CHAPTER ONE

Introduction: A Ubiquitous Computing Approach to Play and Performance

> *We live in a complex world, filled with myriad objects, tools, toys, and people. Our lives are spent in diverse interaction with this environment. Yet, for the most part, our computing takes place sitting in front of, and staring at, a single glowing screen attached to an array of buttons and a mouse. From the isolation of our workstations we try to interact with our surrounding environment, but the two worlds have little in common. How can we escape from the computer screen and bring these two worlds together?*
>
> —Pierre Wellner, Wendy MacKay, Rich Gold, "Computer Augmented Environments: Back to the Real World" (24)

1.1 "This is Not" a(s) Design Philosophy

In 1993, digital artist and technologist Rich Gold published a short essay on what was then the brand-new field of *ubiquitous computing*, the invisible integration of networked computer functionality into everyday objects and physical environments. Gold, a founding member of the Xerox Palo Alto Research Center (PARC) team that first coined the term, argued that ubiquitous computing was more than a new technological practice.[1] It was, he wrote, a novel worldview, one that would invert the operational metaphor of the digital age.

To capture the reigning worldview he predicted ubiquitous computing would overturn, Gold titled his thought-piece "This is Not a Pipe." This title is meant to invoke French surrealist René Magritte's famous painting of a pipe (*The Treachery of Images,* 1929), which is captioned with the same disavowal. A small black-and-white reproduction of

[1] Xerox was the official corporate sponsor of the Palo Alto Research Center (PARC) when the ubiquitous computing project was first conceived in 1991. On January 4, 2002, PARC incorporated as an independent company, dropping Xerox from its name. However, as a historical matter, it was the Xerox PARC team that launched ubiquitous computing, which is why I have opted to use the now anachronistic name when writing about the early era of the ubicomp project.

1.1 Reproduction of *The Treachery of Images*. This black-and-white reproduction of René Magritte's painting appears at the top of Gold's essay "This Is Not a Pipe". (Gold, 1993)

Magritte's painting appears at the top of Gold's essay (see figure 1.1). This electronically reproduced image is a performative reference, which Gold makes to draw our attention to the ubiquity of *visual reproduction* in contemporary computing culture. Gold observes: "The twin inventions of photography and electricity shattered objects into new and novel pieces. The camera could skin an object and then reproduce the pelt over and over, collaging it into nearly any context" (72). As a demonstration of the profusion of electronically mimetic images, Gold digitally skins Magritte's oil painting and reproduces it in a rather unexpected context: the computing research magazine *The Communications of the Association for Computing Machinery* (72). For Gold, this kind of promiscuous visibility—semblances allow themselves to be reproduced by anyone, anywhere, anytime—is the defining wonder of what he calls the "postmodern" computing age (72). It is "the skin," as he puts it, that current technology desires. And as a result of this desire, resemblances—digitally-enabled images of real referents—blanket the world. For Gold, it is ubiquitous *imaging*, we might say, that precedes the coming age of ubiquitous computing.

What is ultimately being made pervasive via this process of endlessly replicated and recontexualized skins? Gold reminds us that it is not just the images themselves, but also the *notion* of their referents. He observes how effectively, on a cognitive level, skins stand in for the animal itself: "Our [brain's] pattern-matching mechanisms seem to make only a lazy distinction between the symbol and the symbolized" (72). In other words, mimetic semblances are excellent conductors of cognitive concepts. We know what the skins *mean*, or at least what they mean to call to mind. And if we are not inclined to make a more emphatic distinction, Gold suggests, our brains may well process the idea suggested by the image exactly as it would process an unmediated experience of its referent. The age of ubiquitous imaging, then, is a period of prolific and powerful *semantic* replication.[2]

The ability to trigger successful recognition, however, does not mean that the skinned object is rendered in all of its *phenomenological* fullness. Gold writes: "As Magritte so surreally points out, the image of an object is not the same as its Real McCoy, 3D Cousin. While the painting of a pipe might produce a pattern on our retina similar to a real pipe, the pipe of pigment cannot be held, weighed, fingered, stuffed, lit, puffed or thrown" (72). Here, Gold's reading of Magritte's famous caption, "*Ceci n'est pas une pipe*", differs significantly from some of the more well-known critical theory of the painting. Michel Foucault, for example, in *This Is Not a Pipe*, famously calls Magritte's work a break from "the old equivalence between resemblance and affirmation" (43). Mimetic efforts, Foucault observes, have traditionally been aligned very closely with an identity claim, an

[2] Gold's emphasis on image reproduction and replication in general presents an uncanny reminder of the official corporate sponsor of the original ubiquitous computing project: Xerox Technology, which made its name and fortune precisely in the field of document reproduction. The thematic connection between Gold's critical computing vision and the corporate sponsor of his research is an excellent reminder of the importance of social and historical context to the production of any critical theory.

affirmation of sameness. And the disavowal "This is not a pipe," Foucault suggests, cautions the viewer against accepting this claim. "*Don't be misled,*" Foucault speaks for the painting, "*I am mere similarity*" (48). Paired with the sensory-realistic image of a pipe, Foucault writes, the caption emphatically "denies the assertion of reality resemblance conveys" (47). The treachery of Magritte's image without such a disclaimer, then, would be to mislead the viewer into eliding the difference between what is real and what is mimetic of the real.

Here, I want to suggest, Foucault is exploring the critical work of Magritte's provocatively captioned painting in primarily *ontological* terms. If the painting asks us to attend to the difference between persuasive appearance and full material substantiation, then the stakes of this difference according to Foucault are the right to be perceived as real, rather than as mere imitation. Gold, however, considers the painting in primarily *phenomenological* terms. He does not ask how *real* the image of a pipe is versus how real a material pipe is. Instead, he asks, what can we *experience* of an actual pipe that we cannot experience of its perceptually persuasive image? What interactions are possible with the object that its skin alone could never afford?

When Gold speaks of holding, weighing, fingering, stuffing, lighting, puffing and throwing an actual pipe, he is laying out a spectrum of *physical affordances*, or what design psychologist Donald Norman would call "the actionable properties between the world and an actor" ("Affordances and Design"). Affordances are physical properties that invite action and interaction; as such, they are the domain of the material, embodied world. Images do not, as a rule, have affordances. They invite only perception, recognition. What Gold calls the skin of an object, like language, replicates meaning and

content. It does not replicate the functionality or interactivity that we might also associate with the referent. As Gold has argued elsewhere, "A virtual lunchbox, while it looks like it has the affordances of a phenomenal lunchbox, actually has only the affordances of two pictures of a lunchbox, one presented to each eye." ("Art in the Age of Ubiquitous Computing" [29]) For Gold, then, the importance of the phrase *Ceci n'est pas une pipe* is the way in which it points to the lack of pervasive affordances in a post-modern, or ubiquitous imaging, computer culture. There is, instead, a disproportionate focus on the non-actionable skins of things and, concomitantly, an underdeveloped curiosity about how we might digitally reproduce not just the image, but also *the interactive features*, or phenomena, of their original referents.

Ubiquitous computing, or ubicomp for short, addresses precisely this underdeveloped curiosity about the reproduction of phenomenal functionality. It drives digital design beneath surfaces toward a focus on what happens *under* the skin. Ubicomp culture, to extend Gold's metaphor, cares not for the pelt, but rather for the blood and the bones of the beast—the structures and systems that make the animal work. If, as Gold argues, the defining desire of the electronic age so far has been its ability to rip and replicate the perceivable, surface data of a thing, then the ubicomp era finds as its main attraction that which we cannot perceive, but rather must *engage*: the *inner life* of the digital systems. Ubiquitous computing aims to reproduce not appearances, but rather network structure and computational functionality, embedding *systems* rather than *semblances* within nearly any context. It is not the mimetic references or cognitive concepts that ubicomp wants to proliferate; it is rather interactive experiences and phenomenal affordances that will be made pervasive.

There is, by design, a kind of secretiveness inherent to this proliferation of embedded functionality. Not all in a ubicomp world is what it seems. As Gold defines his vision for the nascent field, “Ubiquitous computing is a new metaphor in which computers are spread invisibly throughout the environment, embedded and hiding as it were, within the objects of our everyday life” (72). Here, Gold suggests, features and connectivity go under cover. Interactivity and active networks hide where we least expect them. “The everyday objects themselves become a kind of ruse” (72). One way to think about this change in computing design philosophy, about the move away from perceptible surfaces to imperceptible functionality, is to view it as a shift from powerful *simulation* to masterful *dissimulation*. In both cases, what you see is not necessarily what you get, but for very different reasons. In a world of computer-driven simulation, that is to say in the “skins” scenario, appearances *make empty promises*. The image is not in fact the thing itself, the referent, but rather simply one of infinitely many cognitively convincing references. However, in a world of computer-driven dissimulation, that is to say in the secret “inner life” scenario, appearances *feign a lack of promise*. The seemingly ordinary object conceals its own extraordinary capabilities. The simulation, the reproduction of semblances, likes to show-off. It aggressively and proudly demonstrates its mimetic charms to you. The dissimulation, the reproduction of systems, on the other hand, is coy. It reveals its true affordances only to those who pay special attention, who investigate its properties further than the surface.

