Patterns and embodiment: An examination of human knowing in "A Day Made of Glass"

Mary Kathleen Speckhard
Iowa State University

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Patterns and embodiment: An examination of human knowing in “A Day Made of Glass”

by

Mary Kathleen Speckhard

A thesis submitted to the graduate faculty
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MASTER OF ARTS

Major: Rhetoric, Composition, and Professional Communication

Program of Study Committee:
Katherine Gossett, Major Professor
Gregory Wilson
Jonathan Tsou

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CHAPTER 1. OVERVIEW

“A Day Made of Glass”: A Work of “Design Fiction”?

In 2011, Corning, “world leader in specialty glass and ceramics” (“Corning Incorporated”), released a YouTube video titled “A Day Made of Glass” followed by two videos in 2012, “A Day Made of Glass 2” and “A Day Made of Glass 2: Unpacked” (“Corning’s…Videos”; see Appendices A and B for detailed synopses of the videos). These videos gave viewers a “vision for the future of glass technologies” and featured “[u]biquitous displays” of “interactive glass surfaces,” adding new “dimension[s]” to “ordinary surfaces” (“Corning’s…Videos; “A Day”; qtd. in “A Day”). In the world of the video, a host of everyday items, from countertops to refrigerators to mirrors to dashboards, are enhanced to become giant touch screens that can also augment reality. Corning’s website describes it as one “in which interactive glass surfaces help you stay connected through seamless delivery of real-time information—whether you’re working, shopping, eating, or relaxing” (“A Day”).

Although these videos were dubbed an example of “design fiction” by Wired author Bruce Sterling, Corning implies that these videos are not merely speculative. They are a rhetorical argument for what Corning wants the future to look like. The company is working with other “companies and organizations” to “make [its] vision a reality” (“Corning’s…Videos”). Even if the particulars of the vision of “A Day Made of Glass” do not come to fruition, Chairman and CEO Wendell Weeks is confident that “this world is being created as we speak” (“A Day”).

The president of Corning Glass Technologies, Jim Clappin, continues, “The consumer trend driving our vision for tomorrow is very clear…We all want to be connected with what we
want…when we want…anywhere…and with great ease. Corning’s innovations in glass will enable this journey to continue” (qtd. in “A Day”).

This view of the future that includes access to information on demand is shared not just by the businesspeople of Corning but by academics and researchers of technology. For example, in his book *Ambient Findability*, Peter Morville envisions “a fast emerging world where we can find anyone or anything from anywhere at anytime. We’re not there yet, but we’re headed in the right direction” (6). Jakob Nielsen also predicted this future in 1993 in *Usability Engineering*, writing that future interfaces would feature “higher dimensionality,” would be “highly portable and personal,” would “be more object-oriented,” and would have a more open system that allows multiple applications to function at the same time (63, 64).

**Literature Review**

If this vision is likely to become reality, it is imperative that we consider the impact it will have on the humans who will be affected by it. The very ubiquity of the displays envisioned by “A Day Made of Glass” means that humans will be constantly interacting with them. Such interaction means that humans will be influenced by this new technology, for better or for worse, particularly if it is as inevitable as both Corning and some scholars think. The whole field of digital humanities considers just this human aspect of technology; it is devoted to exploring the connection between technology and people. Although digital humanities is characterized by wide variety of methodologies and disciplines, the overarching goal behind its practices is “ask[ing] what it means to be human in the networked information age” (Burdick et al. vii).

Digital humanities asks about what it means to be human in the wake of technological advance; Corning’s video prompts several such questions. Is this technology, in its attempt to be human-centered, helping or hurting humans, specifically in how they will come to know all of
the information displayed by the screens? Is interaction with a touch screen embodied enough? Do the benefits to vision through spatial information and augmented reality outweigh the possible detriments to touch? Can humans determine how to work with the virtual without crossing into disembodiment or confusing it with the real? I will examine and evaluate Corning’s vision of ubiquitous display using these questions and using a framework that stems from the cybernetics and literature theory of N. Katherine Hayles and the epistemology of Michael Polanyi. First, I will briefly survey some of the literature surrounding ubiquitous display that raises the aforementioned questions regarding its potential benefits and drawbacks.

**Ubiquitous Display as Human-Centered**

The scientists and engineers behind the creation of ubiquitous displays believe that this technology will only help humans. One of the key benefits of this technology is that it allows for active display, as opposed to traditional passive display. In “Human Centered Ubiquitous Display in Intelligent Space,” from the proceedings of the 33rd Annual Conference of the IEEE Industrial Electronics Society, Joo-Ho Lee describes “‘passive information display’” as ordinary signs on which “fixed information is written on constant media in advance and those media are located at some specified place” (22). According to Lee, there are several problems with this old system. First, before people can actually access the information they need, they have to first look for the source of that information. Second, people may not actually find the specific information they need since passive information displays can only contain so much information. Finally, a significant amount of work is required to change the information on the displays, which could be detrimental in emergency situations (22).

In contrast, all of these problems are solved by what Lee calls “‘active information display’” (22). (Though his specific method to create active displays differs from that used by
Corning, they both share the active quality.) In addition, in active information display, “information approaches a user” as opposed to the situation in passive information display, where “a user approaches information,” thus making active information display “a human centered [sic] information transfer” (22).

Lee also introduces the concept of “Intelligent Space,” “the main purpose” of which “is the accomplishment of human-centered systems” (22). Also called “intelligent environments,” they are able to be human-centered because they can “act as a context-sensitive user interface” (22). This means that they “are able to monitor what is occurring in themselves, to build models, to communicate with their inhabitants and to act on the basis of decisions they make” (22). Conveniently, this also means that humans “do…not need to learn how to use” them (22). The environment adapts to the user, not vice-versa.

These definitions correlate with the definitions of ubiquitous display and “context-sensitive display environments” given by Florian Daiber, Antonio Krüger, Johannes Schöning, and Jörg Müller (32). To describe ubiquitous display, they cite Marc Weiser’s article from 1991, “The Computer for the 21st Century,” which says, “Specialized elements of hardware and software, connected by wires, radio waves, and infrared, will be so ubiquitous that no will notice their presence” (33). As Daiber, Krüger, Schöning, and Müller elaborate, this means that computers are becoming “an integral, invisible, and unobtrusive part of the environment” (33). A computer that is context-aware, then, is one that “uses context to provide relevant information and/or services to the user, where relevancy depends on the user’s task” (qtd. in Daiber et al. 33). Again, the information comes to the user as is deemed necessary and helpful. It is centered around humans.
Ubiquitous Display as Empowering to Vision

Others have written about ubiquitous or intelligent displays or environments as being liberating to the human senses. In *Designing Interactions*, Bill Moggridge writes, “We all have five senses; how sad that our connection to computers is ‘sensory deprived and physically limited,’ as Nicholas Negroponte so aptly describes it” (515). He calls for “interaction design” to become more adapted to humans’ senses of sight and touch (515). Describing the benefits of more vision-oriented design, Moggridge says:

> Why should you be chained to your computer? You sit for so many hours at time, staring at that small rectangular display of information: it is always the same focal length, with no relief for the eyes; it makes no use of your peripheral vision; it is so dim that you have to control the surrounding lighting conditions to see it properly. Why not break away, and wander in smart environments covered in living displays, or carry a system with you as an extension of your senses, augmenting vision? (516)

Such design frees users from being tied to a stationary screen that only hurts the features of their vision instead of enhancing them. More ubiquitous display gives users access to information in a way that honors their physical need for “relief for the eyes,” in addition to incorporating peripheral vision and even augmenting it. It is worth noting that Corning’s “A Day Made of Glass” features both living displays and a portable system that can augment vision.

