move as a bureaucratic opening, especially given the general absence of federal regulatory mechanisms governing fertility medicine.

Interestingly, the approval of *family balancing* as an *indication* for MicroSort use by an IRB coincided with the first of several changes in institutional oversight of the trial. The decision was approved not by the trial's original IRB at Inova Fairfax Hospital, rather by GIVF's own, newly composed in-house IRB (Wadman 2001, 178), which in 2009 faced warnings by the FDA of failure to adequately review on-going research or prevent conflicts of interest in research approval decisions

(<http://www.fda.gov/ICECI/EnforcementActions/WarningLetters/2009/ucm203906.htm>, accessed January 30, 2012). The institutional change in IRB and rapid implementation of a *family balancing* policy at GIVF may mean that *family balancing* did not receive a full ethical review. *Family balancing* remained an *indication* for MicroSort use in the clinical trial for fifteen years until the FDA in 2010 prohibited continued enrollment of *family balancing* subjects while they make a determination on the safety and efficacy of the method. I describe this *institutional* intervention by the FDA in greater detail in chapter five.

Part of the power and influence of *family balancing* can be shown through its travels outside of GIVF where it has indelibly reshaped understandings of sex selection into a contemporary lifestyle form. Articles in *news and popular media* that focus on MicroSort began to appear in 1998. Some of these are featured on the MicroSort website and they show an evolution in the way the term is applied. Science writer, Gina Kolata, wrote the first news media piece in 1998, announcing MicroSort technology in a report about (and coinciding with) the publication on the first births of MicroSort babies in the scientific journal, *Human Reproduction* (Fugger et al. 1998). This representation of a feat or achievement centers the reproductive scientists as subjects and presents the term, *family balancing*, as artifact of the MicroSort trial. “Dr. Joseph Schulman, director of the Genetics & IVF Institute, “Kolata writes,” said most of the couples wanted to choose their baby’s sex for ‘family balancing’”(Kolata 1998). However, articles from 2004 (the latest appearing date of news or popular media featured on the MicroSort trial website) no longer attribute the term to GIVF or MicroSort, and the quotes around the term begin to drop.

As news and popular media begin to mention PGD as an alternative to MicroSort around the mid-2000s, they continue to use *family balancing* as an umbrella term that could refer to the use of either technology. A 2004 *Newsweek* cover article begins and ends with successful case stories of families with three boys who utilized PGD (the opening case) or MicroSort (the closing case) to have a girl child. The article defines “family balancing” as “the popular new term for gender selection by couples who already have at least one child and want to control their family mix” (Kalb 2004). Such usage reveals the plasticity of the term, which partly through interventions made in news and popular media, begins to define a broader set of “high tech” technological interventions that include PGD. *Newsweek* (Kalb 2004) changed reporting on PGD, which till then was only briefly mentioned, if at all, as a technically possible alternative to MicroSort, that was however too expensive, invasive and besides, largely inaccessible for non-medical use. The *Newsweek* piece foregrounds PGD, referring to it instead as a commercially viable techoscientific option alongside MicroSort available to prospective consumer/patients of lifestyle sex selection.

Jennifer Merrill Thompson, an early user of MicroSort for *family balancing* and author of the self-help book, *Chasing the Gender Dream: The Complete Guide to Conceiving Pink or Blue With the Latest Sex Selection Technology and Tips From Someone Who Has Been There* also recalls the initial strangeness of the term. An advocate for MicroSort once she successfully conceived a girl after several attempts with the technology, Thompson contributed to a MicroSort informational video clip on *family balancing*. Thompson recalls GIVF staff repeatedly prompting her to refer to her treatment as *family balancing*, though it did not come to her naturally

(<http://www.givf.com/aboutgivf/video/thompson.shtml>; accessed June 27, 2011; personal communication, June 20, 2011).

Years later, the term appears to have taken a hold among MicroSort and PGD users and consumer/patient advocates in on-line, self-help communities. In their now taken-for-granted usage of *family balancing*, they often make explicit what GIVF only implies. “Maureen,” an early user of MicroSort and participant in on-line forums at [ivillage.com](http://ivillage.com) and [babycenter.com](http://babycenter.com), pioneered the first comprehensive website, [in-gender.com](http://in-gender.com), to contain both self-help information and forums to share experiences and questions between those who desire a baby of a particular sex. In her “Gender Selection Glossary,” for example, Maureen assertively reclaims “sex selection,” just as she redefines it as “family balancing:”

#### family balancing

Using gender selection methods simply because parents prefer to choose their baby's sex, rather than medical necessity due to a [sex linked genetic disorder](#). The term was coined to allay the stigma associated with "sex selection", which to many people equates to "boy selection" and the notion that one sex is inherently better than the other. "Family balancing" is meant to convey the desire of many couples, not to conceive the "better" gender, but to balance their families with children of both genders. (“Gender Selection Glossary,” <http://in-gender.com/XYU/Glossary.aspx>, accessed on June 24, 2011)

“Sex selection” does not appear as an entry in the glossary and the entry “social sex selection” advises, “See family balancing.” Therefore, *family balancing* displaces “sex selection,” represented in this way as sex selection’s socially legitimate form. Self-help author’s like Maureen make explicit how the new term works to define a new practice against an existing “stigma associated” form.

“Jane,” who belongs to a later cohort of women who has participated in this public culture sought a boy through PGD after having three girls. At the time we spoke her son was still under one year old. Jane’s newly authored site, [genderdreaming.com](http://genderdreaming.com), which went public at the end of 2010 uses *family balancing* as a title that is hyperlinked to the subcategories “high tech family balancing” and “natural gender swaying.” Thus, while news media and PGD providers grouped PGD under the *family balancing* umbrella along with MicroSort, on-line self-help authors stretch the term even further to encompass “natural” or “low-tech” methods used to influence the sex of a baby before conception.

The power behind the term lies both in its generalizability with regards to methods used (so long as they preclude sex selective abortion), and its specificity to geopolitical and cultural “western” context. Like Maureen, self-help author Katherine Asbery deploys *family balancing* explicitly as a way to demarcate a different (more legitimate and unbiased) form of western, sex selection practice.

...in many nations in the Far East, such as India and China, there is an unnaturally high ratio of males to females....When used for *family balancing*, indications in such countries as the United States, gender selection is widely sought without any preferential selection of males. (emphasis mine, Asbery 2008, 76)

Unlike its material counterpart (MicroSort under GIVF’s exclusive license), the term has had open access, and is applied in many ways both inside and outside of clinical settings. By conferring reasonableness and thus, social legitimacy, to certain sex selection cases, the term lies at the crux of biomedicalization processes involved in lifestyle sex selection. Elaborations on the term by self-help authors take for granted the meaning of *family balancing* as harmless, if not a corrective antidote to the harms related to *sex selection*.

In addition, their references to the term make explicit that *family balancing* situates globally as a western practice.

***Tension 1: Family balancing is sex neutral***

As already indicated, the term originated at GIVF, where Dr. Joseph Schulman, the clinic's founder and director, introduced the concept (without directly naming it) in a 1993 issue of the scientific journal, *Human Reproduction* as part of "carefully defined conditions" that "would permit more ethically acceptable gender preselection of healthy girls or boys" (1541). Conceptually at the outset, Schulman tasked the (then not existent) term with defining a new practice in relative (rather than absolute) terms, to signify something "more" in this case "ethically acceptable" than something implicitly "less." From the outset then, the term was meant to produce meaning in relation to what it was not. It was *not* son preference, *not* gender bias, *not* abortion, not eastern, *not* even *sex selection* in so much as *sex selection* associated with son preference, gender bias, or abortion.

Both Schulman and Edward Fugger, a reproductive scientist at GIVF instrumental in the transfer of MicroSort to human medicine and steering the clinical trial in its earliest years, carefully conceived the *policy* to deflect expected criticism. In her documentation of early years in the trial, journalist Meredith Wadman of *Fortune Magazine* explains,

Fugger pondered how he might expand the trial without causing an ethical uproar. His solution was to offer the treatment to parents trying to conceive a child of the sex found in fewer than half of the family's existing children....Critics could hardly blast the institute for opening an ethical Pandora's box: MicroSort would be correcting sex ratios, not skewing them (Wadman 2001, 78).

In interview, the MicroSort scientific director reiterated the idea of *family balancing* as policy, and suggested that this policy *by definition* and through its action ensures against sex preferences based on bias.

... family balancing... I want to point out is sex-neutral. MicroSort does not do first baby sorts for family balancing. That is and has been a company policy. Yes, we do first baby sorts for genetic disease patients. Obviously. But for family balancing they have to have children and the sex ratio of those children has to be out of balance, and they have to choose a sort that will increase the likelihood of getting them a baby that is the underrepresented baby of that group.... (Interview Series, MicroSort Scientific Director, December 2010)

Thus, GIVF represents the concept as a *policy*, a field of action that ensures through its very implementation against sex bias. *Balance* capitalizes on associations of evenness, equality, and even harmony, to preemptively disassociate from sex ratio at birth *imbalances*, a phenomenon measured at macro levels of *population* – not at the micro level of a nuclear *family*. As the unit acted upon, *family* not only maintains focus away from national populations (and their possible sex ratio imbalances), but also from *individuals*, whose isolated desire to have a girl or boy may be interpreted as indulgent or frivolous. By taking the emphasis off of individual desire, *family balancing* like *family planning* is code for rational decision-making and a proactive action that one takes for the benefit of the family. Just as the use of contraceptives for *family planning* indicated responsible choice on the part of the user, the use of MicroSort (and then also PGD) indicates the same for *family balancing*. In addition, like *family planning*, the term, *family balancing* not only sanctions the decision to engage in sex selection via ART as rational, it simultaneously constructs the social imperative to do so. *Family balancing* is not only rational, it ought to be done.

Ostensibly, *balancing's* inherent sex neutrality guards against an application of sex selection motivated (unethically) by sex bias such as son preference. It negates the possibility that the majority of “othered” son preference cases could constitute a form of *family balancing*. In this way the term masks the reality that the application of sex selection in regions of the world where boys disproportionately outnumber girls at birth occurs among families only once they already have one or more girl children. Citing several demographic studies on sex ratio at birth imbalances in countries around the world, an interagency United Nations 2011 report on sex selection stated:

In general, sex-ratio imbalances across affected countries increase as birth order increases. As a result, the ratio is more skewed among second, third or higher birth-order children compared to first-borns. This indicates an increasing desire for boys as the number of girl children increases. (World Health Organization 2011)

That is, sex ratios at birth among first-born children tend to be balanced even in countries with known son preference and widely practiced sex selective abortion. This means that if a couple that stems from a country affected by sex ratio imbalance sought services at GIVF for a boy, they would most likely fulfill the MicroSort *family balancing* policy criteria because they would do so only after already having at least one girl child. While *family balancing* may correct sex ratios within an individual family, it does not follow that it would do so in a national population. *Family balancing* by any technology (involving abortion or not) can contribute to population sex ratio imbalances depending on how a population is defined. This is true even in the United States, where a recent study has pointed to sex ratio imbalances at birth among Asian-Americans (Korean, Chinese, and Asian-Indian). While the proportion of boys to girls may start out even among first births, it jumps incrementally at second, third, and higher order births

(Almond and Edlund 2008). The authors interpret their findings as evidence of sex selection practice within these hyphenated American communities. Their data also indicates that son preference and *family balancing* are no more mutually exclusive categories than are East and West. When it comes to sex selection, globalizing practices and spaces bleed into one another. Even when rigidly applied, GIVF's *family balancing* policy provides no real protection against sex biased applications of sex selection.

Furthermore, in its travels outside of GIVF, clinics have borrowed the term and applied it liberally and selectively without the accompanying policy protections that supposedly ensure a "more ethical" practice. By the mid-2000s PGD providers following GIVF's lead began to borrow the existing language of *family balancing* now broadly publicized by news and popular media, but they sometimes substantially reinterpreted it. One clinic promoting primarily sex selective PGD titles its webpage on sex selection services, "Sex Selection and Family Balancing," and a promotional video highlights the term in a definition nearly identical to the one that GIVF has used in relation to

MicroSort:

It's a boy, it's a girl! The anticipation and excitement of creating a new life, the most precious gift in itself, but for some couples, even very fertile couples with several children, the dream of balancing their family and finally having a long-awaited boy or little girl to balance things out remains unreachable. Advances in reproductive medicine and the technology to help infertile couples have babies can now also help fertile and infertile couples choose the gender they wish for.

However, while *family balancing* functions here in a way not dissimilar to MicroSort's meaning, a clip further along in the video makes clear that the clinic does not view *family balancing* as a policy that delimits access to the technology in any way.

A few fertility programs offer sex selection only to limited couples with known genetic disorders. We make this procedure available to all patients, including those seeking to balance their families, and even those wishing to ensure that a first child is of a gender that they pre-choose.

In this way, sex selective PGD providers expand on GIVF's definition of *family balancing* as it arose within the context of the MicroSort clinical trial. Even GIVF, in a newly launched website (as of June 15, 2011) now foregrounds PGD under the banner, *Family Balancing*. The decision by the FDA in 2010 to prohibit continued access to the MicroSort trial for *family balancing* until it decides whether the method is safe and effective likely prompted this change. Yet, this latest FDA intervention comes long after the term has become both robust and plastic enough to encompass related technoscientific situations which make up the umbrella of contemporary lifestyle sex selection.

### ***Tension 2: Family balancing as indication for medical treatment***

GIVF's authorities such as Schulman and Fugger do not appear to have wrangled much over the coinage of "family balancing," whose meaning they convey as simple and self-evident, referring to selecting the least represented sex among offspring within a family. They draw from medical parlance in referring and understanding the term as an "indication" for MicroSort. The MicroSort Scientific Director explains,

In the context of the clinical trial, there are only two indications being investigated, that would be the indication for couples wishing to avoid transmitting sex-linked diseases to their children and for couples who wish to balance the sex ratio among their children. Those are the indications – and it's an actual usage term, it's indications for use. (Interview Series, Scientific Director, December 2010)

Normally, a medical indication refers to a condition or a symptom (headache, for example) for which a treatment (ibuprofen) becomes advisable in order to allay, reduce,

or cure the condition. In this case, however, *family balancing* does not refer to a symptom or disease because *family balancing* does not treat a medical condition, rather consumer desire. As a biomedical intervention that addresses a lifestyle issue, *family balancing* joins recent biomedicalization trends. Mamo clarifies this process:

...in medical discourse and practice there is no longer a prerequisite to pathologize the body to maintain medical authority and jurisdiction; instead biomedicalization extends its reach to include any and all issues concerning life itself, culminating in a moral imperative to be healthy. While cosmetic and other lifestyle issues are already part of the U.S. consumer discourse, their place as objects of U.S. biomedicine is intensifying. (Mamo 2010, 175)

Always in close accompaniment to the *medical indication* of X-linked disease, GIVF distinguishes *family balancing* as the *non-medical indication* for which MicroSort acts as a treatment. There is no need to pathologize or answer questions like what medical condition do families with an uneven ratio of sex in their offspring have and how uneven does the ratio have to be to indicate a medical problem?

In one study, GIVF scientists awkwardly name “discordant offspring gender” families to refer to *family balancing* patients with over three children of one sex. The study used fluorescence in situ hybridization (FISH) to examine the sex ratios in the sperm samples of men in “discordant offspring gender” families. *Before* sorting the semen samples of these patients, GIVF scientists found that the samples contained X and Y sperm populations in approximately 50:50 proportion (Kevanfar et al. 2001). The study thereby disproves any medical-scientific explanation to the occurrence of “discordant offspring gender” families, underlining that *family balancing* treats not a medical condition but a lifestyle desire.

MicroSort informational materials designed to reach potential subjects never address “gender discordant offspring” families. A brochure focuses on a treatment “designed to increase the chance of a couple having a child of a *desired* gender” (emphasis mine, MicroSort brochure, <http://givf.com/specialfeatures/brochures.shtml>, accessed June 15, 2011). GIVF’s website section on *family balancing* speaks of “parents” with a “strong desire” to “complete their family” through “the addition of a son or a daughter.”

Maybe you have three sons and have always dreamed of a daughter. Perhaps you have a daughter and desire a son to complete your family.  
(<http://givf.com/familybalancing/>, accessed on June 24, 2011)

Through its invention of *family balancing*, GIVF constructed the above social situations as reasonable (if not ethical) for the application of a medical technology. In line with a *family planning* objective to determine how many children to have, *family balancing* becomes a reasonable means to “complete” a family. In this way, the “desire” to have specifically sexed offspring (under specific conditions) becomes treatable, and thus, lifestyle sex selection biomedicalized through discursive means. Another section of the brochure entitled, “How Do I Become a Patient?” ensures that those undergoing treatment assume the identity of a “patient.” Nurses and clinicians at the clinics I visited consistently referred to those who took up sex selection services for non-medical reasons as patients. Another indicator of biomedicalization processes, “patients” in this case do not refer to sick persons undergoing treatment to become well. Patients are those on whom the clinic confers a kind of contemporary (western) biological and consumer citizenship (Rose and Novas in Ong and Collier 2005), which entitles the individual to legitimately purchase medical services to treat their desires for a particular (reproductive)

biological future. It is a citizenship project defined as western but not territorially bound to any nation-state.

Under the heading, “MicroSort<sup>®</sup> Family Balancing Policy,” the MicroSort clinical trial website defines,

Family balancing is the process of bringing the number of children of each gender in a family closer to equal. This term cannot apply to a first child, nor can it apply to a family, in which there are already an equal number of boys and girls.  
(<http://microsort.net/msfbpolicy.php>, accessed May 6, 2011)

GIVF hereby articulates policy that polices desire at the same time as it structures a social imperative for heterosexual couples to ideally have an even number of children of both sexes. To qualify patients seeking MicroSort must be a “married” couple consisting of a husband and a wife. Looking back, today’s MicroSort Scientific Director acknowledges that the clinic corporation probably restricted same sex couples from participation at the trial’s outset in order to increase the social acceptance of *family balancing* (follow-up communication, June 27, 2011). As smooth as the policy may have appeared on paper, the realities of family composition, individual desires, and ART likely made its practice stickier. Can a couple count the children from a previous marriage to qualify (asks a woman using an on-line “ask-the-physician” forum)? How do the higher than average rates of multiple births associated with IVF offset the purported balance one is trying to achieve? MicroSort acknowledges that in some cases its success in producing more than one baby of desired gender may “produce another family imbalance (in the opposite direction)” (<http://microsort.net/msfbpolicy.php>, accessed June 17, 2011). As a policy in the MicroSort trial, *family balancing* creates a gap between people’s desires for family that may or may not align with the qualification criteria. Other clinics who borrowed the

language of *family balancing* closed that gap, by opening sex selective PGD to anyone with a desire to sex select. Since *family balancing* as an *indication* for MicroSort treatment is not dependent on a medically diagnosable condition, the inclusion criteria that qualified participants in the trial “diagnosed” the presence of a “reasonable” desire to sex select. Significantly, that criterion does not interrogate how those desires get produced. Individual desire, like dominant freedom of choice rhetoric, can be stripped of the mechanisms that produce it, and thereby efface social problems or the social anxieties (as per Charis Thompson) that lead to those desires. Furthermore, by signifying rational desire, as well as the ideal of a “complete” or “balanced” family, *family balancing* builds the imperative to sex select children – that is, it produces those desires just as much as it “treats” them. In addition to clinics, self-help communities made significant contributions to renaming efforts through subsequent meaning-making practices that strike more emotional chords, reverberating through and shifting affective environments.

### **Gender Dreams and Disappointments**

More so than in the clinic, on- (and sometimes off-) line public cultures that have arisen in lifestyle sex selection allow users to express and get validated the feelings and emotions that surround the practice. Perhaps emboldened by the relatively anonymous spaces they encountered when meeting each other on-line, these self-help, biosocial communities worked to re-evaluate the goodness of the object, “healthy baby” that is supposed to produce feelings of joy. Among their neologisms, *gender dream* and *gender disappointment* gave voice to that which should not be uttered – explicit desires, fantasies, and dreams for a girl or boy baby and, its inverse, feelings of disappointment

when facing the reality of prospective offspring with undesired gender. These discursive practices shaped lifestyle sex selection in a way that the appearance of new material technologies alone could not do. They shifted the affective atmosphere through the construction of new meanings and spaces intended to break taboos and create positive and supportive interfaces.

Drawing on Sara Ahmed's theorizations of affect, I interpret the work of these on-line public cultures as creating the means by which the technologies could become promising – by delivering the “happy objects” (a boy or girl baby) getting passed around in these sites, and accumulating “positive affective value as social goods” (Ahmed 2010, 35). “Happy objects” according to Ahmed, are not only those things that make us happy, but things “evaluated and judged” to be good. Whereas *family balancing* could make sex selection “reasonable” or “rational,” *gender dreaming* or *disappointment* that leads to the pursuit of a “happy object” (in this case, boy or girl baby via technoscience) could make sex selection morally good and socially worthy. Ahmed explains, “Groups cohere around a shared orientation toward some things as being good, treating some things and not others as the cause of delight. If the same objects make us happy – or if we invest in the same objects as being what should make us happy – then we would be oriented or directed in the same way” (35). In this case, self-help, biosocial communities invested in same object – sex specific children.

