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Touching tacit knowledge: handwork as ethnographic method in a glassblowing studio

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Abstract
This article draws from an enacted ethnography conducted over four years in a glassblowing studio, where I immersed myself in the learning process to become a glassblower. Specifically, it uses the visceral ethnographic experience of handwork in glassblowing to unpack the micro-meanings of hand coordination and examine Michael Polanyi's theory of tacit knowledge 'from the body' (Ingold, 2000; Pink, 2009; Wacquant, 2015: 5). Methodologically, handwork is the 'point of production' by which to reflect upon Polanyi's analytical concepts (Wacquant, 2015: 5). Broadly engaging anthropology's study of the relation of gesture and form both within and outside of glassblowing studios and the sociology of skill, this analysis brings the body's embedded experience and constitutive power to bear on analyses of tacit knowledge to reveal how handwork is itself constitutive of form and meaning (Atkinson, 2013b; Harper, 1987; Keller and Keller, 1996; Malafourius, 2008; Marchand, 2010, 2009, 2008, 2001; Sudnow, 1978). It also grounds a reinterpretation of the proximal term in Polanyi's theory of tacit knowledge.

Keywords
body, carnal sensory, craft, embodiment, ethnography, gesture touch, glassblowing, handwork, Polanyi, tacit knowledge

This article draws from an enacted ethnography conducted over four years in a glassblowing studio, where I immersed myself in the learning process to become a glassblower. Reflecting on the visceral ethnographic experience of handwork in glassblowing, I unpack the micro-meanings of hand coordination and examine Michael Polanyi's theory of tacit knowledge '*from* the body' (Ingold, 2000; Pink, 2009; Wacquant, 2015: 5). Broadly engaging anthropology's study of the relation of gesture and form both within

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and outside of glassblowing studios and the sociology of skill, this analysis brings the body's embedded experience and constitutive power to bear on analyses of tacit knowledge to reveal how handwork is itself constitutive of form and meaning (Atkinson, 2013b; Harper, 1987; Keller and Keller, 1996; Malafourius, 2008; Marchand, 2010, 2009, 2008, 2001; Sudnow, 1978).

In Paul Atkinson's ethnographic vignette of glassblowing, he 'thinks literally' about handwork through an account of the greater material and intercorporeal choreography in which it is embedded: glassblowing pedagogy, he argues, 'is … in part, inscribed in the material arrangements of the studio, and couched in terms of those physical competences that the tools and techniques call for. … It is *centered* on techniques, tools and materials. Its embodiment lies not just in the physical bodies of the students and teachers, but is equally embodied in the materials and the physical arrangements of the studio itself' (2013a; 2013b: 403). Whereas Atkinson's one-day vignette in a glassblowing studio moves outwards, as indeed have previous analyses of my own, this article moves inwards, taking literally the modalities of handwork – the way the hands hold, squeeze, rotate, balance, and use tools and equipment – and treats such gestural minutiae as microcosms to be interpreted (O'Connor 2016a, 2007, 2006). This does not perpetuate phenomenological analyses of handwork, in which the hands are arbiters of intentionality, but rather reveals how inter- and intra-actions of hands with tools, hot glass, and equipment in glassblowing shape both form and meaning. Handwork is itself an ethnographic methodology – enacted and sensory – that positions not only the body generally, but the hands specifically as a 'point of production'; their perception is central to this analysis of tacit knowledge (Wacquant 2015: 5; Pink, 2009: 11). Thus, I turn to a consideration of handwork across the typical stages of blowing a vessel from hot glass and simultaneously, of Polanyi's theory of tacit knowledge.

Handwork, gesture, and form in hot glass vessel making

To blow a vessel, a glassblower typically gathers, marvers or blocks, and then shapes the glass using a variety of handtools while seated in the bench, respectively called gathering, marvering (or blocking), and tooling. At no point in this process do bare hands directly touch hot glass, housed at 1800°F in a furnace and continually reheated by the glassblower in the 2000°F reheating kiln called a glory hole. Instead, tools, even if only a wetted folded newspaper held in the palm, mediate the inter- and intra-actions between glassblower and hot glass.[1] This choreography includes both macro- and micro-dynamics. The practice's macro-dynamic is a coordinated collaboration of body, tools, equipment, material (breath, hot glass, and fire), and centrifugal force. Each stage of glassblowing shares this macro-dynamic. The micro-dynamics of handwork differ, however.