Gold’s invocation of Magritte’s painting, then, not only is illustrative of the post-modern computing era; it also provides leverage for understanding the coming age of ubiquitous computing. In the earlier technological culture of simulation, “this is not a

pipe" means *this is not* really *a pipe*. But in the new technological culture of dissimulation, "this is not a pipe" means *this is not* only *a pipe.* The difference between "really" and "only" here is profound. The former is a dismissal; the latter, an invitation.

In his essay, Gold imagines what extraordinary kinds of interaction a "not only" a pipe might invite. He anticipates a "Magritte's Ubi-Pipe of the not-so-distant future," describing it as having the appearance of an ordinary pipe, but *secretly* containing a range of interactive systems: "a location device so it knows where it is, a small microphone for speaking to friends… [and] a pointing device that works with large, wall-sized, electronic displays (to be used during lectures, say)" (72). It might also possess, Gold notes, the surprising network-enabled abilities of "detecting legal and illegal areas of smoking" and also "monitoring vital medical signs" (72). Here, Gold shows us how ubiquitous computing offers the possibility of replicating specific features and functionalities, stripped from their original system locations—a collection that might include a separate global positioning system reader, a cellular phone, a laser pointer, a digital thermometer, a blood pressure monitor, and so on. Ubiquitous computing collages and recontextualizes these systems inside everyday objects to create new networks of interactivity and functionality. The skins and original sensory forms of the referents stay behind; the pipe does not *resemble* any of the original functioning objects. However, the referents' underlying affordances are reproduced; the pipe successfully reproduces the technological *performances* of the original objects. They may not look the same, but they *act* the same.

Although Gold never uses the term 'performance' to describe the phenomenon of ubiquitous computing, the concept of performance is in fact key to his vision of

embedded and networked systems. He closes his essay by describing the world of ubiquitous computing as an "enchanted village, in which common objects have magically acquired new abilities, a village where toy blocks really do sing and dance when I turn out the lights" (72). I want to linger on this fanciful notion, these closing words. What does it mean to compare computing-enhanced objects to inanimate props that secretly come to life? Why leave the reader with a vision of technologies as *toys*, as playthings? What does it mean to end with the performing arts, the singing and the dancing? And why does this performance take place in the dark? These questions matter a great deal, as I want to argue that Gold's vision for ubiquitous computing is fundamentally a vision of distributed networks of play and performance. It therefore is essential to understand precisely which specific kinds of play and performance ubicomp culture is designed to generate. Here, it helps to consider a few theoretical perspectives on the relationship between performance and technology, and between performance and play.

1.2 Technological Performance and Dark Play in Ubiquitous Computing

Gold's use of a performing arts metaphor to describe the lively function of computing-enhanced objects must first be contextualized as part of the larger trend of talking about technology in terms of performance. Jon McKenzie's 2001 *Perform or Else: From Discipline to Performance* traces the emergence of performance as a metaphor for the functionality of technological systems at the turn of the twenty-firsts century. Noting "capability, operation, function, and efficiency" as synonyms for a technology's performance, McKenzie defines technological performance as a system's "effectiveness at a given task" (97). This effectiveness is measurable and comparative, so that individual technologies can be competitively evaluated and refined to deliver ever higher

performance. McKenzie argues that both the processes for evaluation and the venues for demonstrating and evangelizing a system's performance abilities are as ubiquitous as the technologies themselves. In other words, a technology must be not only effective at the thing it is designed to do, but also effective *publicly*. A technology's total worth is measured through its ability first to perform (to function), and second to perform for an audience (to demonstrate). It successful operation must be a *visible* part of the technological culture.

The first order of performance described by McKenzie, performance as the ability to complete a specific technological function, is certainly a kind of performance that Gold envisions for ubiquitous computing. Gold intends to strip specific functionalities from their original computing sources and to reproduce and recombine them pervasively in entirely new contexts. This act of recombinant repetition, the restoration of interactive capacity in novel arrangements, aligns perfectly with McKenzie's notion of technological performance, which as he notes, is always a matter of repetition. McKenzie cites performance theorist Richard Schechner's well-known definition: "Performance means: never for the first time. It means: for the second to the *n*th time. Performance is twice-behaved behavior, restored behavior…. These strips of behavior can be rearranged or reconstructed; they are independent of the causal systems that brought them into existence. *They have a life of their own*" (214). Here, in Schechner's description of recontextualized patterns of behavior, we find the model of performance that underlies the reproductive aims of Gold's ubiquitous computing. The ubicomp object is a collage of restored functionality, rather than a collage of semblances. And where Schechner suggests that the strips of behavior that constitute performance "have a life of their own,"

Gold clearly sees the strips of computing functionality as having an animating effect—the computing-enhanced toy blocks *come to life* with performance. Elsewhere, Gold has called ubicomp objects "deeply enspirited," a coin termed to indicate the *embedding* of spirit in previously inanimate things ("Art in the Age of Ubiquitous Computing" [13]). I want to suggest that this animating spirit is best understood through McKenzie's use of Schechner—that is to say, it is best understood as the enspiriting force of restored functionality. This force puts performance at the very heart of all ubiquitous computing.

But what about the second order of performance in McKenzie's framework, in which technologies are called upon to demonstrate *publicly* their ability to perform? This aspect of McKenzie's theory is significantly challenged by Gold's vision of secretly embedded computing. His technologies are not meant to perform visibly—remember, "invisible" is one of the defining terms of ubiquitous computing. The computing happens as if by magic; the virtuoso system is not meant to be observed directly. But what kind of performance is cloaked in secrecy? What is the point of performance in the dark?

The *in-the-darkness* of ubiquitous computing calls to mind a particular genre of performance identified by Schechner: *dark play*. In *Performance Studies: An Introduction*, Schechner defines dark play as follows: 'Playing in the dark means that some of the players don't know they are playing" (106). In other words, there are two kinds of participants: those who are cognizant of the underlying play-aspect of an interaction and those who see only the surface ordinariness of the interaction. To those who are "in the dark," the play looks like everyday behavior, *for real* rather than for play. The basic parallel between dark play and ubiquitous computing, then, is that in both scenarios, there is a disparity in information. Some ubicomp users, presumably, will be

aware of the "secret" performance abilities of seemingly ordinary objects, while others are not, just as the dark players are aware of the secret performance taking place in a seemingly ordinary context, while others are not. But beyond this basic parallel, there are two important elements in Schechner's definition of dark play that I want to draw out further: dark play's architecture and its frame.

There is an implicit architecture universal to all acts of dark play: it must be embedded in some ordinary context where play is unexpected. In order for the knowing players to rub up against a pool of non-knowing players, the game must take place in an environment and social context not typically associated with play. The structural elements of dark play require it to be *out in the world*. The connection here to ubiquitous computing is clear: it is also built to be out in the world. Technological systems are embedded in unexpected contexts, in the everyday locations and social situations where users do not (yet) expect to encounter computing. The work of both dark play and ubiquitous computing, then, is a process of tacitly challenging the environmental and socio-contextual categories for their respective modes of interaction. And this work is accomplished through a layered architecting of experience. The hidden performances of ubicomp technologies are designed according to the same interactive blueprint as the hidden performance of dark play.

The second element of Schechner's definition that I want to address is that of frame. Schechner writes of dark players: "They subvert the metacommunicative message 'this is play' that Gregory Bateson posited as necessary for play to begin, continue, and thrive" (107). Here, Schechner refers to anthropologist Gregory Bateson's term for the culturally-specific signals, like winking or smirking, that indicate a playful intention. This

term, ‘metacommunication,’ establishes the proper cognitive frame for interpreting behavior. In dark play, Schechner suggests, the frame is absent; dark players actively avoid giving the proper signal. If ubiquitous computing is like dark play, does that mean ubicomp technologies intentionally offer up an intentionally misleading interpretive frame? For that to be possible, we would have to accept that technologies, in general, engage in metacommunication. Do they? And if so, can we say that ubicomp technologies are designed to stifle that metacommunication?

