

Glass Bellies and Artificial Wombs: Gender, Science, and Reproduction in Early Modern Alchemical Performance

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How can a man tell “signs of breeding” (Webster 1990, 2.2.2)?¹ In John Webster’s Jacobean tragedy *The Duchess of Malfi*, Bosola, a hired spy, attempts to figure out if the titular character, the Duchess of Malfi, is pregnant. That the duchess’s state remains a secret prompts Bosola to reference the voyeuristic properties of glassmaking.

BOSOLA

There was a young waiting-woman, had a monstrous desire to see the glass-house. . . . And it was only to know what strange instrument it was, should swell up a glass to the fashion of a woman’s belly.

OLD LADY

I will hear no more of the glass-house, you are still abusing women! (2.2.5–6, 8–12)

By bringing together the components of the artisanal science of glassmaking—namely, the *glass-house*, or the site in which glass and glass products were produced, and the *glass vessel*, one such glass product—Bosola’s fantasy depicts the means for voyeuristic male viewing of the inside of the female body, predicated on his own “monstrous desire to see.” His voyeuristic impulse at this moment is knowingly embedded in the overlap between theatrical and scientific viewing, gesturing at once to the performative disclosure of the duchess’s state of pregnancy for Webster’s audience, and the early “scientific looking” (Tiffany Watt Smith 2014, 7) of artisanal glassmaking and experimentation.

The early moderns would have found the duchess’s “glass belly,” and the specifically masculine desire to see the female interior, literalized in the glass vessels that comprised early scientific inquiry and “laboratory” experimentation.² Bonnie Lander Johnson and Bethany Dubow examine the allegories of creation latent in glassmakers’ practices prompted by Webster’s glassmaking references in *The Duchess of Malfi* and other works. According to Johnson and Dubow, for Webster especially, the glasshouse was “an arena in which man wrestled with, and hoped to outrival, the generative powers of nature” (Johnson and Dubow 2017, 117), and they locate in Bosola’s glassblowing metaphor the “fantasy of asexual reproduction whereby the male glassmaker is the sole participant in the creation (and inflation) of his glass vessel” (Johnson and Dubow 2017, 115). Indeed, Webster draws on the metaphor of the body as made of glass in various works (Johnson and Dubow 2017, 108; Reiss 2003),³ which serves additionally to strengthen the connection between specifically female bodies and glass vessels, as in the bawdy reference to the male glassblower’s “instrument” which is used to “swell up a glass to the fashion of a woman’s belly.” I am interested in pushing the literary metaphor further, to consider the ways in which the metaphorical glass belly did not remain in the realm of the symbolic, but was actively used in scientific—and primarily alchemical—endeavour to actualize those symbolic purposes: that is to say, how the metaphorical significance of glass vessels informed their use as literal or physical *replicas* of women’s bodies, and how these gendered metaphors became embedded in scientific practices and objects in ways that also made and remade gender (Haraway 2004, 227).

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An interesting precursor to the “birth of the clinic,” the voyeuristic possibilities afforded by the glass vessel are in dialogue with the practices of medieval and early modern anatomy which aimed to expose what lay hidden in the body. In a sense, they literalized early on the dissective impulse of Michel Foucault’s medical gaze, which penetrates beyond the surface of the skin to read the underlying truth of the body otherwise hidden from view: that “opaque mass in which secrets, invisible lesions, and the very mystery of origins lie hidden” (Foucault 2003, 150). But it is especially this latter secret, the mystery of origins, which informed the medically performative *masculinist* inquiry into opening up the female womb for display (Park 2006). The early modern obsession with the gendered secrets of the woman’s womb, in tandem with the specularity of scientific and proto-scientific practices of the early modern period, informs the issues raised by the woman’s body imagined as a glass vessel and the voyeuristic and intrusive nature of Bosola’s wish. It is thus that the glass vessel, or the glass belly, read as a symbol of the pregnant womb made transparent, stages the gendered dimensions of early modern scientific practices.

As feminist scholars have pointed out, women’s bodies were metaphorized throughout the history of science and medicine, particularly in relation to their perceived function toward the goals of human procreation (Haraway 1991; Haraway 2016; Martin 1987; Schiebinger 2004). Emily Martin notes, for example, the development of the metaphor of the uterus-as-machine in seventeenth-century France, according to which the womb and uterus were described as a “mechanical pump” used to “expel the fetus” (Martin 1987, 54). In this model of technologizing the womb, the woman’s body was seen as a machine that could be “fixed” by the physician who acts as “the mechanic or technician” (Martin 1987, 54). I would argue that the glass vessel serves as an earlier model of technologizing the womb that extends beyond the metaphor: it not only imagines the womb-as-technology but also manifests a technology to replicate the womb, to be *used* by the male scientist or alchemist to perform, or (re)produce, his goals.⁴ If the organic, female body is imagined to be technologized, it is by way of alchemy and its practices, conceptualized through analogies of sexual reproduction, that the reverse impulse to *organify* inorganic technological materials emerges in the form of the glass vessel and the ways in which it allowed male scientists to refigure and to replicate organic processes. It is through the staging of glass “bellies” that alchemical practice demonstrates how “repetition . . . can alter material reality” (Crane 2001, 170).⁵ Thus, my interest is not simply in examining the perception of the body as machine, but rather the perception of technologies as capable of life, or capable of performing and reproducing life processes: making glass vessels *breed*.