Gathering is the first step to blow a vessel from hot glass. To gather, the glassblower approaches a furnace with a 'blowpipe', a pipe with an uninterrupted channel running down it's center for air passage. As an assistant slides the furnace door aside, the glassblower extends the pipe over the furnace's sill and dips the pipe's end into the molten glass while rotating, much as one gathers honey with a spoon. In order to rotate, the fingers work in opposite directions: the right fingers push, while the left fingers pull. The thumb is pushing in each case. In the gather, both hands aim to achieve and maintain a

Figure 1. Gathering from the furnace.

steady rotation that is fast enough to ensure that the glass remains hot, but slow enough so that it coils around, rather than spins off the pipe. While the left hand is lowered and the right shoulder raised, such that the pipe is angled, the task of each hand differs little: the thumbs alternatively push, while the fingers of the right and left hands push and pull respectively. The hands, with palms facing inwards to achieve a grip, function 'as one' and are trailed by the glassblower's reaching body, firmly footed in her stance before the furnace. As the glassblower rotates the pipe in the molten glass, glass 'gathers' around the pipe, forming an orb.

Kip, a glass artist and scientist, claimed that gathering well is 'the biggest problem when you start blowing glass': 'You can't actually gather enough glass on the blowpipe …You take these little tiny gathers on these kinda already cold pipes, so that by the time you try to do something, things are already frozen.' In college, as an engineering major with a concentration in glass, Kip had formally studied the relation between viscosity and speed as pertaining to the ability of glass to accumulate upon itself in a glass science class, while simultaneously enrolling in studio glass classes. Despite this commitment, his technique was not proficient: 'I started to get this idea about being able to turn it to make a viscous mound, but it really didn't work.' When a visiting glass artist from Sweden arrived to guest-teach his studio glassblowing class, Kip was 'blown away' by how much and how quickly the glassblower gathered:

> We had a visiting artist from Sweden come over – I mean, that guy could gather. It wasn't so much that he gathered huge bubbles. … He had unbelievable control. If you asked him for a gather the size of a golfball, he'd go in and scoop out a golfball. If you said, I need a baseball, he'd go in and scoop out a baseball – all in one shot. I asked him if I could watch him gather. So, he dipped his arm in the water bucket, then opened the [furnace] door the whole way and went through it in slow motion. He pushed in the pipe and you could see it mound up, then he turned fast, slowed down, and scooped it out. … He sort of knew that ideally you just scoop [the pipe] across the furnace and you just sort of push the glass up on top of itself and then wrap it up and get it out. (Interview, July 20, 2006)

Kip explained that he had 'figured out that viscosity allows glass to mound up on the chalkboard' with his professor, but he had not been able to make it 'physically work'. Through observing the Swedish glassblower's scoop, Kip's focus shifted from an abstract understanding of viscosity to the practical coordination of what the sociologist, Richard Sennett, calls an 'arm assemblage' – the fingers, wrist, forearm, and in the case of the gather, the shoulder, as they appeared in relation to a 'good' gather (Sennett, 2009: 168). This assemblage, moreover, was meaningful only in relation with tools, equipment, hot glass, and the centrifugal force of rotation.

As Kip practiced these movements, rather than applied the principles of viscosity, his gathers improved:

> I didn't have the glass skills then. I wasn't used to moving the pipe so much. I was just so focused on getting it in and out that I could never make it work. But after watching this guy demonstrate for a while and trying to make it work … I was like, 'Wow', and I went from gathering a little bit to probably three times as much – that was probably my biggest learning curve. (Interview, July 20, 2006)