I think there is, in fact, a clear analog to the idea of metacommunication in computer culture: *interface design*, or the process of designing how a user will engage with a system. Of the countless books and scholarly articles that have been written on the subject of computer interfaces, the vast majority of attention has been paid to how thoughtful design can communicate to users the best and most efficient ways to interact with the system. But has there been any work done on the question of how users are first alerted to the opportunity for computing? What signals ‘this is a computer’? In recent work in the field of ubiquitous computing, in fact, some effort has been made to establish visual cues for interactive opportunities. A research team at the University of Oulu published the article “Requesting Pervasive Services”, in which they identify the need for what I would call a metacommunication for computing. The authors write: “As the vision of pervasive computing gradually becomes a reality, we are seeing an increasing number of services in our everyday environments…. Although a positive phenomenon, this transition also introduces considerable challenges to *discovering* and selecting services” (Riekki et al 40, emphasis mine). The authors note the need for a computing signal, a conventional gesture that indicates the otherwise hidden interactive affordances. They

therefore propose a general framework for making passersby aware of ubiquitous computing's undercover functionality: "Visual symbols communicate to users the objects that they can touch and that activate services" (40). In other words, the computing opportunities will be framed.

This kind of conventional symbolic cue to interaction actively works to mitigate the in-the-darkness of ubiquitous computing. It is the first of no doubt many future attempts to metacommunicate the idea: *You are now in a computing-enhanced space*. But in Gold's original vision for the field, it is not clear what, if anything, is meant to signal to the user that this is not only a pipe—it is also a networked computer. I understand Gold's imagined Ubi-Pipe as being completely unframed. There is no mention of a Magritte-style caption for the Ubi-Pipe, no visual symbol to indicate its secret abilities. It is precisely this lack of a visible frame for the computing system that creates the sense of being "in the dark"—visual perception is no longer a reliable cue to frame. Instead, the object requires *exploratory physical engagement* to determine which frame is appropriate. Rather than inhaling traditionally from the pipe, for example, a few experimental exhalations in rapid succession might yield unexpected biometric output. Waving the pipe dramatically in the air as if to emphasize a point through gesticulation might trigger, through accelerometers, the laser pointer system. The Ubi-Pipe is just another object on the shelf—until you play with it.

Here, I think, is where it starts to become quite meaningful that Gold chooses *toys* as his metaphor for ubicomp objects. A toy, of course, is designed for play. And without a conventional system of computing metacommunication, I want to suggest, the only effective way to gauge the proper cognitive frame—can I compute with this or not?—is

to experiment playfully with the space or object in question. Wave it, throw it, drop it, suck on it… this is all, metaphorically, play in the dark. The user must *feel* his or her way to discover the interactive opportunities and to learn the invisible system's rules of engagement.

If ubiquitous computing as envisioned by Gold seems to be itself a form of dark play, then it is important to note that Schechner identifies the motivations of dark play as always, to some degree, hostile and self-serving. He writes: "Dark play's goals are deceit, disruption, excess, and gratification" (107). It mocks and manipulates those who are not in the know. To what extent is this true of ubiquitous computing? Some bystanders will be blind to the ubiquitous computing going on around them, no doubt. And it is equally probable that inadvertent users may occasionally engage the system without understanding how, or to what ends, the system has engendered their participation. However, in Gold's articulation of dark computing, there is no contempt expressed toward those who are unknowing. There is, instead, an invitation to become knowing. Even with the lights out, Gold suggests, it may be possible to discover the secret performance, to become a cognizant player in the enchanted encounter. I would argue that Gold's use of the term "enchanted" to describe his ubicomp village is quite meaningful and telling of his more benevolent vision of dark play. To enchant is to *attract* and to *delight*. These are the aims of the dark play of Gold's ubiquitous computing—not to deceive, but to surprise; not to remain hidden, but to be discovered. Gold's ubicomp toys extend an invitation to all who are willing to be engaged by the things around them. Whereas Schechner's dark play is exclusionary, elitist, Gold's dark play is inclusive; its enchanted objects mean to draw you in, to solicit human action as a

way of revealing the liveliness underneath the deceptively still and ordinary surfaces of ubiquitous computing. This solicited interaction seeks to enable a more balanced relationship between the user and the technology, and to include more potential users in the community of knowing players. Accordingly, the power imbalance Schechner identifies as essential to dark play shifts to a state of mutual and common engagement. With the formation of this relationship built on mutual awareness, the line of dark play is crossed and knowledge of the interactive system is revealed.

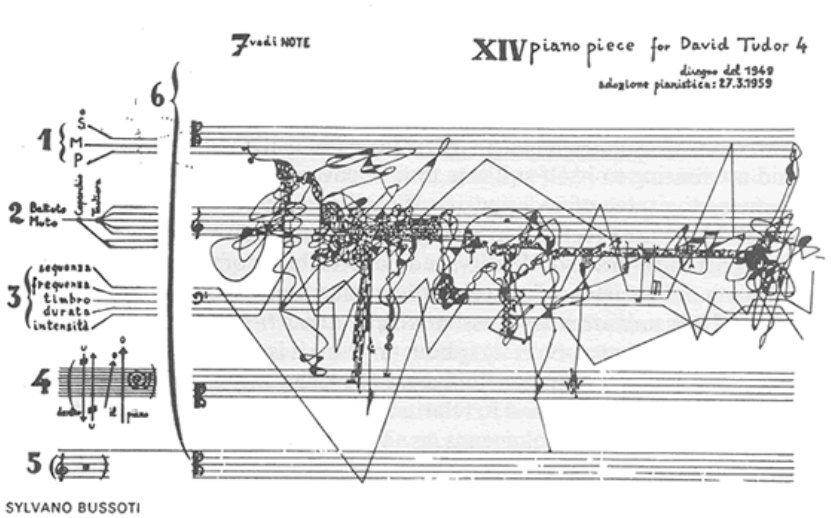
Gold's decidedly benevolent vision of dark play, of course, is by no means an obvious or certain outcome of ubiquitous computing. Ubicomp culture as developed and theorized by other ubicomp researchers might not seek so consistently to inform and to engage those who enter computing-augmented spaces or encounter computing-augmented objects "in the dark". It is quite possible and not entirely implausible, instead, to imagine a technological future in which Schechner's more malevolent dark play is manifest as a defining characteristic of ubicomp society—for example, through secret surveillance practices and socio-technological class warfare. Gold's description of the enchanted village, to be sure, is an optimistic view of the technological future to come. However, it is *not*, I would argue, a naïve one. Gold actively recognizes that technological innovation is not neutral; "This Is Not a Pipe" therefore seeks to shape a socially *positive* set of values for future ubicomp work. In proposing a more benevolent picture of dark play, Gold is not ignoring the negative possibilities of dark computing. Rather, he is outlining an ethical approach to designing, developing and deploying ubicomp systems, an approach that works specifically and strategically against what for him (and arguably for most of us) would represent a dystopic ubicomp society.

I have suggested that Gold's ubicomp objects are capable of overcoming the power imbalance of dark technology to form relationships among users and their computing systems, relationships based on mutual and common engagement. In the next section, I will explore in further detail how relationship formation is a central theme and a core mechanic of the Gold's envisioned ubicomp network.