Insofar as we might define science as a body of knowledge—*scientia*—and a set of practices—*techné*—alchemy was an intellectual endeavour constituted by both (Park and Daston 2008).⁶ If, as Mary Thomas Crane suggests, early modern scholars have sometimes held performance to represent the “deceptive, hollow, and illusory nature of the theatrical, even as it conjures the real into being” (Crane 2001, 169),⁷ I am interested in how alchemy serves as a particularly pertinent case of what I call *literalizing through performance* in the period—attempting to conjure the real into being even as it combatted its reputation as a fraudulent and deceptive mimicry of “real” science (still a misunderstanding in our current, public understanding of alchemy), as appears in early modern literary and dramatic works like Ben Jonson’s satirical comedy *The Alchemist*. As Kirsten Shepherd-Barr notes, science has moved in theatre from “simile and metaphor” to “thorough structural and thematic integration,” and I am interested in tracing this in a particular, charged object—the glass vessel—that not only moves “from the margins to center stage” (Shepherd-Barr 2006, 15) in early modern scientific performance, but exemplifies that oscillation between metaphor and structural agent of gendered replication. Considering the myriad permutations of what it meant to *perform*,⁸ the glass belly, or glass vessel, serves as an instrument of alchemy and early science, a symbol of their

performativity and of the replicability of the female body—a means of translating into “disembodied scientific objectivity” (Haraway 1988, 576) the “embodied others, who are not allowed *not* to have a body” (Haraway 1988, 575). In other words, these glass bellies materialize the transition whereby the *secrets of women* are made the *theatre of women*, intersecting gender, science, and performance in, and through, early modern alchemical practice. This study thus examines how the theatrical looking in glasshouses and on the stage became gendered modes of looking that were additionally embedded in the material practices and texts of glassmaking. This was made most explicit in the masculinist control of reproduction in glassmaking and fantasies of male birth, particularly in the alchemical laboratory where glass vessels were used to replicate reproductive processes toward reproductive ends. What remains at stake are the ways in which the gendered history of the glass vessel haunts the scientific practices that increasingly intersect with the humanistic study of the past, and how these acts of gendered looking and gendered making/remaking risk being uncritically replicated today.

The Glass-House: Secrecy and Openness in the Performance of Science

When Bosola in Webster’s *The Duchess of Malfi* expresses his fantasy that glassmaking, or glassblowing, could make the duchess’s secret—her pregnancy—transparent, referring to a young woman’s “desire to see the glass-house,” the actor playing Bosola also refers knowingly to a working glass-house by the Blackfriars Theatre in which *The Duchess of Malfi* was performed. Spectators of the Blackfriars’s theatrical productions may have been spectators of the artisanal practices of glassblowers, just a few steps away (Floyd-Wilson 2013, 117). In early modern England, glassmaking was recognized as “a craft with its own technological secrets” (Floyd-Wilson 2013, 117), but it also, I would argue, became a kind of performance. Early modern artisans and tradesmen dealt with the secrets of their trades, “expert” knowledge of procedures and skills required to craft particular products. But while early modern artisans might have harboured the secrets behind their making practices, sometimes their practices were put on display. The glass-house was thus a spectacle accessible to the larger masses, a “public [place] of experiment, commercial activity, production, magic, and performance” (Floyd-Wilson 2013, 117–18). In this way, prior to the late seventeenth century when the Royal Society would eventually perform science by “stag[ing] experiments,” glass-makers, or “glass-blowers,” would “stag[e] their techniques for the public” in the glass-houses that housed their activity (Floyd-Wilson 2013, 117). This echoes what occurs in the theatre with *The Duchess of Malfi*, where Bosola prompts the audience to imagine glassblowing on the stage, blurring the distinction between theatre and laboratory and how both stage voyeuristic viewing.

It is worth contextualizing the performativity of the sixteenth- and seventeenth-century artisanal sciences, like glassmaking and alchemy, by juxtaposing them against the scientific performances that came later. In the late seventeenth century, the Royal Society’s scientific endeavours took two forms: that of “experimental demonstrations before an audience” and “the transcription of written information” (Golinski 1989, 16). Furthermore, the written knowledge produced through the Royal Society’s scientific inquiry needed to be “confirmed by exhibition or replication in meetings” in order to prove its legitimacy. The determination of what Jan Golinski refers to as “fully authenticated ‘facts’” of scientific experimentation required firsthand witnesses in the Royal Society’s public meeting space (Golinski 1989, 16). In other words, it was the live and public performance and reenactment of these written experiments—and the presence of a “reputable,” i.e., male, audience as “witnesses”—that gave them their validity: the spectacle determined proof (Golinski 1989, 16; Mintz 1951).⁹ For figures like the Royal Society’s Robert Boyle, held to be the father of experimental science, the laboratory was a “place of worship . . . the experiment, a religious rite” (Haraway 2004,

231; Potter 2001, 9). Significantly it was also an arena not only forbidden to women but one where it was perceived that women would not be able to participate even if allowed in. During Royal Society experiments with Boyle’s air-pump, which had a glass chamber or globe within which witnesses would see birds perish from suffocation from the vacuum, women were reportedly present at one demonstration—though never recorded as witnesses—interrupting it to demand air for a struggling bird; Boyle’s response was to exclude women from further demonstrations (Shapin and Schaffer 2011, 26; Haraway 2004, 232): “women might watch a demonstration; they could not witness it” (Haraway 2004, 231). Experimental history reveals how Donna Haraway’s “gender-in-the-making” operated through the scientific looking that determined the “‘inside’ and the ‘outside’ of science” along gendered lines (Haraway 1997, 29).

