

From Television to Drone Vision: Telepresence and Touch in Contemporary Art
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Chapter 1: The Index and the Interface



Figure 1: Ken Goldberg in collaboration with Mark Pauline, Eric Paulos, John Canny, Judith Donath, and Will Linn, *Legal Tender*, 1996.

In 1996, visitors to the website www.counterfeit.org were invited to take part in an experiment. The site, orchestrated by artist and roboticist Ken Goldberg, presented two \$100 bills for examination, one real and one, allegedly, counterfeit. Visitors were asked to tell the two apart (fig. 1). To aid their investigations, Goldberg enabled a series of actions they might perform on the notes with a telerobot.¹ The visitors, now “users,” could choose to puncture, abrade, burn, stain, or simply observe the distant money and see instantaneous video feedback of the results of

their commands.² Goldberg's investigators were prodigious mutilators of the telepresent currency. They chose to puncture or burn the bills more often than anything else, perhaps because the results were so clearly and immediately apparent. A user would click the command and promptly see the robot move and the mark appear at the indicated place. Despite the real-time feedback and the robot's responsiveness to the user's commands, a poll on the site reported that almost none of the operators believed that what they saw was true: not only were the \$100 bills inauthentic, the users proclaimed, but the actions performed on them with the very real robot in Goldberg's lab were mere simulations as well.³

Goldberg's *Legal Tender* surely aimed to raise questions about authenticity in regard to both the bills and the experience of manipulating them through a digital interface. The project pointed to an age-old epistemological issue that has been reinvigorated in the digital age: as technologies extend sight and hearing, and reach into far-off places, we are given reason, or at least permission, to doubt what we see and do. While a history of doubt in the mediated image can be traced back through Descartes's window, into Plato's cave, and to the beginnings of Western philosophy, the recent rhetoric surrounding digital technology and the concomitant "death of the index" in photographic discourse has given new relevance to this debate. Digital technologies, it seems, have introduced new uncertainty into our understanding of mediated images' relationships to reality. Or, worse, some scholars claim that the very processes of their making have eliminated the indexical connection between the sign and referent, so that doubt has necessarily become the default mode of judgment for mediated images. C.S. Peirce's semiotic category of the index, which

designates signs that have an “existential relation” to the things and events they signify, has come under attack in contemporary media theory.⁴ Photographic theory has typically understood indexical signs as material traces of past moments of physical contact that therefore provide incontrovertible evidence of some existential truth. According to this logic, the footprint, the death mask, the weather vane, and the photograph act as indexical signs of events because one material has pressed against another, resulting in a physical record. Digital technologies, one might assume, sever the indexical link with the world that the physical processes of analog media once insured. Digital and electronic images are “immaterial,” according to this view, in that they are not made by a physical touch or imprint, but by numerical sensors that translate light into data. Accordingly, theorists such as Anne-Marie Willis, W.J.T. Mitchell, and Lev Manovich, among others, suggest that the index is irrelevant to an understanding of digital iterations of formerly analog media, such as photography, film, and video. Such claims—were they true—would be hugely consequential, insofar as the index is a sign that compels belief in its receivers and communicates information about epistemic and existential conditions. The loss of the index in contemporary media would be significant, therefore, suggesting an imminent crisis of belief. As I will argue in this essay, however, this conceptualization of the index is reductive and narrow, if not entirely inaccurate. Moreover, Peirce’s understanding of the index is much more complicated and interesting than these readings allow. The index is not (and never has been) a sign based simply in materiality; it does not necessarily serve as a record of the past or testify to clear evidentiary truth. In fact, returning to Peirce’s discussions of the

index will help to demystify and dispel claims about digital uncertainty and the “death of the index.” Rather than being “dead” in the digital age, I will argue, the index reemerges as a particularly helpful category for understanding mediated information, “digital doubt,” and experiences through virtual interfaces, such as those in live telepresence works like *Legal Tender*.⁵ Contrary to the dominant narratives of photographic theory, the index is an inherently ephemeral, doubtful, and distant sign that hinges on a split temporality. Regardless of when it was produced, the index establishes a forceful present-tense connection with its receiver. It is impossible to understand how indices operate without attending to this curious temporal dimension. Peirce’s theories on logic, particularly his concept of the abductive inference, will help us to understand how the temporal connection between index and receiver functions and comes to hold such epistemic weight. By reexamining and reemphasizing this suppressed identity, the index will emerge as the operative sign for mediated and digital images.

Index Undead

The index is, according to Peirce, “a real thing or fact which is a sign of its object by virtue of being connected with it as a matter of fact.”⁶ In that regard, it differs from the icon and the symbol, which signify their referents by virtue of resemblance or agreed upon conventions, respectively.⁷ Peirce describes the relations among the signs as follows:

An icon is a sign which would possess the character which renders it significant, even though its object had no existence; such as a lead-pencil

streak as representing a geometrical line. An index is a sign which would, at once, lose the character which makes it a sign if its object were removed, but would not lose that character if there were no interpretant. Such, for instance, is a piece of mould with a bullet hole in it as a sign of a shot; for without the shot there would have been no hole; but there is a hole there, whether anyone has the sense to attribute it to a shot or not. A symbol is a sign which would lose the character which renders it a sign if there were no interpretant. Such is any utterance of speech which signifies what it does only by virtue of it being understood to have that signification.⁸

Icons, such as representational images, geometrical figures, and diagrams, signify by means of characteristics shared with the signified, but the signified need not exist in reality. Symbols exist for the pure function of signification—they are arbitrary signs designed to communicate a specific meaning determined by rules, laws, or conventions.⁹ A red traffic light indicates “stop,” and a green, “go,” simply by “consequence of habit.”¹⁰ Indices, however, are not arbitrary, nor could they operate if their referents (or “grounds”) did not, in fact, exist. Despite this necessary connection between sign and ground, an index may exist as a sign even without ever being noticed or interpreted as such. The index, then, has a real and necessary connection to what it signifies, unlike the symbol’s arbitrary connection or the icon’s relationship to the signified, which can be reduced to mere imitation or representation .

The index’s existential relationship to its referent has made it a particularly useful term for theorists of photography and film, who see the sign as describing the

compelling effects of photographic media and their ability to capture and communicate a vision of reality. “Photographs, especially instantaneous photographs,” Peirce wrote in the early twentieth century, “are very instructive because we know that they are in certain respects exactly like the objects they represent. This resemblance is due to photographs having been produced under such circumstances that they were physically forced to correspond point by point to nature. In that aspect, then, they belong to the second class of signs [indices], those by physical connection.”¹¹ Significantly, this description of the photograph comes in the midst of Peirce’s discussion of icons, those signs that operate by means of resemblance. Photographs evidently constitute a special type of representational sign in that they are both icons and indices. They look like their referents, but this resemblance is a product of an existential, necessary connection, one Peirce describes in this particular passage as “physical.” Photographs have long served as markers of truth and “incontrovertible evidence” because of their indexical status and the trustworthy existential connection it indicates.