1.3 Relationships and Rhizomes in the Ubicomp Network

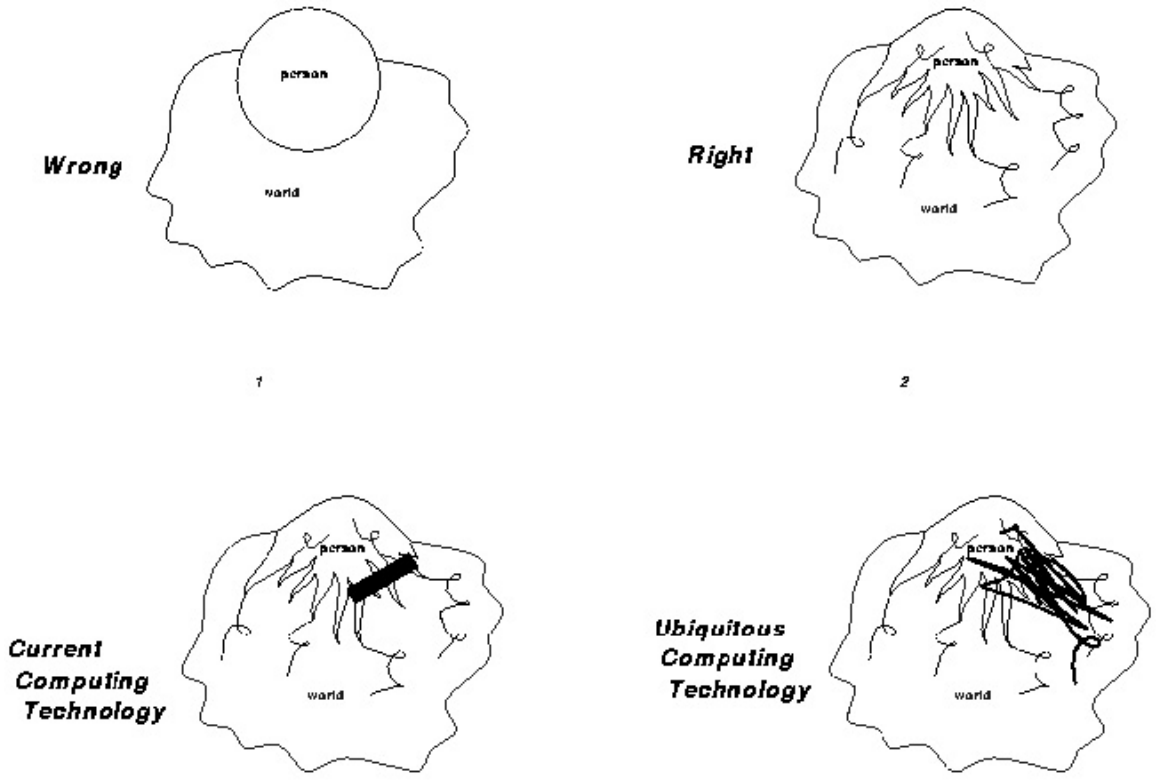
Gold's ubicomp systems are designed to communicate and to interact not only with local users and the local environment, but also with each other, and therefore potentially with remote users and remote environments. The ubicomp infrastructure, we might say, is a kind of *relationship engine*—an always-growing rhizome, with infinitely many points of potential connection. I use the term 'rhizome' here in the sense that French theorists Gilles Deleuze and Felix Guattari adopted the biological stem structure in order to talk about late twentieth-century systems of language and politics, and also in the tradition that their work has been taken up by countless theorists of digital network culture. As Deleuze and Guattari describe such systems, "any point of a rhizome can be connected to anything other, and must be. This is very different from the tree or root, which plots a point, fixes an order" (7). For their work *A Thousand Plateaus: Capitalism and Schizophrenia*, which introduces this notion of the rhizome, the authors choose a section of a musical score by Sylvano Bussoti as their graphical representation of the post-modern configuration (see figure 1.2). In the illustration, *Five Pieces for Piano for David Tudo*r, we see that the individual notes of the score are connected multiply and explosively. The bold lines and fervent squiggles across the musical staff suggest a passionate and almost impossible degree of simultaneous connectivity.

1. Introduction: Rhizome



1.2 "Introduction: Rhizome." The authors of *A Thousand Plateaus* use this experimental musical composition to represent the frenetic interconnectivity of their theoretical concept, the rhizome. (Deleuze and Guattari, 1987)

Mark Weiser, who directed Rich Gold's work at Xerox PARC and is widely considered to be the founder of ubiquitous computing, has explained the ubicomp project in terms strikingly similar to those of Deleuze and Guattari. In 1996, Weiser created and published a cartoon on his personal web site under the title "Phenomenological post-modernism explained and related to computer science, in cartoons" (see figure 1.3). Although Weiser does not offer any further explanation of the cartoon, both the reference to post-modernism in the title and the striking similarity between Weiser's squiggles and Bussoti's score suggests to me the possibility that Weiser is, in fact, referring specifically to Deleuze and Guattari's work on the rhizome. However, even if the reference is not a conscious one, the rhizomatic design of the two drawings on the right-hand side of the cartoon nevertheless suggests a significant conceptual link between ubiquitous computing



1.3 "Phenomenological Post-Modernism Explained and Related to Computer Science, in Cartoons." Here, the founder of ubiquitous computing graphically represents its explosive connectivity. (Weiser, 1996)

and the rhizome. In what Weiser labels as "the right way" for ubiquitous computing to proceed, the single node of an individual user sprouts multiple connections to the surrounding world. Indeed, the stroke of Weiser's lines here are as frenetic and suggestive of the desire to connect to everything at once as the lines of Bussoti's score. Juxtaposing these two figures reveals, I believe, a critical bond between the connective infrastructure of ubiquitous computing, as envisioned by Weiser, and the rhizome, as theorized by Deleuze and Guattari.

If we take ubiquitous computing to be a rhizomatic structure, then what might be the result of its successful multiplicity of relations, its promiscuous connecting of others to others to others? Gold describes his ubicomp system as an enchanted village, and I am very much struck by the term 'village', both in its implications of community and its

intimation of a kind of social life for the technological objects. Gold, in fact, likens the network of ubicomp technologies to a living ecosystem: "Each of these computers can talk with any of the other computers much like chattering animals in a living jungle, sometimes exchanging detailed information, sometimes just noting who's around" (72). Does the network of ubiquitous computing really constitute a social ecosystem? And if so, what are the implications of socializing our technologies? Here, I turn to the work of philosopher of science and technology Bruno Latour, who offers us a rich theory of community across technology networks: *the technoscience collective.*

1.4 The Social Structures of Ubiquitous Computing

In his 1999 essay "A Collective of Humans and Nonhumans", Latour proposes the technoscience collective as a critical framework for understanding three intersecting orders of social relations: the social life of technologies, the social life of technology users, and the social life that develops between technologies and their users. Gold has described these same three orders of social interaction across ubicomp culture: "Ubi-objects are communicative. They talk a lot amongst themselves, between themselves and other ubi-objects, and between themselves and us" ("Art in the Age of Ubiquitous Computing" [21]) Latour asserts that in order to understand how these three orders of techno-social relations function, we must reconsider the traditional dichotomy of subject-object, in which the subject is the human user and the object is the applied technology. He suggests instead the more collaborative pairing of *human-nonhuman*, which he hopes will argue against the perceived passivity of our technologies. Technologies are, he argues, "full-fledged actors in our collective"(174). By *full-fledged actors*, Latour means to indicate that technologies are neither objects fully controlled and instrumentally

deployed by their users, nor are they independent subjects capable of autonomy or spontaneous agency. Rather, they somehow participate collaboratively in the design and execution of technological action. But what is the nature of this participation? Here, Latour's choice of the term *actor* is significant and worth unpacking. What does it mean to say a technology is *acting*? There is a different kind of performance implied here than in McKenzie's notion of computational function.

First, we must understand what Latour means by *collective*, the context in which technological action takes place. For Latour is not just defining technologies as actors, but also defining them as part of what we might call a performance network, across which any member of the network may be called upon to act in collaboration with other actors.[3] Latour uses the term collective, then, to describe the coming together of the material world and the human world into a mutually transformative relationship. He writes: "Our collectives are tying themselves ever more deeply, more intimately, into imbroglios of humans and nonhumans" (201). Of this growing imbroglio, Latour writes: "At each stage the scale and the entanglement increase" (213). Here, the notion of ever-increasing scale and interconnectivity should remind us of both the ambition and implied intimacy of a ubiquitous computing culture. Ubiquitous, or all-reaching, is quite simply the greatest imaginable scale. And the growing entanglement between users and their technologies, or humans and nonhumans in Latour's terms, is strongly suggested by both

[3] Those familiar with Latour's work may be reminded here of his work with Michel Callon to develop the Actor Network Theory (ANT). Latour does not reference ANT in this particular text, although clearly his notion of the technoscience collective echoes many of ANT's principles. I myself prefer to work with Latour's technoscience collective because although ANT is technically called a theory, Latour has frequently argued that it is in fact *not* a theory and cannot be applied as such. Rather, it is a methodology for conducting ethnographic research. (See, for example, Latour's 2004 essay "A Dialog on ANT".) The technoscience collective, I want to suggest, is Latour's actual theorization of the same concepts that he earlier developed as the ANT methodology. As I am doing primarily theoretical work, I will use the technoscience collective theory rather than the ANT methodology.

the *physicality* of ubicomp interfaces, thus requiring a more intimate kind of contact, as well as their *social situatedness*, which embeds them in increasingly personal and interpersonal contexts. Indeed, one of the most interesting areas of research in ubiquitous computing today is the sub-field known as "intimate computing", which explores precisely the physical and social entanglements of users *with* their technologies, and with each other *through* their technologies.[4]

This ever-scaling and increasingly intimate relationship between users and technologies, Latour suggests, leads to a transfer of metaphors and organizational practices across the two groups. "Whenever we learn something about the management of humans, we shift that knowledge to nonhumans and endow them with more and more organizational properties," Latour writes (207). In other words, "To relate nonhumans together… is to grant them a sort of social life" (207). Here, Latour observes that we build technology networks so that they reflect human ways of relating to each other. We socialize our technologies by enabling them to communicate, delegate, share resources, and so on. We observe this socializing practice clearly reflected in Gold's design statements. In a 1993 lecture for the International Symposium on Electronic Art, for instance, Gold elaborates on his previous "This Is Not a Pipe" intimation of a social life for ubiquitous computing. He states: "These enlivened objects help and hinder, collude and conspire, whisper and talk with each other" ("Art in the Age of Ubiquitous Computing" [6]). By adopting network design verbs like to *collude* and to *conspire*, Gold does indeed endow the technologies with human-social attributes. Meanwhile, Latour

[4] Leading researchers in this area include Joseph "Jofish" Kaye, Genevieve Bell, and Mizuko Ito. See, for example, "Intimate Objects" (Kaye, et al 2004); "Communicating Intimacy one Bit at a Time" (Kaye, et al, 2005); "Intimate Ubiquitous Computing" (Bell, et al 2003); and *Personal, Portable, Pedestrian* (Ito, et al 2005).

suggests, because the technocollective is such an intense and intimate entanglement, “The opposite process is at work: what has been learned from nonhumans is re-imported so as to reconfigure people” (208). That is, users start to organize themselves according to the social metaphor of distributed technologies.