### ***Gender Dreaming***

While *family balancing* gained some recognition in the *institutional* realms of clinics and an institutional review board for its pragmatic approach to defining a reasonable situation for sex selection, it failed to touch on the emotionality or morality of those

situations. Self-help authors, both on-line and in print, helped to fill that gap. Jennifer Merrill Thompson, a pioneer in the public culture that has arisen to create new meanings for sex selection and an early user of MicroSort, has documented her experience with the technology in the aforementioned self-published book, *Chasing the Gender Dream*. Thompson may have been among the first to coin, “gender dream,” which put into words the emotions that went with the intention to sex select offspring. She described the intensity of the longing she had for a girl child:

The drive to reach a goal – the determination to see a long-time dream come true – can be a very strong thing. It can occupy your everyday thoughts, it can shape your daily activities, it can become an obsession. It can make you do things you never imagined doing.

That is what happened to me when I decided I wanted a daughter. And even as the months and years went by and it did not occur, and I gave birth to two wonderful, priceless little boys, my longing did not go away. In some ways, it became stronger.... (Thompson 2004, 61)

The desire, she explains, stems from a vision of herself (the dream), which is inextricably tied to a vision of her family. At stake in the decision to “go for a girl” was her own gendered, maternal identity as well as her family identity.

I didn’t want to be just a “boy mom” – I really wanted to experience raising children of both genders. ... I continued to carry that image in my head of a little girl posing for a photo, flanked by her two big brothers. (61)

Thompson describes her desire for a daughter not merely as a preference, but as something far more deep-seated in her own visions and understandings of herself – not as an individual, but a social being configured through family constitution and ties. Other participants in these public cultures describe the importance of these imaginaries.

Writing on the issue in the *The New York Times Magazine*, Lisa Belkin makes public her own personal vision of an imaginary daughter named Emma.

I love my [two] boys fiercely, and I cannot imagine the world without them. But I always thought – always assumed – that I would have a daughter. Emma, I called her during our silent conversations...I bought Emma clothes during my first pregnancy. (Belkin 1999)

Like Belkin, others who have spent time in these public on-line cultures similarly “out” their yearning for imagined daughters whom they sometimes name and for whom they (sometimes secretly) buy real clothes. Such maternal imaginings as described by Belkin and Thompson are imaginings of happiness in the future (i.e., they are anticipatory) and directed toward objects, in this case, a girl baby. Further, since happiness involves intentionality, as per Ahmed,

It is not just that we can be happy about something, as a feeling in the present, but some things become happy for us, if we imagine they will bring happiness to us. Happiness is often described as “what” we aim for, as an endpoint, or even an end in itself. Classically, happiness has been considered as an end rather than as a means. (Ahmed 2010, 33)

Thus, the technoscience of biomedicine extends its jurisdiction into affective environments as a means of acquiring the “happy objects” related to self-actualization. Technoscience becomes instrumental not so much as an expression of personal liberty (or reproductive choice) but in the pursuit of “sociable happiness” (34).

The intention to reach out to others who feel the same way in a space where they will not be judged links members of these new public cultures more than shared experience with technologies. According to “Jane,” author of [genderdreaming.com](http://genderdreaming.com), a site whose name also strikes at the affectivity in contemporary sex selection practices, the large majority of on-line participants are not only women “dreaming” for girls, but participants

who do not, for reasons of cost or moral objections to IVF, seek “high-tech” methods (personal communication, June 21, 2011). Users come to voice their desires in a space of acceptance and validation, to share on-going details of pregnancies, to share ultrasound results and photos, and even knowledge on how and when to best determine sex in ultrasound images. Users also learn about and share on-going experiences with “low-tech” or “high-tech” methods of sex selection, and seek solace when their attempts fail (either to get and stay pregnant, or when they face an undesired sex determination in a current pregnancy).

Self-help authors guard the ability of their audience to voice their desire for a baby of particular sex above all else. Thompson exemplifies this stance:

...although those of us who try gender selection understand that health is extremely important – and who doesn’t want a healthy baby? – we also don’t have to apologize for wanting something more, for hoping to influence gender. (Thompson 2004, 1)

Belkin acknowledges the work done by repeated assertions for a desired boy or girl.

Over time, she sees them conferring normalcy and social value to the object, “girl baby” or “boy baby” without necessarily displacing the social importance of “healthy baby.”

These women do not question whether the sex of a child should matter. They take it as a given. Just as it is different being a boy than a girl, they say, it is equally different being a parent to a boy than a girl. Yes, they understand that the health of a child is most important, but that does not mean that everything else is unimportant. They talk about sex selection as if it were the norm, their right. And all their talk goes a long way toward making it so. (Belkin 1999)

Within these spaces it becomes clear that a boy or girl baby, becomes an “instrumental good” or “object of happiness,” and the technoscience of PGD and MicroSort makes possible not simply the fulfillment of a sex preference, but women’s realizations of their imagined selves. It is this emotionality that begins to explain the drive that motivates

some women to make often several attempts at lengthy procedures that involve risk, and discomfort, if not pain, without any guarantee of pregnancy, let alone (especially in the case of MicroSort's relatively lower efficacy) of a baby of desired sex. Once again, Thompson asks,

Why else would someone end up in the small consulting room of a nondescript building of an infertility clinic in Fairfax, Va., especially someone with no known fertility problems, speaking to strangers about the desire for a daughter? What could drive someone to subject herself to regular blood draws and pelvic ultrasounds, to clinicians poking around and checking her egg follicle sizes and the thickness of her uterine lining, to monitoring and reporting her sexual intercourse days – not to mention having to ask her husband to provide a sample of that most private of things, his semen, for a sperm count?

Only a fixation that won't go away could push someone to do this. And for me, MicroSort was the answer to the unending question that seemed to rule my days: How could I make my dream finally come true? How can I conceive a daughter when it looked like my husband and I could only make boys? Everything I had been hoping for during the past few years had led me to this place. And nothing behind those doors would make me turn away once I got there. (61-62)

Rather than a preference one can live with or without, gender

dreaming/fixation/obsession expresses the intensity of the desires and emotions that drive contemporary sex selection.

The interpellation of a girl or boy baby as the "happy object" that holds the promise of future happiness and self-actualization, means its disruption can spell the inverse – "unhappiness" or disappointment. Thus, self-help spaces conceptualized a condition, *gender disappointment*, perhaps far more precisely in emotional terms than "gender discordant offspring family" to indicate MicroSort and PGD as "treatments." Once again, Ahmed explains the interrelated production of happiness and disappointment, whereby happiness as "an expectation" sets the emotional stage for disappointment (Ahmed 2010, 41).

## ***Gender Disappointment***

Although the precise origins of *gender disappointment* are not documented, both ingender.com and genderdreaming.com devote a web page and forum specifically to this topic, and Katherine Asbery, a participant in the *gender disappointment* boards at ingender.com and babycenter.com, self-published a book on the topic, *Altered Dreams: Living with Gender Disappointment*. Although ingender.com does not provide an explicit definition of *gender disappointment*, it frames discussion by welcoming all users willing to abide by the following rule:

**Rules for posting here:** As always, be kind and respectful to all other members. Posts along the lines of "you should just be happy to have children" are not permitted. (We already know this, thank you.) Unkind posts in this forum will be removed swiftly and without apology. This is a forum for support, not criticism. (<http://ingender.com/cs/forums/t/16155.aspx>, accessed on July 1, 2011)

More recently, it has added a space devoted to those with “extreme gender disappointment.” Genderdreaming.com, likewise acknowledges the diversity of situations that may lead to *gender disappointment*, but it fills in the spaces left by ingender.com. Genderdreaming.com provides in-depth definitions for both *gender disappointment* and *extreme gender disappointment*.

*Gender Disappointment.* Gender Disappointment (GD) is the sadness that results in learning that your child is not the hoped-for gender. For some this is the mild disappointment that lasts for a few days as they adjust their expectations, and for others this can last for a significant amount of time as they deal with letting go of their dream of a son or a daughter and what that means for their family.

*Extreme Gender Disappointment.* Extreme Gender Disappointment (EGD) includes feelings of grief and despair over a child’s gender that seem to be unnaturally severe. Although a very small subset of those encountering GD, those dealing with EGD may be considering drastic measures to overcome the pain they are feeling, including: adoption, abortion, wishing for miscarriage, abandonment of their family, or even suicide. Although apparently and significantly disproportionate to the news of a baby’s gender, those dealing with EGD often

have past issues of physical, emotional, or sexual abuse, substantial loss, severe parental neglect or abandonment, or other markedly painful histories that have been associated with a certain gender. (<http://genderdreaming.com/gender-disappointment/>, accessed July 1, 2011)

The naming and defining of GD and EGD as mental health issues situates them as potentially medically recognizable categories. The site even points out that the American Psychiatric Association has not (as yet) conferred “official recognition” of GD and EGD as mental disorders in the latest edition of its Diagnostic and Statistical Manual (DSM-IV). The prospect of such recognition would mean that those applications of the technologies today deemed “non-medical,” “social” or “lifestyle” (as I have termed them) may be poised for another round of classic medicalization process. Self-help groups present *gender disappointment* as a morally acceptable (western) motivation to sex select as opposed to unacceptable (eastern) gender bias, even though the “condition” as described pertains *in the same way* to the social and affective situations that give rise to sex selection practice in the global East.

In addition to the elaborated definitions of GD and EGD, [genderdreaming.com](http://genderdreaming.com) sophisticatedly argues that *gender dreaming* or *disappointment* is based on the importance of “gender” as a social category. Citing a definition of gender from a social psychology textbook the website asserts,

Because of the substantial role gender plays in our lives, it only follows that it is an important characteristic to us when we imagine parenthood and our future children. We picture both their persons and our interactions shaded by their gender. And for many, this coloring can lead to a very specific desire to raise a certain gendered child, or even disappointment when we learn the child we will have is not the gender we have hoped for and imagined.

This explanation likewise acknowledges the social rather than individual source of gender preferences. Self-help biosocial communities point to the complex social

production of sex preference as a way of presenting desires for a girl or boy baby as benign. Such desire does not stem from prejudice or bias, which according to this representation can only manifest in certain individuals or certain “cultures.”

Mother of three sons, Asbery discusses her own *gender disappointment* as an embodied experience. “You feel like an outcast in your own skin,” she writes. *Gender disappointment* is “one of those closet situations” and a “dirty secret” (Asbery 2008, 10-11). Similar to Belkin, Asbery imagined “Delaney” a daughter to whom she would write actual letters during her third pregnancy. Having to come to terms with an ultrasound result that revealed a third son on the way, Asbery puts into words her own feelings of grief at a “loss,” once again making clear the intensity, indeed the very “realness” of the dream. She describes the moment when she learned the ultrasound result:

Oh, how could I explain [her crying to her two sons]?? I was crying for the loss of another dream. The death of a daughter I will never know. Crying for the sadness I felt for not having the one thing in life I wished for. Sobbing for my lopsided family. (Asbery 2008, 6)

Similarly, self-help book author, Jennifer Merrill Thompson describes her sense of a “void,” again a kind of loss that she felt compelled to fill. It is the sharing of these commonly felt experiences that draws women together in these communities. Through their interaction, they have first found names, and then developed not unsophisticated definitions to make meaning of the emotions and embodied experience connected to lifestyle sex selection. Since *gender dream and disappointment* do not generally receive validation in mainstream public cultures, a self-help community has arisen to carefully guard a safe space where the feelings and experiences of group members can receive recognition. In this way they assert a shift in the affective atmosphere and work to re-

evaluate the goodness of an affective object, a specifically desired girl or boy baby in reproduction.

Through the production and circulation of new language, self-help communities discursively reconstitute sex selection as part of a larger emotional state. *Gender dreaming* and *disappointment* represent what Adams et al. name an “anticipatory mode of affect.” The authors state, “Anticipatory modes enable the production of possible futures that are *lived* and *felt* as inevitable in the present, rendering hope and fear as important political vectors” (Adams et al. 2009, 248). In this case *gender dreaming* represents “hope” in the forms of “anticipation and preparation,” and *gender disappointment* represents “fear” as “surprise, uncertainty, anxiety and unpreparedness” (249). Stories of women who imagine their future child specifically as girl or boy, providing them with names and even sometimes clothes are examples of “thinking and living toward the future” (246), and as such they belong to broader “anticipatory regimes” (248) that particularly characterize the world of ART (Thompson 2005; Adams et al. 2009, 252).

### **Gender vs. Sex (Selection)**


In order to discursively displace “sex selection,” both clinicians and self-help authors assert “gender” in place of “sex,” and sometimes avoid “selection” all together. As MicroSort Scientific Director explains,

When one hears the term sex selection, there is a knee jerk reaction that it is discriminatory against women... I think gender is a more palatable word for many people in the U.S.... (Interview series, December 2010)

A MicroSort ad in the *The New York Times* Sunday Styles section (see following figure) exclusively uses “gender” and “gender selection.”<sup>21</sup>

The MicroSort® Gender-Selection Program at GIVF

## Do You Want To Choose the Gender Of Your Next Baby?



If you want to choose — or need to choose — whether your next baby is a girl or a boy, you may qualify for the MicroSort® gender selection procedure at the Genetics & IVF Institute (GIVF).

Prospective parents come from all over the world to GIVF in suburban Washington, DC. They choose this exclusive *scientifically-based* sperm sorting gender selection procedure, currently in an FDA clinical trial, for several important reasons:

- For prevention of genetic diseases
- For family balancing
- Results so far show 90% success rate for achieving girls and 75% for boys.
- FREE MicroSort for qualifying patients who use Donor Egg or Preimplantation Genetic Diagnosis at GIVF.
- For sensitive, personal attention from a caring staff of professionals, dedicated to the success of your family.

Couples also choose the Genetics & IVF Institute because we are the world's largest integrated provider of infertility and genetic services. Our expertise in the diagnosis and treatment of complex genetic and reproductive disorders is second to none.

To learn more about the Genetics & IVF Institute, and how the MicroSort® technology may help you select the gender of your next child — please visit us at:

**www.givf.com**  
or call us at  
**1-800-277-6607**

Now available in New York and other metropolitan areas through collaborating physicians. Call for details.

**Caution:** This procedure uses an investigational device limited by federal law to investigational use.


**GENETICS & IVF INSTITUTE** 

Figure 9: MicroSort Trial Information in *The New York Times* Sunday Styles section.

<sup>21</sup>According to Marcy Darnovsky, who clipped this ad, it ran for several months during the summer of 2003 and prompted her to write, “Sex Selection Goes Mainstream” published September 25, 2003 on Alternet.org; <http://www.alternet.org/story/16837/>, accessed July 11, 2011 (personal communication, July 5, 2011).

Furthermore, MicroSort.net (the trial website) references *gender selection* five times and Microsort.com/en/ (the commercial website) seven times without making any reference to *sex selection*. Of course, both MicroSort websites also refer to *family balancing* and the commercial (non-trial) website increasingly traffics in the language of “hopes” and “dreams,” in banners announcing “where hope meets science” and “afford your dream.”

The perceived negative connotations associated with “sex selection” elicited a discursive shift to “gender” in promotional or informational materials though providers did not entirely forego “sex selection.” They appear to strategically invoke “gender” or “sex” in conjunction with “selection” depending on audience. As the MicroSort scientific director explained,

We had this discussion here. Are we going to use sex selection or gender selection, and there was a lot of talk about it. And we decided the accurate term is the better term.... When we publish, when we communicate with the FDA, it's sex selection. (Interview series, December 2010)

One director marketing to international audiences said he personally monitored his clients' responses to his advertisements for PGD. He found that Muslim and Catholic countries tend to prefer “gender” over “sex,” but acknowledged that his clinic has used them interchangeably in relation to “selection” (fieldnotes, January 24, 2011). The webpage of his clinic offering the service, references “sex selection” 37 times (not including the title) and “gender selection” 20 times. Similarly, the following ad appearing in *India West*, a weekly newspaper of the Asian Indian American community on November 19, 2010 (in print, A35) used both terms, highlighting a “100% Sex Selection Program,” which even offers a “Gender Selection” hotline.

# Have a Boy, Have a Girl Guaranteed!

## A REALITY AT THE FERTILITY INSTITUTES



### *The Fertility Institutes*

Helping Couples Become Families<sup>SM</sup>

Newsweek Magazine, 60 Minutes, Good Morning America, Dainik Jagran and over 200 international news organizations have all reported that the future of gender selection has arrived at The Fertility Institutes 100% Sex Selection program in Southern California.

Using advanced preimplantation genetic diagnosis (PGD), the physicians and scientists at the Fertility Institutes operate **the world's largest and most successful 100% sex selection program**. Serving couples from all over the world, you are invited to call or visit our website for information on how you can ASSURE that your next pregnancy results in the gender that you pre-select. View our web site to see our physicians interviewed on CNN, 60 Minutes, Good Morning America, MSNBC and other leading news programs. Confidential in-office and telephone consultations with our world renown physicians are available by appointment.

**THE FERTILITY INSTITUTES**  
 Los Angeles, California & New York, New York  
**Where dreams become reality....**  
[www.sexselection.net](http://www.sexselection.net) • [www.fertility-docs.com](http://www.fertility-docs.com)  
**Toll Free Gender Selection Hotline: 800-222-2802**

The Fertility Institute

**Figure 10 Sex Selection Advertisement**

Appearing adjacent to articles headlining news on Indian and Pakistan intended to inform their diaspora, this ad is marketed to a South Asian-American audience, in which the term “sex selection” is not only long established but recognizable.

Self-help websites (ingender.com and genderdreaming.com), on the other hand, discursively center “gender dreams” and “gender selection” and appear to eschew the use of “sex selection” all together. Apart from the first article to reference MicroSort in

1998, U.S.-based news and popular media featured on clinic websites also tend to use “gender” in place of “sex.” Discursive shifts in lifestyle sex selection promote the use of “gender” and “gender selection” often in place of, though sometimes alongside “sex selection.” This discourse strategically distances itself from the negative baggage tied to *sex selection* – presumption of boy preference and selective abortion tied to global eastern contexts. “Gender selection” joins other new discursive formations of lifestyle sex selection – “family balancing” to rename a practice, “gender dreaming” to express and validate the emotional intensity that drives the practice and “gender disappointment” to cope with its failures. This vocabulary by means of contrast reinforces an East/West binary in sex selection practices and situates lifestyle forms globally as western. By means of erasure, a new system of categorization of sex selection also westernizes lifestyle forms.

### New Categories erase Sex Selective Abortion

In *Sorting Things Out*, Geoffrey Bowker and Susan Leigh Star argue not only that categories have “material force,” but in their making they create invisibility (Bowker and Star 2000, 3-5). One system created in the discursive formation of contemporary sex selection categorizes technologies into “low-tech” and “high-tech.” Most pronounced in the work of self-help authors, this system does three significant things in its constitution of lifestyle sex selection. It converges MicroSort and PGD together into the category of “high tech;” it creates and validates the category of “low-tech” as a consolidation of all pre-conception methods that are not “high-tech;” and it fully erases sex selective abortion, the most practiced method of sex selection around the world.

In “high tech” sex selection, MicroSort and PGD are weighted equally as alternative methods. The categorization “High Tech Gender Selection Methods” (in “Maureen’s” [ingender.com](#) and Jennifer Merrill Thompson’s book, *Chasing the Gender Dream*), “High Tech Family Balancing” (in “Jane’s” [genderdreaming.com](#)), and “High Tech Methods of Sex Selection” (in Robin Elise Weiss’ book, *Guarantee the Sex of Your Baby*) all group together MicroSort and PGD as “high-tech” options. The technologies’ common dependence on assisted reproduction, high expense, high emotional cost, and inconvenience to end users are highlighted along with their scientific backing and accuracy. The “self-help” system of categorization minimizes differences between MicroSort and PGD, leveling the playing field between them, as the technologies are presented as options, with comparable risks and benefits, or pros and cons. This “high tech” category is flexible enough to draw in PGD alongside MicroSort, even though professional bioethicists maintained a separation between them (as discussed in chapter five) because PGD necessarily produces the ethically problematic object of undesired embryos. The self-help system of categorizing minimizes PGD’s identity as a genetic disease diagnostic tool, converging MicroSort and PGD into “high tech” sex selection.

The “high-tech” category as reproduced in all self-help primary sources (Thompson 2004; Weiss 2007; [ingender.com](#); [genderdreaming.com](#)) encompasses the Ericsson method described in chapter three in spite of its questioned scientific validity. For that reason, providers of MicroSort and PGD would likely disagree with the inclusion of Ericsson-like methods as a signification of “high tech”. Further dissonance between the self-help community of practice and providers of MicroSort and PGD arises in their differing responses to another newly created category, “low-tech.”