Moggridge also interviews Terry Winograd of the “Stanford Interactive Workspaces” project, which incorporates “large electronic displays” (517). Winogard speaks of the attempts to “try to take information and make it into something that feels like a real space” because “[p]eople are spatial animals” (518). This suggests that other benefits to human senses are made possible by ubiquitous display.

Ubiquitous Display as Demeaning to Touch and Embodiment

Not all of the speculation about ubiquitous displays like Corning’s vision is as positive, however. Although ubiquitous displays wonderfully enhance the power of the eyes, they are not
quite as empowering for humans’ sense of touch. The displays presented in “A Day Made of Glass” are interactive touch screens, but some have questioned the value of the kind of physical interaction promoted by such tools. The fields of tangible and embodied interaction (TEI) and tangible user interface (TUI) specifically call for ways to combine physical manipulation with digital interaction. Hiroshi Ishii of the Tangible Media Group at MIT says:

[W]e must reconcile our dual citizenships in the physical and digital worlds. Our windows to the digital world have been confined to flat rectangular screens and pixels—‘painted bits.’ But while our visual senses are steeped in the sea of digital information, our bodies remain in the physical world. ‘Tangible bits’ give physical form to digital information, making bits directly manipulable and perceptible. (Moggridge 525)

Thus, his group explores ways to incorporate such “tangible bits” into the controls of computation; the goal is to “give physical form to information” (Moggridge 526, 527). But Ishii discusses objects like abacuses, bottles, and wheels; is touching a screen a sufficient tangible interaction?

Eva Hornecker, in describing different facets of TEI, also emphasizes the importance of our physical bodies. She writes, “Physicality is a central aspect of embodied interaction. We are incarnate, physical beings that live in a physical world. Humans are not abstract cognitive entities (the Cartesian view of cognition); our bodies and active bodily experiences inevitably shape how we perceive, feel, and think” (22). If ubiquitous displays do not allow us to express our physicality and embodiment sufficiently, would it be wise to incorporate them so much into our world, as Corning would have us do? Hornecker also references research implying that making things easy to use may not be in the best interest of humans: “We are most happy when we feel we perform an activity skillfully and gracefully even if it takes us a painfully long time…Tangible and embodied interaction can thus be a mindful activity that builds upon the innate intelligence of human bodies” (23).
Some doubt whether touch screens lead to this kind of mindful activity or honor the innate intelligence of human bodies. In “A Brief Rant on the Future of Interaction Design,” designer Bret Victor argues that touch screens, or “Pictures Under Glass,” do not honor the “human capabilities” of our hands and sense of touch. Touch screens reduce “all the tactile richness of working with our hands” to one move: sliding, which “has no connection whatsoever” with what a user is trying to do. He poignantly concludes: “With an entire body at your command, do you seriously think the future of interaction should be a single finger?” (emphasis his).

Ubiquitous Display as Virtual

Perhaps it is the seeming disconnect between bodies and technology that leads some to become skeptical about the virtual aspects of ubiquitous display. Architect Arata Isozaki’s 1991 exhibition “Visions of Japan” featured ubiquitous display, and of it he wrote:

Electronic devices of innumerable kinds have spread throughout society, transforming its systems and practices from within…[they] are irreversibly altering our ways of life. The images produced by these systems are displayed on screens but they are completely separated from the real things themselves—processed, edited, and otherwise qualitatively changed, often into something completely different. That process can be manipulated, creating impressions of convincing simulation. The constant bombardment of such simulated images could cause those images to flow back into the real world, blurring the line between real and simulated. Perceptions may become completely reversed, producing the sensation that reality is only part of a world of simulation. (Moggridge 517)

This statement certainly reflects the fear behind virtualization. On the other hand, in response, while Moggridge agrees that this was the experience of the display, he also notes that this particular display was more like a movie for the participants, and “there were no interactive enhancements to their lives” (517). The vision of Corning is much less like a movie and much more interactive, so perhaps this fear is unwarranted. The fear of a distorted idea of reality may
also be unwarranted because the vision of Corning involves not complete “virtual reality” but only augmented reality; thus, one is not completely isolated from “real life” (Moggridge 519).

Others deny that virtualization is something of which to be afraid. In Becoming Virtual: Reality in the Digital Age, Pierre Lévy argues that virtualization is not opposed to reality: “Strictly speaking, the virtual should not be compared with the real but the actual, for virtuality and actuality are merely two different ways of being” (23). It is not something to be feared but understood (184). Virtuality is hard for humans to grasp because something that is virtual is “detach[ed] from the here and now” and seems “intangible” (27); it allows things to be connected in time without being connected in space (29). Thus, virtualization “necessarily calls into question the classical notion of identity, conceived in terms of definition, determination, exclusion, inclusion, and excluded middles…virtualization is always a heterogenesis, a becoming other, an embrace of alterity” (34). Yet none of these characteristics make something that is virtual unreal. It is just a different kind of reality to which we must adjust.

At the same time, Lévy also does not deny that the threat of disembodiment looms when one reflects on the effects of virtualization on one’s body. Although he asserts that it is “not a form of disembodiment but a re-creation, a reincarnation, a multiplication, vectorization, and heterogenesis of the human…the boundary between heterogenesis and alienation….virtualization and amputation, is never clearly defined” (44). He leaves the responsibility for finding that boundary to both individuals and society (44).

Janet H. Murray also acknowledges the fear that new technologies can bring yet believes that their potential should be embraced. She writes, “Any industrial technology that dramatically extends our capabilities also makes us uneasy by challenging our concept of humanity itself” (1). Yet new technologies, like the computer at the time of her writing, can “offer…a thrilling
extension of human powers,” and she also believes that “some kinds of knowledge can be better represented in digital formats than they have been in print” (6). Essentially, people must become accustomed to new technologies and explore their possibilities (7–9).

**Ubiquitous Display from a Hayles/Polanyian Framework**

The idea of ubiquitous display, specifically through the example of Corning’s vision in the “A Day Made of Glass” videos, clearly raises a host of questions and sources of concern. To explore these questions and concerns, I will use a framework inspired by N. Katherine Hayles, who writes from the disciplines of cybernetics and literature, and Michael Polanyi, a scientist who became a philosopher of knowledge. Daiber et al. call for “many different research fields” to be involved in studying ubiquitous display; although they do not mention literature and philosophy specifically, from a digital humanities perspective, they would certainly be justified (33). Hayles engages the narratives behind the science and shows how stories reveal fears and possibilities with technology. As for Polanyi, since the main point of Corning’s vision seems to be to deliver information to people whenever they want it, studying their technology from the perspective of epistemology seems especially appropriate.

Hayles in *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* argues that digital forms of information have a “dialectic of pattern/randomness” that comes into tension with embodiment and its “dialectic of presence/absence,” raising the concerns of disembodiment and virtuality (247). Yet Polanyi’s epistemology, while being rooted in the body, also acknowledges the key role of pattern-making and environmental clues, which would be aided by ubiquitous display and augmented reality. By examining “A Day Made of Glass” through the combination of their perspectives, I aim to come to a more thorough grasp of whether or not such a technological future would diminish or enhance how humans know as they
increasingly know through this means. In the next chapter I will explore Hayles’ and Polanyi’s theories in order to develop a lens through which I will analyze Corning’s vision of the future of ubiquitous displays.
CHAPTER 2. FRAMEWORK

Hayles and Polanyi: Embodiment, Knowledge, and Patterns

To explore the questions about embodiment, knowledge, and virtuality raised by the potential ubiquitous display technology demonstrated in Corning’s “A Day Made of Glass” videos, I will draw from the theory of N. Katherine Hayles in *How We Became Posthuman* and the epistemology of Michael Polanyi from a number of his works. Although these authors come from different disciplines, they have significant overlaps in their thought when it comes to the concepts of embodiment, knowledge, and patterns that will create a usable framework with which to evaluate the Corning videos. I will explore each of these concepts in turn.