If Latour’s assertion is correct, that technological infrastructure becomes a socializing force on the humans that designed them, then Gold’s vision of the social life of ubiquitous computing takes on added significance. Whatever relational behaviors emerge among ubicomp technologies, we should expect to see emerge within the community of ubicomp users as well. How will Gold’s ubicomp users connect with each other? What new metaphors of ubiquitous computing will organize their user-to-user relationships? Gold characterizes the social life of ubicomp technologies as an enchanted village in which objects plot and conspire; will users enjoy this feeling of playful conspiracy? His objects collaborate through dramatic song and dance; will a kind of technological dramaturgy and choreography become a social practice of the ubicomp set? Gold also describes the social ecosystem of a living jungle. There is a sense that its members are highly attuned to each other, with their constant chattering and tracking of whereabouts. Will ubicomp users therefore be more attentive to the minutiae of each others’ daily lives? Will actively perceiving the presence of others in the network, co-located or not, come to be a defining quality of ubicomp culture?

In all of these potential futures, community ties across groups of users are strengthened as the user communities themselves grow to resemble the dense network of computer systems. Indeed, Weiser predicted in 1991:

> By pushing computers into the background, embodied virtuality will make individuals more aware of the people on the other ends of their computer links… Ubiquitous computers reside in the human world and pose no barrier to personal interactions. If anything, the transparent connections that they offer between different locations and times may tend to bring communities closer together ("The Computer for the Twenty-First Century" 100).

Gold does not make such predictions in his design statements about how technological infrastructure might shape human social structures. However, his imaginative depictions of community across ubicomp technologies, considered alongside Latour's theory of the technoscience collective, suggests a future in which our notions and practices of community are profoundly affected, and potential points of connection massively multiplied, by the social life of our technologies.

Having established the fundamentally relational nature of the technoscience collective, Latour updates his earlier claim for technologies: "They deserve to be housed in our intellectual culture as full-fledged *social* actors" (214, emphasis mine). Here, Latour finally presents a full description of technologies' acting repertoire. To describe this range of "sociotechnical" action, he settles on the word *technique* (209). He writes: "At last we are in a position to define technique, in the sense of a *modus operandi*" (209). A modus operandi is a characteristic pattern and style of doing some particular work. The sociotechnical action of technologies, therefore, is to embody a particular pattern or style—that is, to propose through its very being a specific mode of operation. It must manifest physically and socially the structure of its own deployment. As we have already

noted, Donald Norman, who first popularized the term affordance in the field of technology design, defines the affordances of tools as their actionable properties. Latour pushes further on this concept to describe the embodiment of an affordance as a kind of action in itself. It is a performance of what is technologically possible, a gesture toward what actions the user might take. Latour further describes techniques as "articulated subprograms for actions that subsist (in time) and extend (in space)" (209). These subprograms, or specific sequences of actions and formal parameters for carrying out those actions, are meant to be enacted by the human users. They are both the script and the mold for the users' technological performance. We see here, again, the cyclical flow of technology metaphors from the nonhumans to the community of human users—Latour describes the humans as being susceptible to programming, just as their own technologies are programmed. The mutual performance of technologies and their users, then, can be understood as the technologies' embodied potential for a specific action or interaction and the users' actual execution of that technique.

Do Gold's ubiquitous computing technologies perform through Latour's notion of technique? To say, as Latour does, that technologies are capable of *articulating* is to endow them with a particular kind of speech capacity—capable of speaking not just to each other, but also directly to their users. The signifying faculty of Latour's nonhuman actors certainly makes sense in a world where technologies are clearly on display, where their affordances are primarily at the surface. But ubiquitous computing has been described not only as invisible, but also as fundamentally "tacit"—that is to say, unspoken (Weiser 95). In a ubicomp world, will human users be capable of receiving an

articulated message of technique, when it would seem that articulation is counter to the technology's mission statement?

Here, we return to the basic claim of Gold for ubiquitous computing: that it will replicate and resituate affordances, rather than semblances, or signs. What is being reproduced and embedded are invitations to specific *modus operandi*, opportunities to engage in a particular sociotechnical performance. But the dissimulation of ubicomp objects—it looks like a pipe, but it is not only a pipe—prevents us from recognizing the actionable properties through our usual visual, pattern-matching process. So how are the techniques discovered? Gold, in his brief and whimsical case study of a Ubi-Pipe, has suggested two means of discovery. First, ubiquitous computing invites our participation in the network through a kind of sensuous serendipity. While we may be used to recognizing things based on appearance, we will learn instead to practice a more intuitive kind of attention. What we cannot see, for instance, we will hear and feel as the performing technologies sing and bump into us. The song and dance are clues to a liveliness; they alert us to the need to investigate further. Where the retina fails, Gold suggests, other receptors may succeed in detecting patterns. We simply need to increase our sensitivity.

In his own mission statement for ubiquitous computing, "Open House", Weiser echoes Gold's belief in the potential sensitizing properties of ubicomp technologies. He argues that ubicomp may very well make humans more cognizant of the deep structure of interaction in the world. He writes: "Ubiquitous computing just might help connect us to the fundamental challenge that humans have always had: to understand the patterns in the universe and ourselves within them" (9). Weiser connects the idea of increased

perceptual sensitivity to the rhizomatic infrastructure, adopting again the biological metaphor: "We become smarter as we put our roots deeper into what is around us" (8). He calls ubiquitous computing "one giant connection to the world," and I believe that this proliferation of connections, or receptors as Gold would suggest, requires not a higher *degree* of attention, but rather a greater *range* of sensitivities to the physical environment (8). Indeed, what is the point of escaping the computer screen if not to become entangled with the phenomenal world of objects and environments? The term 'open' in Weiser's title "Open House" works on many levels, but the meaning that I think has been less remarked upon than it ought to be is the sense in which Weiser is urging *us* as technology users to be more open to our computationally-augmented local and daily environments. We must open up more and more peripheral sensors for ubicomp technologies to trigger when we don't yet realize we should be paying attention.

This increased range of sensitivities represents a fundamental shift in the *kinds* of affordances users will be able to recognize. Weiser and fellow Xerox PARC researcher John Seely-Brown speak of an intuitive perception of non-surface affordances in "Designing Calm Technology", another early statement on ubiquitous computing:

> Our notion of technology in the periphery is related to the notion of affordances…. An affordance is a relationship between an object in the world and the intentions, perceptions, and capabilities of a person. The side of a door that only pushes out *affords* this action by offering a flat pushplate. The idea of affordance, powerful as it is, tends to describe the surface of a design. For us the term 'affordance' does not reach far enough

> into the periphery where a design must be attuned to but not attended to (4).

It is clear that both Weiser and Gold are interested in pushing beyond the surface when it comes to communicating affordances. Weiser's notion of tuning into actionable properties as kind of background data processing fits nicely with Gold's description of discovering interactive features in the dark. This kind of articulation of technique works through a higher order of pattern recognition than the more deliberate modes of perceptual recognition in which a user consciously asks, "What do I do with this thing?" The effect of peripheral affordances may be, Weiser suggests, to create a subtle sense of being drawn to something that has triggered our pattern detectors. Like Gold's enchanted village, Weiser's vision of ubiquitous computing simply requires a greater receptiveness on the part of users to their technologies' many charms.