“High-tech” methods are contrasted with “low-tech” methods, sometimes also called “Natural Gender Selection Methods” (ingender.com), “Natural Gender Swaying” (genderdreaming.com) or “at-home techniques” (*Chasing the Gender Dream*). The self-help community, once again unlike the clinics, includes a range of “non-scientific” techniques in their system of categorization that can be applied at home. Their common convenience and privacy in comparison to “high-tech,” and their low-cost is highlighted. These include the Shettles method on timing of conception, its inverse known as “O+12,” diets and methods based on astrology or the lunar calendar. Self-help authors do not deny that these methods have no scientific basis. They often underline that point. Yet, they insist on their inclusion, lumping them together as “low-tech,” and they are open to the voices of some women who swear by them. One self-help author argued with her publisher for the inclusion of “low-tech” methods in her book:

The low-tech was important to me because I didn’t want this to be about money, and I think that we still need the ability to be able to exert some control over our reproductive health. ... You’re a grown up. You can make your own mind up. *This may not be as accurate, but if it helps you feel you have some modicum of control, then that’s fine. So, I felt very strongly.* They [name of press] were not as pro doing that. I convinced them that that was very important. (emphasis mine, Interview, October 20, 2010)

In the tradition of classic, self-help women’s health advocacy, this author’s refusal to deny “low-tech” a place alongside “high-tech” interventions reflects her understanding that “low-tech” may provide women users with “some modicum of control” over the process. Based on women’s experiences with the medicalization of pregnancy, self-help authors rarely tout technoscientific interventions without any reservation. Their stake in the recognition of “low-tech” lies in acknowledging that “high-tech” often is experienced by women as handing oneself or one’s body over to science, and thereby ceding control.

Scientists and clinicians, on the other hand, may have expected that the advent of scientifically proven methods of sex selection would eliminate the use and spreading of, in their view, “old-wives tales.” Yet, these methods have experienced a rebirth of sorts – newly validated as “natural,” “alternative,” or at least an option among today’s techniques. Significantly, they are not represented by the self-help community as “backward.” The MicroSort Scientific Director reacted to this development.

One of the things that is frustrating to me is reading on the internet over and over and over and over again - are - they appear to be blogs about, but I think they’re thinly veiled advertisements for Chinese lunar calendar for having your girl baby or your boy baby, natural methods for gender selection, that sort of stuff. Pretty much tired retreads of the same old thing that just don’t work. As a scientist I find that very frustrating. I cringe when I see references to swaying and that kind of thing, because I know that people are wasting their time. 50% of the time they’ll be successful, and that sort of success, which is not doing it the old fashioned way, perpetuates that sort of hope. (Interview series, December 2010)

Much to the likely chagrin of scientists like him, both “Jane” and Jennifer Merrill Thompson argued that “low-tech” methods would never go away, and “Jane” further contended the existence of clear affinity ties between those in the larger “swaying community” and that smaller subset that go for “high-tech.” Some users want to experiment with “low-tech” for a while and then decide to go “high-tech,” she explained, and some who have had failed attempts at “high-tech” report going “natural” again, which can also mean that they take their 50:50 chances by just trying to get pregnant (outside of a clinic) without even “low-tech” interventions. One self-help author similarly recounts cases in her on-line blog where users choose “high tech” even after successfully attempting “low-tech” because they are getting older, cannot afford to have many more children, and cannot “chance it.” Thus, self-help authors represent “high-tech” and “low-tech” as different ends of a continuum rather than sharply divided,

mutually exclusive categories. Yet, as inclusive and comprehensive as the continuum appears to be, it reinforces the invisibility of sex selective abortion.

Significantly, the alternative to “high-tech” is a wide range of “low-tech” options, but not sex selective abortion. The system sorts out sex selective abortion, “othering” it as a “drastic measure” that someone experiencing “extreme gender disappointment” might take (hardly recognizing it as one of the most commonly used methods of sex selection worldwide). Often conflated with “sex selection,” sex selective abortion is represented as a “backward” cultural practice when mentioned at all, reinforcing its illegitimacy. Sex selective abortion is eliminated often by lumping it together with infanticide as an antiquated “other worldly” cultural practice. Jennifer M. Thompson writes, “In places such as China and India, a boy baby historically has brought joy; a girl baby, the opposite, and sometimes selective abortion or infanticide has, tragically, resulted.” (Thompson 2004, 11) One self-help author, reflecting on why her book content excludes sex selective abortion, stated: “In the historical perspective, and woven in several places in the book – not directly addressed – is the issue of sex selective abortion and infanticide....I felt like the issue of abortion particularly for sex selection [pause] this book was divisive enough on its own. So, I chose not to really focus on that issue” (Interview, October 20, 2010). When mentioned at all self-help authors mark sex selective abortion as something historical or culturally foreign that does not belong within the temporal and spatial “contemporary western” frame of lifestyle sex selection. Their erasure of sex selective abortion as a category of sex selection denies the relative contemporaneousness of ultrasound and amniocentesis (especially in comparison to some of the recognized “low-tech” methods in this system such as the Chinese lunar calendar).

It also denies that sex selective abortions occur unrestricted by geopolitical, cultural, religious, or ethnic East/West boundaries as well in the United States (Puri et al. 2011, Hvistendahl 2011, Almond and Edlund 2008).

As Bowker and Starr contend, “each category valorizes some point of view and silences another” (5). Importantly, the safe, self-help spaces of lifestyle sex selection discursively assert new technologies of the self and the social. However, they create value not in a vacuum, but over and in relation to something else, that which is glaringly absent. The discursive constitution of lifestyle sex selection through new terms and categories is the constitution of a hierarchy that distinguishes between good and bad sex selection practices.

New figures: the ideal gender-balanced family and the white, western woman yearning for a girl

The discursive constitution of lifestyle sex selection brings with it new biopolitical figures such as a “complete,” “gender-balanced,” heterosexual nuclear family. This figure stems from the idealized images in clinic and technology literature, which projects an idealized subject comprising a heterosexual couple with two children, always one boy and one girl. Below is the image of that ideal that has remained a constant throughout the lengthy, clinical trial of MicroSort (Screenshot, <http://microsort.net/>, accessed July 8, 2011).



**Figure 11: “Balanced” Family Ideal**

The Fertility Institutes represent the ideal as well in the following image of this smiling family of four (woman, man, girl and boy) that appears next to a description on how PGD works (Screenshot, [http://www.fertility-docs.com/fertility\\_gender.phtml](http://www.fertility-docs.com/fertility_gender.phtml), accessed July 11, 2011).

**How does it work?**

- Several eggs are extracted from the mother by our doctors, sperm is supplied by the father.
- The father's sperm is used to fertilize the mother's eggs in our lab.
- After 3 days, several 8-cell embryos will have developed.
- Our doctor-scientist specialists examine the genetic makeup of the embryos.

**Figure 12: “Balanced” Family Ideal**

Some of the first faces that come to light of people we should imagine going for lifestyle sex selection appear western and white, relaxed in a recreational or vacation setting. The likenesses of those I actually encountered during site visits to two fertility clinics – one South Asian couple living in the San Francisco Bay area going for a boy, and one Nigerian couple who had traveled from overseas for a boy – do not appear in these materials.

Narrative case stories in news and popular media, and the discursive assertions in self-help materials project an individual woman, most often racialized as white and nationalized as American or “western”, who has strong desires for a girl. Using actual, successful case stories made to appear representative, news and popular media discursively assert a less idealized subject than in clinic images. These are exclusively families with multiple boys who appear to have reasonable, not indulgent or frivolous, desires to have a girl. The focus centers distinctively on the woman, not just a couple or family. Articles most often allow the woman to come to voice, narrating stories of her desire for a girl. The subject is represented as more relatable and less idealized than the images of model families on the clinic websites. The articles and video from news and popular media featured on the clinic and technology websites delve into narratives of the woman’s individual drive and always ultimate success – women like Monique Collins (Time Magazine and CBS/The Early Show), Christine Reed (USA Weekend), Sharla Miller (Newsweek, CBS/60 Minutes), Mary Toedman (Newseek), Lizette Frielingsdorf, (CBS/The Early Show and Newseek), and Jennifer Merrill Thompson (American Public Media, Marketplace). Every single case features families finally getting an “elusive” girl after having several boys.

Beginning with Lisa Belkin’s piece in *The New York Times Magazine* that first reported on “Americans” desiring girls, titles like Belkin’s “Getting the Girl” (1999) abound: “So You Want a girl?” (Wadman in *Fortune*, 2001), “Going for the Girl” (des Jardins in *Parenting*, 2001), “I’ll Have a Girl, Please” (American Public Media/Marketplace, 2006). Belkin’s piece of long-form journalism marks a turning point on popular and news media reporting in which American women desiring girls supercede

scientists making cutting-edge discoveries as the primary subjects of lifestyle sex selection. Drawing much of her material from on-line self-help forums, Belkin produces a deftly written, sympathetic piece, narrating her own personal experience with *gender dreaming* for a girl and *gender disappointment* upon learning the sex of her second son alongside the other cases she follows. These include an unsuccessful “low-tech” attempt and a successful attempt at MicroSort. Furthermore, Belkin discursively asserts the nationality of these subjects as American by juxtaposing them against “much of the rest of the world.” A highlighted line within the Belkin piece announces in bold, “Unlike much of the rest of the world, *Americans* do not prefer boys” (emphasis added, Belkin 1999). Similarly, Perri Klass writes in *Vogue*, “There are countries, as we know, where the spirit of Henry VIII prevails, and everyone wants boys. And then there is the United States, where many of the most determined parents are out for girls” (Klass 2001). To the extent that images are included, these apparently representative *American* cases appear racialized as white.

Self-help authors flourish the subject with context and personality, likewise emphasizing that the subject of lifestyle sex selection is American, a woman with several boys desperate for a daughter. They underline that in making and implementing the decision to “go for a girl,” she is also self-determined, and they do so as well through juxtaposition with a countersubject. Thompsons accounts,

In many countries, women who bring sons into the world are honored and feted; it is considered a great accomplishment for the family. In the United States, on the other hand, there appears to be more interest in trying to conceive a girl – maybe because of American women’s increased roles and rights, their ability to say what they want and to “go for it,” and they often want daughters. (Thompson 2004, 11)

Similarly, “Jane,” author of [genderdreaming.com](http://genderdreaming.com), stridently asserted in phone conversation:

You do know that most people are after girls. The notion is as soon as you say gender selection, people’s minds go to China and India and the discarding of girls because they all want sons. Where *family balancing* happens where it is a legal practice- meaning mostly in the States, people like me, 90-95 percent are seeking girls. I am in a huge minority as someone seeking a boy. The perception is completely wrong. Completely. And the woman is driving this process almost 100 percent of the time. The husband has nothing to do with it other than being nice enough to go along with his wife. So the assumptions probably people make about the decision to do this, the process, and what people are after, they are probably wrong most of the time. It’s mostly women that want daughters. (emphasis added, personal communication, June 21, 2011)

Jane later clarified that her figures (90-95%) were based on her perception of on-line users. “I can only speak to what I have seen on IG [[ingender.com](http://ingender.com)] and GD [[genderdreaming.com](http://genderdreaming.com)] and yes, the vast majority are attempting IVF for a girl, no matter where in the world they live. I do not know how that might align with what the actual statistics are in the real world” (personal communication, June 29, 2011). Thus, self-help authors discursively link *family balancing* and girl preference to U.S. or western practices of sex selection. They make explicit women’s self-determination and imply that in spite of her overwhelming desire for a girl, she would not resort to selective abortion. Often the desire for a girl is imputed to be devoid of bias, but just in case it is not, self-help authors take pains to repeatedly insist that desires for daughters are not accompanied by any devaluation of their sons. The western biopolitical subject, thus, forms counter to “much of the rest of the world,” or “China and India.” Inextricably tied to the making of this subject, then, is the reinforcement of a preexisting East/West or West/the rest boundary. In this way, lifestyle sex selection gets situated globally as western.

### **Actual subjects of lifestyle sex selection**

There appears to be a discrepancy between the desired sex among those who participate in self-help on-line communities (a large majority of whom as Jennifer Merrill Thompson and “Jane” point out are women seeking girls) and the desired sex among those who go for “high tech.” One U.S.-based clinic director volunteered that patients approaching his clinics for sex selection seek boys and girls in a ratio of about 50:50 (Interview, August 24, 2010). At best, the only currently reliable information available on sex preferences among “Americans” or more precisely, among those who seek services at U.S. fertility clinics include clinic specific snapshots of information, nothing comprehensive and inclusive of several clinics in a geographic range, nor during a comparable time period. Nothing appears to be verified by independent sources, and U.S. regulatory mechanisms such as the Centers for Disease Control and Prevention (CDC) do not yet ask specifically about sex selection in their regular collection of data on IVF success rates.

A 2007 article from the scientific journal, *Human Reproduction*, published sex preferences of 92 couples who underwent PGD, a few along with MicroSort, at The Center for Human Reproduction (New York City) between January 2004 and December 2006. Of those 92, 36 selected for girls and 56 for boys – hardly evidence for a predominance of “Americans” wanting girls. The study concluded, “Gender selection choices were to a statistically significant degree dependent on the couple’s ethnicity ( $P < 0.001$ )....there was obvious gender bias in favor of male selection among Chinese, Arab/Muslim and Asian-Indian couples. In contrast, Caucasian/Hispanic couples demonstrated obvious bias toward female selection” (Gleicher and Barad 2007).

However, figures from MicroSort do tilt in favor of girls. Presenting data in terms of number of sorts conducted, only 25% of all sorts conducted were for Y-bearing sperm. Recall from chapter three that MicroSort more effectively selects for girls than boys. When presented with an option, those preferring a boy may choose PGD (over MicroSort) since its efficacy is not impacted by choice of sex. Yet, in a variety of news and popular media publications, including a recent provocative *Atlantic* piece announcing the “end of men,” MicroSort data is presented at face value, without any reference to this technically based bias towards girls (Rosin 2010).

For this study, clinicians provided their impressions of sex selection patient profiles. One director described what he saw as two broad categories of patients whom he has treated.

There are really two populations of patients. One population would be middle to upper middle class or even upper class, females that are usually Caucasian, usually from some part of the British empire – Canada, Australia, New Zealand, England itself, even Hong Kong, and then the United States. It’s weird that it’s all British colonies, but that’s kind of the way it is. I mean we do get some patients from other countries, France, Germany and stuff, but not as many. These are women who are typically in their mid-30s. They have on average 2 boys and they want a girl. So, that’s one patient profile.

The next profile, which comprised mainly Asians (Central, South, and East) as well as some Africans currently residing outside their countries of origin, most often as first generation immigrants in the West.

The other patient profile is going to be someone from Asia, or Africa sometimes, ... it could be China, not really Japan so much anymore, but sometimes Japan, China, Korea, India, Pakistan, some of those other little countries in there. ... And then some of the central Asian republics, they are not really religious people, so it’s more of a cultural thing. But, they’re like Muslims by heritage, but they grew up in the Soviet Union which was totally godless, so it’s not like they’re

religious, but their heritage is still kind of rooted in those types of values, traditional types of values. These would be people that typically would be, if they're in the United States or Canada, then they would be usually first generation, came here to work or whatever, occasionally we'll see 2<sup>nd</sup> generation, but not very many. So, 1<sup>st</sup> generation...

This director's use of "traditional types of values" functions as a stand-in for son preference. He named Turkmenistan and Kazakhstan as specific examples of Central Asian Republics from which his clients stem. Yet, among this second profile, the director differentiates a subset – the wealthiest among these same categories of nationality that reside in their countries of origin.

...or if they're from the country itself, like if they're coming from India, or Pakistan, or any of these other countries I mentioned, they're not middle class people, they're not upper middle class people, they're like upper class people that have a lot of money. People that own big companies, shipping companies, oil companies, computer companies. So, these are people that in their society, I mean even in our society, they would be wealthy people. People that are really high net worth people, maybe 30 million dollars and up type of people.

The director estimates that about fifty percent of his sex selection patients come from abroad, mostly from Australia, England, India, China, South Korea, and Canada. It soon became clear that even more complexity undergirds these transnational routes. For example, he explained that a clinic in Thailand, owned by an Australian clinic, refers patients to him every now and then. Australian patients, who cannot for legal reasons access sex selection in their own country, may first travel to Thailand, and if their attempts at the procedure fail, they may then be referred to a U.S.-based clinic. Thus, the patient stream from Thailand to the U.S., in this case, actually is Australian by citizenship, if not origin.

In the second U.S.-based clinic I visited, about sixty percent of the sex selection patients came from abroad according to the director:

The largest group of foreign patients come from Canada. Number 2 is China. Number 3 is England. But, we've seen people from every continent on Earth. A huge number of people from Nigeria, for some reason. I think that's a combination of Nigeria having oil money and Nigeria having a huge problem with sickle disease.

The reference to sickle cell disease touches, once again, on the phenomenon of cross-over patients. Those who are good candidates for PGD because of their carrier status for a particular genetic disease also have the opportunity to select the sex of the embryos they put back. When I probed for more information on other markers of identity, this director explained that the Canadians seeking his services were often immigrants stemming from China, Armenia and Albania. Thus, both clinics directors provided a picture of routes that complicated the discursively reinforced East/West binary through the presence of immigrant and minority communities within "western" contexts and references to wealthy patients streams from "developing" regions of the world such as Africa, Central Asia, Eastern Europe, as well as South and East Asia.

Clearly, the actual bio-citizen-subject of lifestyle sex selection may be far more complex than the discursively asserted predominant western woman desiring a girl. Which idealized faces appeared on clinic websites? Whose relatable stories have been used to humanize contemporary sex selection, and which voices can be heard in self-help forums? Who can most easily make claim to this discursive formation, this western citizen-subjectivity? The faces that go unseen, and the voices unheard, are not just the anti-citizens, who practice the unspeakable practice of sex selective abortion. Readers do not see a figure of an oppressed woman stemming from a backward, sexist society, a slave to her "culture" and "tradition," yet the numerous implications to a countersubject

ask them to imagine her. Readers do not see or hear about clients of lifestyle sex selection stemming from minority or immigrant communities within the U.S. or abroad. However, ethnic news media within the U.S. uncover these hidden subjects. With headlines like, “Indians Flock to U.S. Sex Selection Clinics,” (Gokhale, *India West*, 2006) and “Wealthy foreign couples travel to U.S. to choose baby’s sex,” (Johnson, *Chicago Defender*, 2006), these Asian- and African-American papers provide a more anxious narrative about local and global implications of these technologies. The magazine, *ColorLines*, in particular points out the racial dimensions of the practice which disrupt the dominant subjectivity of lifestyle sex selection.

In their newsletters and online testimonials, the Washington, D.C.-based Genetics and IVF Institute and The Fertility Institutes with centers in L.A., Las Vegas, and Mexico, feature largely white American couples who herald the technology for enabling them to complete their families. The fact that Asian families use these technologies to sire boys is completely suppressed. While clinic websites project availability and access as a race-neutral phenomenon, the news reports featuring these centers and calls to their information hotlines paint a different picture – one in which representatives grudgingly acknowledge that Asian couples are a huge consumer base that typically prefers boys. (Shekar, *ColorLines*, 2007)

How do clinics accommodate the reality of this contradiction? Increasingly, as provision of these technologies move from U.S. to off-shore sites, or clinics market to international audiences, they use discursive and visual strategies to imbibe the dominant biopolitical subject of lifestyle sex selection with a global, trans-westernized form.

The biopolitical subject of lifestyle sex selection continues to evolve into a global citizen-subject, one that has recently begun to circulate both inside and outside the United States. MicroSort, for example, made public a new website for MicroSort International in 2009. Recall Figure 11, the enduring image of the ideal, white-American family with one boy and one girl used for years on the MicroSort trial website. MicroSort

International instead offers a series of ten rotating images – all likewise idealized, gender-balanced, heterosexual families, but this time representing diverse racial and ethnic backgrounds. Figure 13 shows these ten images side-by-side in a single, still image (Images retrieved through screenshots from [microsort.com/en/](http://microsort.com/en/), accessed July 13, 2011). Indeed, multiracial marketing, which produces visual equality while masking political dimensions of power and difference between these diverse groups, has arrived in lifestyle sex selection.



**Figure 13: Multiracial “Balanced” Family Ideal**

Each individual family image above rotates within the middle pane of the following home page of the English version of the website (microsort.com/en/, accessed July 13, 2011).



**Figure 14: MicroSort International (microsort.com/en/) home page**

The language of hope and dreams, whose initial discursive assertions formed the American woman subject desiring a girl, becomes prominent against the background of rotating “global” families. The combination of language and rotating image produces the convertible, new global subject of contemporary sex selection.

Importantly, the choice of boy or girl does not confer biological citizenship. Rather, an Americanized, westernized and assimilated status allows heretofore hidden subjects to claim legitimacy in their practices of sex selection regardless of where they come from or

their sex preference. One clinic director recounted a particular case of an Indian-American couple going for a boy. His telling reconstructs the self-determined, this time “Americanized” rather than American, woman subject with powerful *gender dreams*, the “exact same story” as the legitimized racially white subject of lifestyle sex selection.