**Embodiment**

Both Hayles and Polanyi acknowledge, in opposition to much of Western thought, the vast importance and significance of the human body as a characteristic of humanity. Hayles begins the first chapter of *How We Became Posthuman* by expressing her incredulity at the idea, held by many across science and popular culture, “that mind could be separated from body” (1). This idea is expressed in the cybernetic idea of the posthuman (2–3). According to the cybernetic portrayal of humanity (or the posthuman), which Hayles traces throughout her book, mind can be separated from the body because information is not, by necessity, attached to the “material forms in which it is thought to be embedded” (2). Thus, both a computer and a human can have a mind in some sense, and humans “can be seamlessly articulated with intelligent machines” (2, 3). In explaining her point of view and disagreement with this idea, Hayles writes,

If my nightmare is a culture inhabited by posthumans who regard their bodies as fashion accessories rather than the ground of being, my dream is a version of the posthuman that embraces the possibilities of information technologies without being seduced by fantasies of unlimited power and disembodied immortality, that
recognizes and celebrates finitude as a condition of human being, and that understands human life is embedded in a material world of great complexity, one on which we depend for our continued survival. (5)

In other words, to allow improvements in technology to deceive us into thinking that our embodiment is not essential to our humanity is to do violence to ourselves. The ideal situation is one where we allow technology to enhance the capabilities of our embodied selves without forgetting that they are, in fact, embodied. Hayles refers to the importance of the body throughout *How We Became Posthuman*; one author that she cites in support of this view is Antonio Damasio, who argues that one’s body “contributes a content that is part and parcel of the workings of the normal mind” (qtd. in Hayles 245). Thus, Hayles calls for a view that posits ones’ body as essential to who one is, with all of the limitations of the finite that that view entails. At the conclusion of her work, she writes, “human being is first of all embodied being” (283).

Meanwhile, Michael Polanyi’s entire theory of knowledge is based within the human body; as Jerry H. Gill describes, Polanyi held to “the crucial role of the body in the shaping of our interaction with the world,” including by not limited to its hosting the “roots of all knowledge and thought” (44, qtd. in Gill 45). In *The Tacit Dimension*, Polanyi writes about how we are always “relying” on our bodies to know things “outside” of it (15–16), which I will discuss in greater detail in the next section. Polanyi was shaped by the phenomenology of Maurice Merleau-Ponty, who held that “the body [was] the axis of the human way of being in the world” (Gill 45). Like Hayles, Merleau-Ponty also rejected the idea of a mind being extractable from the body; rather, minds are “embodied” (Gill 47).

**Knowledge**

The implications of the essentiality of the body to what it means to be human can be seen in Hayles’ and Polanyi’s descriptions and understandings of epistemology. It is fair to say that, at
least in part because both Hayle and Polanyi hold to the centrality of embodiment, they also both believe that the idea of a completely objective, detached knowledge as has been traditionally sought in science is impossible. Indeed, Polanyi’s main goal in his work *Personal Knowledge* was to show that such knowledge cannot be attained, but that science does not suffer as a result: “For, as human beings, we must inevitably see the universe from a center lying within ourselves and speak about it in terms of a human language shaped by the exigencies of human intercourse. Any attempt rigorously to eliminate our human perspective from our picture of the world must lead to absurdity” (3). Additionally, Gill describes more of Merleau-Ponty’s philosophy that influenced Polyani: “the notion of ‘intentional threads’ as that which connects us to the world from the very beginning. These threads form the fabric out of and with which we engage in cognitive activity, and they are constituted by means of our embodiment” (49). We are always connected with the world by means of these threads that stem from our embodiment; it is foolish to think that we can break them in the name of detached, objective knowledge and still know anything about the world. Likewise, in her tracing of the history of cybernetics, Hayles reports a study of a frog’s vision that demonstrated that “the frog’s perceptual system does not so much register reality as *construct* it” (134, 135, emphasis hers). She then notes, with irony, how in the report, the authors assumed the same objectivist stance that denied the constructive implications of their own embodiment (135).

However, a key difference between Hayles and Polanyi is that while Hayles seems to wrestle with the critique of realism that the constructivist view brings (ex., 136), Polanyi’s explanation of how the body is the root of all knowledge leads him to confirm a realist
epistemology, even as he acknowledges that humans shape their perceptions of the world. This is because the body is involved in all of our tacit knowledge, which he argues is “an indispensable part of knowledge” (Tacit 20). Fortunately, throughout How We Became Posthuman, Hayles’ explanations of different aspects of knowledge align with Polanyi’s theory of knowledge.

What is this tacit knowledge? Polanyi begins his explanation of it in The Tacit Dimension with the telling phrase, “we know more than we can tell” (4, emphasis his). Hayles references this type of knowledge when she refers to “embodied learning”: “humans know much more than they consciously realize they know” (202). One example Polanyi gives of this phenomenon is that we can tell a person’s emotional state by seeing her face, yet we often cannot say exactly what feature of her face led us to our conclusion (Tacit 5). Similarly, Hayles refers to the idea that “embodied knowledge may not be completely formalizable” (202). Knowing more than we can tell aligns with the findings of Gestalt psychology, which “has demonstrated that we may know a physiognomy by integrating our awareness of its particulars without being able to identify these particulars” (Tacit 6). This integration, based in tacit knowing that we cannot precisely specify, is, according to Polanyi, how we know anything. What follows is his description of what this process looks like:

[I]n an act of tacit knowing we attend from something for attending to something else; namely, from the first term to the second term of the tacit relation. In many ways the first term of this relation will prove to be nearer to us, the second further away from us. Using the language of anatomy, we may call the first term proximal, and the second term distal. It is the proximal term, then, of which we have a knowledge that we may not be able to tell. (Tacit 10)

1 Although the question of realism is not one of pertinence to this paper, and thus I will not fully explain Polanyi’s account of it, it seemed appropriate for the sake of full disclosure that I reveal my realist assumptions.
Polanyi describes the first term elsewhere as that of which we have “subsidiary awareness” and the second as that of which we have “focal awareness”; in addition, while we have tacit knowledge of the first term, we have “explicit knowledge” of the second term (Personal Knowledge).

How does this structure of knowing incorporate our bodies? Polanyi argues that the proximal term is something that we “incorporate in our body,” “extend our body to include it,” or “dwell” within (Tacit 16). Gill argues that the idea of dwelling in proximal terms shows “[t]he crucial role played by embodiment in the formation and integration of the awareness and activity dimensions of experience” (46). In Personal Knowledge, Polanyi describes this process as central to understanding how we use tools, such as a hammer or the stick used by a blind person; we have “subsidiary awareness” of them as we “make…them form a part of our own body” (55, 59). Hayles refers to the same example of a blind man using a cane, citing Gregory Bateson’s question about whether or not that cane “is part of the man” (84). She goes on to explain that the reason why this question is so provoking is that it interferes with the way that we traditionally think about the “boundaries” of humans, restricted solely to our skin (84). Later, she also discusses a view of thought that holds that “conscious thought becomes an epiphenomenon corresponding to the phenomenal base the body provides” (203).