The second means that Gold suggests for discovering the tacit techniques of the ubicomp world is far more direct than the kind of peripheral, intuitive, sensuous recognition of interactive patterns in the environment. We might call this second means the *collage* of affordances. That Gold chooses to work with a surrealist painting, when surrealism as a practice has so famously made extensive use of the collage, is certainly not an accident. Gold describes his Ubi-Pipe as being constructed through a fanciful layering of actionable properties. The first layer is conventional—the tapered stem of a pipe suggests the action of placing one's lips around it. This is the traditional affordance of material pipe. The underlying layers, or hidden computing affordances, are connected to the social and material conventions of the everyday object. Gold describes this design through collage: "It is a poetic act drawing equally from the functionalism of the Bauhaus

and the symbolism of surrealism" (72). In other words, we have not lost Latour's articulated technique—we have merely buried (and connected) tacit techniques beneath symbolically appropriate, surface affordances. As Gold writes: "It is precisely the pipe's small pocketable size and traditional close proximity to the mouth that make it ideal for containing these features without straining social convention" (72). If the first layer of affordance, its pocketable size, suggests putting the object in a pocket, then it is only through acting on this surface property that a secret layer of affordance can be discovered—perhaps when an embedded computer system in the user's clothing senses the presence of the pipe and activates. What this suggests to me, then, is that in ubicomp world we may simply want to pick up everything of pocketable size and put it in our pockets—just to see what it does. We may want to put anything that looks like it was designed to rest between pursed lips in our mouth—just in case that action might reveal further interactive opportunities. Because as Gold has promised: "There is no telling what a given ubi-object might do" ("Art in the Age of Ubiquitous Computing" [24]).

It is impossible as we discuss this kind of radically tactile play and exploration not to be reminded of early childhood behavior, in which anything and everything is touched, tasted, and torn apart en route to learning what things are for and how they work. Is the experience of ubiquitous computing, in fact, a radical rediscovering of the material world that encourages us to play like children? Here, and finally, I want to return to Gold's decision to describe ubicomp technologies as an "enchanted village, in which common objects have magically acquired new abilities, a village where toy blocks really do sing and dance when I turn out the lights" (72). I have long found these final words profoundly evocative, but I have struggled to articulate why. Only in thinking about the

nature of child's play, and particularly the role of magical thinking in early childhood exploration of the material world, have I come to understand what we might call the psychology of ubiquitous computing. For I believe that in "This Is Not a Pipe", Gold has laid the groundwork not only for an aesthetic and phenomenology of ubiquitous computing, but also for its psychology. And the best critical framework for exploring Gold's proposed ubicomp psychology, I want to suggest, is psychoanalyst D.W. Winnicott's theory of *transitional objects*.

1.5. A Theory of Transitional Play and Ubicomp Objects

Part of a larger work entitled *Playing and Reality*, Winnicott's essay on "Transitional Objects and Transitional Phenomena" outlines a theory of prop-based play, in which the player seems to exert an extraordinary, magical control over the things in his or her environment. Winnicott's primary concern is to understand what he calls "an intermediate area of *experiencing*, to which inner reality and external life both contribute… a resting place for the individual engaged in the perpetual human task of keeping inner and outer reality separate yet interrelated" (2). This intermediate area is first experienced in infancy, Winnicott suggests, calling it "the initiation of a relationship between the child and the world" (13). In infancy, Winnicott claims, there is an "intermediate state between a baby's inability and his growing ability to recognize and accept reality" (3). In other words, the baby must learn that there is world of things and people operating independently of the baby's own desires and impulses. This learning does not occur immediately, Winnicott suggests, because of the devoted attachment with which a mother cares for and feeds her baby. He writes: "The mother's adaptation to the infant's needs, when good enough, gives the infant the *illusion* that there is an external

reality that corresponds to the infant's own capacity to create" (12). The baby wants to feed; magically, the mother's breast appears to satisfy that desire. The infant's resultant belief in his or her ability to affect the external environment through internal thought or feeling is what Winnicott calls the "experience of magical control, that is, experience of that which is called 'omnipotence' in the description of intrapsychic processes" (47). There is a degree of responsiveness and a quality of immediacy to the mother's response that makes the external world seem, to the baby, a fully controllable extension of itself.

In order to overcome this illusion of omnipotence, the child must discover the independent reality of things in his or her environment. This discovery, Winnicott suggests, occurs most commonly through toy objects. Toys engage a rich fantasy life, but also have a tactile reality that resists the complete control of the child. Winnicott calls such toys *transitional objects* and identifies them as the primary platform for *transitional phenomena*, that is, the experiential area "between primary creativity and objective perception based on reality-testing" (11). Here, primary creativity is the experience of being able to control completely the external world, as if one is the creator of all things and phenomena in the environment; whereas reality-testing is the state of being open to frustration, the ability to recognize which things are not under one's complete control and which therefore possess an external reality. A child's experience with these toy objects, like blocks, dolls and blankies, involves both fantasy play, such as projected personalities and superpowers, and real manipulation, such as construction, puppetry, and loving touch. As such, Winnicott writes, "fantasying gets links up with functional experiences" (4). Through this object-based play, "the infant passes from (magical) omnipotent control to control by manipulation (involving muscle and coordination pleasure)"(9). If this passing

out of perceived omnipotence is the end-result of transitional phenomena, then we can understand the child's interaction with transitional objects as retaining some degree of magical thinking with a new and increasing attentiveness to material properties.

But do we ever pass completely out of magical thinking? According to Winnicott, no. While infancy may offer the most pronounced period of transitional phenomena, Winnicott suggests, the intermediate area of experience nevertheless maintains its importance to humans of all ages. He observes: "It is assumed that the task of reality-acceptance is never completed, that no human being is free from the strain of relating inner and outer reality, and that relief from this strain is provided by an intermediate area of experience which is not challenged (arts, religion, etc.). This intermediate area is in direct continuity with the play area of the small child"(13). In other words, even in adulthood, we take up transitional phenomena that allows us a temporary relief from reality and returns to us some of the satisfaction of magical thinking, while still engaging with physical artifacts (think here of the props necessary to both art and religious practice). How these adult forms of transitional phenomena differ from the earliest experience of mixed fantasy and functionality is an important point for Winnicott. He suggests that as we mature, we look for more communal ways to suspend reality and reassert magical control over the environment. This tendency is first seen in the developmental stage that immediately follows individual experience of transitional phenomena, a stage in which multiple children engage simultaneously with the same transitional objects. Sharing common toy objects allows children to "enjoy an overlap of play areas" (48). During this time, the children can agree to certain magical assertions and fantastic claims while perceiving and acknowledging in common certain physical

aspects of the transitional objects. This shared transitional experience serves an important social function, Winnicott suggests: “Thus the way is paved for a playing together in a relationship” (48). As adults, we forge relationships in the same way. “Should an adult make claims on us for our acceptance of the objectivity of his subjective phenomena we discern or diagnose madness. If, however… we can acknowledge our own corresponding intermediate areas, we are pleased to find a degree of overlapping, that is to say common experience between members of a group” (14). Here, Winnicott acknowledges the fine line between acceptable fantasy play and what others perceive as delusional behavior. The question here is whether a player in fact believes in the magical control perceived during transitional phenomena or whether the player is merely inviting others to enjoy the same intermediate experience. Sometimes, Winnicott aptly observes, it can be difficult to tell the difference.

What I want to ask with respect to Winnicott’s theory of transitional play is this: Are the ubiquitous objects described by Gold, in fact, transitional objects? And if so, do they support a collective experience of transitional phenomena? When Gold writes that the toy blocks “really do sing and dance”, I am struck by his careful use of the phrase ‘really do.’ Gold could have described a village in which ‘the toy blocks sing and dance when I turn out the lights’, but the insertion of the phrase ‘really do’ indicates *a prior belief* that maybe, when I turn out the lights, the toy blocks will come to life. In the ‘really do’ scenario, it is not therefore a complete surprise when the objects’ performance begins. It is, instead, hoped for, wished for, and then confirmed. I find this final moment in Gold’s essay to be an excellent example of magical thinking: a fantastic, imagined event seems to manifest in physical reality exactly as it was first conceived in mental space. In other

words, the outer world suddenly reflects the dreams and desires of the inner world. The external world of ubiquitous computing, I would argue, is portrayed as a space of intermediate experience, where the objects have both the degree of immediacy and responsiveness associated with the mother's breast and the material properties associated with mature reality-testing. When Gold calls the experience of ubiquitous computing "magical", I want to suggest that the technology is conducive to the combination of fantasy and functionality that can only be experienced through play. Ubiquitous computing offers to return to us the comforting feeling of having control over our environment. Ubicomp makes it okay to believe at least a little bit that our own imagination has the ability to activate the world around us.

This magical quality is a large part of what makes the promise of ubicomp so exciting to its earliest proponents, I want to suggest. "Play is immensely exciting," Winnicott argues. "The thing about playing is always the precariousness of the interplay of personal psychic reality and the experience of control of actual objects. This is the precariousness of magic itself, magic that arises in intimacy, in a relationship that is being found to be reliable" (47). Here, Winnicott describes the special quality of intimacy that arises from being physically connected to an object that is responsive in just the right way. As the embedded systems of ubiquitous computing are designed to be reliable, that is to say to work properly over time, consistently responding to our needs and desires almost before we have realized them ourselves, the opportunities for physically-enabled magical thinking increase.