The physicality of the indexical sign has often been construed along these lines as one material touching another. In the case of the photograph, particles of light “touch” a photosensitive surface and transfer an image to film without the aid of the human hand or imagination. Susan Sontag, in her careful meditation *On Photography*, explains the photograph’s epistemological and ontological identity by describing it as a sign made by physical and existential contact, thus implying a connection between the medium and Peircian indexicality. Photographs, Sontag writes, are “able to usurp reality because first of all a photograph is not only an

image (as a painting is an image), an interpretation of the real; it is also a trace, something directly stenciled off the real, like a footprint or a death mask.”¹² Paintings, even ones that meet “photographic standards of resemblance,” by contrast, are “never more than the stating of an interpretation, [whereas] a photograph is never less than the registering of an emanation (light waves reflected by objects)—a material vestige of its subject in a way no painting can ever be.”¹³ The difference she draws between the photograph and the “photo realistic” painting is the difference between the index and the icon. In this passage, Sontag aligns the photograph with some well-known examples of indices from Peirce’s taxonomy—footprints and death masks. Both of these signs, which look like the things they represent, were made by pressing one material into another: a foot presses into clay and makes a footprint; plaster is placed on a face and assumes its particular shape. Both are also signs that endure: they preserve a moment from the past in a physical, material, and representational form. Sontag’s descriptions of the photograph, footprint, and death mask emphasize these characteristics—they are “traces,” “material vestiges,” and “direct stencils off the real.” And while all of that may be true, one unfortunate consequence of *On Photography*’s influence and popularity is that the qualities of pastness, permanence, truth, and resemblance resulting from physical contact have come to be seen, inaccurately, as defining characteristics of indexicality rather than as the specific condition of the analog photograph.¹⁴

Accordingly, theorists of new media, such as Anne-Marie Willis, W. J. T. Mitchell, and Lev Manovich have claimed that the rise of the digital has ushered in the “death” of the photographic index. Digital processes, they assert, sever or

degrade the indexical, existential link that once gave photography its identity as a medium and as a guarantor of truth.¹⁵ Digital media are, in their accounts, “immaterial” and, therefore, nonindexical. Moreover, they suggest that without the indexical connection of the sign to its referent, one need not trust what one sees. Following this logic, the users of *Legal Tender* were justified in their doubt. Its interface was digital, and the feedback users saw of their actions was electronically mediated, therefore prior understandings of indexical signs and their existential claims did not necessarily apply.

Willis, writing early in the digital era (1990), described the shift away from analog imaging processes in truly gruesome terms: “Digitization is a process which is cannibalizing and regurgitating photographic and other imagery, allowing the production of simulations of simulations.”¹⁶ Like a “zombie,” photography’s corpse is “re-animated, by a mysterious new process, to inhabit the earth.”¹⁷ The “post-photographic” and “post-apocalyptic” merge, it seems, when the photograph loses its “indexical” (read: material) relationship to its referent and, thus, to truth. Photography’s “claim to be more truthful than painting,” she writes, “has relied . . . on its indexicality, the fact that as a sign it is partially produced by the referent. It is as if the scene or object at which the camera was pointed *imprinted* itself on the film. With digitized photo imagery the viewer will never be able to be sure of this any more—the index will be erased as the photo becomes pure iconicity.”¹⁸ Photography becomes just another form of painting.

Lev Manovich, writing more than a decade later, echoes and updates Willis’s claim: cinema, once “the art of the index,” was “an attempt to make art out of a

footprint.”¹⁹ But digitization has changed that relationship. Film, which can now create images that appear to be “photographic” without a camera, “is no longer an indexical media technology, but, rather, a subgenre of painting.”²⁰ The effects of this change are insidious: one can create images that look exactly like photographs but have no existential connection to what they represent, therefore calling into question the indexicality of *any* photorealistic image. In Manovich’s argument, the power to create convincingly photographic icons amounts to a forgery of the index. If the photographic effect can be so easily simulated, the result is that all indexical images are compromised by the new influx of doubt.

W. J. T. Mitchell, who, in *The Reconfigured Eye* provides an extended account of analog photography’s long involvement with forgery and deception, closes that book with a warning about the threat of digital technology:

For a century and a half photographic evidence seemed unassailably probative. . . . Photographs appeared to be reliably manufactured commodities, readily distinguishable from other types of images. They were comfortably regarded as causally generated truthful reports about things in the real world. . . . But the emergence of digital imaging has irrevocably subverted these certainties, forcing us to adopt a far more wary and vigilant interpretive stance.²¹

The threat of the digital, here, is so overwhelming that it makes analog photography’s always-dubious status seem nostalgically secure. It retroactively becomes a more stable document in the backward glance from the digital era. New vigilance, he argues, is necessary now that the material mark that aligned

photography with indices—the footprint, the bullet hole, the death mask, those compelling signs that bear existential witness to their referents—has been replaced by an electronic pattern.

Arguments such as these are problematic for several reasons. First, having posited indexicality as the defining characteristic of “the photographic,” they assume that any changes to the way in which a photographic image is made will automatically alter the sign’s relationship to indexicality. That is, if indexical signs are understood to be signs made by material contact—by one substance literally touching another—then replacing silver emulsion with electronic light sensors would, in this view, short-circuit the indexical mechanism of the photographic camera. Since material contact has been taken to be the guarantor of truthfulness in these arguments, it, too, fades with the change in technology. The assertion is that digital media aren’t indexical because of the “immateriality” of their processes. Contrary to such claims, I would argue that digital technologies are in no way immaterial.²² The equipment they employ, and the electronic signals they record are patently material entities. Yet, even were this not the case, the “materialist” argument for the nonindexical status of the digital breaks down because, we will see, materiality is not a necessary feature of the index.²³

Another assumption embedded in many of the photograph-as-index arguments is that because of their indexical status, photographs are truthful images that transparently testify to some specific fact. But this claim, too, misrepresents the photographic, as any number of poststructural theorists of photography, including Roland Barthes, John Tagg, Alan Sekula, and Geoffery Batchen, have pointed out.²⁴

Photographs have a loose relationship to proof and truth, these authors argue, because their meanings shift depending on the contexts in which they are presented or used. While a photograph usually represents something very specific—it provides a clear image of a certain moment in space and time—any photograph can be used in a variety of ways and testify to multiple, and contradictory, things. This is not the case only for photographs, but for indices in general. The index, like its subspecies, the photograph, has always been an indeterminate sign that relies on context and narration for its ability to serve as evidence or to testify to a particular event or action. Indices are, by nature, always open to interpretation and doubt.

The photograph is a complex and atypical index. The most startling aspect of photography is its ability to capture an uncannily accurate—indeed iconic—image of the scene before the lens. Most indices, however, carry little or no resemblance to their referents. In fact, according to Peirce, indices “represent their objects independently of any resemblance to them, only by virtue of real connections with them.”²⁵ Elsewhere in his extensive writings on semiotics, Peirce describes uncanny resemblance as the specific semiotic domain of the icon through the example of painting: “So in contemplating a painting, there is a moment when we lose the consciousness that it is not the thing, the distinction of the real and the copy disappears, and it is for the moment a pure dream, not any particular existence, and yet not general. At that moment we are contemplating an icon.”²⁶ One would never mistake a footprint for the person or animal who made it in the same way that one might point to a photograph and say, “*This is my mother.*” Resemblance and its ability to make the viewer believe she is seeing the thing itself belongs to the power

of the icon, not the index. The icon must resemble what it represents, the index need not.