Through practice and emulation, the focus of Kip's awareness shifted from the particular techniques of the 'Swedish scoop' – the rotating fingers, flexing biceps, gripped blowpipe – to scooping itself, such that he attended to the whole, rather than the parts constitutive of the whole. He had developed what Polanyi calls a 'subsidiary awareness' of the components of gathering and a 'focal awareness' of the gather itself (1974: 55-56). Whereas the blowpipe is assimilated into one's body, the gather remains an *object* in a field external to that of the body's operations. The ability to attend from the blowpipe to the gather without an ability to articulate exactly how characterizes the 'functional structure of tacit knowing' while the appearance of the 'good gather' characterizes the 'phenomenal structure of tacit knowing' (Polanyi, 1967: 10-11). Given this separation between that which *attends from* and that which is *attended to*, Polanyi argues that there is a 'distance' between the terms that justifies the definition of one as 'proximal', meaning near the body or point of attachment, and the other as 'distal', meaning that which is situated away from the body or the point of attachment (1967: 11). Since focal awareness can only ever be of a distal term – to hammer well, one can only focus on the nail – tacit knowledge coordinates the proximal term of subsidiary awareness in relation to an explicit distal goal. Having incorporated the steps of gathering, Kip progressed from the 'novice stage' in which he gathered by following the rules of gathering (the non-situational aspects of skill) to the 'advanced beginner' stage in which he began to cope with the real situation and maxims replace rules (Dreyfus 2004: 177).[2] Quite literally, the relation between viscosity and speed in gathering could not be practically understood *beforehand*.

In the next stage of blowing the vessel, typically 'marvering', the glassblower lightly rolls the gathered glass back and forth over a slightly lower than hip-height steel table called a marver in order to 'skin it', that is chill its outermost layer, while slightly tapering the glass furthest from the end of the pipe.[3] After rolling the gather over the marver, the glassblower blows into the mouthpiece of the pipe, opposite of the gather, and the breath pushes into the hot glass to form a bubble. In marvering, the distal term 'appears'

Figure 2. Marvering.

in more diverse ways than in gathering; rather than some type of orb, marvering yields a variety of shapes. For example, in order to blow a cylinder, a glassblower should marver the bubble into an 'acorn' shape, namely an orb with a tapered end, while when preparing a handle for a cup, for example, the glassblower should marver a solid orb into a long finger-like piece, called a 'spaghetti bit'.

As in gathering, the marvering left and right hands coordinate to attend to an overall goal, but do not mirror each other.

When learning to marver in my beginning glassblowing class, I struggled, and my instructor, Paul, advised me to spread my grip:

> 'Ok, you are too choked up on the pipe. If you hold your hands too close together too far down the pipe, it won't give any support to the pipe and will create this very vulnerable place where the pipe can just rock in any direction – it's flimsy. Spread your hands, the left hand forward – it'll be your cradle of support – and the right hand further back – that'll be your rotating device, it'll power your marvering. Raise your right arm – that's it, you want a bit of an angle.'… He reiterated that while the left hand can assist in rotating, it really should be the back right hand which is giving the power. (Field Notes, February 2, 2005)

The hands are spread out further and the right elbow acts as a hinge to extend the right hand outwards and draw it back in so that the glass rolls back and forth over the marver; the right hand orients, while the left hand cradles. The 'cradle' of the left hand should not be perceived as passive, however, as I noted a few months later:

> All of a sudden my left palm started to reach outwards to propel the pipe towards the right. …It has itself become a generating force of movement and is indeed a cradle, but it is a moving cradle, a powerful cradle. This resonates with me in particular having held a newborn yesterday – cradling or holding is never a passive activity. It has been silly of me to 'cradle' by holding my hand stiff and still, while struggling to rotate the pipe with my right. (Field Notes, April 7, 2005)

Figure 3. Tooling in the bench.

In marvering, the glassblower propels the pipe at an angle across the marver while simultaneously cradling and pulling it. Paul's instruction made the handwork of marvering an object of focal awareness, so that I could adjust my technique and, with practice, allow the adjustments, much as Kip's scoop, to become integrated and known via the appearance of the goal – a symmetrically rounded and tapered 'acorn'. Analytically, the functional and phenomenal structures of tacit knowing are at work in marvering as in gathering and the hand's tacit knowledge *disappears* as the object of attention *appears*.