Winnicott's notion of the inherent materiality of play, of the importance of objects, helps us understand why a ubiquitous computing practice focused on animating objects

with functionality would be so conducive to play. Indeed, this practice would be conducive to *collective* play, I would argue, because of the shared nature of the environment and computer-enhanced objects. Weiser has described the pre-ubicomp desktop era of computing as having "one person and one computer in uneasy symbiosis", whereas the ubicomp era will have "many computers serving many people everywhere in the world" (2). The networked aspects of ubiquitous computing and the co-locatedness of multiple potential users for each object or system increases the potential for what Winnicott has called the "corresponding areas of intermediate experience", the areas where our subjective beliefs about what things might do are manifest for multiple people.

There is one other aspect to Winnicott's theory that I want to attend to by way of understanding not only the play, but also the performance, of ubiquitous computing. "The transitional object gives room for the process of becoming able to accept difference and similarity," Winnicott writes, where difference is *everything-that-is-not-me*, that is to say what is external reality, and similarity is everything-that-is-me, that is to say what is fully subject to internal will (6). The intimacy of ubiquitous computing, then, can also be understood as breaking down the perceived difference between us and our technologies, returning us to a mode of perception where there is more fuzziness about what is different and what is the same. As Latour has said of technologies: "Do they mediate our actions? No, *they are us*" (214, emphasis mine). If we view ubiquitous computing through the dual frame of Winnicott's and Latour's theories of play and performance, we can see that the social action, or performance, of ubiquitous technologies is to occupy that in-between space of what is different but what is also the same. That is, ubiquitous computing ultimately troubles the distinction between our own subjectivity and the performance of

external technologies, as well as the distinction between our interpersonal relations and the social life of the digital network itself.

1.6 Ubicomp Research Culture: The Player and Performer in Residence

In teasing out the theoretical underpinnings and social implications of ubiquitous computing, I have focused on a particular vision of the emerging technological practice—the vision laid out by Rich Gold in his short text "This Is Not a Pipe." Gold's is not the best-known or most authoritative mission statement on ubiquitous computing. Mark Weiser's founding ubicomp essays, for example, and the first technical papers authored by Xerox PARC's ubicomp team are cited far more widely.[5] These other early ubicomp texts, several of which I have referred to already in as much as they underscore and clarify Gold's arguments, traditionally are privileged as more historically significant. They are considered to have played a more decisive role in defining the field and shaping the course of ubicomp research as it has actually unfolded, and therefore they appear repeatedly on reading lists, syllabi, and in works cited, whereas Gold's essay does not. However, I have chosen to work primarily with Rich Gold's essay for several reasons I will outline here.

First, despite having appeared in the prominent computing publication *Communications of the ACM*, Gold's "This Is Not a Pipe" is rarely referenced in the field. This is not too surprising: the essay resembles an art manifesto more than it does a

[5] A traditional reading list of the essential founding texts of ubiquitous computing would likely not include Rich Gold's "This Is Not a Pipe." Instead, it would include the following: "Some Computer Science Problems in Ubiquitous Computing" (Mark Weiser, 1993); "The Computer for the Twenty-First Century" (Weiser, 1994); "The ParcTab Ubiquitous Computing Experiment" (Roy Want, Bill N. Schilit, et al, 1995); "Open House" (Weiser, 1996); "Designing Calm Technology" (Weiser and John Seely Brown, 1996); and "The Origins of Ubiquitous Computing Research at PARC in the Late 1980s" (Weiser, Rich Gold, and John Seely Brown, 1999). For readers interested in a particularly thorough set of historical documents, Xerox PARC has also compiled the first 25 major research reports from their ubiquitous computing group at http://www.ubiq.com/weiser/researchreports.html.

scientific paper. But if Gold's complicated and playful analysis through the lens of an early twentieth-century surrealist painting has not lent itself, upon first reading, to widespread citation, I am hoping here to provide a second reading that encourages further discussion. Why does Gold's statement demand closer attention than it has been paid so far? Gold occupied a unique position on the original ubicomp research and development team, a position that I would argue makes his writing about the field especially important to thinking critically about both the history and future of ubiquitous computing.

Gold, notably, was both a practicing digital artist and an active advocate for the role of the artist in the development of new technologies. The same year that he published "This Is Not a Pipe", Gold created, and went on to manage, the influential PARC Artist-In-Residence program (PAIR), which paired fine artists and scientists together based on shared technologies. In a 1993 lecture for the International Symposium on Electronic Art, Gold described the PAIR program, which is also documented in the book *Art and Innovation*, as follows: "PAIR is a conscious attempt to boost and redirect the creative forces of PARC by providing alternative view points, theories, personalities and methodologies within the halls and long corridors of the community" ([2]). Although Gold was not one of the artists brought on board through PAIR, but rather an established researcher at the center, he nevertheless identified strongly as an artist in his PARC work. Indeed, Gold has said of one own PARC research presentations: "As an artist like myself who works full time inside of a corporation, this is how I do my art and get it shown" ("PAIR: The Xerox PARC Artist In Residence Program" [1]). Gold argued that artists in residence at a computer science lab could have a profound impact on the culture at large. He wrote: "PAIR is awake at a time when fascinating new genres of communication are

forming; when the aesthetics of these genres are pushing against the sciences and technologies of various emerging media: a cusp when small activities can create large folds of culture in a not too distant future" ([5]) Indeed, PAIR has been the subject of much attention and praise for its courage in taking artists seriously as research collaborators. In 2001, Gold reflected on the program: "PAIR has become a draw and a source of pride for PARC. They say things like: 'PARC even has Artists!'" ("The Dialectics of PAIR" [8]) Here, Gold suggests in what I take to be a teasing tone that PARC as an institution might in fact be paying more lip service to its artists than attention to their work. However, regardless of the institutional motivations for its public promotion of the PAIR initiative, Gold argues that whether or not everyone realizes it, "PAIR has a profound effect within PARC" ([8]). And I believe that if anyone's work embodies the spirit of the PAIR experiment, and if any artist's vision merits serious consideration as a force within the field of technological innovation, it is Rich Gold's. To try to understand the culture of ubiquitous computing and ubicomp research without accounting for the work of the artist-researcher at the center of its conception would be to fail the recognize the very real institutional factors that have influenced both the definition of the field and its subsequent development.

It is worth making one more biographic remark regarding Gold. I have proposed through a close reading of his text and through a parallel consideration of relevant critical theory that ubiquitous computing as envisioned by Gold is fundamentally a network of play and performance. What I want to suggest here is that the spirit of play and performance that pervades Gold's vision can be explained, in part, by examining his previous technological pursuits. An excerpt from the brief biography Gold composed for

his own website reveals that games, toys, and the performing arts are a constant in Gold's professional background:

> Rich Gold is a digital artist, inventor, cartoonist, composer, lecturer and inter-disciplinary researcher who in the 1970s co-founded the League of Automatic Music Composers, the first network computer band…. In the 1980s he was director of the sound and music department of Sega USA's Coin-op Video game division and the inventor of the award winning *Little Computer People* (Activision), the first fully autonomous, computerized AI person you could buy and which was an inspiration for *The Sims*. From 1985 to 1990 he headed an electronic and computer toy research group at Mattel Toys and was the manager of, among other interactive toys, the Mattel PowerGlove ("Short Biography").

Gold's biography drives home an important fact often overlooked by those working in, or writing about, the field: The original design philosophy and goals of ubiquitous computing were constructed in part by someone with a lifelong interest in playful objects and collaborative performance.

That Gold brought to the original ubiquitous computing team a tremendous amount of experience with interactive toys, video games, and networked performance has been ignored, I think, because of the work-focused research context in which ubicomp was first conceived. The first Xerox PARC test of the ubiquitous computing philosophy was the PARCTAB system, developed specifically for the work environment. This experiment is famously documented in the paper "The PARCTAB Ubiquitous Computing Experiment," authored by all eight members of the original ubicomp team

and dealing with "the design and application issues involved in constructing a mobile computing system within an office building" (1). Indeed, of the Xerox PARC research publications from the seminal period 1991-1995, all of those that report on actual applications and prototypes focus on the office environment: "Responsive office environments" (Elrod, Hall, Constaza et al); "Liveboard: A large interactive display supporting group meetings, presentations and remote collaboration" (Elrod, Bruce, Gold et al); "Dealing with tentative data values in disconnected work groups" (Theimer, et al); and so on. Under the weight of all of this work-oriented research, the origins of ubiquitous computing in play and the performing arts have been lost. Taking up Gold's essay, and taking it seriously, is a way of ensuring that the centrality of play and performance to the original aesthetics, phenomenology and psychology of ubiquitous computing will not be overlooked.