Peirce's separation of representation from indexicality might seem perplexing. The photograph, however, is a special kind of index: the camera is a machine that makes icons through an indexical process. As I noted earlier, Peirce describes photographs as having been "produced under such circumstances that they were physically forced to correspond point by point to nature."²⁷ As Laura Mulvey points out in her 2006 book *Death 24x a Second*, in this quotation Peirce establishes "a link between physical presence and physical inscription" in the photographic, and this trait indicates the indexical element of the photograph.²⁸ While Peirce does suggest that the photographic index is a physical trace that results in resemblance, it is, I argue, a leap to think Peirce is here defining the index in general by means of a discussion of the remarkable and singular mechanism of the analog camera. Point-by-point resemblance, inscription, and "nature's" role in the process are part of the analog photograph, but not of the index in general.²⁹ Conventional theories of the photograph-as-index, however, have often collapsed the distinctions between the photograph, with its distinctive combination of indexical and iconic traits, and the index in general, resulting in the understanding that "photography" and "the index" are virtually synonymous and therefore interchangeable. Mulvey, for example, conflates the two terms: "The index, an incontrovertible fact, a material trace that can be left without human intervention, is a property of the camera machine and the chemical impact of light on film."³⁰ Mulvey claims to describe the index, but instead she writes about the photograph

specifically. The photograph may be an “incontrovertible” fact, which is material and left without human intervention, but this is not a sufficient or even accurate definition of indices in general (and is only arguably true for photographs), which are not necessarily material, permanent, representational, recognizable, or caused by physical touch. In Peirce’s writings, the index possesses no such secure identity. In fact, as we shall see, the index is the root of the photograph’s openness to interpretation and doubt, not its guarantor of truth. Photographs are illusive and confounding objects not despite their indexical qualities, but because of them.

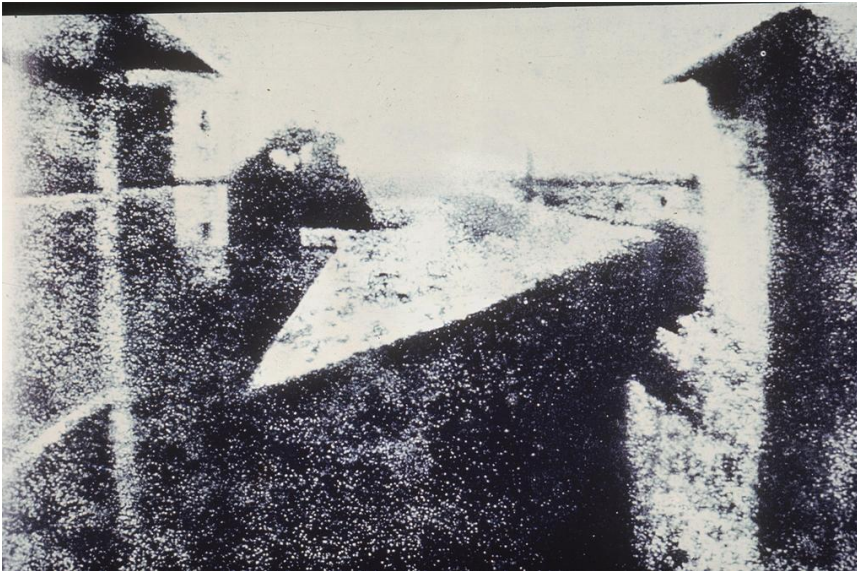


Figure 2: Joseph Nicéphore Niépce, *View from the Window at La Graz*, 1826

Indices are never as clear as they might seem. Early photographs, especially before sophisticated lenses, fast film, and quick shutters, seldom captured a good likeness. Even a sharp photograph may capture a poor representation of its subject or be completely unrecognizable as an image, person, or thing. The first *permanent* photograph, Joseph Nicéphore Niépce’s *View from the Window at La Graz* (1826; fig. 2) had only a loose hold on representation. Earlier photographs, such as those taken

by Thomas Wedgwood, were not permanent and did not endure for more than moments after their capture. Man Ray's *Rayographs* (fig. 3) are photographs (albeit without using film or a lens) that were created by objects literally touching the photosensitive surface, but they are barely resemblances. The masters of modernist photography, as Tom Gunning argues, "work with (and against) the recognizability and reference of the photograph."³¹ "Photographic" representation is not necessary for the index or the photograph. The photograph, the footprint, and the death mask may all be signs from the past that resemble their referents, are caused by touch, and endure in time and space, but this makes them unusual, atypical indices.

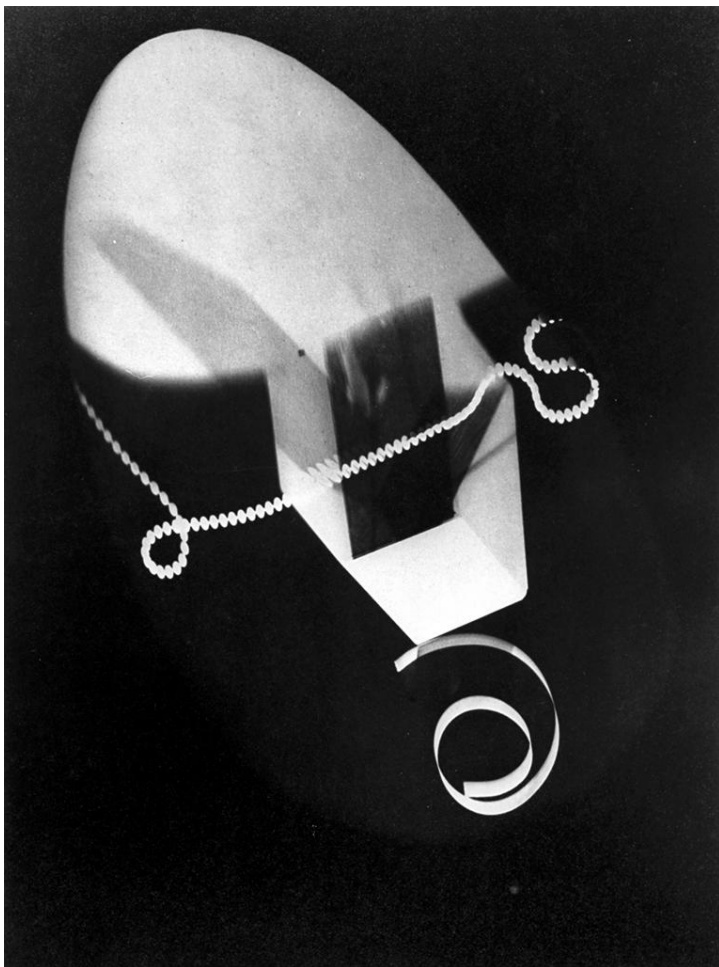


Figure 3: Man Ray, *Rayograph*, ca. 1925

Indices are signs of presence, but this presence is not necessarily spatial or physical; it is, however, always temporal. Though one may encounter the indexical sign *after the fact*, as with the photograph or footprint, indices are always created simultaneously with the action or event that they indicate.³² The centrality of temporal copresence may not seem evident in relation to indices that are physical marks of past encounters, but it becomes apparent with other examples that Peirce evinces, ones that do not leave permanent “material traces” or occur in the past: a pointing finger indexes something to be seen; smoke rising on the horizon is an index of distant fire; a shadow is an index of an object obstructing light; a mirror reflects the fleeting image before it. These four indices have much more tenuous claims to materiality than do the previous examples.³³ They all also occur in the present. Like Peirce’s exemplary index, the word “this,” as well as other deictic shifters, such as “here,” “there,” “I,” and “you,” indices rely on a contextual present to exist as signs. They are indicators of the present, not the past.

