

How can experience inform the practitioner's tacit knowledge and mediate the distance in glass making?

Design Thinking and Material Practices

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Abstract

In this essay, tacit knowledge is explored through the phenomenological experience of tool-being, indwelling, sensory experience and material thinking. This is observed through Martin Heidegger's theory of Tool-being and praxical knowledge in relation to Michael Polanyi's concepts of awareness, activity and indwelling. This original relationship of tool to craftsperson indwells in practice, developing the practitioner's tacit knowledge. Through experimentation, material thinking evolves and the maker thinks in terms of the glass. These notions combined bridge the physical distance in glass making thus the experience is a collaboration of craftsperson, tool and material, each taking on important roles in the making process.

How can experience inform the practitioner's tacit knowledge and mediate the distance in glass making?

Due to the nature of the material, glass does not allow direct contact between practitioner and material when making. Consequently, there is a physical distance in the making process; where the craftsman relies on their tacit knowledge to produce their work. This distance will be challenged in this essay and demonstrate how tacit knowledge can bridge the physical boundary. Tacit knowledge will be explored through four components that are: tool-being, indwelling, sensory experience and material thinking. Michael Polanyi's ideas of awareness and activity (1962) will be analysed to show how the consistent use of tools become an extension of the body, known as indwelling. This will then be discussed in conjunction with Martin Heidegger's notion of tool-being and praxical knowledge (1962). This highlights how a maker's encounters with their tools, creates an understanding, forming a relationship between the practitioner and their tools. The sensory experience includes the use of all senses, not being limited to touch and tactility. The use of the senses and indwelling may be referred to as embodied knowledge and so it is a phenomenological experience. Explorative and experimental process will be the final component. This will demonstrate how material intelligence is gained, which allows the practitioner to learn about the properties of the glass. These four components rely on each other to inform the practitioner's tacit knowledge.

It has been suggested that knowledge can be considered in two forms, tacit and explicit. These forms of knowledge are unlike in character and acquired in different ways (Collins, H. 2019). Explicit knowledge can be articulated and expressed freely through books, note taking and sharing of information. It is typically logical and objective and can be transferred easily. Whereas tacit knowledge does not rely on language but instead through example and personal experience. This type of knowledge is subjective, cognitive and experimental. Due to its perceptive quality, it is not as easily transferable as it requires face to face interaction and often cannot be articulated for understanding. Learning the information and skills through experience makes tacit knowledge a personal and phenomenological experience. Sorri suggests that tacit knowledge is more fundamental than explicit, as explicit knowledge evolves from tacit knowledge but not vice versa (Sorri, M. 1994). Polanyi states "we can know more than we can tell" meaning that explicit knowledge is not needed for a skill of tacit knowing (Polanyi, M. 2009). This implies that there is no need for a practitioner to articulate how something is made in order to make it, and being able to articulate it, does not mean the individual knows how to actually make the object. Therefore, the knowledge of making is tacit.

Polanyi outlines his theory of cognition that develops tacit knowledge through two dimensions, awareness and activity. He suggests that awareness happens in states that are subsidiary and focal; these types of awareness occur simultaneously. An example of this can happen when reading. The reader is focally aware of the information on the page and subsidiary aware of the text size and font. If they were to divert their focal awareness to the details of the text, they would not be understanding the information they were reading and so would need to revert their focal attention back to the information. Polanyi's example of this, is through a blind man's use of a mobility stick (Polanyi, M. 1962). The man is focally aware of the ground by the shocks communicated through the stick to the muscles in his hand and arm. However, he is subsidiary aware of the stick in his hand. Through repeated use of the stick, the stick becomes an extension of the man, allowing him to be focused on his surroundings and not of the stick. Polanyi calls this experience indwelling (Polanyi, M. 1962). The other dimension, he labels as activity, lies between bodily activity and conceptual activity (Polanyi, M. 1962). Bodily activity is non-verbal and concerns the body, whereas conceptual activity is verbal and concerns the mind. He states that as embodied beings, humans cannot experience activity as solely conceptual, having no bodily aspect. The same can be said that no experience can occur with no mental activity, therefore, human activity is a mix of both (Polanyi, M. 1962). Activity involves constant judgement making, but these are not exclusively made by the mind. During a bodily activity, such as walking, the body can make judgements to avoid uneven ground while the mind is distracted in conversation. He illustrates these thought processes through continuums for each dimension. He states that tacit knowledge occurs when embodied activity meets subsidiary awareness and explicit knowledge occurs when conceptual activity meets focal awareness.