In glassmaking and other earlier artisanal practices, the interest in scientific and theatrical “looking” did not fall quite as explicitly along those same gendered lines, though these practices began to establish what it meant to have permission to observe, and to disclose, that which was historically kept secret. Glassmaking, like most arts, had not always been public. It began as a trade with secrets that were guarded by its guildsmen. As with other artisanal secrets, glassmaking developed as a craft that merged the “awareness of performing an art,” in Marco Beretta’s words, with “the most hidden mysteries of matter” (Beretta 2009, 148). It was not until the Italian Renaissance that glassmaking went “public” with the publication of the first treatises on glassmaking, like Vannoccio Biringuccio’s metallurgical treatise *De la pirotechnia* (1540) which devotes an entire chapter to glass (Beretta 2009, 149). Images began to appear that depict the workings inside the glass-house, open to display on the page, and depicted as open to display to the casual passer-by, allowing, for example, Bosola’s “young waiting-woman” to satisfy her “monstrous desire to see the glass-house.”



Glass furnace, with workers. Georg Agricola (German, 1494–1555). In *De re metallica* [Berckwerck Buch, Frankfurt-am-Main, 1580, p. cccxc]. Rakow Research Library, The Corning Museum of Glass (66820). Photo: The Corning Museum of Glass. <http://renvenetian.cmog.org/chapter/look-inside-renaissance-venetian-glasshouse>.

In a period in which the world was increasingly “conceptualized as a theatre” (Vermeir 2012, 181),¹⁰ knowledge, too, began to be understood as performance (182). In particular, the performance of knowledge was enmeshed in the history of secrets; integral to the secrets of the early scientific trades—as well as those of the occult sciences like alchemy, defined by their hidden mysteries—was the inherent *performativity* of secrecy. “To captivate the public,” Koen Vermeir writes, “one should not disclose too much at a time. In order to incite the imagination and to give the public a sense of wonder, hidden things should be gradually unveiled, building up the tension and slowly increasing the fascination” (Vermeir 2012, 182–83). This interplay between secrecy and openness often merged with theatre quite literally: in the “public” and “private” spaces designated to distinguish between what is displayed and what remains “behind the scene,” or even more specifically with mountebanks who would “[climb] the stage” to sell their secrets, forming the basis for the staged *commedia dell’arte* (Vermeir 2012, 184). Indeed the Italian scholar Giambattista Della Porta, famous for his work publishing the secrets of natural magic, was also a playwright who conducted his own stage plays (Vermeir 2012, 184; Koderer 2014).¹¹ The stage itself played with its spaces of openness and secrecy in the frontstage and backstage dimensions of theatre, with its working components hidden off stage and its “productions” manifested onstage—a trope that early modern playwrights would use to comment on the metatheatrical aspects of performance.

To return to Bosola’s glass-house, Webster in this moment brings attention to the physical juxtaposition of theatre and glass-house, theatrical stagecraft and performed scientific secrets, and uses this moment of wishful imagining to juxtapose in his viewers’ minds the spectacle of the secrets of glassmaking next door with that of the duchess’s hidden pregnancy through her imagined glass belly. In doing so, Webster guides his audience’s attention from the exposed space of formerly secret practice to the desired exposure of the most secretive space of all, the female womb. This moment of theatre makes gender by enticing the audience to push further on this desire to look, to move from what has been to what is not yet exposed, locating the new object of the gaze in the hidden interior of the female body—an unveiling from secrecy to openness along gendered lines.

Thus, Webster intimately connects early modern theatricality to the secrets that defined the period’s sciences—“*Secretum* . . . replaced by *theatrum*” (Vermeir 2012, 182)—and does so through the female body. The shift from *secretum* to *theatrum* significantly reveals the gendered ramifications of merging “scientific” and “theatrical” looking. What Tiffany Watt Smith observes about the participation of Victorian scientists in the “passionate and demonstrative looking . . . firmly linked to theatrical audiences” (2014, 7) finds points of uneasy cohesion even earlier, when disciplines like medieval and early modern anatomy made use of actual anatomy theatres for both the educational and spectacular display of their practices of dissection. The desire to reveal or to discover the secrets of women, as in Bosola’s wish to know the duchess’s (pregnant) state, finds its theatrical drive in early anatomy, in which the impulse manifest as dissecting open the womb, believed to be the site where women’s secrets were hidden. Thus, the “*secreta mulierum*, the literature on women’s matters,” became a “*theatrum mulierum*” (Vermeir 2012, 182). That the secrets of women were made the theatre of women demonstrates the affinity between scientific and theatrical viewing (Tiffany Watt Smith 2014, 7), merged in the material construction of glass vessels through glassmaking and alchemy.