The “*This*”

Perhaps the most accurate and helpful account of the index in relation to the photograph comes from Roland Barthes’s *Camera Lucida*, despite the fact that the author never mentions indices there by name. Photographs, unlike other icons, contain what he terms “the *This*,” which is the photograph’s connection to “the real.”³⁴ Like other theorists of photography, Barthes relies on “touch” as a means of explaining this connection. But the touch in question is not the “material” touch (of light on emulsion) that creates the index in other accounts of photography. Rather, it

is the effect the photo has, the way it *touches him*. “The *This*” is not *made* by touching; it is instead a *thing that touches*, whose effect is largely separate from the depictive qualities of the photograph.

Each photograph, Barthes writes, contains an “average affect” that elicits a general interest in what the photograph depicts—its figures, subject matter, and so on—that he names the “*studium*.”³⁵ While the *studium* is formed by the indexical mechanism of the camera, it designates what might be thought of as the iconic aspect of the photograph: it communicates what the photograph is “about” and what objects, people, and places it represents. There is, however, another element to the photograph that goes beyond depiction or “mere interest.” Photographs also provoke what Barthes calls “tiny jubilations” in the viewer that indicate something beyond what is represented. Barthes names this the “*punctum*”—or again, “the *This*.” It is what reaches out and touches him:

The second element will break (or punctuate) the *studium*. This time it is not I who seek it out (as I invest the *studium* with my sovereign consciousness), it is this element which rises from the scene, shoots out of it like an arrow and pierces me. A Latin word exists to designate this wound, this prick, this mark made by a pointed instrument. . . . This second element which will disturb the *studium* I shall therefore call *punctum*, for *punctum* is also: sting, speck, cut, little hole—and also the cast of the dice. A photograph’s *punctum* is that accident which pricks me (but also bruises me, is poignant to me).³⁶

This is a curious description of a photograph. As a function of “the *This*,” the *punctum* is focused on the relationship between the sign and its viewer, not the sign

and its referent. It erupts from the photograph and reaches out to the receiver. It is an active agent and a confrontational sign. The photographic *punctum*, Barthes writes, is “an antiphon of ‘Look,’ ‘See,’ ‘Here it is’; it points a finger at a certain *vis-à-vis*.”³⁷ “The *This*” of photograph calls out to the viewer in the imperative, “See, here!” It points; it solicits her attention and seems to look back at her. It engages her in a present-tense relationship, even if the photograph is a sign of a past event. The viewer is not passive in the encounter, but nor is she the sole active agent. The relationship to the photographic image is mutual and reflexive. The *punctum* reaches out and touches the viewer, pierces her, bruises her, and then causes her to reach back and explore its root and its cause. Barthes writes, “I wanted to explore [photography] not as a question, but as a wound: I see, I feel, hence I notice, I observe and I think.”³⁸ The *punctum* causes a sensory encounter (from ground to the sign to the receiver), which then starts a chain of associative and exploratory thoughts. The *punctum*, then, “expands” and points to something “beyond” what is merely represented.

Barthes’s description of the *punctum*, its agency, and its effects on the receiver may seem anachronistic or even magical, but it corresponds closely with Peirce’s descriptions of indices and their reception. Throughout Peirce’s work, his descriptions of indices, like Barthes’s description of the photographic *punctum*, hinge on the way in which the sign “touches” the receiver, demanding that she pay attention, and he elaborates this function through a series of examples that exactly match Barthes’s descriptions of the *punctum*: the index is a pointing finger, a deictic shifter, a bolt of lightning, a call of attention—“lo!”³⁹

Just as the *punctum* summons the viewer's attention in an urgent, forceful, sensuous way, so does the index. Indices, Peirce writes, are in the "imperative, or exclamatory [mood], as 'See there!' or 'Look out!'"⁴⁰ They focus the receiver on the present situation rather than a past context. Peirce repeatedly makes this point in his various discussions of the index. For example, he explains that the demonstrative pronoun "this," as well as "that," "here," and "there," are indices because "they call upon the hearer to use his powers of observation, and so establish a real connection between his mind and the object; and if the demonstrative pronoun does that—without which its meaning is not understood—it does so to establish such a connection; and so is an index."⁴¹ Here Peirce makes clear that it is the sign's power to force a connection between the object and the receiver's mind in the present moment that makes it an index. If the index is based in "touch," it is not the material touch that creates the sign, it is the way in which the sign touches its interpreter.

Throughout his many essays on semiotics, Peirce consistently explains what indices are by describing how they inspire thought in the receiver and put her in a present-tense relationship with the referent. Materiality and physical touching do not play important roles. Describing the index, he writes, "When a driver, to attract the attention of a foot passenger and cause him to save himself, calls out 'HI!' . . . So far as it is simply intended to act upon the hearer's nervous system and to rouse him to get out of the way, it is an index, because it is meant to put him in real connection with the object, which is his situation relative to the approaching horse."⁴² This definition of the index is interesting, for Peirce describes the index as a sign that

puts the receiver into “real connection” with a contextual situation. If it were a matter of materiality, the shout would index the driver’s vibrating vocal cords. But it does not. It indexes a present situation of danger. If it were an enduring sign of an incontrovertible fact from the past, it would have no relevance to the situation at hand and would not need any interpretation or response. But it is not. It is a sign that has an existential relationship to what it represents and transfers that connection to its receiver. Earlier in this essay I quoted the first half of one of Peirce’s definitions of the indexical sign; it is worth attending to the full quotation now:

“[The index] is a real thing or fact which is a sign of its object by virtue of being connected with it as a matter of fact and by also *forcibly intruding upon the mind*, quite regardless of its being interpreted as a sign.”⁴³

The first, “existential” part of the definition can encompass understandings of the index-as-physical-trace, but the second half points to the way in which the sign pulls the receiver into this relationship of presence and presentness. The index is a sign that calls all three terms—sign, referent, and receiver—into a contextual, present-tense situation. The index is a sign, and it is an event.

The second part of Peirce’s definition—that of “forcibly intruding upon the mind” —has tended to be overlooked in discussions of photography. The index’s solicitation may be somewhat less mysterious than Barthes’s *punctum*, yet it works similarly to emphasize how temporal copresence, as well as the receiver’s reception and interpretation are all part of the index. Indeed, the specifically temporal relationship between the sign and the viewer’s mind is the defining characteristic of

the index in Peirce's writings. An index, he explains, is "a sign, or representation, which refers to its object because it is in dynamical (including spatial) connection with both the individual object on the one hand, and the senses and memory of the person for whom it serves as a sign, on the other hand."⁴⁴ Peirce's parenthetical statement in this quotation is significant: each time Peirce describes the index he makes it clear that the sign is in a live, present-tense relationship to its viewer; he also suggests that it can—but evidently need not always—have as a component a spatial or physical connection to its referent. Much as with Barthes's account of the *punctum*, Peirce's explanation of the index focuses on the sign's reception, on the crucial link between the receiver and the referent. The index must, then, be understood not as mark of resemblance, proof, or truth, but rather as an instance of relationality, interpretation, and decision.