Heidegger uses the term "Dasein" to mean "being (t)here". He limits this term to humans, as our existence has no certainty and so our being is different to that of an entity with specific purpose, "the essence of Dasein lies in its existence" therefore, "expressing not its 'what' ... but its being" (Heidegger, M. 1962). This implies that the phenomenological experience belongs to the practitioner and not the tool. In *Being and Time*, he discusses the tool analysis of equip-mentality and praxical learning. Heidegger states that practical learning is not developed through explicitly learning the information but by handling the materials and tools and negotiating them, thus creating an original relationship through experience (Bolt, B. 2006). By handling the tools, materials and thoughts, experiential learning forms and processes are learnt in a phenomenological way. He suggests that in everyday life, tools, things and entities are not noticed in themselves and are forgotten by habitual acts. These daily entities get lost in their use, in order to do or achieve a goal (Bolt, B. 2010). When a practitioner makes their work, they create a space for the tools to be noticed as entities in themselves. Being forced to

consider the relationships that occur between the tool, material, thought and maker, as without one, the idea cannot come to fruition. Learning about the tools in their own right informs the maker of their own practice. Handling and dealing with the entities enable the practitioner to think through practice. In his tool-being analysis, Heidegger refers to this thinking as praxical understanding and material thinking (Heidegger, M. 1962). This thinking puts the tools and equipment to use by encounter. He argues there are two ways in which the craftsperson encounters their tools, through handling “readiness-to-hand” and by looking “present-to-hand” (Bolt, B. 2010). When handling the tool, the tool is being encountered by the hand, discovering it through experience. A tool being “presented” to the maker in the form of an image does not inform the maker of its qualities (Bolt, B. 2010). The more the tool is used the more original the relationship of the practitioner to tool evolves. By looking at the tool, the maker doesn’t know it any better, but by using it, the maker is informed of its handiness (Bolt, B. 2010). He suggests that this notion is not blind and has its own way of seeing that directs the process and gives it its “thingly” quality (Heidegger, M. 1962). Meaning the craftsperson’s handling of the tools allows their processes to be discovered. These discoveries of the tool, material and thinking are formed through their attentive handling, not by them being used as a means to an end.

Heidegger argues that an understanding of the process is not cognitive but developed through handling. This could be seen through a series of trial-and-error where the maker develops their material thinking. A sequence of trial-and-error experiments can build a series of samples that show a movement of thoughts. Dealing with the problem opens a different way of thinking, producing an original relationship to the tools and material. Therefore, an understanding of the tools and material unfolds from working with them. Heidegger’s theories here focus on the human tool relationship and how a practitioners handling shows an awareness and new way of thinking about the materials that cannot happen through uninformed and well experienced use.

When understanding tacit knowledge in craft, it is most frequently researched and understood through processes of ceramics. Clay as a material is unique, in its natural state it is very malleable and responsive, therefore, it can be manipulated into shape easily through direct contact of the hands to material. When discussing her practice, Kemske draws on the boundaries of the maker and material, known as encroachment (Kemske, B. 2009). She explains how at first touch, the clay is cold and damp but after a few moments of handling the clay, the material becomes warm. This makes the ceramicist aware of where they have held the clay and how they are affecting the clay as much as the clay is affecting them. Kemske explains how touch is the practitioner’s most direct sense; it is tangible and grounding giving them a sense of place in their environments (Kemske, B. 2009). When working with clay,

moisture content is an imperative aspect to the making process and by handling the material, the maker is informed of its state and is then able to make a judgement of its potential. If the clay is too dry or too wet the ceramicist would recognise that it would need to be soaked or dried so that it became a malleable consistency for throwing or sculpting. Sight can also be important, as the practitioner can visually tell how high the ceramic has been fired. If the surface of porcelain or stoneware is light and porous it would have been fired at a low temperature. However, if the surface had vitrified it would have been high fired, making the material stronger and waterproof (Adamson, G 2018). This demonstrates how tacit knowledge in ceramics is developed through direct contact with the material, making it a tactile and intuitive experience. In contrast to this, glass is only responsive when heated to high temperatures. Consequently, it does not allow direct hand to material contact when sculpting. Instead, the practitioners rely on tools and equipment to create their work. The glass can be manipulated into shape through processes such as kiln forming, casting and glass blowing.