Glass Bellies and Gendered Vessels

Alchemy as a science prescribed to the idea that heterosexual intercourse was, in Jonathan Hughes words, “essential to stabilizing . . . women” as well as the body politic, which was “conceived as

female when unstabilized” (Hughes 2003, 148). Alchemy was thus an especially masculinist endeavour—with the exception of very few apocryphal female figures in alchemy’s history, alchemists were portrayed to be male figures—and invested in situating the artificial re-creation or replication of human sexual reproduction under male control. Alchemical processes involved the use of replicated artificial wombs, which were controlled and manipulated by male alchemists who conceptualized their practices using the terms of reproduction. Hughes notes that in alchemy it was the “female principle” that was “appropriated by the male alchemist” because it was valued for its “generative power” (Hughes 2003, 140). Men in medicine already routinely referred to the bodies of women as vessels; in Hippocratic tradition women’s reproductive parts—i.e., the womb or “matrix,” uterus, and the vagina—were conceptualized as “one organ, like an upturned (weaker) vessel” (Hughes 2003, 147), while both medically and religiously, men referred to the bodies of holy women, especially in relation to dissection, as “holy vessels” (Park 2006, 35). If women’s bodies were already conceptualized as vessels, alchemy enabled their actual artificial reconstruction by virtue of glass vessels and instruments.

Glass vessels to be used for science were among the technologies produced during the advancement of science in early modern England, a significant time of development for England’s cultural and intellectual history (Godfrey 1974, 244). However, glass had long played a large role in the alchemical literature of antiquity. The chemical procedures involved with ancient and early glassmaking—and, in particular, the process of transmutation—were inspiration for alchemical theory (Beretta 2009, xi). Marco Beretta notes that while scholars have studied ancient alchemists’ use of various alchemical instruments, there has been relatively little attention given to the use of materials like glass in the construction of those instruments—the glass vessels and receptacles that enabled alchemical experimentation (Beretta 2009, 109). Instead, as Beretta points out, both chemists and historians of chemistry seem to have taken for granted the use of glass in the manufacture of laboratory equipment, which has continued to the chemical laboratory today in which experimental practice requires “the mass use of instruments made entirely, or partly, of glass” (Beretta 2009, 109–10)—instruments historically constructed to embody gendered dimensions.

Glass vessels were described in gendered terms, drawing from the female body and its parts. Of the wide range of specialized terminology used for an equally wide range of glass vessels, one called the *botarion* was “shaped like a breast (*mastarion*),” as Beretta describes, and “used as the receiver of an alembic”; Beretta’s reference to the breast-shaped glass derives from a passage by Synesius of fourth-century Greece (CE), in which is described a “glass instrument having a breast-shaped protuberance” later referenced simply as “the breast”:

With this emission of heat, a glass instrument having a breast-shaped protuberance is slotted into the vessel; put it on the top of the vessel and turn it upside down; catch the water going up through the breast and keep it for the fermentation. This water is the divine water, and this is her extraction. (quoted in Beretta 2009, 114)

Because developments in glassmaking were closely tied to the beginnings of alchemy (Beretta 2009, 122–23), it would not be unreasonable to assume that glass vessels were in part produced for their uses toward the goals of alchemy. The gendering of various glass instruments was thus fitting for the alchemical project of replicating, if symbolically, human reproduction. Leonardo da Vinci even aligns glassmaking with alchemy in his critique of alchemy and other occult sciences, bringing attention to their material imitation of other processes. For example, Leonardo’s contemporary Vannoccio Biringuccio compares the famed glassmakers of Murano, Italy, to “ingenious alchemists,” able to

reproduce, or counterfeit, gems from glass (Beretta 2009, 150). For Leonardo, the difference between alchemy and darker and more “foolish” arts like necromancy, which give birth to “lies,” is that alchemy “works by the simple products of nature” (Beretta 2009, 149). However, alchemy cannot be performed “by nature herself” because, as Leonardo articulates, there are in nature “*no organic instruments* [emphasis mine] with which she might be able to do *the work which man performs with his hands, by the use of which he has made glass* [emphasis Beretta’s]” (Beretta 2009, 149). The glass instruments, therefore, aid the active male alchemist to produce that which “nature herself,” passive and feminized, cannot. I bring attention here to Leonardo’s emphasis on the reproductive goals of alchemy and the use of glass vessels toward that very purpose: lacking “organic instruments,” or the natural, living bodies that can reproduce, alchemy requires its male performers to perform manually, and to plunder feminized Nature for her secrets, for which execution they used glass to serve for artificial instruments.

From a literary vantage point, the material practice of alchemical work was entangled with the alchemical allegories that found their model in human reproduction. Allegory, after all, had its own performative slippages between secrecy and openness, obscuring and revealing. Alchemical literature often used “highly allegorical language,” which included coded names for various substances and the processes in which they were implicated, one of the “techniques of concealment” used to protect the secrets of alchemy (Nummedal 2011, 333). This highly allegorical language of alchemy, applied to alchemy’s physical practices, informs the reproductive symbolism of alchemical performance. The study of alchemical texts was rooted in the actual practices of alchemy and the spaces in which it was practised—the laboratories and kitchens in which alchemists “collected, collated, and organized snippets of text in order to locate recipes and processes, test theories, and make things” (Nummedal 2011, 333). The practices themselves, then, were imbued with alchemical symbolism and implicated in the process of replicating sexual reproduction. The famous *Codicillus*, a supplementary treatise in the Lull tradition, makes explicit the association between human reproduction and alchemical process which “imagined . . . an intimate physical connection (or correspondence) between the world at large (the macrocosm) and the body of man (the microcosm)” (Moran 2005, 19–20). This allegorical concept was integral to alchemical practice, transforming the earth into Nature’s womb, the secrets of which had yet to be uncovered.