Of course, the fact that the index issues a call does not guarantee that the sign will be recognized, or, even if it is recognized, that it will be understood. Most indices in Peirce's account are not as legible as photographs, and while they may exist as facts, they are by no means "incontrovertible." In another helpful description of the index and its connection to thought, Peirce highlights the potential undecidability of the sign. He writes, "A rap on the door is an index. Anything which focuses attention is an index. Anything which startles us is an index, in so far as it marks the juncture of two portions of experience. Thus a tremendous thunderbolt indicates *something* considerable has happened, though we may not know precisely what the event was."⁴⁵ Indices require interpretive work because they are, in Peirce's own words, simply "symptoms."⁴⁶ A symptom—a fever, an ache,

and so on—indexes *something*, but what that something is can be quite unclear or have multiple explanations. Indices need to be decoded. Take, for example, two particularly enigmatic examples of indices from Peirce's writings: "I see a man with a rolling gait. This is a probable indication that he is a sailor. I see a bowlegged man in corduroys, gaiters, and a jacket. These are probable indications that he is a jockey."⁴⁷ The way a man walks or dresses can index his profession, yet they are hardly transparent signs. The index is *a clue* that points to something not yet known or to what one can't be sure. The great achievement of the index is its ability to signify without the benefit of convention, resemblance, or direct observation.⁴⁸ This ability comes from the thought processes it activates in the receiver.

Logic as Semiotic

Although Peirce never explicitly discusses his theories of logic in his detailed taxonomy of signs, "Logic as Semiotic: The Theory of Signs," the title of the essay makes it clear that he regards this link as imperative.⁴⁹ For a sign to signify, the receiver must interpret it. His three semiotic categories, symbol, icon, and index, are connected to his categories of logic, deduction, induction, and what he calls abduction or hypothesis. Induction is reasoning by resemblance, just as icons signify by means of likeness; deduction is reasoning by the application of a law or rule, much as symbols signify by means of agreed-upon meanings.⁵⁰ As for abduction and indices, Peirce provides the following example in his essay "Deduction, Induction, Hypothesis" of the kind of sleuthing both involve:

A certain anonymous writing is upon a torn piece of paper. It is suspected that the author is a certain person. His desk, to which only he has had access, is searched, and in it is found a piece of paper, the torn edge of which exactly fits, in all its irregularities, that of the paper in question. It is a fair hypothetical inference that the suspected man was actually the author. . . . If the hypothesis were nothing but an induction, all that we should be justified in concluding, in the example above, would be that the two pieces of paper which matched in such irregularities as have been examined would be found to match in other, say slighter, irregularities. The inference from the shape of the paper to its ownership is precisely what distinguishes hypothesis from induction, and makes it a bolder and more perilous step.⁵¹

Induction is founded upon resemblance: characteristics of the sign analogically correspond to elements of the referent. It is, therefore, limited to the directly observable. But in the case of reasoning by hypothesis or abduction, things are different. The scrap of paper indexed not the fact that it was torn, but its ownership. It pointed to things not directly witnessed and therefore needs a certain amount of conjecture even to determine what the relevant facts were, much less how to interpret them. Abduction infers information in excess of the evidence at hand. It is a guess, albeit a very compelling one, and the only means by which one properly interprets an index.

There is always the possibility, if not the necessity, of doubting information one does not observe directly. If indices are signs that often come to their receivers at a spatial or temporal remove and, unlike icons and symbols, need contextual

information to signify, how is it that they are able to inspire conviction on the part of their receivers? Moreover, if this is the case, why have theorists of photography associated them with certainty and proof? To answer this question, we will have to look a bit more closely at the means by which they signify.

Abduction, which, again, Peirce alternately calls “hypothesis,” “is when we find some very curious circumstance, which would be explained by the supposition that it was a case of a certain general rule, and thereupon adopt that supposition.”⁵² That is, in certain instances when one is confronted with a fact or sign out of context, one must guess its meaning. Abduction, he writes, “furnishes all our ideas concerning real things, beyond what are given in perception.”⁵³ It is the means by which one adds information to indices, which as I have already established, are signs in need of contextual or supplemental information. This is the great feat of abduction: it adds to one’s knowledge by providing an explanatory theory for what was not directly witnessed. And this is what makes it particularly useful in decoding mediated images, be they analog or digital. Photographs, as well as Goldberg’s *Legal Tender*, are distant images (in space or time) that need interpretation that goes beyond the directly observable. Abduction makes the index intelligible.

Peirce’s explanations of abduction hinge upon examples of indices. Throughout “Deduction, Induction, Hypothesis,” Peirce explains the logical process via an anecdote reminiscent of the jockey and sailor examples he used in “Logic as Semiotic”:

I once landed in a seaport in a Turkish province; and, as I was walking up to the house which I was to visit, I met a man upon horseback, surrounded by

four horsemen holding a canopy over his head. As the governor of the province was the only personage I could think of who would be so greatly honored, I inferred this was he. This was a hypothesis.⁵⁴

Peirce guesses the occupation of the man by his mode of conveyance. Abduction, then, is when one jumps from what is directly observable to something that is supplementary to the evidence at hand.

Peirce follows the example of the Turkish governor with another instance of abduction by means of an index: “Fossils are found; say, the remains like those of fishes, but far into the interior of the country. To explain the phenomenon, we suppose the sea once washed over this land.”⁵⁵ In other words, after encountering a fish fossil far inland, and recalling the rule that “fish live in the water,” the abductor surmises that “water was once here.”⁵⁶ Such an explanation may have come to the observer instantaneously in a flash of insight and may be perfectly reasonable, even scientifically sound, but it is important to bear in mind that other conclusions are also possible: an animal may have left the fish’s remains long ago, the fossil may have been planted as a hoax, and so on. The situation is the same with any index, and with any photograph, digital or analog. It has a “real” connection to its ground, but it is the observer who gives it the power to represent and who must interpret what it means.

Abducting the Index

The origin, authenticity, and significance of photographic images are never as obvious as they seem. This is not a condition brought on by the digitization of analog

media, digital manipulation, or the prospect of total simulation and virtual imaging. It is the condition of indexicality, the openness of the sign to interpretation and doubt. To understand what indexical signs signify and how they communicate information, one must engage in abduction. Abduction is, in its most general sense, “the action of drawing or leading something away.” Peirce’s “abduction” is no less a leading away; it leads one away from the facts at hand to a hypothesis based on conjecture.⁵⁷ In this essay, I have attempted to “abduct” the index in two ways. First, I led the concept of the index away from the qualities linked to it in the analog era—materiality, physicality, proof, and the past—in order to bring into focus its identity as an ephemeral, doubtful, distant, present-tense sign that has a specific temporal relationship to its interpreter. Second, following Peirce, I connected this type of sign to the logical category of abduction, an intellectual process by which one adds information to a sign in order to interpret it. Again, abduction is essentially a leading away from the facts at hand to something that goes beyond literal, factual, and material information.

The connection of the index to abduction returns us to the interesting problem raised earlier: if doubt and error are built into the means by which indices are interpreted and explained, and abduction is a “weak” form of logic, how is it that indices and their corresponding abductive inferences tend to compel such strong belief? As Peirce explains, the results of abduction are often experienced by the thinker as possessing the certainty of a fact or even innate knowledge. The abductive inference, like the index itself, strikes the receiver with a kind of phenomenal force. Peirce writes:

When our nervous system is excited in a complicated way, there being a relation between the elements of the excitation, the result is a single harmonious disturbance which I call an emotion. Thus, the various sounds made by the instruments of an orchestra strike upon the ear, and the result is a peculiar musical emotion, quite distinct from the sounds themselves. This emotion is essentially the same thing as a hypothetic inference, and every hypothetic inference involves the formation of such an emotion. We may say, therefore, that hypothesis produces the sensuous element of thought, and induction the habitual element.”⁵⁸

Abduction is a phenomenal and embodied kind of thought. As Peirce describes it, the receiver experiences something in excess of the individual elements at hand, and yet in that moment feels the same degree of certainty that usually accompanies direct perception. Although only conjectural, the hypothesis feels true.