In the tooling phase, the glassblower 'blows out' and 'opens up' the marvered bubble while similarly constantly reheating the piece at the glory hole to restore the material's malleability. In contrast to marvering, the glassblower sits in a bench in order to use the handtools kept atop an adjacent table rather than stands. Among others, the standard glassblower's tools – jacks, tweezers, and shears – variously angle, constrict, push, pull, flatten, or expand the glass. In proto-industrial and traditional production, tooling was the responsibility of the gaffer, or boss, of the glassblowing team, while the team's assistants gathered and set-up the glass. Studio glassblowing, such as that at New York Glass, defined its emergence in the 1960s by the artist's control over the entire process. By the early 2000s, however, the artist-glassblower or artist at New York Glass typically worked on teams following the incorporation of the traditional choreography of teamwork into studio glassblowing in the late 1970s. In this context, a studio glassblower may gather and marver herself and also tool the glass as the team's gaffer.

Invented in Venice in 1600, the bench is crafted from wood, which serves as the gaffer's seat, and in its contemporary version, steel, rather than iron, from which the bench frame, as well as the legs supporting the seat and the 'arms' extending outward just above thigh level when seated are forged (Polak, 1975: 19). In the bench, glassblowers, who traditionally rolled their pipes over 'wooden boards attached to their thighs' can roll the pipes back and forth over the arms, making 'freer and more individual manipulations' possible since the glassblower 'could effortlessly keep his glass in constant movement, while his right hand was free to shape' (Polak, 1975: 19). In tooling in the bench, the

coordination of the left and right hands becomes even more differentiated than in marvering and gathering.

As with the cradling left hand in marvering, the rotating left hand in shaping in the bench is not passive. Quite to the contrary, if the left hand's rotation is not steady, no technique executed by the right hand will be effective. Thus, encouragement of steady rotation is *the* mantra of beginning glassblowing instructors:

> Keep your pipe rotating smooth, real steady, turn it nice and easy. … That's it, roll it out to the end of your arm's stretch, roll it using this part of your hand [he points to the pads at the top of my palm] … roll over the pipe – it's like a wave not a jerky movement, bring your fingertips into it – that's it nice and easy, now bring it back – go out, then in. Your rotations need to be steady so that you're piece will stay on center – otherwise everything you do will be off – your jacklines, blowing it out – it will all be uneven and off-center. (Field Notes, October 30, 2004)

As 'steady rotation' becomes the left hand's maxim in the bench, the right hand-tool assemblage assumes a variety of positions to manipulate the glass in a highly specialized manner and assistants may work, in effect, like additional hands, helping to rotate at times, as well as to support or expand upon the manipulations by the glassblower's right hand.[4] An asymmetry between the hands is further developed and emphasized through the coordination of the left rotating hand and right shaping hand in benchwork and an even greater diversity of forms are achieved than the orb of gathering and acorns or spaghetti bits of marvering, such as bowls, goblets or vases.

Again, an arm assemblage and even a 'body assemblage' are at work: 'a hand', Atkinson notes, 'is useless on its own, it has to be part of a bodily gestalt' (2013a: 59). In terms of Polanyi's theory of tacit knowledge, the meaning of tooling in the bench is understood, as in gathering and marvering, as displaced away from oneself in the appearance of the object. Such a phenomenological analysis of handwork is retrospective in character. That is, the handwork that attends and reaches toward the distal term is known and made meaningful via the appearance of the distal term; it's attribute is 'in order to' rather than 'for itself'. Within this framework, the appearance of three-dimensional forms across the techniques of gathering, marvering and shaping distinguish handwork rather than the handwork's coordination itself.

Theorizing hands as that which 'lead us toward things' and 'define a pragmatic area around the body that has significance for movement, action, attention, and accomplishing tasks,' as Shaun Gallagher (2013) argues, employs a framework of intentionality that falls short of fully accounting for the manner in which the outcomes of handwork materialize the 'choreography of the hands'; it merges the specificities of hand coordination into a generalized proximal term and the relation of gesture to the process of becoming is lost (Makovicky, 2010: 77). Handwork in glassblowing is embedded within a choreography of materialities, including hot glass, tools, equipment, and others (Atkinson, 2013a, 2013b; O'Connor, 2016a, 2009, 2006). Yet another choreography lies within the bones, sinews, muscles, and their gestures. As I moved from a novitiate experience of glassblowing – the all-consuming experience of heat and weight as noted by Atkinson (2013b) – to an advanced beginner stage, I noted how handwork's gestures mirrored the form being produced and moreover, variously made the experience of making at any given moment meaningful.