...in the case of a Sikh couple I took care of, they are both 2<sup>nd</sup> generation people, pretty Americanized, as Americanized as you can be with the whole get up on and everything. Guy’s a doctor, lady’s a lawyer. He doesn’t care. They have two daughters. He just wants to have another kid and is very indifferent about the whole thing. But, she, in her mind’s eye since she was a very little child has always envisioned having a son and played through her mind model parenting this son, like when they were like four or five years old, played through her mind the sense of achievement, or kind of the praise, or whatever, the reinforcement that she would get from her parents, and from her in-laws, and from her family for achieving this. I thought that was really interesting. So, the women who want girls that are here in the states, or one of the British commonwealths, they, since they were little, when you talk to them, they give the exact same story, but it’s a girl. The exact same story. They have, in their mind walked down the aisle, seen this person walk down the aisle. They have taken them to go shopping, taken them to ballet class. They have done all these things. Since they were very, very little, when they think of being a mother, they envision a daughter, so they really feel like this is something where they are really going to be sorry if they miss out on. (Follow-up Interview, January 26, 2011)

His insistence on “exact same story” in comparing these cases aligns the sex -selective practice by the Americanized Sikh couple with those of the dominant, western subject of lifestyle sex selection. Clinics, thus, have begun to discursively produce a global subject of lifestyle sex selection, by evolving significant aspects of the still formative American subject into a trans-westernized, global citizen.

Thus, lifestyle sex selection is discursively constituted through new terms, categories, and subjects asserted by clinic providers themselves, by the mainstream news and popular media featured on their websites, and by self-help authors. Against a countered situation of sex selective abortion practices taking place in South and East Asia, the

newly legitimizing white and western woman subject having deep and reasonable desires for a girl began to form in the late 1990s and early 2000s. These discursive practices constitute a hierarchy of good vs. bad sex selection practices, and reinforce an East/West boundary, situating lifestyle sex selection as western and good within a global moral-economy of reproduction. These practices produced a civilized, if still contentious, form of sex selection, one that above all does not involve abortion. Discursive assertions masked the existence of other kinds of subjects practicing sex selection via MicroSort or PGD, particularly those stemming from “developing” regions of the world or those belonging to immigrant communities in the west. Yet, more recent discursive strategies by clinics produce a global figure, a trans-westernized or -Americanized flexible bio-citizen subject (an individual, couple, or family) that exists both inside and outside the United States, whose status can bypass the strictures of “culture” and “tradition,” irrespective of sex preference.

## **Chapter 5: The Institutional Constitution and Global Situation of Lifestyle Sex Selection**

In chapters three and four I focused on material and discursive processes that harnessed valued elements across reproductive binaries (ARTs and white-American biopolitical subjects). In this chapter I examine institutional processes in the formation of lifestyle sex selection that add to this grouping individual control over technological processes supported by clinic networks.

The institutional seat of lifestyle sex selection is the fertility clinic. Lying at the cusp of emerging biotechnology within what feminist science studies scholar, Sandra Harding, calls “modern Western sciences” (Harding 2006) on the one hand, and of neoliberal (contra) state regulation on the other, the U.S. ART clinic provided the home from which a new set of valued sex selection practices could form. Apart from the clinics, professional associations, government regulatory bodies, non-governmental advocacy and international organizations produced institutional texts and activity constitutive of lifestyle sex selection. The institutional constitution of lifestyle sex selection came about through both assertions of clinic authority and through protection of clinic autonomy by various stakeholders in the United States. Globally, lifestyle sex selection has taken on an institutional form through the establishment of discrete, informal, clinic-to-clinic networks across borders or through off-shore satellite provision. Within these assemblages, clinics act as endpoints of travel by information, biomaterial, equipment, patients and providers across borders. In order to analyze the local and global institutional frame of lifestyle sex selection, I begin with an institutional case history of

the Genetics and IVF Institute (GIVF) largely in relation to MicroSort. Although GIVF faced regulatory challenges from the state, it has found ways to both address and circumvent these. Next, I combine a range of texts, arranged from local to global order, such as informed consent forms, statements of professional associations and documents of major international conferences or agencies. Using Dorothy Smith's ideas on "texts as coordinators of institutional activity," I analyze the institutional relations that support contemporary sex selection (Smith 2006, 79). Finally, I draw largely on interview data to map the global institutional form of lifestyle sex selection. My own participant observation at the annual meeting of the professional association, the American Society for Reproductive Medicine (ASRM) in 2010 also informs the institutional analysis in this chapter. As in chapters three and four, this chapter takes on a specific focus – *institutional* texts and activity, which as before, always emerged in concert with material developments and discourse.

### Vying for Control: The Case of GIVF

ART clinics in the U.S. have asserted institutional control over what and how they practice medicine. In spite of some challenges to their authority, they remain at the core of a broader institutional frame around lifestyle sex selection. GIVF, the clinic that pioneered MicroSort, provides an interesting example. The clinic corporation faced numerous challenges to its authority over practices with MicroSort, and yet it has managed to reclaim it in some ways. The U.S. has always been characterized by regulatory absence in the area of assisted reproductive medicine. This vacuum created the opportunity for clinics to assert authority over emerging practices and research on experimental technologies. GIVF has since faced a number of challenges to that

authority, but managed to maintain institutional control over lifestyle sex selection.

While following regulatory directives within the U.S., GIVF has at the same time moved into international locations where U.S. federal authorities have no jurisdiction and into technologies (PGD for sex selection) over which federal authorities have not asserted substantial oversight.

### **Regulatory absence and the assertion of clinic institutional control**

Depicted by legal scholar Alexander Hecht as “the wild wild West,” a lack of national institutional sources of funding and governing authority characterized the regulatory climate of U.S. assisted reproductive medicine in the early 1990s (Hecht 2001).

Reproductive politics in general, and the contested moral status of an embryo in particular, prevented both federal funding and oversight of clinical practices and research involving ART (Ouellette et al 2005; Adamson 2005-2006; Hecht 2001). Health and human rights scholar, George Annas explains,

Because it centers on babies and pregnancy and is fostered by the creation of extracorporeal embryos and the private recruitment of “surrogate mothers,” reproductive medicine has proved impossible to regulate at the federal level in the United States and formidable to regulate at the state level. (Annas 2011, 459)

Regulatory absence has remained a hallmark of U.S. ART. Yet, much institutional work goes into maintaining this absence of state intervention. To counter the image that anything goes in the “wild wild west,” clinics proclaim that they self-regulate or adhere to professional guidelines on “best practices.” They sometimes point to the existing minimal oversight by some federal agencies over different aspects of their work

environments, such as laboratory safety standards, quality control, and IVF success rates (Schuppner 2010). As bioethicist, Guido Pennings asserts,

...‘no law’ is also a moral position. Neutrality of the state is impossible here. A nation without legislation on bioethical issues supports the liberal position that every citizen should decide according to his or her moral convictions. (Pennings 2004, 2689)

Indeed, this position seems to have motivated the safeguarding by various stakeholders (the U.S. government, the clinics and otherwise) of a relatively unregulated clinical ART practice. Instead, many U.S. fertility clinics operate in the private sector as part of a global industry that has grown out of reproductive medicine, a commercial enterprise that business administration scholar, Debora Spar, calls, “a baby business” (Spar 2006). Lisa Ikemoto describes the role of physician-entrepreneurs – the professional corps that drives this institutional system:

Fertility doctors have not played the role of passive professionals surrounded by a whirl of commercial activity; many have become influential stakeholders who use a combination of medical and commercial practices to enhance their market positions. (Ikemoto 2009, 280)

Exemplary among these physician-entrepreneurs is Joseph D. Schulman, whose professional engagements indicate this trend. Schulman, for example, founded GIVF, contributed to the advancement of several technologies and methods in reproductive medicine, and has published a popular book on investing in addition to his scientific publications (Schulman 2007; <http://www.givf.com/aboutgivf/ourfounder.shtml>, accessed September 26, 2011).

Right from its founding in 1984 and motivated by Joseph D. Schulman’s frustration with the National Institute of Health’s lack of funding of IVF research, GIVF has epitomized the ethos of the self-determined, private clinic corporation of U.S. ART

(Schulman 2010). However its experience with sex selection demonstrates the tensions characteristic in a context of regulatory inconsistency. Initially, the unregulated institutional climate was constitutive of MicroSort's advance because it provided a "not illegal" space for new sex selection practices to form and gain definition inside the U.S. ART clinic and outwardly through its website. By contrast, recall that in Britain, PGD was conceived in 1990 at the same time as the U.K. act that created one of the world's first state institutions (the Human Fertilization and Embryology Authority-HFEA) to govern it. One of the HFEA's mandates was to establish a Code of Practice as "guidance about the proper conduct of licensed activities" (Code of Practice, 1<sup>st</sup> Edition, <http://www.hfea.gov.uk/2999.html>, accessed August 5, 2011). Released in 1995, the third edition of this Code prohibited the selection of embryos or sperm by sex for "social reasons" (Code of Practice, 3<sup>rd</sup> Edition, <http://www.hfea.gov.uk/2999.html>, accessed August 5, 2011). Thus, in the very year that MicroSort in the U.S. first extended its trial to the non-medical *indication* of *family balancing*, the U.K.'s HFEA prohibited sex selection for "social" or non-medical reasons. Currently in its 8<sup>th</sup> edition, the Code today provides a more elaborated version of the U.K.'s prohibition on sex selection. The first institutional recognition of non-medical sex selection in the U.S. took place, therefore, the very year of the first institutional prohibition in the U.K., creating a transatlantic dissonance in ART regulatory practices that provided an early impetus for the development of cross-border sex selection.

GIVF's application to the USDA for an exclusive license to commercialize MicroSort for humans exemplifies the clinic's tenacity in actively seeking control over its overlapping research and commercial domains as it committed the investment needed to

bring the technology to market. The purpose of the USDA issued license was to commercialize the government's invention, and the "most critical item" on the application requires the submission of a commercial plan, including "estimates of potential market size" and "profitability analysis" (License Application Instructions for Patents or Pending Patents, <http://www.ars.usda.gov/business/docs.htm?docid=768>, accessed August 9, 2011). According to the U.S. code of federal laws, the purpose of the *exclusive* license is to grant the applicant "a reasonable and necessary incentive to," among other things, "call forth the investment capital and expenditures needed to bring the invention to practical application" (Title 35 – Patents, Part II, Chapter 18, § 209, U.S. Code, [http://www.law.cornell.edu/uscode/35/usc\\_sec\\_35\\_00000209----000-.html](http://www.law.cornell.edu/uscode/35/usc_sec_35_00000209----000-.html), accessed August 9, 2011). GIVF received the exclusive license in 1992 granted for the life (17 years) of the patent (number 5,135,759 dated August 4, 1992). With it, GIVF assumed *institutional* authority over the technology in the realm of human medicine. GIVF sought to demonstrate the technology's viability in humans for the sake of an explicit commercial aim.

Before the FDA took over the trial in May 2000, GIVF made one of the most significant institutional moves in lifestyle sex selection. It established a policy that identified appropriate recipients of MicroSort on the basis of current family status, e.g. married couples with an uneven ratio of sex among their offspring. Through its formulation of a "family balancing" *policy* (rather than only the invention of a new term or idea), GIVF applied a form of self-regulation. Rather than offer MicroSort to anyone, the clinic constructed self-imposed barriers to subject participation in the trial in order to avoid practices that might be viewed as motivated by sex bias. By demonstrating

prudence rather than carelessness, GIVF preemptively self-regulated in order to prevent outside institutional intervention in its affairs. The clinic drew a line between the acceptable and non-acceptable as it asserted a non-medical application of sex selection. GIVF's policy ruled out couples who want to choose the sex of their first baby or the sex of an additional baby that would not "balance" their offspring sex ratio. The USDA implicitly validated GIVF's "family balancing" policy when it, at GIVF's request, expanded GIVF's exclusive license to commercialize sperm sorting for all human uses (as opposed to only medical indications). Yet, the policy required explicit approval by the institutional review board (IRB) monitoring the trial. This forthcoming validation coincided with the first of two institutional changes in IRB oversight of the trial. Initially, an IRB at Inova Fairfax Hospital approved the MicroSort trial in 1993 for medical indications only. In 1995, GIVF formed its own, in-house IRB, which took over monitoring the trial and approved the "family balancing" policy (Wadman 2001). Thus, "family balancing" was a self-regulatory institutional assertion by GIVF just as much as a contribution to emerging discourse. Accompanied by institutional action, change, and validation, the policy represents assertions by the clinic institution, GIVF, of its authority and control over the trial.

### **Regulatory challenges to the clinic**

GIVF's assertions of authority and self-regulation in relation to MicroSort occurred alongside its initial resistance to federal regulatory mechanisms. For example, GIVF did not comply with the Centers for Disease Control and Prevention's minimal, self-reporting requirement on IVF success rates throughout the 1990s. Ouellette et al. assess GIVF's noncompliance in light of their venture to develop MicroSort:

The number of nonreporting clinics documented by the CDC has decreased from 30 of 390 in 1998, to 29 of 399 in 1999, and 25 of 408 in 2000. While many consider it a successful reporting trend, a significant cohort of programs continues to defy the law by not reporting verified ART success rates....One clinic, The Genetics & IVF Institute (GIVF) of Fairfax, VA, was listed as non-reporting in 1996, 1997, 1998, 1999, and 2000. This is especially disturbing because GIVF is a particularly large and well-known clinic. They have received national attention for pioneering the “Micro sort,” sperm-sorting technology and advertise nationally on the Google search engine and in the New York Times Magazine. (426-7)

When the FDA first began to assert control over the MicroSort trial, GIVF resisted that as well, arguing that the use of MicroSort occurred within the practice of medicine.

Early on the trial was started here at GIVF in house under IRB approval. That was underway for several years before the FDA came to us and said what you’re doing is a medical device, and therefore we have jurisdiction in regulating that, and in fact, we responded we believe this actually is the practice of medicine, and that is something that you do not have jurisdiction over. They disagreed, and said no it’s a device and if you want to continue doing this, you’re going to have to do it within the context of a clinical trial. (Interview Series, MicroSort Scientific Director, December 2010)

Ultimately, GIVF ceded authority to the FDA. GIVF has since complied with FDA requirements, for example by answering FDA warnings, ensuring quality control in its laboratories and including trial data in MicroSort literature without making claims on the technology’s safety and efficacy. In fact, the clinic corporation’s commercial aspiration for MicroSort had to be fully set aside during the trial since the FDA prohibited GIVF from making promotional claims and profit with respect to MicroSort. The trial’s recent move to Chesapeake Research Review, Inc., a commercial IRB service company, appears to have occurred as a way to address the issues raised in a 2009 letter from the FDA to GIVF’s CEO, David Wise, warning of “objectionable conditions” and five “serious

violations” that turned up in their inspection of GIVF’s in-house IRB (<http://www.fda.gov/ICECI/EnforcementActions/WarningLetters/ucm203906.htm>, accessed August 10, 2011).<sup>22</sup> Thus, IRB hopping reflects institutional changes in the life of MicroSort and GIVF, the timing of which coincide with periods of relative clinic authority in the first case, and challenges to it in the second.

In 2010 GIVF faced two further challenges to the control it once held in the 1990s over the development and use of MicroSort – the FDA prohibited access to MicroSort for “family balancing” in 2010 while it continues to review data on the method’s safety and efficacy. Secondly, the U.S. Patent and Trademark Office (USPTO) declined GIVF’s request for an extension of the patent on which it held exclusive license for over 17 years. GIVF contested but lost both of these challenges. In 2008 the trial officially ended after reaching its sample size limit of 1,050 babies. According to MicroSort’s scientific director, the FDA denied “continued access” to MicroSort for “family balancing” in 2010 on the grounds that MicroSort does not fulfill a compelling public health need.<sup>23</sup> GIVF’s argument that MicroSort prevents repeat abortions, which compromise women’s health,

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<sup>22</sup> FDA warning letters were also issued to MicroSort investigators, Daniel Potter and David Karabinus, respectively on November 2 and November 20, 2009 citing breaches of informed consent and the investigational plan. (<http://www.fda.gov/ICECI/EnforcementActions/WarningLetters/ucm193908.htm> and <http://www.fda.gov/ICECI/EnforcementActions/WarningLetters/ucm197438.htm>, accessed August 10, 2011)

<sup>23</sup> Allotted for periods of six months at a time, “continued access” periods approved by the FDA allow trial sponsors like GIVF to maintain laboratory infrastructure, and continue enrolling patients and collecting more data, while the FDA reviews results (Interview series, December 2010). FDA memorandum (IDE Memorandum - #D96-1) explains its policy thus, “a sponsor may propose to conduct an ‘extended’ clinical trial if: 1) there is a public health need for the device and 2) there is preliminary evidence that the device is likely to be effective and no significant safety concerns have been identified for the proposed indication” (Continued Access to Investigational Devices During PMA Preparation and Review July 15, 1996 (Blue Book Memo) (D96-1) (Text Only), <http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/GuidanceDocuments/ucm080260.htm>, accessed August 12, 2011).

failed to convince the FDA otherwise (follow-up personal communication, June 27, 2011).

Expiring in August 2009, the USPTO granted the USDA a one year extension on the patent relevant to MicroSort (5,135,759), but a second request for an extension was denied because the USDA failed to submit the request by a statutory imposed deadline. Thus, GIVF lost exclusive rights to MicroSort, because the patent expired (personal communication with June Blalock, Office of Technology Transfer, Agriculture Research Service, USDA, December 21, 2010). GIVF sued the USPTO in the hopes of regaining its exclusive use rights to MicroSort, but recently (July 2011) lost the case ([http://www.fdalawblog.net/fda\\_law\\_blog\\_hyman\\_phelps/2011/07/district-court-says-shall-means-must-in-challenge-to-pto-denial-of-interim-patent-term-extension.html](http://www.fdalawblog.net/fda_law_blog_hyman_phelps/2011/07/district-court-says-shall-means-must-in-challenge-to-pto-denial-of-interim-patent-term-extension.html), accessed August 9, 2011). Thus, GIVF's experience with federal authorities can hardly be described as "hands-off" or indicative of regulatory absence. Although the loss of exclusive use license means the clinic corporation is more vulnerable to competition, the clinic remains not only a leading provider but at the institutional helm of lifestyle sex selection practices through both jurisdictional and technological circumvention.

### **Regulatory Circumvention**

GIVF's recent opening in 2009 of MicroSort International by establishing sperm sorting laboratories outside the FDA's jurisdiction restores institutional authority to the clinic corporation, which has moved forward with the commercialization of MicroSort outside the U.S. When I asked the MicroSort scientific director why GIVF established MicroSort overseas prior to a determination by the FDA on its safety and efficacy, he responded,

The FDA has jurisdiction in the U.S. It does not have jurisdiction outside the U.S. So, their involvement in whatever the decision was to go overseas, they were not involved in that. Here's the thing that you've got to realize. The company has been involved in this clinical trial for 15 years, and conducting a clinical trial, and bringing a medical device to market is first not an inexpensive undertaking, and second it's not being performed for the sake of science. Any company that is developing drugs or devices is doing that with a commercial view in mind. So, identifying international locations where MicroSort might set something up is logical, wouldn't you say? Companies don't spend millions and millions of dollars developing things for fun. (Interview Series, MicroSort Scientific Director, December 2010)

Thus, GIVF has produced two institutional faces of MicroSort, an investigational device in a U.S. FDA clinical trial and a commercialized product for sale outside the U.S. In this way, the clinic both complies with and circumvents U.S. state regulatory mechanisms by strategically situating MicroSort labs in spaces where sex selection remains “not illegal.” By pursuing MicroSort as a commercial enterprise outside the U.S., GIVF has preemptively undercut the FDA's authority. Owned by GIVF, the new laboratory sites in Mexico and Cyprus, re-center the authority of the U.S.-based clinic corporation in the development and use of MicroSort.

Furthermore, in revisions to their websites both GIVF and HRC Fertility, the two laboratory sites of MicroSort in the U.S. have now situated PGD as the prominent technology under the banner of “family balancing” (GIVF) or “gender selection” (HRC Fertility). Not without coincidence, both clinics released newly revised or newly launched websites in the wake of the FDA decision to prohibit MicroSort for “family balancing” (givf.com on June 15, 2011 by GIVF, and gender-baby.com by HRC Fertility on September 21, 2011). Once foregrounded, MicroSort has receded to the margins of clinic websites at the same time that “MicroSort International” claims its own virtual

space at [microsort.com/en/](http://microsort.com/en/). This process first began due to FDA prohibitions on “making claims” related to safety and efficacy when presenting data. GIVF had to ensure that informational materials as well as those stemming from collaborators in the trial complied with FDA restrictions on labeling that prohibit commercial promotion of the experimental device.

We have some regulatory lawyers that review everything that we write. Not only from a logistical standpoint it adds another layer of things that have to be done, it’s expensive. In some cases it turns us, GIVF, the sponsor of the clinical trial into the bad guys. For example, we might come across just by chance a website of one of our collaborators that we believe in good faith has got something up on their website about MicroSort, and I usually am the one that ends up being the bad guy, contact them, and say no you can’t say that. This is inaccurate, and I know that those words come from their media/advertising people, and not their scientific people. (Interview Series, MicroSort Scientific Director, December 2010)

The receding promotion of MicroSort in clinic on-line spaces has increased pace due to the 2010 decision by the FDA to prohibit enrollment of new subjects in the MicroSort trial for “family balancing” while it makes a determination on its safety and efficacy.