Despite—or indeed *because of*—its emotional charge, the abductive inference is not always easy to recognize: it “flashes so naturally upon the mind and is so fully accepted,” Peirce writes, “that the spectator quite forgets how surprising those facts are which alone are presented to his view.”⁵⁹ The abductive explanation is often so rapid that Peirce figures it as an instinctual power of the human mind. “We often derive from observation strong intimations of the truth,” he writes in “Guessing,” “without being able to specify what were the circumstances we had observed which conveyed those intimations. . . . Our faculty of guessing corresponds to a bird’s musical and aeronautic powers; that it is to us, as those are to them, the loftiest of our merely instinctive powers.”⁶⁰ Humans, Peirce claims, have an inherent

ability to make abductive inferences and to be (very often) right. But, again, the abductive inference is always only one possible explanation; however emotionally compelling, it remains merely a guess. It also requires that the receiver approach the sign in good faith; she must not assume that the sign is a simulation simply because of its medium.

Peirce's explanations of the index are integrally related to abduction. He uses not only examples of indices to explain abduction but also abductive processes to explain what indices are and what they do. Just like the abductive inference, the index "acts upon the [receiver's] nervous system."⁶¹ It forces itself on to the receiver's eyes, ears, and skin. It is a phenomenal and embodied kind of sign, just as abduction is a sensuous, emotive, embodied kind of thought. Both require information and lead to interpretations that exceed what one is given. For this reason—and despite the receiver's own sense of certainty—doubt has always shadowed both abduction and the index. Faced with the contemporary "threat" of the digital—its immateriality, its manipulations—one forgets that forgery, manipulation, ambiguity, and uncertainty have constantly accompanied the photographic index, and the index in general. The digital revolution has not destroyed or undermined the index; instead it has called attention to the index's true identity as a sign from which one is separated, with a meaning one must guess. Indices are signs unusually subject to doubt, and this doubt is emphatically predigital.

Virtuality and Indexicality

In this chapter I have aimed to show that the digital and the indexical are not in opposition. The Peircian index has wrongly been associated with materiality, surety, pastness, and truth, whereas none of these qualities are actually inherent in it. In fact, the opposite qualities could be linked to the sign just as well, if not better. Indexical analog media, and photographs in particular, as Tom Gunning points out, are only able to “tell the truth” because they are also capable of telling lies. “In other words,” he writes, “the truth claim is always [only] a claim and lurking behind it is a suspicion of fakery, even if the default mode is belief.”⁶² For doubt to be the default mode of belief where digital images are concerned is no more or less sensible than with analog media. Should we doubt what we saw in *Legal Tender* because it comes through a digital interface rather than an analog one, like conventional television? Was its information less reliable because it was live and responsive rather than a recording of the past? To disbelieve mediated information simply because there is the possibility of deception, I would like to argue, is inconsistent with way media have been used and understood in the past. As doubtful, distant, and dubious as analog photographs were, they still inspired strong belief in their veracity. Moreover, were disbelief to become the norm in regard to digital media, the consequences would be dire. The contemporary subject would be alienated from the world around her and from the consequences of her actions.

In *Digital and Other Virtualities*, Antony Bryant and Griselda Pollock explain the relation between the indexical and the digital by saying it is no longer a question of “truth” with digital technology, as it was with indexical analog media, but rather one of “trust.”⁶³ Digital media might be virtual and, therefore, untrustworthy.

However, just as I have claimed that the digital and the indexical are falsely opposed, Bryant and Pollock argue that so are the virtual and the real. They point out that the word “virtual” is a “contranym—a word that means its own opposite. . . . Virtual means both ‘not really existing’ and ‘almost the same.’”⁶⁴ The former sense, Bryant and Pollock explain, came about in the 1950s, with the invention of “virtual memory,” a technique for “fooling” a computer into “believing” that it has more memory than it does. This understanding of “virtuality” as a practice of “fooling” someone (or something) with what is only an illusion grew into the term “virtual reality” by the 1990s.⁶⁵ In these computer-based systems, “users can be ‘fooled’ into thinking and experiencing things, environments and interactions that do not have any material existence.”⁶⁶ Virtual systems generate representations and simulate events that have no “material” or existential connection to world as indexical signs; however, as the authors make clear, the experiences within them can have real effects on the users, emotionally, psychologically, financially, intellectually, and physically.

The common understanding of virtuality as “not really existing” tends to overshadow its alternative meaning of “nearly the same.” This secondary definition, Bryant and Pollock point out,

suggests something that is effective, working in parallel to, but at a distance from the concrete, actual, material or lived reality. There is a similarity with the actual thing, but it is not the thing itself. It is not the real; yet it is not false. It displays, nonetheless, similar enough traits for our interactions with the virtual to function as if they were indeed real.⁶⁷

In this passage, Bryant and Pollock speak of virtuality as if it were a kind of sign, indeed, as if it had, like a photograph, elements of both the indexical and the iconic. Like an icon, virtuality as they describe it here, is similar enough to function as the thing itself; yet like the index, it has an existential relation to its referent, without in fact being the thing itself. This is a helpful description, for it points to the differences that exist between virtuality and pure simulation. What their discussion avoids addressing, however, are virtual interfaces like *Legal Tender's* that do in fact give the user information about the real world and real events that do not simply “function as if they were indeed real.” Interfaces of this sort, be they representational, like television screens or webcam feeds, or abstract, like radar and tracking equipment, are both mediated and indexical. They are virtual but not simulated. The distinction here is significant: the interface may be virtual, but the represented events and any actions one takes via the interface and its controls are real; the images are mediated and indirect, but they, like the photograph, are existentially connected to the world. Goldberg's telerobotic art projects fall into this category, as do more familiar technologies, such as remote weapons systems and drones. These interfaces are often digital and abstract, rather than analog and photographic, but the places, people, and things they represent have a physical, existential reality, and the user's real-time engagement with them has ethical consequences. Borrowing from Bryant and Pollock's second definition of virtuality, I would like to stress that interfaces such as these are “effective, working in parallel to, but at a distance from the concrete, actual, material or lived reality” *of the user*. This does not mean that virtual interfaces have no connection to concrete, actual reality in general. What they

represent may just be distant from the user. The interface provides a parallel and effective portal for engaging with a remote reality. To understand virtual images and interfaces as nonindexical by default is an ethically and epistemologically dangerous position, as *Legal Tender* points out on a small scale.

In *The Virtual Window*, Anne Freidberg offers a definition of the virtual, one slightly different from that of Bryant and Pollock, which seems to have room in it for both the real and the indexical, as well as the imaginary and iconic. She traces the meaning of “virtual image” to seventeenth-century optics and philosophy of vision. Even then, she writes, the term had two meanings: it could indicate “an image produced in the brain without referent in the world” or “an image produced out of some optical mediation,” such as mirrors or lenses.⁶⁸ In these two definitions, the iconic rests uneasily against the indexical. The virtual image is either without referent or tethered to some existent thing. It is either an image that represents something, though that thing need not exist, or it is the sign of a real-time event in the world that is merely mediated and only indirectly or partially available to view. Negotiating between these two apparently opposed meanings, Friedberg considers the term more broadly. The virtual is “any representation or appearance (whether optically, technologically, or artisanally produced) that appears ‘functionally or effectively but not formally’ of the same materiality as what it represents.”⁶⁹ Screen-based images, such as film and television, and mirror reflections would fall into this category, as well as a whole range of representational and nonrepresentational indices. Blips on a radar screen are not of the same materiality as the fighter jets they represent, nor do they look like the planes, but they stand in for them as

mediated, indexical images and are used as such. Friedberg's definition of the virtual opens up the term to encompass both the mediated and the simulated. The abductive crux in the current media age, then, is to determine which virtual images are mediations (and therefore indexical) and which are simulations. Peirce's notion of the index's call to the receiver and the emotional, intuitive abductive thinking it puts into action suggests that the distinction may not be as hard to parse as one might think. According to this logic, the receiver would have strong intimations of the truth or of being deceived, that is, if she didn't dismiss the situation immediately because of its material or technological basis.