In glass blowing, the practitioner uses the blowpipe to gather the hot glass from the furnace. Due to the heat of the furnace, both the glass and furnace glow making it difficult to see the glass. In order to gather the correct amount of glass and do it proficiently, they must balance the rod on the ledge of the furnace and rotate it clockwise. This helps the glass gather around the rod and stops it from falling into the furnace below three inches where the glass is molten (O'Connor, E. 2007). Glass blower Erin O'Connor says that an apprentice will be focally aware of each step when learning to gather glass, however, over time these steps will become subsidiary and intuitive. She states, when gathering and walking to her bench she "did not consciously decide to continue to twirl when removing the blowpipe from the furnace, only sensed that" (O'Connor, E. 2007). This shows how her tacit knowledge was regulating her "bodily activity" and "subsidiary awareness" manoeuvring the blowpipe around her workshop while also balancing the hot glass from the furnace. To shape the glass, the maker may hold wet newspapers against the hot glass to create the form. The wet newspapers allow the practitioner to feel the form of the glass and shape it, giving a sense of touching the glass with a safe barrier. Tools such as picks and tweezers may also be used to pinch or stretch the glass into shape. This use of equipment can demonstrate Polanyi's ideas of indwelling, in that the glass blower's tools are an extension of the body (Polanyi, M. 1962). Their "subsidiary awareness" is used in rotating the blowpipe at the correct pace and while being "focally aware" to form the glass with their tools (Polanyi, M. 1962).



Figure 1- *Gatherings from Furnace*, Erin O'Connor, 2007

On the other hand, in processes such as kiln forming and casting, the maker will have no contact at all when the glass is heated. Instead, they are required prepare moulds or structures for the glass to form around. To cast glass, the maker would first have to sculpt their object into wax. A plaster mould would then be made around the object leaving a reservoir for the glass to flow through. When making the mould, the practitioner would plan how the glass would flow into the mould and completely fill the void. This is done by altering the position of the object so the glass flows and fills the mould affectively. Sprues are also added to help the flow of the glass and allow the air to escape. In kiln forming, a structure would be made for the glass to slump over. These forms would be constructed so when the glass heats, it softens and slumps to the shape of the structure while being supported. At the top temperature, the kiln is opened to see if the glass has taken shape before the kiln enters the annealing cycle where the glass cools and solidifies back to its rigid state (Cummings, K. 2009). Again, these structures are formed with the glass's material properties in mind. Though both of these processes do not involve the glass in the early making stages, the material intelligence of knowing how the glass will behave is thought of throughout the process.

The processes above show there is an absence of physical contact with the material when producing work, meaning there is a distance in making. This requires the practitioner to

prepare and make amendments to the process based on their material knowledge gained from experience or “Dasein” in Heideggerian terms. They then must step back and allow the glass to take shape no longer having control. The success of the process is based on the makers tacit knowledge of material intelligence and handiness and indwelling of the equipment. It can be suggested that tacit knowledge is therefore a formula of material intelligence and embodied knowledge. Material intelligence referring to the understanding of material properties and behaviours. Embodied knowledge, meaning a phenomenological experience of understanding the tools and equipment and indwelling them as an extension of the body. The use of the senses can also be an example of embodied knowledge. When cutting glass, the maker scores the surface with a glass cutter, this makes a zipping noise informing the maker on the quality of the score. The score line can also be seen, if it is a good score, it will appear shallow and continuous without any fragments. Another instance where sight is important is when firing the glass. An experienced practitioner can estimate the temperature of the glass from looking at it, enabling them to alter the kiln cycle if needed during the firing. For example, in kiln forming, the glass may need to be held at the top temperature for longer, if it has not taken shape or increase the temperature if it is struggling to slump. Alternatively, the kiln may need to be opened to allow the glass to cool and not slump into the shape any further. This suggests the glass making experience requires a tacit knowledge that is derived through sight and sound rather than touch of the material.

Rubin makes note to basketball coach, John Wooden’s comments on the first lesson in coaching. He states that in order to be successful in the sport, the player must know how to appropriately put on their socks to avoid blisters and tie their laces so they do not come loose during a game (Rubin, R. 2023). Rubin compares this to an artist’s practice to demonstrate how understanding the basics of the material is imperative to any making process. When working with glass, these first lessons can be knowing how to properly handle, cut and clean the glass as initial steps of any process. Understanding good preparation of the glass, means variables which may later impede on the outcomes of explorations, are consistently controlled. This also informs the maker of how the material is truly behaving and not to be confused with external factors. Making good habits of these details improve the probability of the experiments being a success and therefore becomes tacit knowledge; happening at the start of each method without question. Tim Ingold argues the difference of habit and skill, he states that habits depend on environmental factors whereas skill is challenged by external factors (Ingold, T. 2018). It could be argued that in practice, habits are formed from fundamental knowledge of material and process, likening to the notion of glass handling and care. He suggests that habit is a repetitive pattern of behaviour that “falls beneath the horizon of awareness”, this could be compared to Polanyi’s “subsidiary awareness”. Instead of a skilled craftsperson being