PGD has closed the void left by MicroSort, even at GIVF which historically only pursued marketing a *preconception* method of sex selection such as sperm sorting. Even though GIVF possessed the capability to conduct PGD early on, it did not initially seek to commercialize PGD for sex selection (Schulman 2010).

The far less regulated status of PGD (than MicroSort) along with the material, discursive, and institutional convergences of MicroSort and PGD in lifestyle sex selection created the conditions for a (technological) regulatory circumvention by clinics. By technologically circumventing FDA encroachment on the development and use of MicroSort in the U.S., the meanings and practices of lifestyle sex selection continue to

evolve. Baruch et al., in their assessment of the “current policy environment for PGD” explain how PGD has fallen outside the purview of various federal agencies of regulatory control. No U.S. federal agency collects data on PGD use. The FDA has not required premarket approval that would classify PGD as experimental and forestall commercialization pursuant to a determination on its safety and efficacy. Finally, the current federal guidelines that monitor clinical laboratories (the Clinical Laboratory Improvement Amendments of 1988) ceded control over their monitoring functions of PGD facilities to the FDA (Baruch et al. 2008; Baruch 2008; Schuppner 2010). The practice of PGD remains largely unregulated by federal mechanisms in the United States, and state mechanisms have only rarely filled that void (New York is an exception with regard to the fulfillment of laboratory standards) (Baruch et al. 2008). Therefore the decision of whether and how to apply PGD, especially with regard to ethical considerations, falls outside the locus of government or clinic independent regulatory mechanisms. In this way, ART clinics have maintained institutional control over sex selective PGD practices.

### Intertextual relations: centering institutional control in clinic hands

*Intertextual hierarchy* is a “regulatory hierarchy of texts” (Smith 2006, 66). Dorothy Smith uses the term to examine how higher order institutional texts “regulate and standardize” lower order texts. According to Smith, the embedded structure of multiple texts coordinates institutional activity in ways that expose “ruling relations” (79). In the case of lifestyle sex selection, local to national to international texts move from most to least legally binding. Indeed, globally relevant texts such as those that stem from international agencies are not even applicable to lifestyle sex selection practice. An

analysis of multiple institutional texts reveals interrelation, though they are not embedded as in the case of hierarchized institutional levels determined by ownership. Sex selection texts expose an institutional coordination between national and local level texts in the U.S. that form a neoliberal, (contra) state regulatory structure centering power at the site of local clinics. Together, they situate the ART clinic as the authoritative site of decision-making and binding policy related to sex selection practices. In contrast, disjuncture and lack of coordination arise between this set of local and national texts, and those stemming from international agencies – revealing a binaried system of global reproductive politics that produces divergences in sex selection forms – a hierarchy of valued vs. devalued sex selection.

### **Clinic/patient texts: Institutional variance**

Directors, CEOs, and in some cases, in-house clinic ethics committees or medical boards determine the course of lifestyle sex selection practices, which can vary widely. For example, according to the Genetics and Public Policy Center survey conducted in 2005, 47% of U.S. ART clinics that offer sex selection do so for any reason, 41% only for second or higher order births, and 7% only when patients undergo PGD for other medical reasons (Baruch et al. 2008). In the absence of any extra-clinical institutional body that would mandate if or under what circumstances sex selection should take place, these decisions are left to individual clinics. Clinics formalize the terms of their practice in “texts” such as informed consent forms, or patient signed and initialed informational documents that act as service contracts between clinics and their patients. These “texts,” and clinic presentation of PGD in general, varies. Clinics may or may not offer PGD through protocols approved by an institutional review board that would require human

research subject protection. Clinics may or may not describe PGD as an experimental technology. The U.S. government has not provided federal funding for PGD research, nor has it therefore mandated research subject protections in cases involving PGD (Baruch et al. 2008). Highest in the order of PGD governance, these clinic/patient texts reveal the centrality of clinics themselves in determining the course of sex selection practice and policy. They coordinate patient-provider practice, relations, and decision-making.

The two sets of patient-provider texts I received during clinic site visits reveal both disparities and similarities in their presentation of PGD. While both acknowledged the chance of procedural error or misdiagnosis, only one discussed risks, known or unknown, to the embryo, patient, or resulting child. One clinic labeled these texts as “Informed Consent,” generalized for all PGD use. The other clinic headed its text with “Information, Education, and Acknowledgement Document” that specified its terms of practice to the use of PGD for “Gender Selection.” The latter document emphasized in bold and caps among the rest of the fine print, “We are unable to assure or guarantee that any embryos of the desired gender will result,” and “We do not ‘guarantee’ that a pregnancy will result from the transfer of the chosen gender.” Neither clinic explicitly discussed PGD as an experimental procedure. In contrast, the extra-clinical designation by the FDA of MicroSort as experimental ensures the uniformity of informed consent forms used in those very same clinics. Clinics handle PGD and MicroSort differently due to FDA regulation of the latter. As the MicroSort Scientific Director explained, “Each of the consents that we use is approved not only by the IRB, but the FDA.” He also confirmed the identicalness of forms used at both sites of subject enrollment in the U.S.

(Interview Series, December 2010). Far from identical, clinic/patient “texts” that lay out the terms of PGD service between patients and their providers reveal a level of variance indicative of the “laissez faire” institutional structure governing PGD in particular, and ART more generally in the U.S. (Schuppner 2010).

### **Professional association texts: devolving institutional control to individual clinics**

Committees on ethics within two major, national professional organizations, the American Society for Reproductive Medicine (ASRM) and the American College of Obstetricians and Gynecologists (ACOG) have released statements related to ethical issues in contemporary sex selection. The ASRM released two separate statements early in the formative stages of the practice – one in 1999 on PGD and the other in 2001 on sperm sorting. ACOG’s single statement on “sex selection” drafted without respect to method used, arrived on the institutional scene much later in 2007.

#### ***The American Society for Reproductive Medicine (ASRM) Statements***

The ASRM statements 1) recognized both MicroSort and PGD for their application in sex selection practices, 2) participated in the institutional convergence of MicroSort and PGD as a preferred set of techniques to those that require abortion, and most significantly 3) opened a door that authorized clinics to interpret on a case by case basis whether sex selection should be ethically permitted.

The first ASRM statement on PGD from 1999 begins by referring back to a 1994 conclusion it made regarding the inappropriateness of PGD for nonmedical sex selection, much like the U.K.’s Code of Practice from 1995. The HFEA code, however, constituted binding law in the U.K. while the ASRM conclusion was an unbinding recommendation

intended for fertility clinics operating in the U.S. In particular the advent of MicroSort appears to have precipitated a return by the professional association to the issue of sex selection in general, and PGD in particular. Indeed, the timing of the 1999 statement came on the heels of the first media articles reporting the birth of MicroSort babies in 1998. “Since 1994, the further development of less burdensome and invasive medical technologies for sex selection suggests a need to revisit the complex ethical questions involved....Among the methods now available for prepregnancy and prebirth sex selection are prefertilization separation of X-bearing from Y-bearing spermatozoa” (Ethics Committee of the ASRM 1999, 595). The statement recognizes MicroSort (without using its commercial name). The advent of MicroSort prompted professional institutional response and action on PGD. In this way, PGD’s potential use as a nonmedical sex selection technique gained recognition *in relation to* MicroSort.

In one significant paragraph, the statement underlines a convergence of MicroSort and PGD as a preferred set of sex selection techniques:

This document’s focus on PGD for sex selection is prompted by the increasing attractiveness of prepregnancy sex selection over prenatal diagnosis and sex-selective abortion...

Inclusive of both MicroSort and PGD, “prepregnancy” techniques *converges* the two technologies in relation to less “attractive” forms of sex selection that involve an abortion, thereby validating some forms over others. It continues:

...and by the current limited availability of methods of prefertilization sex selection techniques that are both reliable and safe. Although the actual use of PGD for sex selection is still infrequent, its potential use continues to raise important ethical questions. (595)

Here, the statement singles out PGD as a potential alternative among more “attractive” forms of sex selection, given the undetermined safety and efficacy of “prefertilization” methods such as MicroSort. Thus, as an *institutional* intervention, the 1999 ASRM statement confers recognition of a practical application of PGD for sex selection just as it institutionally addresses PGD with respect to MicroSort.<sup>24</sup>

The text lays out a range of four different potential clinical scenarios that range from patients choosing sex as a byproduct of other medically indicated PGD services, to undergoing PGD for the sake of sex selection alone. It evaluates these from least to most ethically questionable. Acknowledging that ethical concerns sometimes conflict, the Committee advocates for “ethical caution” in general, recommending that the most ethically questionable scenarios “should be discouraged,” and the least “should not be encouraged.” Importantly, the Committee rules out “legal prohibition” as an appropriate response, “because it is not clear in every case that the use of PGD and sex selection for nonmedical reasons entails certainly grave wrongs or sufficiently predictable grave consequences” (598). Embedded as it is in the policy worlds of U.S. ART, the ASRM professional association assumed its traditional advocacy position, which generally prioritizes access to technologies for individuals over government regulatory restrictions (Schuppner 2010, 449). In this way, the association ultimately confers decision-making

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<sup>24</sup> The FDA has also participated in the institutional convergence of MicroSort and PGD. I accessed 2003 and 2007 versions of MicroSort informed consent “texts” on-line (more recent versions have been taken off-line to correct a breach in consent processes that involved patients signing outdated versions). One glaring difference between 2003 and 2007 versions was the inclusion in the latter of PGD as an “alternative treatment” to MicroSort. The scientific director of the trial indicated this change came in response to FDA directives. (Interview series, December 2010). Thus, the FDA has insisted on recognition of PGD as an “alternative treatment” for “family balancing” in MicroSort informed consent forms, thereby contributing to the *institutional* convergence of PGD and MicroSort as a set of alternative technologies for sex selection.

authority to clinics, which are in an institutional position to weigh the ethics of sex selection on a case by case basis. Although ASRM recommendations are non-binding, they nonetheless do institutional work by maintaining a status quo that discourages government interference while promoting practice guidelines which clinics can choose to adhere to or not.

The 2001 ASRM statement on sperm sorting further widened the institutional recognition and opening to lifestyle sex selection. Though it questions the validity of Ericsson-like methods, it labels sperm sorting by flow cytometry (such as is MicroSort) as experimental, potentially efficacious for producing females, but whose safety and efficacy have yet to be firmly established. Just as in the 1999 statement on PGD, the text vehemently argues against policy prohibitions, but also against policies that would “condemn as unethical all uses.” (Ethics Committee of the ASRM 2001, 861) So long as such methods are found to be safe and effective, the statement goes on, “physicians should be free to offer” them. It recommends “gender variety,” which it defines identically to MicroSort’s “family balancing,” as “the most prudent approach” (863). In contrast to its ethically cautious approach towards sex selective PGD, the ASRM took on a far more liberal stance towards sperm sorting, because “it causes no destruction of prenatal life and is less intrusive and costly” than PGD (861). These attributes of MicroSort presume that MicroSort will be coupled with IUI as opposed to IVF. The statement, which offered the largest *institutional* opening for clinics to pursue lifestyle sex selection practices, qualifies its conclusions only on whether MicroSort can be shown to be safe, but not on the ART method used even though MicroSort use with IVF would raise its risk/benefit and ethical profile closer to that of PGD.

Taken together, the two ASRM statements, which the Ethics Committee has reaffirmed without change at regular intervals since their publication, *institutionally* constitute lifestyle sex selection. First, they recognize some forms of practice as not necessarily or always unethical. Second, the statements recognize individual clinics as the appropriate institution to interpret on a case by case basis, and without government interference, ethical sex selection practice. While the advent of MicroSort appears to have precipitated ASRM review of sex selective PGD in 1999, the pre-existing interpretation of PGD provided the basis from which the Committee could take a more liberal stance toward the ethical application of MicroSort. Indeed, the institutional constitution of lifestyle sex selection took place within the ASRM through ethical interpretation and comparison of the material dimensions of each technology against one another. Unlike PGD, MicroSort was labeled “experimental,” but ethically allowable for “gender variety” if found to be safe and effective.

The fallout of the two ASRM interventions was that they invited – even provoked – clinics to make their own interpretations. Just a few months after the release of the second statement on sperm sorting, Dr. Norbert Gleicher from the Center for Human Reproduction in New York challenged the opinion of the Ethics Committee. The New York Times’ science writer, Gina Kolata, reported that the ASRM’s statement on sperm sorting released in May 2001 “prompted” Dr. Gleicher to write to the Ethics Committee of the ASRM:

...Dr. Gleicher said, if sperm sorting is all right for sex selection, why prohibit preimplantation genetic diagnosis for sex selection? “How can you say that a method that would be 100 percent reliable is not ethically acceptable?” he asked. He brought the question to his own ethics board.

“Our I.R.B. felt that it was unethical to offer an inferior method, if a superior method is available,” Dr. Gleicher said, referring to the institutional review board, an ethics committee. (Kolata 2001)

Similar to the ASRM’s approach, which produced different ethical opinions based on technological attributes, Gleicher argued an ethical stance backed by his own IRB that compared PGD’s near 100% accuracy in determining the sex of embryos with sperm sorting’s inability to isolate absolutely pure samples of sexed sperm.

In the same article, Kolata reported on Gleicher’s intention to immediately begin offering sex selective PGD because his question to the ASRM elicited agreement from the acting chair of the ASRM Ethics Committee, John A. Robertson. Appearing under the title, “Fertility Ethics Authority Approves Sex Selection,” Kolata’s article publicly announced an institutional green light from the ASRM for sex selective PGD on the basis of Robertson’s response to Gleicher. However, that response, it turns out, misinterpreted the consensus view of his committee as well as the gist of the ASRM statements.

Consulting with only one member, Robertson wrote a response to Gleicher indicating ASRM approval of the ethical use of sex selective PGD for “gender variety,” although the association had accepted “gender variety” as “prudent” only for the application of sperm sorting should it be determined safe and effective. Elsewhere, Robertson has published his personal opinion on the bioethics of sex selection. Robertson feels that all individuals should have the right to choose the sex of their children, arguing that understandings of reproductive rights should broaden to include individual choice of offspring sex in addition to whether and when to have children (Robertson 1998).

Five months later, in February 2002, Kolata reported that Robertson retracted his opinion, deferring to the consensus view of the committee, which upheld the 1999

statement recommending that PGD use solely for nonmedical sex selection “should be discouraged” (Kolata 2002). Yet, the upshot of Gleicher and Robertson’s institutional interventions was the public display of debate on the ethics of sex selection, leaving confusion on the ASRM opinion, thus further inviting clinics to compare methods and develop their own interpretations.

Ten years after the release of the ASRM statement on sperm sorting contemporary lifestyle forms of sex selection can no longer be described in potential terms. The evolution of the practice reveals the increasing inapplicability of the ASRM positions to real world situations of lifestyle sex selection. Clinic directors have moved from comparing and contrasting the ethical to the commercial dimensions of MicroSort and PGD. For example, one clinic director who has largely promoted PGD in his practice admits that MicroSort has a “draw” for potential users over PGD, because of the relatively low cost of IUI. However, since couples have to attempt IUI several times for it to reach the same rate of effectiveness as IVF, he argued, the expenses tend to equalize and the “draw” was “artificial” (Interview, August 24, 2010). By offering both technologies, his clinic appeared to use MicroSort as “bait” to attract consumers who might “switch” to PGD.

Secondly, although MicroSort, unlike PGD, can be used with IUI, this combination cannot be presumed. Subjects in the MicroSort trial initially sought to couple MicroSort with IUI over IVF, but this has changed over time because, as the MicroSort Scientific Director explained, “the people who enroll in MicroSort want a baby,” and the success rates of IVF far exceed those of IUI. “The IUI- IVF/ICSI ratio [ratio of trial participants attempting MicroSort with IUI to those attempting it with IVF/ICSI] was running about

60:40, but recently over the last couple of years it has been gradually moving toward 50:50” (Interview Series, December 2010). Self-help author, Jennifer Merrill Thompson, for example, wrote of her own experience with several failed IUI attempts before successfully attempting IVF. Therefore, it is possible that trial participants – most of whom attempted MicroSort on average three times (Darnovsky 2003) – gravitated towards IVF, if their attempts with IUI failed to get them pregnant. Given this reality, ASRM ethicists likely overidentified MicroSort with IUI, wrongly assuming users would always choose IUI when given that option.

Finally, changes in PGD technology as described in chapter three now allow simultaneous analysis of all chromosomes on the biopsied embryonic cell. Results of a PGD analysis using microarray technology will always include information on sex as a byproduct of any application of PGD. In addition, most cases of sex selective PGD in the clinics I visited involved some form of a combined “medical” application of PGD such as aneuploidy screening (tests that check for chromosomal abnormalities) even when patients approached the clinic initially only for sex selection. Thus, in real world practice, both the least and most ethical case scenarios of PGD for nonmedical sex selection as described in the 1999 ASRM statement apply. These include the “patient requests IVF and PGD solely for the purpose of sex identification” (case scenario “d” evaluated as least ethical), but also the “patient learns sex identification of embryo as *part of*, or as a *by-product of*, PGD done for other medical reasons” (case scenario “a” evaluated as least unethical). Thus, to the extent that PGD becomes a routine intervention in IVF, so does the option to preselect the sex of embryos. The line between non-medical and medical applications of sex selection, which the ASRM attempted to

draw in order to evaluate the ethical acceptability of sex selective PGD in relative terms, blurs. As a direct result of lack of regulation, practices move increasingly into a grey area of overlapping medical and non-medical use.

### ***The American College of Obstetricians and Gynecologists (ACOG) Statement***

Unlike the ASRM, the American College of Obstetricians and Gynecologists (ACOG) in their 2007 statement on “sex selection” opposed the practice on the whole irrespective of method/technology used. The statement rejects even “family balancing” as a meter for ethical practice, “because of the concern that such requests may ultimately support sexist practices” (Committee on Ethics, The American College of Obstetricians and Gynecologists 2007, 1). Unbinding like the ASRM statement, ACOG provided a significant institutional rebuttal to the ASRM, but its relatively late appearance, only reinforced an institutional frame tolerant of different opinions. While the statement did not oblige providers to perform sex selective procedures, it did uphold an individual’s right to receive when requested information about the sex of potential offspring. By upholding individual choice, the statement must acknowledge the “unwitting participation” by clinicians in sex selection (4). Like the ASRM, ACOG thereby assumes its long-standing advocacy against government interference in the “private” determination of reproductive practices that takes place in clinic institutional settings.

### **NGO texts: raising the institutional stakes**

Advocacy texts on sex selection stemming from NGOs have also made institutional interventions. In early 2002 representatives from five NGOS (myself included) drafted an open letter signed by over 90 organizations and individuals to the Executive Director

of the ASRM copied to each member of the ASRM Ethics Committee. It expressed concern over the “actual repercussions” of John A. Robertson’s “widely publicized letter” which had mistakenly interpreted ASRM opinion on PGD for sex selection as ethical approval. The open letter provided the following example.

According to media reports, [Robertson’s] letter is already being used by some fertility specialists to justify offering IVF/PGD even to fertile couples for the sole purpose of sex identification and selection. One fertility center's website seems to suggest that ASRM approves of this practice, citing ASRM's "official opinion" that PGD is no longer "considered an experimental procedure" and then stating a few sentences later that "PGD also lends itself to non-medically indicated gender selection." (Committee on Women, Population and the Environment 2002)

Advocates urged the ASRM “to take the earliest and strongest possible actions to discourage the use of pre- and post-conception sex selection for anything other than the prevention of serious medical conditions.” Just a month after this letter action, the New York Times reported on the ASRM “revision” of its opinion, clarifying that the ethics authority upheld its 1999 statement suggesting that PGD use solely for non-medical sex selection “should be discouraged” (Kolata 2002, Ethics Committee of the ASRM 1999, 598).

In 2009 twenty NGOs signed a letter sent to the FDA Director for Devices and Radiological Health timed in advance of its possible premarket approval of MicroSort . Citing studies that have reported on sex ratio imbalances occurring in some communities in the U.S., the letter urged the FDA “to gather input from a range of experts and stakeholders about the potential impact of such [sex selection] products on the public health.” The FDA’s decision to disallow continued access to MicroSort for “family balancing” on the basis that this use did not fulfill a compelling public health need followed several months later. While it is difficult to gauge the impact these letter

actions had on the institutions they addressed, NGOs imposed interventions in favor of extra-clinical oversight of lifestyle sex selection practices. Yet, stepped up legislative proposals in 2008 and 2009 sponsored by anti-abortion lawmakers to ban sex selective abortions in a number of U.S. states and at the federal level have recently motivated advocacy more explicitly in line with ASRM and ACOG opposition to government interference in clinical practice related to sex selection. NGOs like Generations Ahead, the National Asian Pacific American Women's Forum and Asian Communities for Reproductive Justice, who have recently led advocacy efforts on the issue of sex selection interpret sex selection through a "reproductive justice lens" as "rooted in sexism and gender inequality" (Generations Ahead et al. 2009, 18) However, they also view "attempts to address the issue of sex selection legislatively in the United States," as "bids to limit access to abortion" (cover letter). Thus, current abortion politics have fine-tuned advocacy for some NGOs in line with the (contra) state regulatory structure of U.S. ART. As one NGO Executive Director explained:

For us it's a stretch beyond just the issue of sex selection. So, we think about how to protect women's reproductive autonomy particularly in a climate where those rights are *so* under attack. Everything and anything is used as an excuse to regulate women and undermine women. And, the women who are going to be the most impacted are poor women and women of color. In that kind of political environment, for now, *for now* the best strategy is professional self-regulation. Frankly, I would much rather have a network of doctors making these ethical decisions than the men in U.S. Congress (Interview, October 19, 2010).