This leads to one of the chief anxieties of entering a world of increasing technology: will interacting with technology distort the idea of what it is to be human? According to the cybernetic view that Hayles has described, in which information is seen as disembodied, “cane and man join in a single system, for the cane funnels to man essential information about his environment” (85, 84). This is due to one of the key “assumptions” of the posthuman mindset, which is that “the body [is] the original prosthesis we all learn to manipulate, so that extending or
replacing the body with other prostheses becomes a continuation of a process that began before we were born” (3). Yet with Polanyi’s view, it is possible to acknowledge that a cane, temporarily, becomes part of the man without having to, at the same time, hold the assumption that information is disembodied. Rather, a tool is embodied in the process of tacit knowing. Perhaps this can lead to Hayles’ vision of “extending embodied awareness in highly specific, local, and material ways in that would be impossible without electronic prosthesis” (291).

Hayles also discusses the potential power behind this kind of tacit knowledge taking place in bodily practices when she discusses the “incorporating practice,” which “cannot be separated from its embodied medium” (198). She goes on to describe such a practice as that which is “encoded into bodily memory by repeated performances until it becomes habitual” (199). This sounds very similar to Gill’s description of Polanyi’s idea of tacit knowing, which he says happens through the combination of “subsidiary awareness and bodily activity” (46). He describes, “We do this by imitating the meaningful behavior of those around us even though we do not understand them fully, because we expect to be able to do so. Moreover, such imitation is accomplished through our embodiment, through putting ourselves in the place of others and behaving as we see and hear them doing” (Gill 46).

Such knowledge formed thorough bodily habits makes clear that environment or “context” is crucial to “human cognition” (203). Given that context is crucial, what kind of context humans create for themselves has vast implications for their bodily and tacit knowledge. This leads Hayles to question in the conclusion of her book what the implications of technologically advanced environments like that foreseen by ubiquitous computing are (287). She writes of Hutchins’s theory:

[E]very day we participate in systems whose total cognitive capacity exceeds our individual knowledge, including such devices as cars with electronic ignition
systems...Modern humans are capable of more sophisticated cognition than
cavemen not because moderns are smarter, Hutchins concludes, but because they
have constructed smarter environments in which to work. (289)

This concept is known as “distributed cognition,” in which both people and “intelligent
machines” think and make decisions (Hayles 288, 289, 290). In this view, such collaboration
does not deprive humans but only “enhance[s]” their lives (290). Such a view involves a shift in
thinking of human identity no longer in terms of autonomy with concrete boundaries that can
“dominate and control the environment” but rather in terms of dependency on our environments,
including virtual ones (290). Although I am not certain whether I agree with the deemphasizing
of humanity that seems implicit in this view (I believe that humans, while they should be
responsible and good stewards of their environment, are distinct in importance from the
environment around them), I think that, appropriated from a Polanyian perspective, this
distributed cognition can enhance human life as it allows them to incorporate more tacit
knowledge into their bodies that will lead to focal knowing. The question, then, becomes
whether Corning’s vision of the future is one of those smarter environments of distributed
cognition that will expand the human capability for knowing. The emphasis on context also
makes it clear that the process of tacit knowing is not limited to interacting with concrete,
physical tools. This brings us to the next realm of similarity between Hayles and Polanyi that
forms the third part of the framework: the importance of patterns.

Patterns

As Hayles traces the history of the construction of the idea of the posthuman, one of the
key features of the posthuman mindset is that “human identity is essentially an informational
pattern rather than an embodied action” (xii). If this is the case, then it becomes no problem to
essentially equate human capabilities with that of a machine; as Hayles writes, “the posthuman
view privileges informational pattern over material instantiation, so that embodiment in a biological substrate is seen as an accident of history rather than an inevitability of life” (2). From here, it is easy to take the next step toward virtuality, which Hayles defines as “the cultural perception that material objects are interpenetrated by information patterns” (13–14). As our culture engages in more technology from the internet to credit cards, this view becomes paramount; the “pattern is predominant over presence” (27, 19).

Such a view entails that information and material are completely different and that information is the more crucial of the two (18). However, such a view neglects the fact that information always comes in some material form, whether that be a book or a “cathode ray tube”; it is a “holistic phenomenon” (13). Yet our culture continually moves toward “dematerialization,” defined by Hayles as “an epistemic shift toward pattern/randomness and away from presence/absence” (29). In other words, our culture considers informational patterns to be more real and/or separate from the material presence in which they come to us, which, as we have just seen, gives us an incomplete picture of the reality of information.² What is to be done?

Hayles argues that there is a threefold solution. The first is to create an idea of virtuality that does not deemphasize the embodiment of humans (20). The second is to note that just because pattern has become more emphasized does not mean that there is actually a lack of presence from the physical world. Hayles affirms, “In fact, it is precisely because material interfaces have changed that pattern and randomness can be perceived as dominant over presence and absence. The pattern/randomness dialectic does not erase the material world; information in

² The randomness and absence parts are the “complements or supplements” to the pattern feature of information and the presence feature of material instantiation, respectively (Hayles 25). For example, informational patterns can become more advanced when some randomness is included (Hayles 25).
fact derives its efficacy from the material infrastructures it appears to obscure” (28). Given this understanding, it becomes possible to evaluate the material that makes pattern/randomness so prevalent in order to see what effects they could have on the posthuman (47). One way to do this, Hayles writes, is by looking at the “functionality” of the material (47). This is “a term used by virtual reality technologists to describe the communication modes that are active in a computer-user interface” and could be anything from a glove to a voice to one’s whole body (47). But the functionality does not just tell us about what the technology is capable of; it also tells us what humans will become capable of as they interact with it, for “[t]he computer molds the human even as the human builds the computer,” including at the level of the brain (47). Thus, we can look critically at technology to see the impact it is making on the push toward pattern/randomness over presence/absence.

But there is still another step that can be taken; there may be another way to look at the relationship between presence/absence and pattern/randomness. Hayles explains:

Implicit in nearly everything I have written here is the assumption that presence and pattern are opposites existing in antagonistic relation. The more emphasis that falls on one, the less the other is noticed and valued. Entirely different readings emerge when one entertains the possibility that pattern and presence are mutually enhancing and supportive. (48)

To take such a view may be crucial, for as Hayles concedes, the state of the world has made it apparent that we will more and more live life in ways that “construct us as embodied virtualities” (48). Therefore, the best choice we have is to see if it is possible to make this idea of mutual enhancement a reality (48–49). Hayles explores this idea by engaging literature; I will explore this idea by diving deeper into Polanyi’s epistemology, exploring his own use of pattern.

In her work on Polanyi’s epistemology, Esther Meek describes subsidiary and focal awareness as a shaping of “clues” into a “pattern,” as can be seen in the following passage:
Integration is a risky, responsible struggle, a skilled groping toward the not yet known. It involves shifting from looking at puzzling and apparently unrelated particulars to relating to them differently: relying on them, or attending through them or from them, to comprehend a deeper pattern. The shift to identifying a coherent pattern is a moment of insight … the one struggling for understanding integrates to a pattern. The pattern becomes focal: we focus on it. The random, apparently meaningless, opaque, and personally external particulars that had previously drawn our attention are transformed, in the integrative feat, into subsidiary clues, and thereby endowed with a transformed appearance, joint meaningfulness, and for the knower, a sense of incorporation into oneself. (69–70)

Polanyi also uses the word “clues” to describe subsidiary knowledge in *The Tacit Dimension*, where he writes that tacit knowledge is similar to “a clue to a reality of which it is a manifestation…all the time we are guided by sensing the presence of a hidden reality toward which our clues are pointing” (24). This reality is the pattern of which Meek speaks. This understanding of Polanyi’s thought makes it less difficult to see how Polanyi’s thought can be applied to non-physical objects. In fact, Polanyi gives many examples of his epistemology working in such situations, from using a theory to believing in new “moral teachings’ (*Tacit* 17).