Drawing upon Leroi-Gourhan's *Gesture and Speech* (1964), anthropologists Nicolette Makovicky (2010) and Tim Ingold (2011), in the cases of lace-making and sawing a plank respectively, argue that 'rhythm creates form': 'Like a stylized dance,' Makovicky notes, 'the movements of the hands are rhythmically repeated in order to produce a material expression' (Leroi-Gourhan, 1993: 309; Makovicky, 2010: 81).[5] Handwork is not only means to an end – a proximal term anchoring attention toward a distal term – but is *co-present* in the unfolding appearance of the goal. Whitehead calls this the 'principle of process': '*how* an entity *becomes* constitutes *what* that actual entity is'. 'Its "being" is constituted by its "becoming" ' (Whitehead, 1978: 23, emphasis in original).[6] As noted in Malafouris' analysis of the potter's handwork: 'It is at the potter's fingers that the form and shape of the vessel is perceived as it gradually emerges in the interactive tension between the centrifugal force and the texture of the wet clay' (2008: 34). Form and awareness emerge not simply in relation to the end of an arc of intentionality, but within and from the hands-in-practice; it is present in and emergent from the hands' gestures and their coordination with undulating hot glass, stagnating cooling glass, equipment and tools – their complex, embedded, involved and touching configurations.[7]

Atkinson argues that the 'gaze of the craft', namely the interaction of 'embodied skills and educated eyes', characterizes the craft of ethnography as much as that of a studio, like glassblowing (2013b: 399; 2013a: 62).[8] In my refinement of this practical gaze over time – an interaction of practicing glassblowing as well as writing about glassblowing – the analytical purchase of handwork emerged much like the practical knowledge of skill itself. Methodologically, it is such emergent 'analytical themes and ideas … [that] then guide further, more focused and directed fieldwork, in turn yielding more detailed and finely tuned analytical ideas (Atkinson, 2014:11). Handwork – a carnal and sensory method – revealed the relation of gesture, or more specifically, a gestural system, to not only the form being produced, but also the meaning of that moment of making.[9] Embodied knowledge, as discussed by anthropologist Trevor Marchand in the case of British woodworkers, 'constitutes a *knowing how from* the body' and 'is not amenable to description or explanation in propositional thought or language' (2008: 64).[10] Embodied knowledge not only grounds 'practical skills', but also thinking itself: handwork, as a method, 'touched' Polanyi's concept of the proximal term of tacit knowledge and revealed its failure to accommodate handwork's generative undulations.

In the following consideration of handwork across the three stages of blowing a vessel, I unpack the proximal term of tacit knowledge vis-à-vis its carnal and sensory experience – a kinesthetic and intra-corporeal take on the micro-ethnographic method typically used to study social interaction (Pink, 2009: 8; Garcez, 1997: 187; Atkinson, 2007: 191). This makes manifest not only the relation of a gestural system to form, but also of a gestural system to the experience of the meaning of making. Theorizing the proximal term of tacit knowledge as the silent handmaiden of explicit goals fails to account for how specific corporeal and material configurations of handwork generate form and meaning.

Handwork and the meaning of practice in hot glass vessel making

Consider the handwork of gathering – those hands turned inward and rotating by the push of the right fingers, pull of the left, push of both thumbs, and their embodiment of and

extension through the pipe. Though the left and right hands are poised palm-to-palm such that one hand could grasp, while the other could manipulate, they work in a highly integrated manner, mirroring each other's movements. In gathering, which capitalizes upon the hand's grip capacity, both left and right hands extend themselves 'as one' through the blowpipe, which in kind, demands certain support, and, as such, touch the glass in a particular manner. Like an arm of a ladle, the hands and 'arm assemblage', that 'bodily gestalt' noted by Atkinson to be inclusive of 'balance, posture, choreography', *scoop* (2013a: 59).