Thus, the feminized body—and in particular the female womb, a source of mystery and fascination as the hidden site of women’s secrets—was conceptualized and replicated in the alchemist’s laboratory through his materials. A connection already existed between literature on women’s secrets and alchemy, as information on the former was included in and circulated with natural philosophical texts of interest to alchemists (Green 2008, 211). The macro- and microcosmic narratives in medieval alchemy claimed that the “generation of mettals” in the earth imitated the generation of life in the womb, wherein “the imperfect matter . . . must be chosen and made perfect,” work that was noted to be similar to the procreation of humans (Bacon 1597, 10). Metals were believed to lie in the womb of the earth, and some, like gold, “reached maturity while others did not,” informing the alchemical analogy that the womb of the earth could be replicated artificially in the alchemical laboratory through the model of the female body, which mimicked “the earth that provided the warmth and nutrition necessary for the birth of the stone” (Hughes 2003, 141). Reproductive metaphor and analogy provided the impetus for the physical and material manifestation of the artificial womb by way of glass bellies and artisanal furnaces. To be able to imitate nature, Bacon posits, alchemists must have a source of constant heat and a vessel that can be “close shutte, containing in it the matter of the stone”; moreover, that same vessel had to be “round, with a small necke, made of glasse or some earth, representing the nature or close knitting together of glass”

(Bacon 1597, 11). The glass vessel or alembic that alchemists would use, placed in furnaces for heat, was thus described as “a matrix or womb” (Hughes 2003, 143). In this way, the alchemist’s laboratory was created to be what Hughes calls “a feminine world of vessels and water” (Hughes 2003, 143).

Performing Alchemy, Replicating the Womb

The creation of artificial glass wombs and the metaphorical language in which alchemy is rooted enable the alchemical performance of the possibility, through replication, of generation without women (Schneider 2001, 96).¹² Rebecca Schneider articulates, specifically, the fear of the “copy,” that it will “not only tamper with the original, but will *author* the original [emphasis mine],” indeed that the copy “will *come to be acknowledged* as author, father, First [emphasis in original]” (Schneider 2001, 96). Where Schneider subtly notes the fear of the copy in the gendered terms of Genesis’s “the rib, the second,” here I locate an anxiety in the reversal of that gendered fear: male alchemists’ motivation to be acknowledged “as author, father, First” in the deeply gendered conceptualization of human generation. This is a reconfiguration of the dichotomy between copy and original, the replicated and the authentic, which privileges women and their bodies as original and, subsequently, elicits a masculine reaction to reclaim that position of authority and originality. In alchemy, then, cloning is the goal: to reproduce without women, remaking gender inequality through replicating “nature.” The performative disclosure of the secrets of the womb is not sufficient; rather, the masculinist alchemical impulse is to *perform*, reenact, and *produce* those secrets themselves—in other words, to be acknowledged, indeed, as author and First.

This drive manifested in the gendered ways in which the glass vessels, now as the alchemists’ tools, were evaluated for their ability to produce the alchemical goals. In *The Compound of Alchymy*, reprinted in English in 1591, George Ripley describes the alchemical work that takes place within the alembic, one such glass vessel used in alchemy, in the terms of “the sexual restlessness and fulfilment of the womb” (Hughes 2003, 143). As a warning to the male alchemist working toward producing the Philosopher’s Stone, Ripley notes that he will never attain the stone if he handles the alembic “Matrix” (Latin for *womb*) the way “strumpets” treat their wombs; his reasoning emphasizes that strumpets are barren and thus “seldome haue children” born from their wombs (Ripley 1591, E3r). Therefore, according to Ripley, to produce the stone successfully, the alchemist must be sure to close up his glass vessel, again described in terms of the woman’s womb: “That after she once haue conceiued of the man, / Her Matrix be shut vp from all other than” (Ripley 1591, E3r). In this explicit connection between (alchemical) science and the social control of the body politic through the woman’s body, the woman and her womb are figured as property, with chastity figured as crucial to her reproductive success. If, as Hughes notes, the female was the “elemental principle,” her *menstrua* became the model for alchemical solvents that were given the same name; this “menstrue, like lead,” was made to be integral to starting the alchemical process, and its status, described as “Elusive in its virgin state,” could only be “controlled . . . by making it *breed* [emphasis mine]” (Hughes 2003, 142; see also Martin 1991, 486).¹³

It was thus through alchemical performance that the ever-elusive womb and its corresponding female secrets could be dissected and artificially constructed in the laboratory. Even more explicitly, alchemical practice was predicated on the notion that there were biological wombs, like those of “strumpets,” that were being ill-used; the implication was that the birth process was particularly fraught, and that the male alchemist could produce, and thereby control, his own perfect womb.

Thus, not only were female wombs in need of regulation, lest biologically they become unfruitful, but they additionally required *reconstruction* in order to ensure the ideal conditions for reproduction, according to male practitioners. Under male control, the secrets of generation could be realized by means of artificial replacement and staging, divorcing the process of (re)production from the potentially flawed, female body.