The Index and the Interface

I opened this chapter with the example of *Legal Tender* and the ambivalent responses it prompted from its users in order to call attention to the ways in which the rhetoric of the "death of the index" plays a particularly divisive role in the current media environment. It is my contention that *Legal Tender* can act as a case study for the way the index exists and operates in new media environments, whether they are digital, virtual, mediated, or any combination thereof. Goldberg's project appeared at an interesting moment in time. In 1996 the web was still a new thing. The Internet had been around for decades, but only as the narrow province of researchers and the military; it was just then emerging as a public space, one that was riddled with the anxieties that anonymity and openness seem to bring.⁷⁰

Legal Tender compounded the anxiety of forgery and the devaluation of currency with the insecurities of the virtual world and the new experiences it

appeared to enable. Users could see a mediated, distant environment and affect it as well, complicating the customary unidirectionality of televisual experience. These new powers did not come without a hitch: before performing any action, individuals had to register their contact information and confirm that they understood Title 18 of the US Code-Section 333, which forbids the “mutilation of national bank obligations.” With a click of a button, they “accepted responsibility” for anything they might do through the interface. Under the law Goldberg cited, the crime they were investigating (forgery) was on the same plane as the one they were committing (mutilation). The law reads:

Whoever fraudulently alters, defaces, mutilates, impairs, diminishes, falsifies, scales, or lightens any of the coins coined at the mints of the United States, or any foreign coins which are by law made current or are in actual use or circulation as money within the United States; or Whoever fraudulently possesses, passes, utters, publishes, or sells, or attempts to pass, utter, publish, or sell, or brings into the United States, any such coin, knowing the same to be altered, defaced, mutilated, impaired, diminished, falsified, scaled, or lightened—Shall be fined under this title or imprisoned not more than five years, or both.⁷¹

This 1994 version of the law, current at the time of *Legal Tender*, mentions both actions—forgery and mutilation—in a single breath. By “investigating” the forgery on counterfeit.org, the users were, potentially, committing another analogous crime. Both diminish value, one by marring or destroying the notes (by defacement, shaving, filing, and so on), the other by undermining their ability to convince the

user of their veracity. One is an attack on the existent thing; the other threatens the currency's claim as a symbol or stand-in for value. The first assault is indexical, the other symbolic or iconic.

What is particularly concerning is not the users' doubt in whether the bills were authentic or counterfeit, but their doubt in their actions upon those real or forged bills. *Legal Tender's* investigators/mutilators, however, claimed they didn't believe in what they saw and did through the interface, despite seeing the real-time feedback and indexical results of their actions (burn holes, stains, and pinpricks appearing on the surface of the bills). Users disregarded their actions as inconsequential because they were "virtual" and therefore likely to be simulations regardless of what users did and saw. This is a more complex reaction than it initially seems. It presupposes an opposition between the virtual and the real and between the digital and the indexical that allows users to disregard their experiences in these environments. Of course, it also offers plausible deniability as a motivating factor. It may have been precisely because they were worried about the authenticity of their actions and their potential culpability that they chose to claim doubt. Either way, digital doubt opens up a problematic ethical situation: users can disregard their mediated actions (or claim to) when it is convenient for their own physical or emotional security. This logic is made possible by the false oppositions of the virtual and the real, and of the digital and the indexical. There is no doubt that this kind of logic is dangerous. It leads to an *Ender's Game* scenario in which a user might assume that there are no consequences to actions via virtual interface. *Legal Tender's* ethical stakes were relatively low in comparison to other technologies that

enable action at a distance, particularly surveillance and weapons systems. The disclaimer Goldberg required each user to sign, however, acted to introduce the threat of legal repercussion: the user was able to manipulate—to puncture, burn, injure—a distant object with no risk to her own person, but a legal punishment might have come at a lag.

Goldberg's project activated the nascent fears about the threats digitality and virtuality might pose for the indexical sign and our relation to it. The site paired conventional indexical signs (the burn, the cut, the hole) with more illusive indexical traits (present-tense engagement, real-time feedback, and the engagement of a receiver with a dynamical sign that requires immediate interpretation and action). It also introduced a kind of (im)material touch into the user's interaction with the sign. Through the virtual interface, the user could touch and affect the thing without experiencing the automatic, reciprocal experience of being touched back that occurs in embodied action—if I touch a surface, it, touches me too. When the virtual index touches the user, it is in the Peircian register: the sign provokes the user to apprehend its significance and make an abductive leap.

If indices, as I argued earlier, are signs that are often not directly witnessed, that come to their receivers from a spatial or temporal remove, and require hypothetical or abductive inferences because the user must furnish information beyond the directly observable, *Legal Tender* provides a provocative test example for how we will understand mediated images and our own mediated actions in the wake of the “death of the index.” As more and more of our actions and experiences are mediated by digital media and virtual interfaces, this scenario has implications

beyond semiotic theory. It becomes a question with implications beyond semiotic theory. It has ethical, epistemological, and existential consequences relevant far beyond discussions of Internet art.

The virtual and the real, the indexical and the digital, exist as strange bedfellows. The indeterminacy of the virtual image's ontological status as simulacral or simply mediated may seem to be specific to digital technologies and their uncanny capabilities to "fool" the viewer. This is not, however, a condition of digitality or virtuality. All media are mediated. All involve signs. But some of these media, and some of their signs, communicate information about the existent world to their receivers while others do not. Mediation is an inherent part of the index—it is a sign that stands between the receiver and the event. This has always been the case.

The current wave of digital doubt and the rhetoric of the loss of the index only serve to call attention to what indices are and always have been: dubious, open-ended, present-tense signs whose meanings are dependent upon context and clamor for attention and interpretation. Undecidability and skepticism are part and parcel of the indexical sign. Rather than becoming irrelevant in our current media moment, the index is an exceptionally useful semiotic category because of the uncertainty it represents and the urgent call it issues for interpretation and action. If the index is a sign that inherently sets up connections between it, the event that created it, and the receiver's senses and mind, it is particularly well suited for the analysis of experiences enabled by digital and telecommunications technologies. The interface is an index. The index is an interface.

¹ A telerobot, as defined by robotics engineer Thomas B. Sheridan, “is an advanced form of teleoperator the behavior of which a human operator supervises through a computer intermediary. ” A teleoperator is ‘a machine that extends a person’s sensing and/or manipulating capacity to a location remote from that person; Thomas B. Sheridan, *Telerobotics, Automation, and Human Supervisory Control* (Cambridge, MA, 1992), 4.