The clinic space as ultimately the most appropriate institutional authority for regulating ethical practice gets affirmed, even though NGOs such as this one simultaneously press for greater clinic adherence to existing extra-clinical professional guidelines. Below, I will discuss how clinic providers, often interpret protection of the clinic space as a site of unencumbered reproductive decision-making as affording them the power to determine

whether or how to provide sex selection on their own terms, based on personal instincts, “comfort level,” or commercial interest.

***On my own terms: Providers self-determine sex selection practice***

Baruch et al.’s survey conducted in 2006 of all U.S. ART clinics revealed a variety of approaches taken by clinics to the practice of sex selection. Some disclose the sex of embryos to their patients in all cases, and some only when patients ask for that information. Some comply with parental choice on the decision to transfer sex-specific embryos in all cases, while some only for second or greater order children. Baruch et al.’s findings, which showed no dearth in the number of clinics five years ago that had provided non-medical sex selective PGD against professional guidelines that discourage the practice, may no longer be current. The decision on whether and how to provide appears to be increasingly influenced by economic pressures. Two of my informants suggested that the willingness of clinics to provide PGD for sex selection has increased in recent years due to economic strains faced by the industry.

A lot of the people that are sort of jumping on the bandwagon and doing it now are the same people that really were beating me up and had all these moral concerns about it five years ago, but now that the economy is lousy they need the money, they need the business. (Follow-up Interview, Clinic Director, January 26, 2011)

An embryologist from the other clinic I visited also suggested that the promotion of sex selection services provided a means for his clinic to stay profitable even in lean economic times (fieldnotes, clinic site visit, January 24, 2011). An NGO director who directs advocacy towards providers, confirmed this trend. “We have heard from enough doctors that they themselves are sort of ethically queasy about this except that they also feel the

market pressures. Right? So, the fertility doctor down the street is offering it, so there is some pressure” (Interview, October 19, 2010). The Center for Human Reproduction (CHR) in New York, claims to be among the first to commercially provide sex selective PGD in 2002. In a media blog posting on CHR’s website, the clinic similarly claims that it “has, so far, not experienced the decline in IVF cycles reported by other centers” on account of recent economic recession because of its diversified “special” services beyond the treatment of basic infertility, which include “gender selection” ([http://www.centerforhumanreprod.com/media\\_blog.html](http://www.centerforhumanreprod.com/media_blog.html), and [http://www.centerforhumanreprod.com/treatment\\_special.html](http://www.centerforhumanreprod.com/treatment_special.html), accessed August 30, 2011).

Law scholar, Nicole C. Schuppner, who argues for greater regulation of PGD in the U.S., contends:

Often ART providers decide themselves what procedures of ART to practice and exercise discretionary control over the application of practice guidelines and their interpretation. Substantive decisions, particularly in ART, regarding the ‘ethical acceptability of certain practices’ have in the past fallen within the physician’s own medical judgement. (Schuppner 2010, 450)

As she suggests, several providers preached the principle of “individual choice” and “reproductive freedom,” but often conveyed these ideas just as much in relation to provider choice as patient choice. Speaking of ART physicians’ reception to MicroSort, the Scientific Director assessed that its future provision ultimately depended on the “comfort level” of individual physician providers:

You show them the evidence, and you allow them to make their decision. What I feel they will conclude is that it [MicroSort] does work. It is something that if they feel comfortable doing it, that that’s something that they could do. (Interview Series, December 2010)

Repeatedly, informants guarded the choice of whether to provide or not as falling within the autonomous territory of the clinic. They suggested that physicians should base these decisions on their personal “comfort” or moral and ethical convictions. The clinic director who expressed dismay at ART physicians “jumping on the bandwagon” of sex selection for economic reasons, stressed that the decision ought to be made based on their own “principle:”

I respect people who disagree with me if it’s based on a principled approach that is really thought out based on some conviction that they may have. But, when you have somebody who was against something, and goes on about how terrible it is, but now it’s okay, you know, like all of a sudden it’s okay, I don’t like that. (Follow-up Interview, January 26, 2011)

Clearly, these “personal” decisions reflect those with authority within clinic institutional hierarchies, not the views of providers of lower rank. Some nurses I encountered in the field both during site visits and at a nurses roundtable at the ASRM annual meeting, for example, described their own ambivalence to sex selection, especially when transitioning from working primarily with infertility patients. One nurse working at a clinic in the U.S. northeast, who attended the nurses roundtable on gender selection at the ASRM annual meeting 2010 described her own feelings of “disgust” when a couple presented themselves for sex selection for a boy for inheritance reasons. She described feeling personally offended (fieldnotes, October 25, 2010). Another described at length, the difficulty of transitioning from treating infertility to “gender selection” patients.

When I started in fertility, and I think I can speak for a lot of nurses, it was a huge change. In the beginning you are talking to these patients that can’t have kids. Right? So, you have that mentality, these poor people they can’t have kids. It’s very emotional, very stressful. And, then all of a sudden now you’re treating these patients that already have kids, right? And, they’re coming in just because they want to have the sex that they want, so you have a totally different outlook of the patient and what their expectations are when they come in. ... It was a hard

transition for me and a lot of nurses, and our embryologist too. She's doing something different than what she was used to doing, too. It was all about getting a fertility patient pregnant and starting a family, and now we're building on families that have already formed. (Interview, July 26, 2010)

Leading the roundtable luncheon organized by the ASRM Nurses' Professional Group at the annual meeting of the ASRM in 2010 one nurse discussed patient counseling, support, screening and consent procedures related to sex selection. The session seemed to mark a small but nonetheless existing institutional openness by the ASRM to providers' growing willingness to move beyond the ethical controversy of sex selection to face challenges associated with the practice. The nurse, for example, contrasted for her small but avidly interested audience fertile, sex selection patients, whom she characterized as having "high expectations," and being, "determined, anxious, demanding, independent," with the more familiar infertile patients she described as "hopeful, grateful, dependent, needy, fearful" (handout of powerpoint slides to roundtable participants). One challenge faced in her clinic related to accommodating sex selection patients with children in separate waiting rooms with play areas so as not to offend infertility patients. During discussion at the roundtable, an attending fertility doctor from Nigeria forcefully predicted that sex selection would eventually, like IVF itself, transition from a controversial to an accepted practice. Many of the providers I interviewed during this study repeated this very expectation. Having paved the way for other clinics, they took on a "wait and see" attitude that anticipated growing normalization in the same tradition as IVF itself.

## International agency texts: disjuncture along geo-bio-political lines

From binding clinic/patient texts, to unbinding professional association statements which clinics might feel compelled to negotiate, to the uncertain impact and uneven influence of NGOs, institutional texts coordinate power at the clinic site and away from government regulatory institutions in the U.S. International agency statements that define sex selection as an international issue of concern, on the other hand, do not even address clinics. By addressing nation-states, international statements bypass the locus of institutional power in contemporary sex selection, the clinic, along with a growing globalized institutional structure of fertility clinics networked across national borders. Furthermore, although the most recent interagency statement released by the UN mentions PGD and sperm sorting, it excludes political, economic, social, and cultural elements related to lifestyle sex selection in its framing of sex selection as an issue of international concern. In this way, the geo-bio-political “western” site in which lifestyle sex selection formed gets sketched out of definitions of sex selection as an international issue.<sup>25</sup>

The first mention of sex selection in an international document came at the 1994 International Conference on Population and Development (ICPD) in the pre-formative stages of lifestyle sex selection. Those who drafted and signed the ICPD Programme of Action in 1994 would likely not yet have encountered MicroSort or PGD in relation to

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<sup>25</sup> An exception to this is the 2005 statement of the International Federation of Gynecology and Obstetrics (FIGO) that addresses clinics by way of their professional associations. For example, FIGO urges its professional member societies (as is ACOG) to “**ensure** that their members and their staff are accountable for ensuring that their techniques for sex selection are employed only for medical indications” and to “**work** with their governments to assure that sex selection is strictly regulated.” With its 2007 release of its own statement on sex selection, ACOG responded only to the former directive, because, like the ASRM, ACOG supports a system of voluntary “best practices” over government intrusion in clinical practice involving reproductive technologies (Schuppner 2010, 449)

sex selection. In chapter four, the practice of “prenatal sex selection” is interpreted as a symptom of gender discrimination and (nation-state) governments are urged to act by implementing measures that would prevent “prenatal sex selection” (ICPD 1994). The Beijing Declaration and Platform of Action from the Fourth World Conference on Women made a similar plea, urging governments to “enact and enforce legislation against the perpetrators of practices and acts of violence against women, such as...prenatal sex selection...” (Article 124 (i), UN Women 1995). UNESCO’s International Bioethics Committee declared PGD for nonmedical sex selection “unethical” (UNESCO IBC 2003, 9). However, the later appearing UNESCO statement moves away from interpreting sex selection as part of systemic violence against women and girls.

Recently in 2011, five UN agencies (OHCHR, UNFPA, UNICEF, UN Women, and WHO) released an interagency statement that defines sex selection as a symptom of discrimination against girls and women, reminding governments that they must address the issue as part of their obligation to uphold the human rights of girls and women without compromising on their obligation to provide women access to safe abortion. The fifteen page document highlights the problem of sex selection contributing to sex ratio at birth imbalances that exist or have existed in South, East, and Central Asian countries, but warns against stringent legal prohibitions of sex selective abortion that might compromise women’s access to needed reproductive health technologies and services (WHO 2011).

The title of the new interagency UN statement released by the WHO, “Preventing *Gender-Biased* Sex Selection” (emphasis added) seems to implicitly recognize the

possibility of a not “gender-biased” form of sex selection. The qualification departs from the 1994 ICPD recommendation, which simply asks governments to prevent (comprehensively) prenatal sex selection. The cover image of three brown-skinned children clad with South Asian garments visually distances itself from the biopolitical subject represented on U.S. fertility clinic websites discussed in chapter four. The document interprets “sex selection in favour of boys” as a “symptom of ...injustices against women” (4). It problematizes thus, the choice itself rather than the act of choosing. A brief mention of “family balancing” in the executive summary treats it as an exception. “Sex selection is sometimes used for family balancing purposes but far more typically occurs because of a systematic preference for boys” (V). Specifically mentioning China, India, Vietnam, Korea, Armenia, Azerbaijan, and Georgia, the document entirely leaves out western regions of the world in its analysis. Indeed, it is difficult to juxtapose the latest UN document focused as it is on the obligations of nation-states with the (contra) state regulatory system that has concentrated power in ART clinic institutions. The UN interagency statement exists in an entirely separate internationalized frame that does not implicate the ART clinics driving lifestyle practice. From its inception within the long established contours of UN discussion on population and development to its growing relevance across five UN agencies, the internationalization of sex selection addresses mainly global south and east countries, son preference, and population sex ratio imbalances. Its refusal to incorporate issues related to lifestyle sex selection further accentuates the divergence between a more and less valued kind of sex selection, the latter of which is problematized by the UN while the former is left alone. Thus, the intertextual relations between local and national texts (such as informed

consent forms and professional association statements) that coordinate a high degree of clinic autonomy in self-determining sex selection practice collide against international texts (such as the concluding documents of the ICPD and Fourth World Conference on Women in Beijing) that define sex selection as an international issue. Outside the margins of international attention, in the meantime, lifestyle sex selection assumes an alternative global form through clinic networks that move across borders, circumventing national regulatory jurisdictions.

### Cross-Border Sex Selection: the global form and situation of lifestyle sex selection

Cross- (national) border movements in sex selection are not well documented although scholarship on cross-border reproductive practices recognizes sex selection as a potential border crossing practice (Pennings 2004, Spar 2005). The prime motivating factor for cross-border sex selection is circumvention of legal bans on the practice, though unavailability of technology and expertise contribute to this trend. The inception of lifestyle sex selection practices coincided with the emergence of regulatory inconsistencies governing sex selection worldwide. Business administration scholar, Debora Spar, explains

...the [ART] trade is pockmarked by legal inconsistencies and continent-spanning loopholes....So what's a would-be parent to do? It's easy. They travel, trolling the world in search of their child. And savvy practitioners appeal to these international clients, crafting businesses that capitalize on regulatory gaps. (Spar 2006, xiv)

Like surrogacy and egg donation (practices also affected by legal inconsistencies) sex selection has become a cross-border ART practice. While sex selection in the U.S. has

remained unregulated, China and India prohibited non-medical sex selection in 1994, the U.K in 1995, Europe in 1997, and Canada and Australia in 2004<sup>26</sup>. This “legal mosaic,” (Pennings 2009) results in U.S. clinics having an edge in global markets. According to estimates made by their directors, international clients make up substantial proportions of the total sex selection clients who presented themselves at the two U.S.-based clinics I visited (sixty and fifty percent). The departure locations of these international patients suggest that many come to the U.S. or other potentially growing international sex selection hubs such as Mexico, Northern Cyprus, Saudi Arabia, South Africa, and Thailand to circumvent laws prohibiting sex selection.<sup>27</sup> In some cases, streams originating in parts of Africa such as Nigeria, the Balkans and Central Asia seek access to technologies unavailable in their locales (Interview, CEO of fertility clinic in Nigeria, October 12, 2010; Interview, U.S.-based clinic director, January 26, 2011). Cross-border sex selection *to* the United States from other countries functions *institutionally* through an informally constructed and discretely maintained web of

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<sup>26</sup> **China** (Law on Maternal and Infant Health Care, 1994, <http://www.unescap.org/ESID/psis/population/database/poplaws/china/china6.asp>), **India** (The Pre-natal Diagnostic Techniques Regulation and Prevention of Misuse Act, 1994, <http://www.india.gov.in/allimpfrms/allacts/2605.pdf>), **U.K.** (the Human Fertilisation and Embryology Act, 3<sup>rd</sup> Code of Practice 1995, <http://www.hfea.gov.uk/2999.html>), **Europe** (Article 14, European Convention on Human Rights and Biomedicine, 1997, ratified by 28 member states of the Council of Europe, [http://www.coe.int/t/dg3/healthbioethic/Activities/01\\_Oviedo%20Convention/](http://www.coe.int/t/dg3/healthbioethic/Activities/01_Oviedo%20Convention/)), **Canada** (Assisted Human Reproduction Act, 2004 S.C. ch. 2, s. 5(e), available at [http://laws.justice.gc.ca/en/showdoc/cs/A-13.4/bo-ga:s\\_5/20090616/en#anchorbo-ga:s\\_5](http://laws.justice.gc.ca/en/showdoc/cs/A-13.4/bo-ga:s_5/20090616/en#anchorbo-ga:s_5)), **Australia** (Australian Government, National Health and Medical Research Council, *Ethical guidelines on the use of assisted reproductive technology [ART] in clinical practice and research*, 2004, ¶ 11.1, [http://www.nhmrc.gov.au/publications/synopses/\\_files/e78.pdf](http://www.nhmrc.gov.au/publications/synopses/_files/e78.pdf)).  
<sup>27</sup> Saudi Arabia (Spar 2005); Australia to Thailand to U.S. (Interview, U.S.-based clinic director, January 26, 2011); Nigeria to South Africa (Interview, CEO of Nigerian fertility clinic, October 12, 2010); Cyprus [site of MicroSort laboratory and clinical provision, <http://www.microsort.com/en/en/findlocationsanddoctors.php>, and U.K. to Cyprus (Foggo and Newell 2006)]; Mexico (site of MicroSort laboratory and clinical provision, <http://www.microsort.com/en/en/findlocationsanddoctors.php>, and satellite location of U.S. clinics offering sex selection (Interviews, clinic director and embryologist, January 24, 2011)]; U.S. to Mexico (Interview, Clinic Director of Mexico-based clinic, November 19 and 24, 2010). The U.A.E. is significant generally in cross-border ART (Inhorn and Shrivastav 2010) and MicroSort had an active on-line recruitment advertisement for a lab technician in Dubai at [www.jobsintheuae.com](http://www.jobsintheuae.com); accessed December 22, 2010).

networked clinics that facilitates the treatment of moving patients. Cross-border movements from the United States takes place largely among providers through the operation of clinic and laboratory satellite locations abroad. These institutional formations foster movements of information, biomaterial, patients, providers, and equipment across borders and together they make up the emerging global form of lifestyle sex selection.

### **Destination to U.S.: Patient crossing through clinic-to clinic institutional networks**

As described in chapter three, the lengthy processes involved in ART treatment can be broken up into parts. To facilitate a continuum of care for patients who cannot afford the time and expense of lengthy stays abroad, lifestyle sex selection has developed into an inter-clinical, cross-border practice that spans across nation-states. Similar to the “affiliations and partnerships” in cross-border egg donations such as from Britain to Spain or Canada to the U.S. (Ikemoto 2009; fieldnotes, annual meeting of ASRM 2010, “Cross-Border Care,” Scientific Program, Symposium, October 25, 2010), departure and destination clinics work together to provide a continuum of care for moving patients. Departure clinics offer preparatory services such as initial testing, administration of fertility drugs, and monitoring of ovulation via ultrasound. In this way, the time needed at destination clinics can be reduced to the clinical procedures that span from egg retrieval to embryo transfer. When patients abroad contact clinics in the U.S. for sex selective PGD, nurse coordinators direct them to their local area clinics to begin the process. U.S. clinics take measures to keep network activity discreet for the sake of departure clinics operating in jurisdictions where sex selection is illegal.

In London we've got some clinics, we keep them busy, but we're very cautious, we won't give the patients the names of the places in advance. They're not doing anything illegal. It's totally legal, they're basically doing ultrasounds for us. But, I don't want to expose them to that, because they're very valuable to us and if they shy off, it's a hard [pause] we've developed these relationships over years, and the understanding is we keep it low key, cause they don't need the grief. (Follow-up, Clinic Director, Interview, January 24<sup>th</sup>, 2011)

Interestingly, one departure clinic in the U.K., which openly provides and advertises preparatory treatment for sex selection that ends "abroad" also does not disclose the names or locations of destination sites on its website ([genderselection.uk.com](http://genderselection.uk.com), accessed September 21, 2011). The website explains in a FAQ section that, "The initial appointment and preparatory treatments take place in London, however, the egg pickup, fertilization, biopsy and embryo transfer take place in another country," at an "associate clinic" and that patients should expect to be abroad for about a week (<http://genderselection.uk.com/home.html>).

Given both legal restrictions and the disrepute of sex selection among some reproductive professionals, the process of beginning an interclinical connection for sex selection treatment is not always easy. One U.S. clinic director, who has his nurses interface with departure clinics before sending patients there, described the process of approaching clinics for the first time.

We'll approach a clinic, if somebody lives out somewhere where we haven't worked before. We call the local fertility center, listen we're from the [ART clinic name], we've got this lady who wants to do gender selection, would you mind helping us out? 90% of the time they're fine with it, and 10% of the time we get cursed at. (Interview, August 24, 2010)

On the other hand, a nurse working at a different U.S.-based clinic explained that at first contact to a new clinic, she might not relay that the patient needing preliminary ART services seeks sex selection.

They don't usually cause a big stink. I had once in a while - a lot of times I don't put on there [the service orders] they're doing gender selection. They know they're doing IVF. IVF is IVF. They really don't have any business knowing unless the patients want to disclose. What they're doing with their embryos. When I do the orders, it's just pretty much, I need an ultrasound and estrogen on these days. That's it! (Interview, July 26, 2010)

She further described ways she minimized direct contact with departure site clinics by communicating to them via the patient.

A lot of times what I usually do is I send orders out and there's a website that I go on and I'll look up the patient's zipcode and it will bring me up within a 50 mile radius the nearest infertility clinic. So, what I usually do is I'll pick the ones that I've already worked with first, if there is one there. If there isn't, then I'll pick one that is close to their house, and I print it up for them, and I usually have them contact the center because they have to anyways to give them their information and set up their appointment and the only time I really get involved with that is if - cause I talk to them for results and things like that but I usually send the patients their orders and everything and I'll fax the orders over to the clinic that they choose. That works out pretty well. Nowadays, I don't really need to call them on the phone and say I'm sending a patient. That doesn't usually happen anymore. Like I said, I work a lot with emails. A coordinator will email me to say now you have my email address. If they have any questions they'll call me, but a lot of them I just meet at meetings that I go to. It's like, Oh, I know who you are. We've seen your patient. (Interview July 26, 2010)

In the case of sex selection, the need to keep things "low key," minimize direct communication, and generally uphold privacy (both for clinics and patients involved especially from jurisdictions where sex selection is illegal) impacts institutional arrangements by keeping them informal.