The products of alchemical performance took various related forms: the birthing of the matured, perfect metal of gold; the discovery of the regenerative Philosopher's Stone; even the creation of life in the form of the *homunculus*, the man-made man. When in his *De rerum naturae* the Swiss-German alchemist and physician Paracelsus poses the question of "Whether it were possible for Nature, or Art to beget a Man out[side] of the body of a Woman, and naturall matrix?" he finds his answer in "the generation of Artificial men" (Paracelsus 1650, 8). The generation of artificial men, or *homunculi*, was the alchemical goal that most explicitly replicated human reproduction; it was the creation of new life, of a man-made man. Paracelsus's recipe for the alchemical production of the homunculus draws on reproductive materials and the terms of procreation:

Let the Sperm of a man by itself be putrified in a gourd glasse, sealed up, with the highest degree of putrefaction in Horse dung, for the space of forty days, or so long untill it begin to bee alive, move, and stir, which may easily be seen. After this time it will be something like a Man, yet transparent, and without a body. Now after this, if it bee every day warily, and prudently nourished and fed with the *Arcanum* of Mans blood, and bee for the space of forty weeks kept in a constant, equall heat of Horsedung, it will become a true, and living infant, having all the members of an infant, which is born of a woman, but it will be far lesse. This wee call Homunculus, or Artificiall [Man]. (Paracelsus 1650, 8–9)

Paracelsus refers to the creation of this homunculus, typically gendered male if at all, as "one of the greatest secrets, that God ever made known to mortall, sinfull man," calling it also "a miracle, and one of the great wonders of God, and secret above all secrets until the last times, when nothing shall be hid, but all things be made manifest" (Paracelsus 1650, 9).¹⁴ It was Paracelsus's homunculus that was notorious during the early modern period for providing "instructions on how to create an actual person" (Eggert 2015, 158) without women. This concept of masculine parthenogenesis was particularly compelling to early modern male scholars as it seemed to provide what Katherine Eggert calls "a workaround for the seeming feminine mastery of the reproductive process" (Eggert 2015, 158).

The production of the homunculus referred to three distinct but related alchemical products, described in John French's chapter on "The famous Arcanum, or restorative Medicament of Paracelsus, called his Homunculus" in his *Art of Distillation* (1653). According to French, one definition of the homunculus referred to "a superstitious image made in the place or name of any one," another specified that it referred to an actual "artificiall man, made of *Sperma humanum Masculinum*, digested into the shape of a man, and then nourished and encreased with the essence of mans blood," and the third defined it as "a most excellent *Arcanum* or Medicament extracted by the spagyricall Art" (French 1653, 115). In other words, the generation of a homunculus took the form of both a literal artificial man and, in a figurative sense, the Philosopher's Stone or Elixir as the great alchemical medicine. Either way, French describes the process as taking place within an alchemical glass which again performs the part of the female womb, within which "the matter will be turned into a spagyricall blood, and flesh, like an Embryo" (French 1653, 115). Continuing with the

alchemical and reproductive language of generation, French articulates that the “two former sperms, *viz.* of the man and woman, the parents of the *Homunculus*” are “closed up together in a glazen *womb* [emphasis mine] sealed with Hermes seals for the true generation of the Homunculus produced from the spagyricall Embryo” (French 1653, 117). This, he concludes, is “the *Homunculus* or great Arcanum, otherwise called the nutritive Medicament of *Paracelsus*” (French 1653, 117). Even if the homunculus, the man-made man of artificially conceived life, was sometimes used as another name for the medicine alternatively called the Philosopher’s Stone, which granted immortality, this continued to signify that, once again, the immortal prospects of reproduction and the secrets of generation formerly relegated to women could be harnessed under the complete control and purview of men in the alchemical context, wherein the glass vessels that replace women’s generativity perform the female role necessary to propel “science” forward.

Performing/Replicating the Early Modern Laboratory

I conclude by returning to the performance with which I began—the imagined transparent glass belly of the Duchess of Malfi and the possibility of spectating on the hidden contents of her womb. What begins with Bosola as a desire to unveil women’s secrets, by way of imagining the reconstruction of the duchess’s womb as transparent glass, finds its manifestation in the practices of alchemy that sought to dis-cover those secrets: by echoing the anatomical impulse to reveal the secrets hidden in the womb, and mimicking the methods of human reproduction to produce those secrets—if analogically—by replicating the womb outside of the female body. It is through the performance of alchemy that Bosola’s fantasy is, in a sense, brought to life; in the alchemical laboratory, glass bellies reveal their contents and can be manipulated to realize the secret products that promise to deliver men’s hopes for immortality.

It might at first seem a jump to move from the artificial wombs of alchemical glass to practices in the modern science laboratory. Though the translation of scientific “facts,” especially in reproduction, continues to be articulated in metaphorical language that both constructs and reinforces cultural narratives about gender (Martin 1991, 491–92), the analogies between the female body and the glass vessels that make laboratory work possible do not appear now in the rhetoric of scientific experimentation. But we might look to the transition from the secret and occult practices of early modern alchemy to the public experiments of the Royal Society as a period that witnesses the origins of the move away from explicit “gender” to the vague concept of “neutrality” in the performance of science—with the caveat that “neutrality” is, becomes, the cloaked signifier for the traditionally male (Haraway 1997). In the time of the Royal Society, the practices that would become “chemistry” were increasingly made distinct from the practices of “alchemy,” though the two were very much linked in their origins (Newman and Principe 1998, 38).¹⁵ If, as William R. Newman and Lawrence M. Principe note, the distinction between alchemy and chemistry was “extremely diffuse at best” (33) it is unsurprising that the growth of chemistry as a legitimate scientific discipline involved attempts to distance it from its related predecessor. A number of Royal Society apologists, like Joseph Glanvill, would claim chemistry’s place among areas of significant scientific achievement (Golinski 1989, 13), but continued to be troubled by alchemy as a corrupted and corrupting precursor of chemistry, noting that “among . . . the *Paracelsians*, and some other *Moderns*, *Chymistry* was very *phantastick*, *unintelligible*, and *delusive*; and the *boasts*, *vanity*, and *canting* of those *Spagyrist* [alchemists], brought a *scandal* upon the *Art*, and exposed it to *suspicion* and *contempt*” (Glanvill 1668, 12).¹⁶ Perhaps having established a need to remove itself from the “scandal” of alchemy, chemistry, as the laboratory science of and for the future, no longer foregrounds the gendering of scientific

matter and process in the rhetoric of laboratory experimentation. What has resulted, I might argue, is the now-celebrated sterility of laboratory work, wherein the instruments previously so charged with gendered and symbolic meaning—the glass breasts and wombs—have become the “neutral” vehicles for scientific experimentation—the test tubes and beakers with which we are now familiar.