In gathering, scooping is meaningful beyond the appearance of the orb as the event of the gather. In glassblowing, the gather is a quintessentially relished moment, in which the glassblower measures the gather's potential and promise; it is the nascent object. Never again in the process of blowing a vessel will the glass be so hot or contain so many possibilities. This – the manner of becoming – is meaningful aside from the appearance of the orb; *how* one touches rather than that one touches matters. A scoop *retrieves* and *presents* from the furnace's tank of molten glass using heat and the centrifugal force of rotation. This handwork, understood as a gestural system of hands, tools and material, presents a place – in answer to Kevin Hetherington's call to examine how the encounter between the hands and the materiality of the world shape 'a scopic we call place' – that might be conceived as a disposition, that is natality, wherein the hot glass presents its potential (2003: 1938–1939). Bodily posture postures sensibility, the experience of the choreography in which one is caught up. The orb created by the scooping handwork of gathering not only makes the gesture of gathering manifest formally – the cupped-like hands and the orb – but also, in the fact of presenting, the experience of beginning.

As the glassblower progresses through the stages of blowing a vessel, that which appears, classically understood as the distal term, differs as the modality of touching, classically understood as the proximal term, changes. This is not purely a function of instrumentality. That is, handwork's choreography cannot simply be understood in relation to the intended object of production, i.e. deduced from the needs of a model.[11] To further explore the emergence of form and the meaning of making from within the gestural system of handwork, consider marvering in comparison to gathering. In marvering, touching becomes more complex as handwork not only capitalizes upon the body's asymmetry as the left hand cradles and the right hand motors and orients, but also integrates an external object in addition to the pipe, namely the marver itself. As such, the left hand becomes an intermediary between the marver and the right hand.

To balance the glass on the pipe between the marver and rotating hands is a feat of coordination often dispensed with for beginners, as in Kip's beginning glassblowing class:

> [The teacher said], 'Go in [the furnace], you turn it over once, you come out and then you roll it on this metal table until it's cold … It was lopsided, smushed on one side – it looked more like a paddle. Because I wouldn't turn – you know, I'd turn it once, lift it up, pull it out of the furnace, walk over to the table, smack it down, it'd kind of puddle out and then I'd roll it over itself, back and forth until it got cold. (Interview, July 20, 2006)

Whereas the scoop of gathering manipulated the glass around the pipe, marvering brings the glass between the pipe and an external object. The hands and arm assemblage, which express a more highly differentiated integration, *sweep* the glass against and over the

marver, as the almost lifting power of the orienting right hand *buoys* the glass. While the goal of sweeping and buoying the glass is to avoid creating a lopsided bubble, this goal is met not only with attention to form, but also to thermal dynamics as expressed in a quip used to encourage beginning glassblowers to roll the glass lightly and quickly over the marver to minimize the loss of malleability: 'steel steals'. As an interaction between the marver and the pipe-glass entity, marvering plays the thermal dynamics of hot glass and cold steel against each other to cool the gathered orb's exterior surface. The glassblower then blows into the orb's still-hot interior and creates a hollow in the orb that eventually distinguishes the object as a vessel. Whereas, the gathering scoop retrieves and presents possibility, the gestural system of marvering, it's sweep and buoy, explicitly frame and bound the gather and the experience of natality gives way to delimitation and containment. The relation between corporeal posture and the posturing of sensibility can be seen by further in the next stage of glassblowing, called 'tooling', which scripts the roughly contained, or delimited, glass.

In tooling, to blow out the vessel, the glassblower must first blow out the shoulders, that area of the bubble closest to the pipe, which did not touch the marver and thus blew out more than the orb's tapered end. Seated in the bench, the glassblower's right hand holds a tool called the 'jacks', outsized tweezers with an upside-down U-shaped hinge and blades shaped like pointed butter knifes, palm up, above and horizontal to the bubble and 'rides' the tapered angle set by the marver like a surfboard to a wave while an assistant blows. Next, the glassblower 'puts in the neckline' by constricting, i.e. squeezing, the area between the blown-out shoulder and the pipe whilst rocking the vertically held jacks back and forth. This creates a valley, which separates the glass that is around the end of the pipe from the glass of the vessel-to-be, which is worked off the pipe. Following 'necking', the glassblower continues to blow out the remaining body of the piece. For example, if blowing a traditional straight-sided cylinder, the glassblower rides the entire bubble with the horizontally-placed jacks to form a straight edge. After flattening the bottom of the straight-edged bubble, the shaped bubble is ready to be transferred to a solid pipe, called a punty for the next stage of blowing a vessel in the bench – 'opening up'.