Within this global form, the U.S. serves as one key destination site for cross-border sex selection and U.S.-based clinics act as nodes from and to which informational and patient streams transfer. This cannot function without the involvement of departure clinics, but the degree to which they knowingly contribute to a sex selection cycle, and participate in decision-making around pre-treatment protocols is unclear. One U.S.-based

nurse clearly indicated that her clinic controls all aspects of a cross-border cycle, and the departure site clinic merely carries out their protocols.

We follow-up every day. There is no question about that. It's not like you send them to the [local, departure site] clinic and they manage through the clinic. The main management is through us. The clinic is just following the protocol that Dr. \_\_\_\_\_ is sending, but every single day that they have appointments or results, we go through that result so the clinic doesn't deal with them directly, we do. The clinic deals with us, not with the patient. (Interview, January 24, 2011)

In contrast, the website of the Rainsbury clinic ([genderselection.uk.com](http://genderselection.uk.com)) at which U.K. residents can begin their treatment, indicates that the clinic site in London has a hand in both departure and destination protocols and procedures.

U.S. clinic websites increasingly market to patients abroad. The Fertility Institutes' website touts the clinic as the "worldwide leaders in gender selection technology," provides foreign language access in Chinese, French, and German, and offers travel assistance to international patients. The website also offers a sample case story of successfully assisting a couple from Canada facing legal prohibitions in their home country. A new website ([gender-baby.com](http://gender-baby.com)) launched by HRC Fertility on September 21, 2011 by press release is solely devoted to sex selection. An entire page on "international patients" indicates their importance in sex selection commerce. A physician on the website proclaims,

Gender selection is legal in the United States. Living in a country where gender selection is not legal does not preclude you from becoming an HRC patient and making use of our advanced technology. In addition, HRC is very adept at finding and working with physicians and fertility clinics in your country so that you can be monitored close to home. ([http://www.gender-baby.com/community/message-board/?no\\_cache=1&view=single\\_thread&cat\\_uid=2&conf\\_uid=3&thread\\_uid=29%2357](http://www.gender-baby.com/community/message-board/?no_cache=1&view=single_thread&cat_uid=2&conf_uid=3&thread_uid=29%2357), accessed September 22, 2011)

The website further reassures international patients that they can begin treatment in their home countries and lists the tests they need to begin the process.

Results of tests get passed along the routes before patients even make their way across them.

First contact is usually is by internet or telephone...We've got sort of a form that answers most of their questions, tells them where the offices are. The big question is always, well can you work with me if I'm from, you know, Surrey, England, and it includes an answer to that, yeah, we work with local centers, we interface with them, *we can keep you at home for all but a week....* And, once the consultation occurs, then we go through all the details. We have the local centers near them order the preliminary blood work and all the testing they need. We have physicians see them at home. Get a clearance from the physicians and off we go....*We work with about 140 - last time I counted - different clinics around the world.* (emphasis added, Interview, U.S.-based clinic director, August 24, 2010)

Once the testing is complete, results are faxed to the U.S. clinics. One nurse described the challenge of having to interpret results in different languages at times. A director described the daily routine in the informational transactions taking place between clinics working across borders.

And, they fax us results, each day as the stuff is coming in. So, you get here 4 o'clock, we got faxes flying in from all over the world, and we sit down as a group. We do a grand rounds with the list of active patients, and I call out the orders for all those people, the nurses hit the phones, and everybody's given their instructions for that day. The next day we do it again. Get more people going. (Follow-up Interview, January 24, 2010)

After testing, patients begin taking fertility drugs in their own home locales.

Working across international borders appears at times to complicate the process of accessing and beginning fertility drug regimens that kick off the ART cycle. The Mexico-based clinic director serving international clients said he sometimes has to order

drugs from global pharmacies that deliver directly to a patient's residence because such pharmacies have more "flexible" registration requirements for the doctors who place orders (Interview, November 19, 2010). Similarly, "Jane," the author of [genderdreaming.com](http://genderdreaming.com) also conveyed that participants within private international forums on her website relay self-help advice to one another on how to access fertility drugs that start off their treatment cycles (personal communication, June 21, 2011). Once the patient has several maturing follicles, they travel to the destination location for the procedural aspects of the treatment – egg retrieval, IVF, PGD, and then embryo transfer, which all take place in less than two weeks. One nurse described the process from start to finish:

So what I usually do is send to the patient all of their testing information like all the tests they have to do and I'll look up some clinics, *cause now with me doing this I know some clinics from all over the world*, so I'll just send them, this is your local clinic, I know this coordinator there, just give her a call, they'll get you in for your testing. And so we make the testing happen. Once we get the testing back, Dr. \_\_\_\_\_ will review those results and make me out a plan of treatment for the patient, and then what I do I make the patient a schedule according to whatever dates they want to be here for their vacation, or whatever, *cause they're here for about 12 days* when they go through the process. So, they start in the country or the city that they are in with beginning of cycle, they can do it, and *they come here for the very end part or procedure part* with Dr. \_\_\_\_\_. ...

... We have centers that do outside monitoring, so they'll do our ultrasounds, and our lab work as the patient's cycling and then they'll come to us for the last ultrasound, and Dr. \_\_\_\_\_ will make a decision that they're ready to be triggered [ready to undergo an egg retrieval procedure], and then they're here for their egg retrieval, their biopsies, their transfers. (Interview, July 26, 2010)

The global form, then, centers institutionally around the clinic located in largely unregulated legal frameworks. From that node, bi-relational, clinic-to-clinic circuits evolve with flows moving between them and across national borders. With the

development of satellite clinics and laboratories abroad, the U.S. also functions as a departure site for providers in cross-border sex selection.

### **Departure *from* U.S.: Providers crossing to satellite clinics abroad**

The U.S. has also served as a departure site in cross-border transactions for sex selection. In general, U.S.-based patients need not circumvent restrictive laws in order to access new sex selection technologies. However, given the FDA's 2010 decision to deny new subject enrollments in the U.S. MicroSort clinical trial for "family balancing," while a decision is made on its safety and efficacy, some might. Further, lower costs could draw others to head to Mexico. However, providers themselves appear to be active in this area, reaching out to both other globally situated and local markets. In this section, I provide a glimpse into the emerging global form of border-crossing by providers, first through the particular case of MicroSort/GIVF, and then through two other U.S.-based clinical extensions that have established satellite locations abroad.

### ***The MicroSort Clinical Trial: A testing ground for crossing borders***

Although GIVF held an exclusive license to MicroSort, it created an institutional mechanism by which other ART clinics, both within the United States and abroad, could provide the technology as "collaborating physicians" (not as co-investigators) in the trial. Collaborating physicians had to sign an agreement with GIVF in order to provide ART services locally using sperm sorted at one of the two U.S.-based MicroSort lab sites. Collaborators agreed to provide GIVF with follow-up information on cycle procedure and outcome. As sponsor of the trial, however, GIVF investigators determined eligibility for patient enrollment, conducted all trial related informed consent procedures, and if

pregnancy occurred, pursued pregnancy and pediatric follow-up data. The MicroSort Scientific Director underlined that collaboration relationships did not involve financial transactions, and both collaborating physicians and trial investigators described the formalized institutional aspects (especially paperwork and data collection) as cumbersome. Yet, the formal collaborative process provided vital information on the material and institutional challenges to MicroSort provision across – both state and national – borders. As the Scientific Director explained:

It's really kind of a neat design, because assisted reproduction, if you think about it as a lay person, you go it's all the same it's all an IVF cycle, or it's all an IUI cycle or an ICSI cycle. Well, every physician does things just a little bit differently, so with collaborators we really get a good sample of how MicroSort sperm work out in the real world, as opposed to just results that were generated just at the GIVF program. So, it gives you broader, more real world results. (Interview series, December 2010)

This formalized system of collaborative relationships to ART clinics in a variety of states and countries as well as the construction and incorporation of a new laboratory site in 2003 in California provided the institutional blueprint for launching “MicroSort International.” As the MicroSort Scientific Director tried to explain, “You can think of it like this. Having a sorting site in a city in Mexico instead of having a sorting site in a city in the U.S.” (Interview Series, December 2010).

Since 2009, *MicroSort International* has opened three laboratory sites, two in Mexico and one in Northern Cyprus. Local ART clinics and physicians near these sites willing to provide the technology as part of their product portfolio have become “participating” rather than “collaborating” physicians. In spite of the change in designation, the institutional connection that these “participating” clinics have to MicroSort appears similar apart from reduced paperwork obligations and increased physician discretion over

patient access and advertising. Operating outside of the trial framework and FDA jurisdiction, the strict need for follow-up, clinical trial data collection and enrollment criteria such as age restrictions are not enforced. One participating physician in Mexico explained the institutional agreement between his clinic and MicroSort:

It's not a contract, it's more like an agreement...It works like this. I don't earn anything by sending patients to them, and I don't get any commission fees for any patient they refer to me. ... They trust me. They send me patients. As much as I can I'll send patients to other clinics... With patients coming from abroad [pause] I was trained in the UK, we have the same name, and we have the support of a large clinic in [name of major city on U.S. east coast], and they [MicroSort] talked to me and we have a lot of experience with patients from abroad, so we have a well-structured method to deal with patients from abroad, and people from MicroSort know this. So, most patients coming from abroad they are sent to us. I don't pay them any fee. I don't earn anything by sending them patients for sorting. I don't charge any extra. So, what we have on paper has much more to do with the health department. (Interview, November 19, 2010)

The director underlined his clinic's capability of servicing patients from abroad as appealing to MicroSort. He laid out four advantages to Mexico as a global destination site for ART as: 1) its geographic and relative cultural proximity to the U.S. and Canada (compared to reproductive tourism sites such as Singapore and Thailand), 2) a growing second generation of low middle-class, Mexican-Americans who speak Spanish, and reside but cannot afford treatment in the U.S., 3) cost, and 4) limited treatment options for women over age 40 in the U.S. The attractiveness of Mexico as a cross-border site may well have influenced GIVF's decision to locate new labs in major Mexican cities. Indeed, MicroSort does not appear to have advertised much locally. According to one of the technicians at a MicroSort lab in Mexico, MicroSort had not launched a major advertising campaign, expending most of its outreach efforts to physicians at conferences and by invitation to an opening event. One Mexican ART clinic offering MicroSort

clearly appeals to global patient traffic in an advertisement on a medical tourism website, “connecting patients & doctors worldwide.”

Medical tourists seeking to use [Microsort](#) to increase the chances of having a baby of a specific gender should look no further than Mexico City, Mexico. Mexico City, Mexico is the most popular non-beach town in Mexico, and is known for its top fertility specialists. While in Mexico City, Mexico for Microsort (Gender Selection) enjoy breathtaking sunset views from the Bellini revolving restaurant which overlooks the entire city....

Such advertisements can make claims regarding the technology’s safety profile, and promote the comparative advantage of cost. This would not be possible in the U.S. while the technology remains unapproved by the FDA

... There are no reported risks and side effects directly attributed to MicroSort (Gender Selection) in Mexico City, Mexico.

... The cost of Microsort (Gender Selection) in Mexico City, Mexico is low compared to other countries that provide this service, and easily accessible due to Mexico’s healthcare advancements. The average Microsort lab only charges \$1,100.00 per sort. ([http://www.wheremydoctor.com/microsort-gender-selection\\_mexico-city\\_mexico](http://www.wheremydoctor.com/microsort-gender-selection_mexico-city_mexico), accessed September 20, 2011)

Similarly, [microsort.com/en/](http://microsort.com/en/), which accompanied the launch of Mexican laboratory sites, is clearly directed at the “international” consumer. It can be accessed in both English and Spanish, offers skype communication services and a currency converter using “live midmarket rates” to provide up-to-date calculations of the MicroSort cost of 13,500 Pesos in Mexico or 1,400 Euros in Cyprus into other currencies.

### ***Moving practices abroad through the establishment of off-shore clinics***

As in the case of GIVF establishing MicroSort laboratories abroad, U.S.-based clinics also construct off-shore locations for conducting clinical practice. My research data encompassed one U.S. (west coast) based clinic with a satellite arm in Mexico, and one

satellite clinic in Mexico connected to a different, main clinic in the U.S. (east coast). I refer to the bundle of clinics connected by ownership across borders as clinical extensions. Both clinical extensions in my data provided sex selective PGD in Mexico. Without access to PGD screening facilities on-site in Mexico, both satellites send cells extracted for PGD testing back to U.S.-based laboratories. Both also had a small number of permanently based employees. One staffed two gynecologists, an ultrasound technician, and a hormone specialist, and the other a director and his personal assistant/receptionist, two nurses, and two embryologists. Within both clinical extensions, regular travel to and from main clinic sites in the U.S. took place.

The director of the U.S., west coast clinic explained that he travels about every seven weeks to the Mexican satellite location with a team of embryologists. An embryologist who has travelled with him described the process:

What we do is we batch patients down there, so we tend to do all the patients in a few days, so it's real intense, cause you got to get everything all done within a finite amount of time, cause we only have [pause] we do the transfer on day 4 or 5, depending on [pause] so we're there for 5 days so we gotta squeeze all this work in five days. But, pretty much what happens is, same kind of thing, except the slides [on which biopsied cells are placed] we can send out from down there back to the states here... (Interview, January 24, 2010)

The embryologist's reference to "batching" patients was reiterated by his clinic director as "packaging" or "synchronizing" cycles. Due to the limited time traveling specialists spend in Mexico, a number of women's cycles (the director mentioned 47 cases on one visit, and 30 on another) must be "synchronized" so that the team can perform multiple egg retrieval surgeries on the first day and embryo transfers on the last. He explained, "Because if I go to [name of city in Mexico], I have to get all those 47 women to have their eggs ready on the same day, and we do. And, we do it over, and over, and over

again” (Follow-up Interview, January 24, 2010). The other clinic satellite in my investigation extended from a main clinic on the U.S. east coast. In this case, both the satellite director and the chief embryologist at the main clinic travel to each other’s locations every two to three months to discuss clinical and laboratory results of their patients. According to this satellite director, sex selective PGD patients tend to come from abroad, while MicroSort with IUI provided a more financially accessible option for local patients. However, he also said he routinely recommended combined MicroSort-PGD treatment to all his sex selective PGD patients (Interview, November 24, 2010).

In the case of MicroSort, a laboratory supervisor does occasionally travel to the facility set up in Mexico from the U.S., but day to day contact is made via cameras that allow facility owners in the U.S. to both communicate with locally based technicians and visually see the off-shore lab.

We have a supervisor from the U.S. who comes and checks the lab, and we usually have them on call. If we have a question or anything, we call, and contact with them, and they will answer right away. We’re always in communication, but basically, here they only come and visit every now and then, just to review that everything is fine. We have cameras, so they can check the room, so in case we have questions, and they have to see what we’re doing they’re able to. We take advantage of technology as much as possible. We don’t actually need a person physically here. They can be working over there. They just turn on the camera, and say okay what am I doing here, what should I do here, and they can answer and let us know what we need to do. So, you don’t actually need someone here all the time or someone travelling frequently here, because we have technology here. (Interview, MicroSort lab technician, October 22, 2010)

Thus, in cross-border sex selection, the U.S. is situated as both a destination and departure site within a growing spectrum of traveling practices. The “transnationalization” of clinics (Ikemoto 2009), or the establishment of off-shore labs

and sites of clinical operations owned and operated by U.S. clinics, has extended these practices into other globally significant hubs. The entire system escapes national and even weaker international regulatory mechanisms. International agency directives that inscribe sex selection as an international issue do not seem to have on their radar this emerging global form of sex selection. Like movements to access egg donation and surrogacy, sex selection has become a cross-border reproductive practice. Cross-border sex selection is not only a global form, but an institutional means to decenter state authority. In this sense, cross-border sex selection is both institutionally constitutive of lifestyle sex selection and it situates such practices within transnational circuits of travel. Through institutional work various stakeholders have safeguarded the relatively unregulated status of lifestyle sex selection in the U.S., which in its institutional contrast to other national regulatory jurisdictions, has provided the impetus to the growing global form of lifestyle sex selection.

## Chapter 6: Conclusion

In her article addressing “equality concerns in the global market for fertility services,” feminist law scholar, Lisa Ikemoto, describes dominant narratives that entitle purchasers to reproductive services, even those services whose very obtainability depends on the existence of prevailing inequalities (she refers mainly to surrogacy and egg donation accessed across differences in wealth between poorer and richer nations). The “family formation” narrative centers the “yearning” of infertile couples willing to travel across the world for children, and the “free market” narrative views third parties in ART as “free agents.” She considers how the long-standing narrative of population control fuses with the other two to support that “sense of entitlement” to purchase services via “reproductive tourism.”

Both narratives [family formation and free market] express a sense of entitlement. Purchaser’s power may account for some of that. Yet, the claim to purchaser’s power here is not based solely on greater wealth. The use of women for their biological capacity to reproduce, in a context in which geopolitical differences between departure points and destination spots often account for the wealth disparities, supports a sense of entitlement. In addition, well established narratives that describe low-income women, women of color, and women in less developed nations as “too fertile” nourish the claim of the infertile to ART use as their due. In other words, the identity of those who provide eggs and gestation for others overlaps with those deemed in need of population control. The population control narrative has already cast the women sought for eggs and surrogacy as subalterns. In doing so, the population control narrative has prepared the ground for claims of entitlement in the family formation and market narratives. (Ikemoto 2009, 307)

Ikemoto traces how preexisting ideas about differentially valued reproduction of peoples around the world (constituted through a narrative of population control) contribute to emerging global forms and assemblages in “reproduction tourism.” Ikemoto joins a small number of feminist theorists of reproduction who purposively conjoin meanings

normally separated within a dichotomized world of reproductive technologies. Marcia Inhorn, for example, explains that, “fertility and infertility exist in a dialectical relationship of contrast, such that the understanding of one leads to a much greater understanding of the other” (Inhorn 1994, 23). In a recent conference presentation, Sharmila Rudrappa similarly argued that a fuller understanding of assisted reproduction cannot happen in isolation from “desisted reproduction” by which she means processes that prevent reproduction using methods such as sterilization, contraception, and abortion (Rudrappa 2011). I follow their lead in seeking how the reproductive “subaltern” figures in the constitution of lifestyle sex selection. She figures as a person who aborts because of wrongful bias against girls. The wrongfulness of her action intensifies with the formation of lifestyle sex selection because it is not based on her bias alone but because her mode of sex selection, the abortion itself, is wrongful.

In her argument that a global theory is needed to explain the phenomenon of gender imbalance existing in parts of eastern, southern, and western Asia as well as eastern Europe, Hvistendahl points out the commonality of pervasive abortion practices, recent drops in fertility and recent rapid pace of economic development experienced in these regions (Hvistendahl 2011, 10). It is perhaps then not coincidental that lifestyle sex selection formed and has initially begun to spread in areas with significant anti-abortion strongholds. Lifestyle sex selection was constituted as “good” or at least “benign” in contrast to the social harms that result from the subaltern’s deviating reproductive practices. As discussed in chapter two, reproductive binaries that posit ARTS, valued reproduction, individuals, (in)fertility and pro-natalism in opposition to contraception/sterilization, despised reproduction, (over)fertility, and anti-natalism “prepared the

ground” for the constitution of a new, more valued form of sex selection. Since both MicroSort and PGD are a highly complex set of processes embedded in ART, their meanings gain definition through belonging on the valued side of reproductive dichotomies. Specifically, the constitution of valued elements in *stratified reproduction* – materially via ARTS as discussed in chapter three, discursively via biopolitical subjects racialized white and nationalized western in chapter four, and through institutional mechanisms that support individual control in chapter five – helped to produce a valued set of sex selection practices. These elements all associate with wealthy world regions and the global West. They endow lifestyle sex selection with meaning through association: western, individually determined, unbiased, producing desired babies and “family balance.” These formed against a less valued form: eastern, culturally determined, gender biased, wrongful abortions, and causing population imbalance in sex ratio. In this way, the existence of *stratified reproduction*, and the meanings tied to the reproduction of different groups of people around the globe, helped to produce *stratified sex selection*. While sex selective abortion has been subsumed within international population frameworks that have deemed it a problem of international proportion, sex selective ART emerges in privileged western sites of high culture and technoscience.

In the introduction to this dissertation, I pointed out that since 1995 innovations in reproductive technologies combined with changes in economic, political, social and cultural processes shifted the terrain of reproduction to reveal new forms of reproductive activity, inequality and transnational movements. These shifts have unsettled binaries that sometimes get taken for granted in feminist theorizing on reproduction (what I referred to as binary capture in chapter two). While the intensity and amount of

inequality may or may not have changed, certainly its organization has. In order to make that organization visible, I asked how a new form of sex selection got constituted and how it situates globally.

My methodology employed an organizing principle that made artificial distinctions between material, discursive, and institutional domains, each of which I analyzed separately in individual chapters. Consequently, a break occurs between what I call the material and what I call the discursive that is in reality not so sharp. Rather, these processes should be understood as a set of overlapping, co-constituted meanings guided conceptually by material-semiotics in which the material should be understood simultaneously as semiotic (constituted through the work of translation, negotiation and compromise) and the semiotic qualified by or constituted always in relation to matter (e.g., made bodies) (Haraway 1991, Butler 1993).