But it is this elevation of neutrality and objectivity in what we now call science that seems to suggest that the scientific laboratory—and the products, or publications, of its performed experiments—might be exemplars of intellectual inquiry. Evidence of priorities in funding in higher education can be seen in the improvement and renovation of the facilities that house scientific experimentation and the equipment and technologies needed to advance scholarship in the sciences. Prioritized support for the sciences has prompted a number of humanities disciplines to pursue the model of the laboratory as a space of inquiry and experimentation—to *perform scientifically* to legitimize the future of humanities study. I wonder, however, in the construction of newer scientific and humanities laboratories for objective academic inquiry, if there is space to address the elimination of the rhetoric of making or re-making gender which serves, if inadvertently, to erase the gendered history of laboratory technologies and processes, as in the glassware used for (al)chemical endeavour.

A fruitful site might be the performative reconstruction of the early modern laboratory, and of laboratory methods, today—now used not so much to verify scientific discoveries, but to verify the *history* of scientific discoveries, and historical discoveries more broadly. *The Making and Knowing Project* is one such initiative, founded by historian Pamela Smith at Columbia University, which aims “to study the nexus of historical craft making and scientific knowing,” realms “regarded as separate” today but which were integrated “in the earliest phases of the Scientific Revolution” when “nature was investigated primarily by skilled artisans by means of continuous and methodical experimentation in the making of objects—the time when ‘making’ was ‘knowing’” (The Making and Knowing Project 2014; see also Pamela Smith 2004, 2008). Indeed the project resonates with surging contemporary public interest in maker culture and DIY and the expansion of “maker spaces” both on higher education campuses and in broader public spaces that enable participants to learn artisanal skills and technologies to “make” various products and projects. *The Making and Knowing Project* has received glowing praise and publicity, featured in a 2016 *New Yorker* article titled, appropriately, “Twenty-First-Century *Alchemists* [emphasis mine]” which reports on the laboratory and its “team of science historians who are attempting to re-create recipes from a sixteenth-century text” (Kean 2016), opening up the “secrets” of early modern making and knowing to scholarly research today. Emphasizing what she calls “Reconstruction as Method,” Smith provides a rationale for replicating laboratory work, drawing on Francis Bacon’s seventeenth-century call for a “New Philosophy; or Active Science” and the early modern discontent with the “inadequacy of words” for experimental endeavour: “writing was inadequate to convey [the] skills [of craftspeople], and . . . book learning was inferior to bodily experience” (Pamela Smith 2016, 210).

Historical reconstruction, according to Smith, “involves both subjective action, self-reporting, and the manufacture of evidence by the historian in the present” (Pamela Smith 2016, 220); I would argue that it is also an act of performance, complicit in the history of making and remaking of gender. *The Making and Knowing Project* conducts its research through workshops, working groups, and laboratory seminars, performing “hands-on work in the laboratory carrying out historical reconstruction research” (The Making and Knowing Project 2014). It is a fascinating phenomenon to see this project invested in explicitly replicating early modern methods—indeed, of replicating the early modern laboratory—integrating the performance of science into humanistic inquiry. It

foregrounds experiential research, precisely the kind of knowledge-construction that early modern craftspeople argued could only be gained from experience. It aims to “[cross] the science/humanities divide”—a divide that did not exist in early modern intellectual inquiry but which has been constructed to define aspects of modern disciplinary thinking today—as well as the divide between the early modern past and our present, “between today’s labs and the craft workshops of the past, and between early modern conceptions of natural knowledge and our own understanding of science, art, and historical scholarship” (The Making and Knowing Project 2014). Feminist scholars have argued, rightly, that early humanistic concerns never receded from modern laboratory science, and I think what is unique about this instance, with *The Making and Knowing Project*, is not so much the reverberations of early science in modern science, but the explicit turn to *replicating* the early modern laboratory and its practices, which itself signified as a performance of remaking gender in the early modern period.

I thus wonder if new projects like Smith’s, of replicating laboratories in humanistic inquiry, can be used as a vehicle not only in tandem with but *responsive to* early modern and performative scholarship. In using “reconstruction as method” in the study of the past, how can we remain attuned to the ways in which scholarship unveils and replicates the charged history of the materials we [*use to*] reconstruct? To what extent might participants think critically about what it means to hold a glass vessel shaped like a pregnant woman’s belly, and how does it shape their perception of the scientific processes that these vessels enclose? How might participants understand the layers of performance embedded not only in their current practices but the early modern precursors to those practices? What remains to be a future area of dialogue is the way in which these projects might be aware of their performativity, of their intersection with the discourses of literary and performance studies that examine the nuances of just what the performance of early modern science, and of alchemical transformation, meant. As we move forward with pursuing humanistic inquiry in laboratory spaces, and as we shape future spaces and methods of knowledge construction and (re)production, attending to the early literary and symbolic registers of science and performance—the glass bellies and artificial wombs that haunt the gendered, performative history of modern scientific inquiry—may indeed be what connects historical reconstruction, and historical performance, to the overlooked gendered valances of the history it aims to bring to life.