A transfer flips the glass, so that the shoulders are furthest from the pipe and can in turn be tooled. Opening up the bubble, like blowing up the bubble, is achieved via diverse positions and manipulations by the right hand as the left hand rotates that may include techniques like jacking, but also 'tweezing', 'crimping', 'trimming' or 'puffing out the shoulders'. These techniques employ a variety of handtools held by the right hand, including the jacks, 'tweezers', 'shears', 'choffes', 'blocks' or 'paddles', which variously 'ride', 'cut' or 'flatten' the glass. In tooling, not only do the hands collaborate in a more highly asymmetrical manner than in gathering or marvering, but they also interact not only with heat and a surface, but as many surfaces as there are possibilities for the tools to touch the glass and as many angles or pressures, for example, as are possible for the right hand to assume. Once again, handwork in the bench is a matter of a greater 'bodily gestalt', inclusive of, Atkinson notes, 'posture, the angles of the body, the rhythms of the body, the co-ordination of different workers' bodies in the confined space of the studio', but it is also matter strictly concerning the right hand; there are no procedures, as also observed by Atkinson, for left-handed persons and the bench, in particular, is strictly set up to aid the right hand (2013a: 59; 2013b: 398). Whereas both hands are charged with

rotating in the cases of gathering and marvering, in tooling hands no longer rotate in mirrored unison so as to scoop or in a greater relation of asymmetry in inter- and intra-action with equipment, tools and thermal dynamics so as to sweep and buoy, but rather, the right hand specifically angles, compresses, cuts, flattens, opens, pulls, pokes, cups, spreads, contracts, curls and extends in collaboration with handtools, thermal dynamics and other glassblowers, as the left rotates.

Such coordination of differentiated handwork is, for the psychologist, Yves Giuard, characterized by difference in the 'spatio-temporal' dimension of the hands: the movements of the right hand are 'fast, brief and usually repetitive,' while those of the left are 'slow [and] postural' (Wilson 1998: 162). Technically speaking, 'the spatial and temporal scales of movement of the two hands were different, the dominant being "micrometric" and the nondominant being "macrometric"' (Wilson 1998: 160). In this context, the macrometric movement of the left hand frames, that is "sets and confines the spatial context in which the 'skilled' movement will take place" (Wilson 1998: 160). Though both hands attend to the object that is being made at the end of the pipe and, in this sense, function as the proximal term of tacit knowledge as did the hands in gathering and marvering, the stationary body-bench allows for the hands to work in a highly differentiated matter, such that while the left hand frames, the right hand *scripts.* From the scriptive gestures of tooling, unlike the sweeping and buoying handwork of marvering or the scooping handwork of gathering, emerge highly specialized forms: amphoras, pitchers, plates and bowls, which circulate within the broader social world as gifts, commodities or Work. Tooling's handwork, its gestural system, not only contains and delimits natality as did marvering, but it also scripts the glass with specialized social meanings.

The inter- and intra-actions of handwork create dispositions or parameters across the stages of blowing a vessel within which the world becomes meaningful. By 'touching tacit knowledge', that is practicing the gestural system of handwork as a method by which to understand the generation and experience of both form and the meaning of making, the proximal term, much less than sitting at a distance from the distal term, is seen to be the manner of becoming. As such, the meaning of handwork is not solely 'displaced' from the body, characterizing the 'semantic aspect of tacit knowing' (1967: 13) as Polanyi argues, but rather is co-present, emergent from, and *of* an animate and animated body. The body is not simply a 'vehicle for the expression of extra-sensory, cultural values' as Tim Ingold (2000) argues against David Howes (2003), but rather is itself generative not only in the correspondence of gesture and form, but also the meaning and experience of making (Ingold, 2000: 285; Pink, 2009: 10). The proximal term is an heterogeneous system of touching corporealities rather than a generalized term of intentionality confined to an arcing extension toward a distal term; it is co-present with and thus some type of place in which form, as well as the meaning of action, resides.