## Constitution

I have argued that the appearance of the technologies alone did not determine the formation of lifestyle sex selection. For that to happen, their meanings had to evolve and converge through two historical turns as the technologies moved from agriculture research to benefit the livestock industry to human reproductive genetic medicine and then to human lifestyle medicine. Through each turn, their meanings had to stabilize. Thus, lifestyle sex selection constituted materially not simply through the emergence but convergence of MicroSort and PGD as a set of “adjunct” or alternative pre-pregnancy “sexing” technologies embedded within ART. Lifestyle sex selection constituted also through discourse that unlocked the path to biomedicalization through meaning-making practices that imputed “family balancing” to be sex neutral and thus a reasonable way to

complete a family. As an *indication* for medical treatment via MicroSort, *family balancing* biomedicalized the desire to have either a girl or boy child. In particular self-help authors contributed to emerging discourse of lifestyle sex selection through new terms that attribute goodness to practices that could potentially produce the “happy objects” (girl or boy babies) that would fulfill the deeply held and shared desires of (at least some group of) women. Their systems of categorization significantly fortified the convergence of MicroSort and PGD as a set of high tech gender selection technologies in contrast to low-tech interventions. Finally, the technologies converged institutionally – both housed within ART clinics. In the relatively unregulated zone of U.S. ART the practice could grow and gain meaning. Non-intervention by the state and non-binding intervention by other stakeholders such as professional associations protected the ultimate authority of clinics to decide whether or how the practice should take place. Projected by news and popular media, clinic representatives and professional associations deliberated and released position statements conferring recognition of the practice by either method and unleashed a groundswell of debate on the comparative risk/benefit profiles of the technologies. The push and pull of elements of PGD or MicroSort design and function in relation to IUI and/or IVF formed the basis of assertions of ethical acceptability based on relative efficacy, intrusiveness, and the production or not of ethically problematic objects such as undesired embryos. Since the presence of one always seemed to prompt discussion on the other in these institutional domains, the technologies converged to constitute a set of new biomedical practice. Arguments in support of the development of PGD in the U.K. laid the groundwork for the transfer to human medicine from agriculture research, while the assertion of *family balancing* as an *indication* for MicroSort *treatment*

initiated processes of biomedicalization manifest in lifestyle sex selection. My argument assumes that this formation may very well not have occurred as it did without the presence of both technologies construed in relation to one another. However, I do not presume that both are equally significant to a future of lifestyle sex selection in ART.

## Situation

Housed within “Fertility, Inc.” both technologies embed within ART processes, latching on to sites of meaning related to high Euroamerican technoscience and culture, assuming anticipatory (hopeful) and happy affects related to fulfilling desires for family and children. In this way, they situate on the valued side of reproductive binaries associated with the global West. Scientists and providers, who have actively developed and promoted the technologies, draw boundaries between their own methods and the “pseudoscience” of preconception methods such as Ericsson and Shettles as well as sex selective abortion. By erasing abortion as a sex selection option, self-help authors often explicitly disassociate “western” (which in their categorization systems includes “high-tech” or “low-tech” options) from “eastern” (abortion) practices. A western frame fortifies around lifestyle sex selection through the figurative language and visuals in clinic websites and news and popular media that feature a new, biopolitical subject: a woman racialized white and nationalized as western or “American” yearning for a daughter. Her desire to sex select is her own, and her male partner merely supports her in that effort. This figure contrasts with the anti-citizen of backward sex selection practices who is racialized brown and nationalized Asian. She is forcefully made to abort due to the biased desires of her husband or his family for a son.

The complex and unwieldy form of the technological processes involved in sex selective PGD and MicroSort do not permit mass production and dissemination more typical of the population control design criteria inherent in “modern” contraceptive and sterilization methods and handheld ultrasound devices. Yet, MicroSort and PGD’s lengthy processes are divisible and can be broken up into movable parts and steps that can occur in different locations. Providers, patients, information, cryopreserved sperm, and biopsied embryonic cells move across routes between clinics. Thus, the technologies globalize through emerging transnational circuits that cross networked clinics, rather than take place within one discrete and bounded national space. For the most part, these movements are driven by uneven regulation. Patients most often move from jurisdictions where sex selection is illegal to where it is not illegal, but sometimes also due to a lack of access to PGD or MicroSort facilities. The technological forms of both have compelled movements of patients largely to the U.S., which has served as a significant destination node in these informal networks. Further, through the establishment of satellites, U.S. owned clinics have extended their spheres of practice across national boundaries. According to the directors of the two U.S.-based clinics I visited, foreign patients make up at least half of their sex selection patients. Significant routes of travel exist between the U.S. and Mexico, Canada, the U.K., Australia, China, Nigeria, South Korea, India and the Central Asian Republics. The institutional structure mimics a neoliberal, non-governmental, globalized form centering clinics in contrast to the traditional structure of international population control that has centered nation-states. Thus, the western practice travels so that sufficiently globalized citizens (often immigrant communities within the global West, or the wealthiest within global East countries) can

access a trans-westernized entitlement to purchase and engage in sex selection, where their choice for specifically sexed child will not be read as gender biased. As I have argued, lifestyle sex selection situates, then, not so simply in the West, but across a number of nations spanning the geo-bio-political domains of West/East.

### Towards new directions in feminist theorizations of reproduction

Informed by the case of lifestyle sex selection, I return to the concept of *stratified reproduction*. In order to account for a shifting terrain of reproduction in feminist theorizing, I offer the concept of *reproductive stratifications* as a parallel idea to *stratified reproduction*. To begin with, *reproductive stratifications* changes focus on reproduction, conceiving of it not as an endpoint, but as a process in and around which stratifications occur. Women engage in many new kinds of activities that involve their reproductive bodies that do not necessarily have their own reproduction as their aim but a breadth of goals such as their future reproduction; their own economic security (in service of the reproduction of others); a contribution to research; or the fulfillment of particular parental or family formation identities – the case in point is lifestyle sex selection. Those activities may or may not end in a child, but it is important that we conceptually capture situated reproductive activities that people engage in towards multiple ends, not merely to have or to prevent having their own child, but to live particular kinds of lives.

Furthermore, that which is stratified in *stratified reproduction* is human reproduction, or the reproduction of some groups of people relative to others. The concept usefully draws our attention to the idea that some people's reproduction is valued while other's despised. Within complex new transnational reproductive processes, the despised can

double up as “valued” in markets that states often assist either by non-intervention (e.g., in the case of U.S. ART) or by providing substantive support to the medical and reproductive tourism industry (e.g., medical visas that permit entry into a country to purchase medical services). That is, the despised reproductive producer in Ikemoto’s account can become “valued” as raw material and exercise what some view as agency in new kinds of reproductive transactions in which she is not wholly victimized. Further, the purchasing and cultural capital of globalized citizens (regardless of where they may reside) can gain them a kind of biological citizenship that entitles them not only access to global ART services, but to the meanings ascribed to their related practices. In this way, as state boundaries get crossed in transnational routes of reproductive activity, the line unsettles between rigid understandings of “despised” tied to global East - contraceptives/sterilization - people of color - poverty and “valued” tied to global West – ART – racialized white – wealth. Indeed, there are multiple ways in which reproduction is stratified. This not a call to replace *stratified reproduction*, because the idea that reproduction is stratified helps us see how the presence of preexisting inequality in reproduction “prepares the ground” for the formation of new inequality. In part, the idea of *reproductive stratifications* should complement the former term by conveying a structure of inequality that is not sedentary but always in motion. Stratification itself reproduces or produces more stratification. As already stated, the assemblage of associated valued elements in stratified reproduction (white, well-off, global West, ARTs, individual control) became the springboard to a more valued set of sex selection practices that constituted in opposition to a despised form of sex selective abortion, and with it stratified sex selection. Value immunizes reproductive choice from scrutiny on social or

cultural grounds. Choosing a boy is wronged in one context where sons are expected to fulfill economic and social needs of a family, but choosing a girl in a context where daughters are expected to fulfill emotional needs is projected as a good pursuit in fulfillment of an individual dream, and therefore not constrained by social and cultural problems.

Finally, multiple kinds of stratification result from human reproductive activity. Rather than asking how transnational inequality stratifies reproduction (as undertaken in the 1995 Ginsburg and Rapp volume), theorists today should ask how transnational reproduction produces inequality of various kinds. That which is stratified or valued or devalued in transnational reproduction is not merely the reproduction of different groups of people relative to one another, but differential valuations along varying axes of sex/gender, sexuality, nation, race, class, and ability. I sketch these briefly below as they appear in relation to my studied case: lifestyle sex selection.

Clearly implicated in sex selection practices is large scale gender-based violence as evidenced in “missing girls” in proportions much larger than those lost in the world to AIDS (Hvistendal 2011, 16). Sex ratio imbalance is tied to a general neglect and disadvantage faced by the girl child in many parts of the world. In practice for decades in some regions, “missing girls” have become “missing women,” and Hvistendahl documents how the phenomenon of widespread sex selection now instigates trafficking of brides and prostitution across borders (2011). In addition, the “choice” to sex select is sometimes taken in situations where women face both verbal and physical violence. Puri et al.’s recent qualitative study involving in-depth interviews of 65 Indian-American women (some of whom attempted sex selective ART) revealed that some faced threats of

losing their immigration status or abandonment by their in-laws or husband if they did not produce sons, and some faced physical violence and neglect when sex determination of their fetuses turned out to be female. Since the phenomenon of sex selection intensified in the global South and East as a direct result of following fast-tracks of “western” economic development and a population control imperative also imposed by the West, it should perhaps not be surprising that living in the U.S. on its own, where “choice” is protected, does nothing to diminish the practice or its root causes.

Moreover sex/gender binaries get reinforced through practices that provide a choice between blue and pink, which translate to the chromosomal options of XX or XY. Consumers of lifestyle sex selection choose the sex of embryos on the basis of an imagined already gendered child. In effect, societal or parental gender expectations and desires, which appear to hinge on common gender stereotypes, get fused at the site of the sexed infant body, fetus, embryo or sex chromosome of sorted sperm. The process renaturalizes gender in sex as though gender can be determined by chromosomes. In addition, the promoted ideal of “family balancing” reproduces heteronormative attitudes that appear to exclude the participation of same sex couples. Non-traditional family forms seem to confound the very idea of “balance” in a family. While the option to engage in sex selection increasingly opens to same sex couples as they are welcomed by “Fertility, Inc.,” certainly within the context of the MicroSort clinical trial where the term originated, GIVF limited enrollment of “family balancing” subjects to “married couples” consisting of a “wife” and “husband.”

Lifestyle sex selection has always been open to all racial, national and ethnic identities so long as they have the requisite wealth. Nonetheless, only women racialized as white

with a Euroamerican national identity have been endowed with the power to represent or act in the issue. Today, multiracial marketing has begun to appear producing new figurative ideals that promote entrance of multiracial and ethnic identities in lifestyle sex selection so long as these subjects are sufficiently westernized or globalized. The poor, “Third World” woman’s option remains sex selective abortion following prenatal diagnostic screening, even though in developing regions, this method associated for decades with the upwardly mobile, middle class.

Finally, sex selection most often ignites controversy through a questioning of the “non-medical” rather than the “medical” as justifiable grounds to engage in the practice. As the choice of sex increasingly binds to routine practices of “medical” genetic screening, and a “medical” indication remains unquestioned as a way to determine which lives are worth living, the choice of sex and perhaps other kinds of “non-medical” preferences might become an accessory to powerful (and unquestioned) ways of reproducing the normal as “healthy” and able-bodied.

The concept of *reproductive stratifications* draws attention to various forms of stratification as they relate to reproductive processes. Centers of power have historically intervened in human reproduction that produce or maintain social inequality. In the current neoliberal moment, uneven regulation across global sites benefits new globalized nodes of power vested in the ART clinic corporation networked across borders, and a state’s prerogative not to intervene powerfully assists that structure. Far from discouraged, the practice continues to grow. A (de)regulatory environment that permits marketing of the practice seems wholly at odds with professional ethical guidelines that aim to discourage it. Therefore, policy implications are many. To begin with there is a

dire need to fill an information gap both on the extent of sex selective ART but the multiple ways in which it is practiced in and across different clinic domains. Variations in informed consent and technological procedures as well as pricing structures ought to be studied – at least out of a motivation to provide basic consumer protections. Recognizing that no clear line divides medical from non-medical forms of biomedical practice, strategies to collect data should aim to identify the practice alongside other instantiations of ART and PGD. The positions of professional associations need updating, but deliberations on ethics must be informed by comprehensive data collection stemming from independent sources to which clinics are compelled to contribute. We cannot expect to learn much about these practices from retrospective analysis on data that individual clinics may or may not undertake and publish. Furthermore, ethical deliberations such as those conducted by the ASRM without accompanying mechanisms of accountability are implicated in the rise of the very practices they aim to discourage. In order to prevent recognized harms related to the practice, we need effective governance in which regulatory bodies cannot shift responsibility for ethical practice onto the same institutions that stand to gain commercially from them for this represents a glaring conflict of interest.

Government agencies, professional associations, non-governmental, and international organizations should question the *balanced family* as an ideal and *family balancing* as a rational practice necessarily devoid of bias. Sex selection by whatever means – even when the practices aim to make babies rather than prevent them – and wherever they take place (east or west) occur inside culture and power, and thus are implicated in various kinds of local and global stratifications. International policy recommendations that

primarily raise concerns about abortion access in relation to sex selection leave the door open for an interpretation of sex selection as a reasonable family limitation strategy. Rather than only identify sex selective abortion as cause for international concern, which plays into reproductive binaries, such organizations should broaden their scope to consider more fully the various stratifications that occur in and around sex selection including border-crossing and ART forms. Finally, for individuals and communities, the choice to question the practice has the potential to powerfully resist mechanisms that produce inequality and deflate false promises of individual fulfillment promoted in lifestyle ideals that compel sex selection.

## **Appendix A – Interview Guides**

### **Self Help Author**

1. What prompted you to begin the book/website project? When did you begin the project and how long did it take you to complete?
2. What was your intention at the start of the project? What did you hope to achieve with this work?
3. Who else besides yourself participated in this project?
4. Can you profile the audience you imagined as you built the site/wrote this book?
5. How did you go about researching the content of the site/book?
6. Can you tell me a little bit about the process of making decisions around the site/book structure and content?
7. Which section did you enjoy authoring the most?
8. What have you learned through creating this site/book that you didn't know before?
9. How do you feel your book/site compares to others out there on the same topic? Please highlight for me the similarities and differences.
10. How do you see your work in relation to the kinds of information that patients might receive at a clinic?
11. How has the site/book been received so far by users? By providers?

### **Nurse**

1. What is your job title and can you describe your work task and responsibilities? (communication – patient and professional, treatment coordination, consultation, scheduling, follow-up)
2. Tell me what a typical work day is like?
3. Tell me a little about your occupational history? Have you always worked in fertility?
4. When and how did you begin working on sex selection?
5. Walk me through what happens when a couple first contacts the clinic with an interest in sex selection?
6. How (mis)informed are patients when they first approach the clinic?
7. How helpful are clinic independent sources of information such as in-gender.com?
8. Walk me through what happens when a couple's first treatment cycle is not successful in establishing a pregnancy?
9. In the course of their treatment cycles when and how do you interface with the patients?
10. Can you profile the gender selection patients?
11. How similar or different are gender selection patients from patients seeking other services at your clinic?
12. Are you in touch with nurses at other clinics that provide sex selection services?
13. How do you interface with clinics abroad when patients travel from outside the U.S. for sex selection?

**Embryologist/Lab tech**

1. Can you tell me your job title and describe your work tasks and responsibilities at the lab?
2. Can you describe a typical work day at the lab?
3. What is it like working with MicroSorted sperm?
4. Can you estimate the PGD cycles specifically devoted to sex selection as a percentage of total PGD?
5. What is the basic PGD protocol for sex selection?
6. What is the basic screening protocol?
7. Which specialists are involved in these processes?
8. Which parts of the procedures are conducted on-site; which off-site?
9. How transportable of a technology is PGD/MicroSort (equipment, specialists required)?
10. Describe the advantages and disadvantages to services conducted “off-site?”
11. How do you advise a patient on embryo selection when the embryos they desire are not the best quality?
12. Do you travel for your work? Can you describe what those working trips are like?
13. Do you ever work with frozen embryos or sperm? What is that like?

**Clinic Director**

1. What is your job title?
2. Briefly tell me about your professional background and how you got involved in gender selection?
3. How many of your monthly IVF cycles are devoted to gender selection? How has that changed over time?
4. Can you profile your staff and consultants for me? What types of expertise and personnel are needed to handle every aspect of gender selection at your clinic?
5. How do you and your staff engage with other providers of sex selection?
6. Do the staff ever travel to assist in administering the technologies elsewhere?
7. Can you give me a profile of your gender selection patients?
8. What are the major challenges you face in communicating with patients about the technologies?
9. How helpful are the existence of clinic independent sources of information such as self-help internet blogs to the patients and your work? Does your clinic participate in any of these forums or sites?
10. Describe your clinic’s interactions with new smedia on the issue of gender selection?
11. How do you advertise your sex selection services?
12. Walk me through what happens when a couple first contacts the clinic with an interest in gender selection?
13. Describe the processes involved in the application of PGD/MicroSort?

14. Can you describe arrangements your clinic has developed with other clinics when servicing international patients?
15. How will things change, if MS is approved by the FDA, both for your own work and for the provision of gender selection in general? If it is not?
16. What is your perception of the future of gender selection technologies and their provision in the U.S. and worldwide?

**NGO staff**

1. Can you tell me a bit about your professional background and specifically how you came to this issue?
2. Do you view sex selection as one of your advocacy priorities? Why?
3. How does [NGO name] fit in the larger picture of organizations advocating on this issue?
4. On specific actions:
  - a. what prompted the action?
  - b. What was your organization's objective?
  - c. Describe the process of undertaking the action.
  - d. How was it received? What were the responses?
  - e. What sorts of follow-up to the action has been planned?
5. What kind of regulation, if any, would you like to see put in place in the U.S. on sex selection and which institution do you think ought to step up to the task?
6. At this point in time, do you perceive a need for transnational advocacy on this issue? Why or why not?

## Appendix B – IRB Approval<sup>28</sup>



UNIVERSITY OF  
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INSTITUTIONAL REVIEW BOARD

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April 01, 2010

### MEMORANDUM

*Application Approval Notification*

**To:** Dr. Bonnie Thornton Dill  
Rajani Bhatia  
Women's Studies

**From:** Joseph M. Smith, MA, CIM  
IRB Manager *ms*  
University of Maryland, College Park

**Re:** IRB Application Number: 10-0159

**Project Title:** "Exploring the local and global dimensions of U.S. Sex Selection: the Technologies, Work Sites, Work Processes, and Communications"

**Approval Date:** April 01, 2010

**Expiration Date:** April 01, 2011

**Type of Application:** Initial

**Type of Research:** Non-Exempt

**Type of Review for Application:** Expedited

The University of Maryland, College Park Institutional Review Board (IRB) approved your IRB application. The research was approved in accordance with the University IRB policies and procedures and 45 CFR 46, the Federal Policy for the Protection of Human Subjects. Please include the above-cited IRB application number in any future

<sup>28</sup> Renewal Applications were approved on February 21, 2011 and January 18, 2012. The latest approval expires on February 20, 2013.

communications with our office regarding this research.

**Recruitment/Consent:** For research requiring written informed consent, the IRB-approved and stamped informed consent document is enclosed. The expiration date for IRB approval has been stamped on the informed consent document. Please keep copies of the consent forms used for this research for three years after the completion of the research.

**Continuing Review:** If you intend to continue to collect data from human subjects or to analyze private, identifiable data collected from human subjects, after the expiration date for this approval (indicated above), you must submit a renewal application to the IRB Office at least 45 days before the approval expiration date. If IRB approval of your project expires, all human subject research activities including the enrollment of new subjects, data collection, and analysis of identifiable private information must stop until the renewal application is approved by the IRB.

**Modifications:** Any changes to the approved protocol must be approved by the IRB before the change is implemented, except when a change is necessary to eliminate apparent immediate hazards to the subjects. If you would like to modify the approved protocol, please submit an addendum request to the IRB Office. The instructions for submitting a request are posted on the IRB web site at : <http://www.umresearch.umd.edu/IRB/addendumapp.htm>.

**Unanticipated Problems Involving Risks:** You must promptly report any unanticipated problems involving risks to subjects or others to the IRB Manager at 301-405-0678 or [jsmith@umresearch.umd.edu](mailto:jsmith@umresearch.umd.edu).

**Student Researchers:** Unless otherwise requested, this IRB approval document was sent to the Principal Investigator (PI). The PI should pass on the approval document or a copy to the student researchers. This IRB approval document may be a requirement for student researchers applying for graduation. The IRB may not be able to provide copies of the approval documents if several years have passed since the date of the original approval.

**Additional Information:** Please contact the IRB Office at 301-405-4212 if you have any IRB-related questions or concerns or email at [irb@umd.edu](mailto:irb@umd.edu).

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