We come to understand the pattern or idea among the clues; we suddenly “get it.”

Hayles seems to allude to this understanding of knowing as finding patterns when she describes the cybernetic view of communication: “Perception does not reflect reality directly but rather relies on transformations that preserve a pattern across multiple sensory modalities and neural interfaces” (98). Hayles’ concern with this pattern-making, however, is the potential for abstraction from the “embodied materiality” and “particulars,” as in math or logic (99, 98).

However, what Polanyi describes, is, I argue, more (if not completely) immune from this risk because it is the knowing process of embodied humans themselves, based on the world around them. Thus, through our presence, we engage patterns and bring them into our own embodied selves.
Evaluating “A Day Made of Glass” through a Hayles/Polanyian Lens

Given these themes of embodiment, knowledge, and patterns, I will use the theories of Hayles and Polanyi to evaluate the “A Day Made of Glass” videos. Following Hayles, I will examine whether or not the future given in “A Day Made of Glass” properly acknowledges embodiment in the virtuality it involves. To do so, I will look at the functionalities that the technology of “A Day Made of Glass” involves, seeing how it shapes humans, given how crucial embodiment is to knowing. This will also include a look at what incorporating practices using this technology will involve. Finally, I will look and see if the positive relationship between presence and pattern made possible through Polanyi’s philosophy of tacit knowledge is enhanced or diminished in the environment of “A Day Made of Glass.”
CHAPTER 3. ANALYSIS

Of course, this is not just a story about glass. It’s a story about a shift in the way we will communicate and use technology in the future. It’s a story about ubiquitous displays, open operating systems, shared applications, cloud media storage and unlimited bandwidth. We know there are many obstacles to be overcome before what we’ve just seen can become an attainable, reliable reality. But at Corning, we believe in this vision, and we’re not waiting. Care to join us?

~ “A Day Made of Glass 2: Unpacked. The Story behind Corning’s Vision”

Corning believes in its vision of ubiquitous display that includes augmented reality and that it will soon become reality. But in order to decide if we want to join them, we need to see if their vision of days made of glass properly honors human embodiment and the convergence of patterns and presence through tacit knowledge found in the thought of N. Katherine Hayles and Michael Polanyi. In this section, I will apply that framework, described in the previous chapter, to the vision of the future found in the “A Day Made of Glass” videos, starting first with Hayles’ threefold solution toward an acknowledgment of presence and moving to Polanyi’s conception of tacit knowledge.

Examining the Material: Applying Hayles to “A Day Made of Glass”

In order to evaluate the material that makes pattern/randomness seem more prevalent than presence/absence, Hayles says, we must examine its functionalities, or the “communication modes that are active in a computer-user interface” and also see what these modes make people capable of even as they reveal the possibilities of technology (47). Therefore, I will first list what communication modes are available in the world of “A Day Made of Glass” and then examine their impact on human abilities, or “how the user’s sensory-motor apparatus is being trained to accommodate the computer’s responses” (47)
Functionality 1: Touch-Sensitivity

The most prevalent functionality displayed by “A Day Made of Glass” is that of the ubiquitous display’s touch-sensitivity; the information displayed on it can be manipulated by the user’s fingers or hands. The following screenshots give examples of the various ways this touch takes place.

Figure 1: A woman checks her schedule on her bathroom mirror. (“A Day Made of Glass”)

Figure 2: Setting the stove temperature (“A Day Made of Glass”)
Figures 1, 2 and 3 give examples of the most prominent form of touch-sensitive interaction: using a single finger to manipulate the information on the screen. Figure 2 shows the finger manipulating the heat setting on the stove embedded within the glass countertop, showing that more “tangible” effects, such as heat, can result from this interaction. Figure 3 shows that the technology allows for multiple finger-interactions to occur at the same time; Corning describes such “community activity tables” as this one as “multi-touch” (“Unpacked”).

Less frequently, the videos show users using their entire hand to manipulate the screens, as shown in Figure 4. However, this is the most direct physical contact that the people in the video ever have with the display screens.
Functionality 2: Spatial Location

Hayles describes spatial location as a functionality in which “the computer can sense body position” (47). This functionality in terms of the displays sensing the actual physical person seems to occur to some extent in the first “A Day Made of Glass” video, such as when a woman walks towards her car and the car responds by displaying on its dashboard her personal settings, as shown in Figure 5. This same woman also walks up to a display glass in clothing store that acknowledges her presence, shown in Figure 6.
However, in the “A Day of Glass 2: Unpacked. The Story Behind Corning’s Vision” video, in which a narrator provides commentary on the visuals of the video, the narrator never refers to bodily presence activating the screen; instead, he mentions that the closet door that becomes a display is “driven by [a] tablet” and is “smart enough to be aware of [the] device, and based upon proximity and other rules, it knows what to display and in what format.” Later, he also specifically says that a tablet “drives the…edge-to-edge wall display.” The videos also directly
show either small cell-phone-like devices or larger tablets being the source of spatial location, as in Figures 7 and 8. Thus, it seems reasonable to conclude that the devices are the source of the spatial location functionality, not the bodily presence of the people themselves. The smaller devices can also receive information by being in close proximity to the larger displays, as shown in Figure 9.

Figure 7: The dashboard responds to a tablet ("A Day Made of Glass 2")

Figure 8: The dashboard responds to a cell phone ("A Day Made of Glass 2")
The devices can also be used to connect with the larger displays by directly touching the larger display, as shown in Figure 10.

**Figure 9: The cell phone responds to the larger display ("A Day Made of Glass")**

**Figure 10: The larger display on the counter responds to the direct touch of the cell phone ("A Day Made of Glass")**

**Functionalities’ Effects on Human Capability**

We have seen that there are two major functionalities in the interactive displays of “A Day Made of Glass”: touch-sensitivity using hands and spatial location of smaller devices. If humans were to interact in these ways over time, what would be the effect on their bodies? In
other words, to use another Hayles phrase, what types of “incorporating practice” do these actions entail (198)? Essentially, these functionalities entail two actions: sliding one’s fingers or hands and committing oneself to carrying around a second, smaller piece of technology at all times that can be used to communicate with larger displays.

In terms of a “prosthesis” or “extension” of the body, conceived as a physical tool, these functionalities do not seem to particularly add much to human capabilities. Information that would otherwise be manipulated by something like a mouse on a computer is now capable of being moved directly by a finger. While this may be faster in some ways (and is a more direct interface than a mouse or other such tool), it does not alleviate the concerns expressed by Hornecker that humans appreciate things most when skill is required to carry them out, or by Victor that “pictures under glass” unnecessarily limit the physical capabilities of humans. It seems to be that the smaller device is doing more of the skilled activity when it comes to interacting with the displays. If the theory of distributed cognition is true, perhaps that is not necessarily a bad thing. It remains a cause of concern.

However, there is more to physical interaction than just touch. Given Hayles’ parameters, I did not think that “vision” could count as a way for humans to interact with an interface. It is clear, though, that the world of “A Day Made of Glass” greatly expands the visual capabilities, akin to the ways described by Moggridge, that just may outweigh the meager gains made in touch. In this next section, I will look at the visual aspects of “A Day Made of Glass” and explore what implications they have for tacit knowledge as described by Michael Polanyi.