Notes

1. Hereafter cited parenthetically by act, scene, and line number.
2. Though the term “laboratory” would not yet embody the laboratories we think of now, I draw on Owen Hannaway’s discussion of the origins of laboratory design and the ways in which the term was associated primarily with alchemy and chemistry in the early modern period (Hannaway 1986).
3. Johnson and Dubow identify Webster’s idea of the glassmaker, for example, as “a potent creator (and breaker) of his lifelike forms” (2017, 108).
4. Karen Barad (2003) articulates the notion of “performative alternatives” to discursive representation, which shifts representational power from words to actions. What Barad presents as the performative possibility that places questions of “ontology, materiality, and agency” foremost beyond linguistic representation, I find useful as a framework for understanding the ways in which the language of allegory intersected with the performatives of alchemical practice.
5. Crane notes, for example, that for performance theorists like Victor Turner and Richard Schechner, performance was defined “not by its representational or deceptive nature, but by repetition and liminality;

they emphasize, in Turner's words, 'process and processual qualities: performance, move, staging, plot, redressive action, crisis, schism, reintegration, and the like'" (2001, 170).

6. Here I follow on the discussion by Katharine Park and Lorraine Daston on the term "science" during the early modern period, what they qualify as an anachronistic "portmanteau term" taken from the later nineteenth century and beyond, meaning a "disciplined inquiry into the phenomena and order of the natural world" (2008, 2–3). Our modern-day idea of "science" had "no single, coherent counterpart" during the sixteenth and seventeenth centuries, and instead what can be traced during the early modern period is "the gradual emergence of a new domain of inquiry" which "embraced both intellectual and technical approaches and was composed of what had previously been disparate disciplines and pursuits" (3). The Latin *scientia* taken from the Middle Ages, then, referred to "any rigorous and certain body of knowledge that could be organized (in precept though not always in practice)" (3).

7. Crane explores the nature of performance, expanding beyond critics like Stephen Greenblatt who have dismissed theatrical performance on the basis that it is "'fraudulent,' and that it 'evacuates everything it represents'" (2001, 169).

8. "perform, v." *OED Online*. March 2017. Oxford University Press. <http://www.oed.com/view/Entry/140780?redirectedFrom=perform> (accessed April 04, 2017). To perform in its primary definition dating back to the fourteenth century meant "To carry out in action, execute, or fulfill (a command, request, undertaking . . .); to carry into effect." But additionally, in the sixteenth and seventeenth centuries, it was defined as an action "Opposed to *promise*," or in other words "to *do*, pay, provide, etc. (something which has been promised) [emphasis mine]." To perform also meant to "carry out, or execute formally or solemnly (a public function, ceremony . . .)," or "To make, construct, or build . . . to create . . . to complete," both stemming from the late fourteenth century, and "to present . . . on stage or to an audience" starting in the sixteenth century.

9. It must be stated that such a reputable audience did not include women, who were excluded from participation, with the notable exception of Margaret Cavendish, Duchess of Newcastle, who was involved in her own literary intervention into performative, scientific, and experimental inquiry and was granted permission, once, to attend a meeting of the Royal Society.

10. In particular, the Baroque period was a "theatrical time" that witnessed the development of what Vermeer calls "techniques of the self," which "allow[ed] one to hide one's secrets and to read the secrets of others" (2012, 181).

11. Kodera situates Porta's scientific laboratory work and his literary work for the stage in the context of what he calls a "peculiar form of theatricality" (2014, 15).

12. Rebecca Schneider speaks of the concerns about "cloning and anxiety" throughout Western history of mimesis and its links to theatrical repetition (2001, 96).

13. Indeed, scientific textbooks throughout history continued to represent menstruation as a "failure" by speaking of it in terms of detritus—the "debris" of uterine lining" (Martin 1991, 486)—which found its found its analogy in the early modern period in the discardable nature of the alchemical solvent after its use.

14. For another recipe for the creation of a homunculus, see also Simon Forman's description in Ashmole MS 1494, 579, Bodleian Library, Oxford. Forman's enigmatic "recipe" describes a homunculus that while different in constitution from Paracelsus's, also physically conforms to a little man.

15. Newman and Principe note the etymological similarity between the two terms: "The Greek term *chēmeia* or *chymeia*, probably derived from the word for smelting metals (*cheein*), had encompassed a variety of metallurgical and chemical techniques by the time it was appropriated by the Arabs in the early Middle Ages. Arabic-speaking authors . . . added the definite article *al* to the transliterated noun *kīmiyā'*, to arrive at *al-kīmiyā'*, the linguistic progenitor of the Latin *alchymia* and its orthographic variants such as *alchemia* and *alchimia*" (1998, 38). By the early to mid-eighteenth century, distinctions between alchemy and chemistry were more explicit, with alchemy "being applied almost exclusively to topics related to metallic

transmutation” and with chemistry “increasingly being defined as the art of analysis and synthesis”: “thus, by that time, ‘alchemy’ and ‘chemistry’ had acquired nearly their modern meanings” (39).

16. Glanvill includes “the AEgyptians and Arabians” in his attack, as they were also associated with the ancient origins of alchemical knowledge and practice.

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