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So far, I have focused almost exclusively on the early years of ubiquitous computing. Where is the field now, a decade and a half later? What has been achieved, and how, if at all, has the vision changed from its seminal design manifestos? As most researchers in the field readily acknowledge, the technological implementation of a truly ubiquitous computing practice has been more difficult to achieve than perhaps predicted. In particular, the goal of developing an infrastructure for *integrated* and infinitely *scalable* computing opportunities has struggled along the road to fruition, while deeply-ingrained social norms about when and where to engage technologies have been harder to change than expected. Recently, IBM researchers Lada Gorlenko and Roland Merrick observed:

> It is now clear that the goal of "anytime, anywhere, anyhow access for anybody" presents more challenges to its inventors and designers than had been originally anticipated. While many existing technological restrictions may be only a few steps away from being resolved, a large number of environmental constraints and some limitations on the human side will remain (639).

Indeed, the downscaling of ubiquitous computing's ambitions, at least for the time being, has been one of the most consistent trends in the field in recent years. While certain goals remain the same—to make computing more tactile, more intuitive, more intimate, more mobile—the idea that the ubiquitous computing network will in fact be literally ubiquitous is very much falling out of favor. Computer scientist Matthew Chalmers calls the state of ubiquitous computing: "anything but seamless, pervasive, or ubiquitous" (174). And in the opening keynote for the 2006 Emerging Technologies Conference, design critic and science fiction author Bruce Sterling predicted to a standing ovation: "Personally, I don't believe that ubiquitous computation, as eventually seen in real life, will turn out to ubiquitous…. I don't think it will be 'every-ware.' I think it's going to be patchy and limited… instead of being some smooth, finished product, like a state-supported Ma Bell universal-access utility. Time will tell."

If ubiquitous computing now finds itself slowly backing away from the scope and scale of the vision first laid out by Gold, Weiser, and other members of the Xerox PARC team, and if the technological infrastructure itself has unquestionably failed to emerge in the first fifteen years of development, must we, as Sterling suggests, wait for time to tell if the original ubicomp design philosophy will ever be achieved in practice?

Here, I want to make a rather bold claim—the central claim of this dissertation. The original design philosophy of ubiquitous computing, particularly as it was articulated by digital artist and Xerox PARC researcher Rich Gold, has in fact been thriving in practice since the turn of the twenty-first century. However, it is thriving *outside the domain of computer science*. We may not have realized (yet, or ever) the specific technological implementation imagined by the Xerox PARC team. But as for the aesthetic, phenomenological, and psychological dimensions of their envisioned ubicomp world, a significant body of experimental art and entertainment projects have absolutely "enspirited" contemporary network society with the kinds of pervasive and interconnected, but invisible and dissembled, opportunities for social action and interaction described in the earliest ubicomp manifestos. Most importantly, these projects have successfully embedded the phenomenal affordances of computer interaction in everyday objects and places—without necessarily embedding computing technology.

This dissertation is a historical and critical consideration of a series of *ludic*, or gamelike, works deployed between 2001 and 2006 that have built, I will argue, what we can recognize as a culture of ubiquitous play and performance, in which the term ubiquitous is meant to specify the original design philosophy of Rich Gold and Mark Weiser. This practice, which I will call *ubiquitous gaming*, is as much an intervention into the contemporary games culture as it is a reclaiming of the distributed play and performance ethos of early ubiquitous computing. In the epigraph for this chapter, three pioneering ubicomp researchers lament: "We live in a complex world, filled with myriad objects, tools, toys, and people.... Yet, for the most part, our computing takes place sitting in front of, and staring at, a single glowing screen attached to an array of buttons and a

mouse.... How can we escape from the computer screen and bring these two worlds together?" (24) Computer-enabled play at the turn-of-the-twenty-first century, I want to suggest, has found itself in the same position as computing practices. Contemporary digital gaming is almost exclusively a screen-based affair, with buttons and mouses and the occasional novel interface like a dance pad or eye tracker that nevertheless keep the player focused on a screen—be it a home television hooked up to a gaming console, a personal computer monitor, a cell phone display, or the screens of a mobile gaming device. The mainstream computer gaming industry shows little sign, at this point, of moving gameplay away from the compartmentalized experience of interacting with content displayed on a digital screen. Gaming, then, is in as much need of seeking a return to the complex world of myriad objects, tools, toys, and people as other everyday computing practices.

To this end, the projects I will analyze as seminal examples of ubiquitous gaming are not computer or digital games in the way we traditionally conceive them—that is to say, not games that require game-specific engines, operating systems or controllers; not games whose primary platforms are PCs, consoles or handheld game devices. Rather they are computer-*enhanced*, digitally-*enabled* games whose interactive experiences and feedback are as much human-powered as they are generated by digital algorithms, games whose primary platform is the phenomenal world.

1.7 The Defining Characteristics of Ubiquitous Gaming

On the fringes of experimental game design and performance practice, Rich Gold's vision for distributed networks of play is both manifest and profoundly changing the technological habits, perceptual techniques and social identities of millions of players

worldwide. Ubiquitous gaming projects include both commercial and independent, grassroots efforts that organize networked player groups ranging in size from the hundreds to the thousands, to even the hundreds-of-thousands. Here, I present the shared characteristics of the experiences that comprise this emerging culture of ubiquitous gaming. While these fifteen points will require further elaboration and exploration through concrete examples, the general theoretical groundwork I have laid above should serve in the short term to activate, if not to explicate completely, these classificatory criteria. Therefore, I am putting these characteristics into play now, in advance of the more complete elaboration this dissertation ultimately will provide.

1. Ubiquitous games are designed experiences with a strong potential for emergent, that is to say unexpectedly complex, group play and performance.

2. They are distributed experiences: distributed across multiple media, platforms, locations, and times.

3. They have a significant *physical* component, phenomenologically speaking, and a significant *material* component, ontologically speaking.

4. They are embedded at least partially in everyday contexts and/or environments, rather than in marked-off gaming contexts and spaces. They prefer to adopt everyday software, services and technologies rather than exclusively gaming-platforms.

5. They have the effect of sensitizing participants to affordances, real or imagined. That is to say, they increase perception of opportunities for interaction.

6. Many, if not most, of their distributed elements are not clearly identified as part of the experience. Thus active investigation of, and live interaction with, both in-game and out-of-game elements is a significant component of the experience.

7. They have the effect of making all data seem connected, or at least plausibly connected.

8. They make surfaces less convincing. Underlying structures are what matter.

9. They establish a network of players who are in the know. They intentionally involve or engage others who are, at least temporarily, in the dark.

10. Through the relationship rhizome, they aspire to a massively-multiplayer scale.

11. They inexorably create community.

12. They structure player relationships with each other according to relevant computing metaphors.

13. They encourage collective magical thinking.

14. They aspire to persistent and perpetual gaming.

15. They encourage players to construct, consciously, a more intimate relationship between gameplay and everyday life.

Each characteristic I have proposed here, in the order I will present and explore them in this dissertation, is a direct extension of the theoretical work conducted in this chapter. And it should be evident in their articulation that in the following chapters, the critical frameworks of Norman, McKenzie, Schechner, Deleuze and Guattari, Latour and Winnicott will continue to provide important theoretical leverage for understanding the novel recombinations of play and performance that ubicomp enables and provokes.

However: ubiquitous gaming as I have defined it above is not the *only* category of playful projects seeking to escape from the computer screen and to return to more embodied, context-rich, and location-aware interactions. Indeed, other powerful, but ideologically and aesthetically quite different, visions for the future of techno-social play

are emerging from the same historical intersection of ubiquitous computing and experimental game design. To ignore them would be to portray Gold's vision as the only conceivable path forward, when in fact several divergent paths are being forged.

Ultimately, I will argue that ubiquitous gaming represents the most scalable, perceptually powerful and socially important vision for future networked play. At the same time, however, I do not wish to take up either a deterministic position or an unduly limited view of the diverse modes and notions of play that are arising currently through the technology and metaphors of ubiquitous computing. Therefore, I will also explore the competing values and stakes of other experimental games and ludic performances that explicitly identify the ubiquitous computing movement as their primary inspiration. In the next chapter, I outline a classification scheme that situates *ubiquitous gaming* in a larger possibility space of ubiquitous play and performance, a space in which design decisions about *what* should be made ubiquitous, *who* should play, and to *which ends* we and our technologies should perform are very much still being made.