unaware of their activity, he states that they have “heightened awareness” also known as “concentration” (Ingold, T. 2018). This “concentration” or “focal awareness” shows the maker is aware of what they are doing as they are thinking in terms of the material in order to achieve the final piece. However, Polanyi’s ideas of “activity” states, if the mind is distracted when making, the body can still make decisions informed by experience (Polanyi, M. 1962).

Having sufficient fundamental knowledge of the glass allows the maker to push the materials limits through experimentation and exploration. Artist Richard Serra made a verb list that he described as “actions to relate to oneself, material, place, and process” (MoMA, 2016). This led him to discover more within his practice and push the mediums he worked with. This style of work can be used as example for how a craftsperson can push the limits of working with glass. Using different verbs for experimental inspiration, makes the practitioner look at the glass from a new perspective and pushes them to find new ways of developing methods. For example, “to inlay” could mean to layer, encapsulate or embed something into the glass. Thus, pushing forwards the makers knowledge and experience of working with the material.

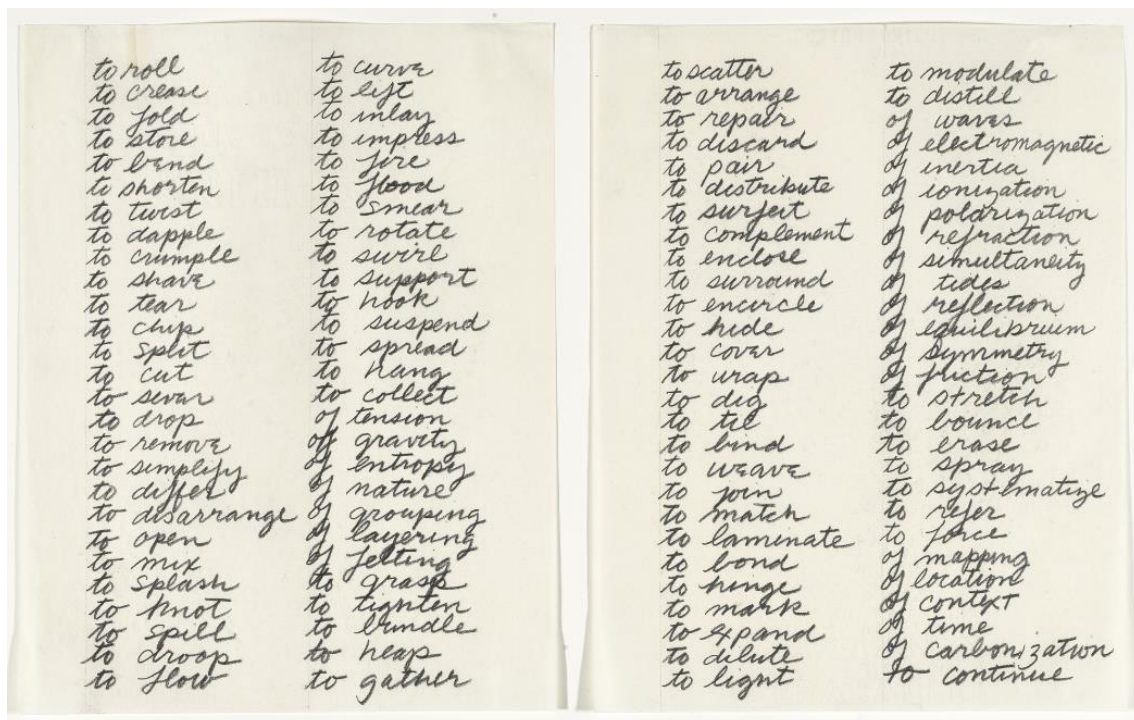


Figure 2- Verb List, Richard Serra, 1967

Eleanor Glover suggests to work in a similar explorative way stating, “I push materials to their limits and often treat one material as if it was another” (Woolley, M. 2016). This approach to experimental work goes hand in hand with the ideas of Serra’s, in that using the material in a way that it is not intended for, opens new possibilities in understanding its potential and

learning its behaviour in a new context. With a background in graphic design, Glover transfers her knowledge of one discipline to another through her experimentation. She goes on to say “I sew metal or ½ mm skin ply on an industrial sewing machine using and leather needle” and “harden paper with liquid fibreglass” showing how her investigations can lead to new discoveries (Woolley, M. 2016). These processes can likewise aid the practitioner in learning the handiness of the tools. Knowing this information helps them to develop their dexterity of the tools, supporting the notion of them becoming an extension of the body and forming an original relationship.