One might suggest that Polanyi addresses this touch dimension of tacit knowledge by way of 'the ontological aspect of tacit knowing', namely the 'understanding of the comprehensive entity' (1967: 13). But, this phenomenological understanding of meaning fails to account for that inter- and intra-active choreography of bodies and materialities that birth form and the meanings of practice within the parameters of that choreography – whether dialing out from or into handwork. Polanyi discusses the 'touch' of a pianist as that which is responsible for that person's particular style of expression, but equating

touch with stylistic expression instrumentalizes it as an exercise of Bourdieusian 'distinction', namely deviation from an internalized 'common style' (Polanyi 1974: 50; Bourdieu 1990: 60). In this vein, one could study the 'contours of competence', namely how shared 'conventions … [are] differentially distributed' (Atkinson 2014: 115). My query into handwork, however, regards 'touch' as a generative gestural system rather than a manner of expression. It is from a gestural system that springs forth both form and the sensibility afforded to the maker in action. From gathering come orbs and natality, from marvering comes acorns and containment, and from tooling comes any variety of shapes and specialized cultural scripts that embed, extend and integrate the glassblower and her team into a social world beyond their practice and the studio. The proximal term of tacit knowledge is a gestural system constitutive of not only form, but also the experience of making known to the touching ethnographer from the inside-out.

Conclusion

An object's being is its becoming, as seen in the preceding consideration of the gestural system of handwork. Moreover, the maker's experience of making emerges from these dynamic processes. Embedded and enacted ethnographic research that theorizes not only from the body, but specifically from the lived and sensuous experience of handwork, reveals the constitutive power of the animate and animated hands. While Polanyi's account of the proximal term integrates practice and corporeal intentionality into theories of knowledge, *how* the body – in the case of glassblowing, the choreography of handwork with glass, tools, and equipment – brings the object into appearance, rather simply *that* it does, is lost insofar as the event of the appearance of the object rather than the process of appearing is the focus. Methodologically, the hands' perceptual capacity dialogued with analytical concepts to reveal this lacuna and I used this awareness to refine the proximal term of tacit knowledge as described by Polanyi and propose an understanding of handwork as heterogeneous gestural system of corporealities and materialities that bears not only form but also the meaning of making. This contribution bears witness to the craft-like basis of knowledge production – a phenomenon that embedded, enacted and sensory ethnography is well-suited to unpack.

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Notes

1. On intra-corporeality, see Barad (2003) and, in the case of glassblowing, O'Connor (2016a). On the question of material agency, see Malafouris (2008).
2. A 'maxim' refers to that which the student recognizes from previous experience (Dreyfus 2004: 177); See O'Connor (2005) for an analysis of the development of skill proficiency in glassblowing.
3. A technique called 'blocking', which utilizes roughly hewn, ladle-like wooden blocks, may be used instead of marvering. It similarly prepares the glass for the tooling stage.
4. See O'Connor (2016a) for a discussion of teamwork and intercorporeality.
5. See Ingold (2011: 53–58; 2013: 45, 115).

6. See also Farías and Wilkie (2016: 5).
7. See also Ingold (2013: 33–45, 109–124).
8. 'Ethnographic fieldwork is as much a matter of "craft" knowledge as it is a matter of epistemology or scientific method' (Atkinson, 2014: 10); '…[E]thnographic research … is creative work, dependent on improvisation that is in turn dependent on repetitive, disciplined work. … Like the craft worker, the ethnographer engages directly with her or his materials, physically and imaginatively' (Atkinson 2013a: 63).
9. 'The development of analytic themes and ideas is an emergent property of our engagement with the field, and of our systematic reflections on the data … These analytic ideas do not leap out of the data….Data, irrespective of their physical form, are something to think with and think through" (Atkinson, 2014: 11); For further discussion on the relations of ethnographic experience, writing and analysis, see Pink, 2009: 132–154.
10. For a discussion of embodied knowledge in glassblowing, see O'Connor (2005).
11. See Ingold on hylomorphism (2013: 17–31); For a discussion of the 'specialization of work' according to the object of production and the salience of models in fabrication, see Arendt (1998: 123, 140–144). On the role of models, induction and deduction in glassblowing prototyping see O'Connor and Peck (2016b).

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