**More Clues in Smarter Environments: Applying Polanyi to “A Day Made of Glass”**

Polanyi argues, as I explained in my last chapter, that we come to know by integrating clues of which we are subsidiarily aware into a pattern on which we then focus. We integrate
these clues by dwelling in them. Hayles wrote about the theory that smarter environments, with
cognition distributed among both humans and smart machines, could increase the capacity for
human knowing. I will now examine the visual environment created by “A Day Made of Glass”
and see if it has such potential to improve human knowledge.

**Putting the “Ubiquitous” in Ubiquitous Display**

Perhaps the most striking feature of the “A Day Made of Glass” videos is the prevalence
of the display. As the narrator in the “A Day Made of Glass 2: Unpacked” video explains, “We’ll
have displays everywhere, not just in the home and in the office, but in your car, too.” While the
display in the car is featured (see Figures 5, 7, and 8), perhaps what is most novel about this
vision is the location of the displays within the home. In the world of “A Day Made of Glass,” no
place is immune from an informational display. Closet doors, countertops, and even the
bathroom mirror are all made into displays (see Figures 11, 10, and 1).

![Figure 11: A closet door acts as a display ("A Day Made of Glass 2")](image)

Displays are featured in public places, too, to provide general information for everyone.

In these examples you can see the benefits pointed out by Lee of the ability to update
information as soon as it is needed. Such information is provided on the road (see Figure 12) and on the street (see Figure 13).

![Figure 12: A road display provides updated information ("A Day Made of Glass")](image12)

![Figure 13: A street display provides updated information ("A Day Made of Glass")](image13)

Not only are the displays located everywhere one could think of, but some of the displays are larger-than-life, surrounding the people and bringing to mind Terry Winogard’s statement that information should feel like a space. The family room display encompasses the whole wall (complete with 3D capabilities), as shown in Figure 14. In the shopping mall, the displays seem
to reach to the sky (see Figure 15). Perhaps most impressively, the hospital room is completely made of glass with capabilities for display (see Figure 16). Describing the use of videoconferencing through the display, the narrator says, “[I]t’s as if the remote location were now part of his room, making it easier to share and collaborate. Now that’s breaking down barriers.”

Figure 14: A family enjoys a whole-wall display with 3D capabilities ("A Day Made of Glass")

Figure 15: A shopping mall is covered with large displays ("A Day Made of Glass")
Augmented Reality

More barriers are broken in the vision of “A Day Made of Glass.” Not only are displays everywhere, but they can be used to add more useful information to reality, above and beyond the “critical and ancillary driving information” displayed by the car dashboard (“A Day Made of Glass 2: Unpacked”). A large display glass is used in a state park to not only display information but to show students the dinosaurs that once roamed there (see Figures 17 and 18). In the woods of the park itself, students can use their tablets to get information on dinosaur footprints that they find or connect it with information spots to see dinosaurs again through their screens (see Figures 19 and 20).
Figure 17: A large, clear display gives additional information while also allowing for visibility ("A Day Made of Glass 2")

Figure 18: The display augments reality by showing dinosaurs ("A Day Made of Glass 2")
Most impressive of all, though, is the digital transfer of a patient in the hospital, so that he is, in electronic form, “present” in the room (see Figure 21).
**Visual Expansion’s Effects on Human Knowing**

What does this use of ubiquitous technology and augmented reality mean for human knowing? In many ways, it would aid the process of tacit knowing according to Michael Polanyi’s theory. Because information would be visually accessible in a whole host of locations, including some that make it feel as though people are really in an information place or environment, people would have much more scope from which to piece together focal knowledge from tacit clues. Tacit clues would be continually present, either in the background or foreground, that could jog the memory of focal patterns. In addition, the technology of augmented reality would allow people to experience focal connections that they never would have been able to see otherwise, like experiencing dinosaurs. As the narrator in the “Unpacked” video says, it is “perfect for education.”

These devices can also become a way of storing focal information when people do not need to be focusing on it at the moment; for example, the narrator also says that a girl’s tablet “captures, organizes, and displays all her favorite things. It also helps her at school and manages her schedule” (“Unpacked”). Although this brings up questions of whether or not people would
really remember things like their schedules as well, in some ways the tablet is just an updated version of a handwritten list or calendar. And if the trend continues toward more full-environment information spaces shown as the doctor interacts with the virtual patient, it seems as though people would be more full-bodily engaged with the information around them as Moggridge suggests.

Some may be concerned, though, about becoming too dependent on other devices or screens for information. Although the option is never shown in the videos, there does not seem to be any reason why one could simply choose to not have the displays in the bathroom, the kitchen counter, or the car present information. Just as people who do not have smartphones currently do not have to engage the extra material provided by scanning barcodes in magazines or on sides, people in the future, it would seem, could choose to not engage the technology available to them at all times. Society has always worked with those who are latecomers to technology, from the telephone to the car to email; it will find ways to accommodate those who choose not to engage in all aspects of this technology as well. What makes this world of ubiquitous display slightly more complex is the public nature of some of the displays, such as the glass in the state park. Some might find the information constantly swirling by to be a distraction from viewing the scenery. One can only hope that diverse needs and desires for technology will be taken into account. The ability to have information everywhere, at anytime, is an amazing possibility, but could become tyrannical if it becomes impossible to turn that information off when needed.

“A Day Made of Glass”: Incredible “Pictures under Glass”

When looking at the “A Day Made of Glass” videos through the lens of Hayles and Polanyi, the technology presented therein has exciting potentials for tacit and focal knowledge
visually by means of ubiquitous display and amplified reality. At the same time, though, it does little to engage the physical, human characteristic of touch through its functionalities. Do the benefits to sight outweigh the detriment to touch? In the last section I will give my concluding thoughts on the impact of “A Day Made of Glass” to human knowing.
CHAPTER 4. CONCLUSION

Summary

In this paper I have examined Corning’s “A Day Made of Glass” through a digital humanities perspective on whether its vision of the future of ubiquitous display and augmented reality would be beneficial or detrimental to humans, specifically in regard to how they know. I began with considering concerns and benefits raised in other literature on ubiquitous technology and the future of technology, including its human-centeredness, its benefits to human vision with possible detriments to touch, and the complexities involved in a more virtual climate. Then, I narrowed in on theory presented by N. Katherine Hayles in *How We Became Posthuman* and the epistemology of Michael Polanyi to use as a lens for analyzing the videos. Through their focus on embodiment, knowledge, and patterns, I was able to look at the “A Day Made of Glass” videos in a light that took into account the concerns of the background literature.

Specifically, I found that the main functionalities of the “A Day Made of Glass” technology were its touch-sensitivity and spatial location recognition. The incorporating practices that this would entail for humans were sliding fingers or hands and becoming used to carrying around a smaller device that could interact with the larger displays. I argued this was not a very sophisticated use of human’s embodiment and did not require skillful use by humans. The more skillful use seemed to be carried out by the smaller devices, which may not be detrimental under the theory of distributed cognition; the limited use of human touch in Corning’s vision, though, is still disappointing.

At the same time, to the extent that the sense of touch is limited in Corning’s vision for the future, the sense of vision is expanded. With ubiquitous displays with the potential for augmented reality, humans would have greater opportunities for perceiving subsidiary clues with
which to integrate into focal patterns, leading to more knowledge.\(^3\) This is especially the case in areas where information truly does become spatial, surrounding the humans and creating a very smart environment. In addition, because tablets and other devices can store unneeded subsidiary and focal information (such as their schedules, etc.) in an act of distributed cognition, people can choose to focus on other, more pressing issues. The concern I raised under this area, however, was that such a system would lead to too much human dependency on intelligent technology.