Bayles and Orland discuss materiality and material potential. All materials have potential and without the participation of the practitioner they remain potential, though they also have limits (Bayles, D., & Orland, T. 2001). They state, “Ink wants to flow, but not across just any surface; clay wants to hold a shape, but not just any shape” therefore the materials do exactly what your hands tell them to do (Bayles, D., & Orland, T. 2001). However, as previously stated, glass cannot be sculpted by hand. They reference Ben Shahn “the painter who stands before an empty canvas must think in terms of the paint” (Shahn, B. 1957). This can be echoed in the circumstance of glass making. Though the glass cannot be touched, the maker must think in terms of the glass. Meaning processes are tailored to the glass’s needs despite not touching the material throughout the process. From an explorative point of view, the material knowledge is then gained from noticing what really happens to the glass as it is tested through experiments. The way the material responds or resists can inform the practitioner of new methods. Trial-and-error is a very heuristic and organic approach to learning about the glass and tools. It allows the individual to learn through their own experience, from “content of the mind to quality of the material” providing the opportunity for problem solving (Bayles, D., & Orland, T. 2001) (Mitchell, T. M., Utgoff, P. E., & Banerji, R. 1983). Working through the barriers of the material enables the maker to respond authentically and lets them learn more deeply about the glass than they would have through witnessing a demonstration that worked flawlessly. When “circumspection” or the new emerges, meanings and knowledge evolve from the use of tools and materials, forming ideas that had not already been formed (Heidegger, M. 1962) (Bolt, B. 2010). Through a series of trial-and-error explorations the maker experiences the first error and then corrects it the second time. The practitioner is “focally aware” during these initial stages reiterating Ingold’s idea that awareness intervenes and “interrupts the otherwise involuntary flow or habitual action” (Ingold, T. 2018) (Polanyi, M. 1962). When the experiment does not work the practitioner is able to reflect on the process to learn what went wrong and evaluate the outcomes. Through repetition of the process, the eye becomes accustomed and tacit knowledge is learnt, as the maker indwells the information. It could be argued that tacit knowledge is only understood when the maker can recreate a successful

experiment, reinforcing their knowledge of the glass, and not being successful by coincidence. At the stages of trial-and-error the practitioner has opportunities move the process from “focal awareness” and “conceptual activity” to “subsidiary awareness” and “bodily activity” thus forming tacit knowledge (Polanyi, M.1962). The maker then indwells the experience and gains material thinking. The experimental processes show tacit knowledge can be explicit as it has reasoning of why processes do not work, but it does not have to be taught explicitly in order to be learnt. This links back to Heidegger’s ideas that understanding is not cognitive but comes from the handling and dealings with things.

In summary, practitioners develop their tacit knowledge through the encounter and experience of tools and material. These encounters build a tacit knowledge of material thinking, sensory experience, tool-being and indwelling. Heidegger’s theory of the encounter and handiness of the tool allows the maker to experience the tool and gain an original relationship. Through consistent use of the tool, it becomes an extension of the body, reiterating Polanyi’s idea of indwelling. Thus, the practitioner’s focus when first interacting with the tool becomes subsidiary in practice. After indwelling the tools, the practitioners focus is then centred on the glass in the making process. These processes require a concerned concentration focused on being attentive and sensitive to the glass. Explorative and experimental processes push the glass’s limits, opening new ways of thinking. These encounters allow the maker to learn more about the glass’s properties, behaviours and limits, developing their material intelligence and praxical knowledge. This knowledge allows the practitioner to predict its behaviour and think in terms of the glass, and so tools and equipment are used to form the glass, instead of the practitioner having direct contact. Through experience, these concepts strengthen the practitioner’s tacit knowledge and bridge the physical distance in glass making. For the craftsperson, the materials are not inert objects but have their own intelligence. The tools and materials come to life when they interact with the craftsperson, therefore the work is a collaboration of the practitioner, tool, material and thought. Meaning, the craftsperson is not the sole maker. This mediates an ethical understanding of practice and process, known as tacit knowledge.

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