Here I will give my final thoughts on whether Corning’s “A Day Made of Glass” vision is helpful or harmful to humans, followed by what modifications I would suggest. If Corning is serious about collaborating with others, I hope they will also take the considerations of digital humanists into account.

**What Does It Mean to Be a Human Knower in “A Day Made of Glass”?**

Looking at the vision of “A Day Made of Glass,” one is struck by several elements of what it means to be a human knower. Knowing involves having constant access to information, everywhere, throughout one’s environment, being fully connected at all times to this information. Knowing is carried out primarily through sight, as demonstrated by the prevalence of the ubiquitous displays and their size. Eventually, knowing will involve being in an entire smart room, where knowledge really does become a space as Winograd envisioned (Moggridge 518). At the same time, knowing also entails carrying around a separate device with you at all times so that you can successfully interact with the larger displays. Knowing is not contained to

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\(^3\) A clarification may be needed here. My main argument for the visual benefits of Corning’s ubiquitous displays is that it provides more opportunity to identify patterns crucial for knowledge, not merely that it provides information wherever we want it (in the bathroom, in the car, etc.). The main benefit of the ubiquitous aspect of the display is that it provides a more spatial environment for knowledge, allowing people to take advantage of things like their peripheral vision for identifying patterns, as Moggridge envisioned (see page 5). Augmented reality especially allows users to experience patterns they otherwise would not because they are able to see things that they would not usually see in nature.
people alone; knowledge is distributed among people and smart machines. In addition, because knowledge is so easily carried from one smart device to another, knowing can become even more collaborative as it becomes increasingly simple for people across the world to interact with each other and with their work.

Although knowing is sight-intensive, it does not entail much touch. All one does to interact with the information displayed by the screens is use a finger or a hand to slide it around the screen. One is able to make connections using sight to incorporate clues into their bodies, but they cannot interact with the focal patterns they see in a complex, meaningful way. As connected as people are able to become with others and the work of others, they remain disconnected bodily with the information with which they interact.

Given both these benefits and these drawbacks, I will now present some suggestions to Corning on making the vision of “A Day Made of Glass” the best it can be.

**Looking Forward: Suggestions and Considerations**

*Vision: Choosing to See or Not to See*

One way in which Corning’s technology truly does enhance human knowing is its capacity for visual display and allowing humans to take advantage of all of the resources of their vision in knowing, allowing them to create more focal patterns through an abundance of subsidiary knowledge and clues. This includes clues provided through augmented reality that open clues to them beyond what they can see in the natural environment. Such expansion of human capacity for knowledge is worth celebrating and embracing.

At the same time, though, I repeat my call for acknowledgment of the diverse technological needs of people that would allow people the freedom, at least in private settings, to
decide where they want information displayed. Some people, myself included, would be overwhelmed by having access to knowledge everywhere, all the time, or they are uncomfortable with the idea of having so much of their cognition distributed to intelligent technology. Thus, they should have the agency to control where displays are located in their home, or at the very least, have the ability to turn them off. Although, again, the videos distributed by Corning do not directly discuss this possibility, it does not seem to be precluded by their videos.

Where more consideration will need to take place is in the display of information in public settings. Corning would do well to ensure that those who do not wish to be dependent on advanced technology would not be completely lost without it, in the same way that today, those without smart phones are still able to function in society. The technology should add benefits to life without becoming a necessity. On a purely practical level, it is imperative that society be able to function should some technological problem cause the displays and tablets to fail.

Such consideration of others who are more hesitant to embrace this vision of the world would also allow for them to adjust to the increasing virtuality of the world of information as well. If one has the ability to turn technology off, one is much less likely to start thinking of the physical world as less real than the information around her, to emphasize pattern over presence, because she is aware of the material presence that makes up the components of the technology, as Hayles suggests (28, 47).

Touch: A Day Made of Glass…and Something Else?

Although Corning’s vision truly does enhance the vision of humans, adding to their ability to know, its vision hardly expands the ability for humans to use their sense of touch to aid them in knowing. The sliding of fingers, while embodied, does not allow humans to dwell in the information around them as well as a more tactile practice would. More concrete physical actions
that involve more than just fingers or palms would allow people to incorporate tools into their bodies more concretely, leading to more skilled use that is ultimately more satisfying, as Hornecker argues.

One could argue in defense of Corning that Corning is expanding the already-prevalent concept of touch screens; humans have accepted them so far without too many problems, so why change? Why force them to adjust to another new form of technology, and instead amplify the possibilities inherent in one that is already used? These are fair points. However, if Corning is really thinking about future possibilities, why not take the opportunity, as Victor writes about, to take more advantage of the physicality and embodiment of humans?

Of course, Corning is a glass company, so it is in their best interest to use the glass that they produce, which goes perfectly with touch-screen technology. They have clearly shown that the visual capabilities that this glass provides are worth pursuing. But it might behoove them, as they work with others, to see if they can find a way to incorporate a more tactile interface into vision. Glass could still be used for display, but perhaps other devices could be used to interact with it. Perhaps, instead of a touch screen tablet, a more tactile type of tablet could be developed with which users could still manipulate the information that is so visually prevalent to them on the ubiquitous displays. The fields of TEI and TUI could be extremely helpful to Corning to make this possible. Although it is beyond the scope of this paper to give definite ideas of what this kind of tablet could look like, one feature that would improve the tactility of a tablet would be responsiveness/feedback to the user through tactile means. For example, just as Wii remotes will shake when you come into contact with certain features in a video game, a tablet could provide a similar kind of feedback when users select items with their fingers, allowing the currently trapped pictures to, in a sense, break through the glass.
Conclusion

After considering Corning’s “A Day Made of Glass” videos through the lenses of Polanyi and Hayles, along with the issues of the background literature, a few things seem clear. First, if Corning is successful in pursuing this vision, it will overall be beneficial for human knowing. In fact, the visual capabilities involved in knowing and creating focal patterns will be greatly enhanced, especially through the potentials of smart rooms and augmented reality. However, if Corning does not change its current ideas for the future, its limited use of tactile interaction will, while not overtly harming how humans know, will not tap into the full capabilities of humans in their embodiment, either. Corning should take advantage of the collaboration with others they have acquired through sharing their video online to make their vision more concretely physical.

Perhaps Corning’s public sharing of the vision of “A Day Made of Glass” is the most encouraging sign of all. It has allowed for public discussion of the effects such a vision would have on humans. It is my hope that they will take into consideration discussions from the perspective of the digital humanities, and in particular, how humans come to know. Without thinking about how humans know information, all the access in the world to information does not mean very much.
APPENDIX I. SYNOPSIS OF “A DAY MADE OF GLASS”

As the video begins, we see a sleeping couple in their bedroom and are told via a caption that it is “7:00am In The Near Future.” We then see a large screen displaying the time. As it changes from 6:59am to 7:00am, we see the wall-to-wall windows change in tone from dark to transparent. Captions at this point and throughout the video name the kinds of glass involved (ex: “Photovoltaic Glass”), as well as some of their features (“High Efficiency, Optically Versatile, Durable”). The husband gets out of bed and walks over to the display screen, where he uses his fingers to bring up items like the traffic report and weather. The scene then cuts to the bathroom, where the wife receives an email message that is displayed on the bathroom mirror (Figure 1). Using her fingers, she manipulates and sends a response to the message.

We now see the man walking in the kitchen, preparing breakfast. As he mixes eggs, he watches the news on the glass screen on the countertop. He then touches the outline of a stove burner controller on the countertop to turn on the burner next to it, all of which are embedded in the same countertop glass (Figure 2). The two daughters then walk into the kitchen. After taking something out of the refrigerator, the younger daughter uses her fingers to move one of the photographs on the refrigerator that is embedded into its glass screen. She is able to expand it and draw a cat face over one of its original faces. In the background, we see that other “photographs” are actually little videos playing on the screen. Suddenly, the small, flat glass phone on the counter rings, and the husband holds it out in front of him in order to accept a video call from his mother. He then sets the phone down on the kitchen counter (the same one that played the news and has stove capabilities), which causes the video image of the grandmother to leave the phone and enter the screen of the counter (Figure 10). The two daughters pull the
image toward them, rotating it using their fingers, and talk to the grandmother. The wife comes into the kitchen, quickly saying goodbye to her family as she grabs an apple.

The scene cuts outside, showing the wife walking to her car. As she nears it, the car’s dashboard, also a glass screen, turns on and acknowledges her presence with the words “Hello Jennifer” written on it (Figure 5). Entering the car, Jennifer uses her fingers to select directions to her office. She also manipulates a box showing reminder of her meeting, and she presses a “call button” attached to it to directly talk to the people at her office. After making a few more adjustments to the dashboard screen, the sunroof glass over her darkens from a transparent to a tinted state as she backs out of the driveway. As she drives, she glances up at a large, glass sign that is over the entire roadway and displays changing information about an accident and the alternative routes that people should now use (Figure 12). In response, Jennifer selects one of the alternative routes on her car’s dashboard screen.

She then drives by two people who are under what looks like a large bus stop waiting station without walls that has a large display at either end (Figure 13). A woman walks toward one displaying a city map. She uses her fingers to interact with a pull-down menu and selects a destination, the directions to which are then displayed on the screen. She then brings her small glass phone close to the screen, and the image on the large screen duplicates itself onto her phone (Figure 9). Meanwhile, the man under the shelter is looking at his phone as he talks to three separate people on the screen in a four-way video call. The scene then cuts to the location of one of the other speakers, who is in a workspace with an enormous display screen behind a glass tabletop surface. He uses his finger to circle something on the table that then shows up on the screen in front of it. A coworker enters, and one of the people on the call waves to her. She places her glass phone on the tabletop, which brings up work related information onto the table’s
screen. She uses her finger to slide pictures of clothes models over to the man, who uses the palm of his hand to spread out the photos like a deck of cards (Figure 4). He touches one of the photos, which then plays a video of the woman in the picture displaying the clothing. He slides a bar at the bottom to change the video to different ones and eventually slides the video upward to display it on the larger screen.

The video transitions to show people, including Jennifer, walking toward a large building covered with large glass display screens (that also appear to function as windows) showing similar videos of clothing models (Figure 15). Inside, the large videos play on the windows and also appear simultaneously on Jennifer’s phone; the video on the phone has a personalized message inviting her to come and view the clothes of the new season. Jennifer enters the clothing store, which is filled with accessories and clothes like today’s stores, but then she interacts with a large display screen showing clothing model videos and then displaying a personal message welcoming her to the store (Figure 6). She presses the “browse store” option and then views pictures of models displaying different blouses.

In the background, a man and woman are standing next to a small table, and the man is setting down what looks like a clear plastic, roll-able sheet. In actuality, though, it is a screen, and he places his clear glass phone in the corner of it to bring up data on the screen that he slides with his finger. Jennifer appears again, having tried on some of the clothes that she was looking at, and then the video switches to her wearing the same outfit walking toward her family in the living room. She and her daughters watch a movie on the large, wall-to-wall screen that also has 3D capabilities (Figure 14). Then the husband is shown in bed reading from a thin, clear glass tablet; when he slides his finger across it, it looks like he is turning a page. Jennifer walks over to
the wall-to-wall windows and touches them so that they darken completely and are no longer transparent. They go to bed, bringing an end to “A Day Made of Glass.”
APPENDIX II. SYNOPSIS OF “A DAY MADE OF GLASS 2: SAME DAY”

As the video opens, we see a girl sleeping in her bedroom. The camera pans over to her glass tablet on the floor, which, when the time changes to 7:05, displays the time and other information, including pictures, in a 3D, floating style above the tablet. As in the first video, captions here and throughout explain the type and quality of the glass used. The girl wakes up as the light enters her room from the full-length window transitioning from a darkened to a transparent state. Picking up her tablet and touching its screen, she moves the display of the information on the tablet to the display of her glass closet door. She manipulates the information on the door by moving and sliding it with her finger, using it to help her pick out an outfit (Figure 11).

The scene cuts to her and her younger sister and father walking out to the car to go to school. In the car, the younger sister gets out her tablet and touches it to bring up a heart background style. The older sister then touches the glass display on the dashboard so that it will accept the new style from the tablet. The younger sister then slides the style in the direction of the dashboard, and the dashboard takes on the heart style (Figure 7). When the father enters the car, he appreciates the joke but does not feel inclined to keep this style, so he holds up his clear glass cell phone close to the dashboard to change it back to its default style (Figure 8). The older daughter then draws a shape on the glass display of the car window, which gradually darkens to a more tinted shade.

When they pull up to the school, the pan shows that the roof of the building is covered with glass solar panels. The daughters walk past a large glass display in the hallway that shows the energy use of the building that it receives from those panels. We enter a classroom, where students attach their tablets to stands on glass tables that expand the display on the tablet by
providing a keyboard, etc. The display on the tablet matches the display on the full wall glass display at the front of the room that the teacher manipulates with her fingers. The students are very engaged by its interaction. The teacher dims the lights by sliding the screen and brings the students over to a large glass table. At this table, the students are able to all interact with colors (the lesson of the day) on a multi-touch surface (Figure 3).

The scene then moves to the hospital where the father works, where both desktop and handheld glass tablets are used. A coworker is able to slide the information from her tablet to the father’s using her finger while they are next to each other. The father then enters an all-glass room that has one glass table in it. Sliding the information from his tablet to one of the all-glass walls, the wall becomes a video conference showing a doctor, nurse, and patient on a table (Figure 16). The doctor in the video slides the information from his tablet to the father so that it shows up on his screen, which the father is then able to manipulate with his fingers. Touching her tablet and engaging the circular machines around the man, the nurse is able to send a complete virtual 3D “copy” of the patient so that it appears on the father’s table. Touching the table, he is able to manipulate the patient’s display, and he can also slide information from the patient himself (Figure 21).

We then see the older daughter on her class fieldtrip in a forest, where an enormous clear display stands in front of the forest, displaying interactive information that can be manipulated by touch (Figure 17). A guide explains the information on the screen to the students, eventually touching a button on-screen that brings up a video of a dinosaur that appears to be integrated into the forest behind the screen, an example of augmented reality (Figure 18). We then see the older daughter walking with another girl through the forest. Coming across a footprint, she holds her tablet over it and touches her screen to bring up information about it (Figure 19). They then
come across a circular orb that glows when she holds her tablet near it, giving her screen images of dinosaurs incorporated into the areas behind it, another example of augmented reality, along with information about those dinosaurs (Figure 20).

The scene then cuts to the same video of the dinosaurs being displayed on the family’s living room wall-to-wall screen as the daughters and mother watch. The younger daughter is then shown completing and submitting her homework on her tablet right before bed as her mother looks on. The mother turns off the lamp by touching a small rectangular display on the wall, and the daughter settles into bed for the evening.
WORKS CITED