² I borrow the term “user” from Roy Ascott, who carefully points out that with telematic art the traditional “dichotomy of artist/viewer or sender/receiver of the earlier era is resolved into a unitary ‘user’ of the creative system”; Roy Ascott, *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*, ed. Edward A. Shanken (Berkeley, 2003), 195.

³ Hubert Dreyfus, “Telepistemology: Descartes’s Last Stand,” in *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*, ed. Ken Goldberg (Cambridge, MA, 2001), 60.

⁴ Charles Sanders Peirce, *Philosophical Writings of Charles Sanders Peirce*, ed. Justus Buchler (New York, 1955), 101.

⁵ Legal Tender, too, plays upon doubts the user might have in regard to capital, and the security measures necessary to protect its semiotic status as a stand in for value.

⁶ The complete quotation is: “This [the index] is a real thing or fact which is a sign of its object by virtue of being connected with it as a matter of fact and by also forcibly intruding upon the mind, quite regardless of its being interpreted as a sign”; Charles Sanders Peirce, *Collected Papers of Charles Sanders Peirce* 3/4 (Cambridge, MA, 1960), 4:359. Later in this essay, I will address this second element of indexicality.

⁷ In Peirce’s semiotic system there are three trichotomies of signs. The icon, index, symbol triad is the classification of signs in regard to their objects. The other two trichotomies divide signs by their mere qualities (qualisign, sinsign, or legisign), or by the sign’s relationship to its interpretant (rheme, dicisign, or argument). These nine types are recombinant and can result in ten classes of signs. See Charles Sanders Peirce, “Logic as Semiotic: A Theory of Signs” in *Philosophical Writings*.

⁸ Peirce, *Philosophical Writings*, 104.

⁹ Some words, however, are also indexical or iconic in Peirce’s system.

Onomatopoeic words sonically resemble what they represent and therefore have iconic qualities. Deictic shifters, as I will discuss later in this essay, relate to context and existence and, therefore, have indexical qualities.

¹⁰ Peirce, *Collected Papers* 3/4, 3.414.

¹¹ Peirce, *Philosophical Writings*, 106.

¹² Susan Sontag, *On Photography* (New York, 1977), 154.

¹³ Ibid.

¹⁴ As I argue later in this essay, pastness, permanence, truth, and resemblance are not necessary traits for the photograph either.

¹⁵ See, for example, Anne-Marie Willis, “Digitization and the Living Death of Photography,” in *Culture, Technology, and Creativity in the Late Twentieth Century*, ed. Philip Hayward (London, 1990); W. J. T Mitchell, *The Reconfigured Eye*

(Cambridge, MA, 1992); Lev Manovich, *The Language of New Media* (Cambridge, MA, 2001).

¹⁶ Willis, "Digitization and the Living Death of Photography," 199.

¹⁷ Ibid., 198.

¹⁸ Ibid., 201–2; emphasis added.

¹⁹ Manovich, *The Language of New Media*, 295.

²⁰ Ibid., 295.

²¹ Mitchell, *The Reconfigured Eye*, 225.

²² In her insightful 2002 book, *Touch: Sensuous Theory and Multisensory Media*, Laura U. Marks argues for the materiality of digital media. "Digital media are indexical," she writes, "if we keep in mind what level of materiality they are indexing. They may index the imperfect flow of electrons that constitute them, or the platforms on which they were built. They may index what they cost to make, or the social networks in which they exist"; Laura U. Marks, *Touch: Sensuous Theory and Multisensory Media* (Minneapolis, 2002), 190. Marks makes an important point here: there are without a doubt material underpinnings to electronic systems. I do not believe, however, that one need to go so far as to insist on the materiality of electrons or point to the financial, and therefore material, underpinnings of any system to keep the category of the index relevant in the digital age. As I will argue in this paper, the index has never had a tight grip on its own materiality and materiality does not make an index.

²³ Tom Gunning, Mary Ann Doane, and Philip Rosen address the false distinction between the digital and the indexical. See Tom Gunning, "What's the Point of an Index? Or Faking Photographs," in *Still Moving: Between Cinema and Photography*, ed. Karen Beckman and Jean Ma (Durham, NC, 2008); Mary Ann Doane, *The Emergence of Cinematic Time* (Cambridge, MA, 2002); Philip Rosen, *Change Mummified* (Minneapolis, 2001).

²⁴ See Roland Barthes, *Image, Music, Text* (New York, 1977); John Tagg, "Evidence, Truth, and Order: Photographic Records and the Growth of the State," in *The Burden of Representation: Essays on Photographies and Other Histories* (Minneapolis, 1993); Allan Sekula, *Photography Against the Grain* (Halifax, 1984). For a helpful and efficient discussion of this "poststructuralist" turn in photographic theory see Geoffery Batchen, "Identity," in *Burning with Desire: The Conception of Photography* (Cambridge, MA, 1999).

²⁵ Charles Sanders Peirce, *The Essential Peirce: Selected Philosophical Writings, Volume 2 (1867–1893)*, ed. Nathan Houser and Christian Kloesel (Bloomington, 1992), 461.

²⁶ Peirce, *Collected Papers of Charles Sanders Peirce* vol. 3, 211.

²⁷ Peirce, *Philosophical Writings*, 106.

²⁸ Laura Mulvey, *Death 24x a Second* (London, 2006), 55.

²⁹ Henry Fox Talbot described his early form of photography, the calotype, as "the pencil of nature." Since then, many theorists of photography have chosen not to see man's invention of and intervention in the process of photography. It is an industrial and scientific activity, not a natural one.

³⁰ Mulvey, *Death 24x a Second*, 55.

³¹ Gunning, "What's the Point of an Index? or Faking Photographs," 32–33.

³² Some indices take more than a moment to appear—such as erosion or a long-exposure photograph. The sign is created through duration, a drawn-out moment of copresence.

³³ Light "touching," "pressing," or "inscribing" film, I'd argue, should be understood as metaphor, rather than as description. The photograph seems to inspire a kind of synesthesia in which a visual quality appears as a tactile one. This is interesting in regard to telerobotic systems that turn vision and light into touch.

³⁴ Roland Barthes, *Camera Lucida*, trans. Richard Howard (New York, 1981), 4. Emphasis in the original.

³⁵ Ibid, 26.

³⁶ Ibid.

³⁷ Ibid. 5.

³⁸ Ibid.

³⁹ Ibid.

⁴⁰ Peirce, *Philosophical Writings*, 111.

⁴¹ Ibid., 110.

⁴² Ibid., 109. "Hi," being a word with a defined meaning, is also a symbol as well. Pierce is clear to parse as much as possible these two identities. Insofar as it is supposed to grab the receiver's attention and call his attention to the present moment, it is an index.

⁴³ Peirce, *Collected Papers* 3/4, 4.359. Emphasis added.

⁴⁴ Peirce, *Philosophical Writings*. 107.

⁴⁵ Ibid., 108–9.

⁴⁶ Ibid., 275. Peirce also calls the index a "true symptom" in his essay "Telepathy and Perception." In this essay, he connects the indexical "symptom" to the illogical, perceptual judgments of telepathy. This seems particularly interesting given the connection I am making between indexicality and telecommunications technology. See Charles Sanders Peirce, *Collected Papers of Charles Sanders Peirce*, vol. 7 (Cambridge, 1960), 373.

⁴⁷ Peirce, *Philosophical Writings*, 108.

⁴⁸ Symbols, as mentioned earlier, operate by convention, and icons by resemblance and direct observation.

⁴⁹ He does map out connections to logic in chapter 2, "Division of Signs," in *Speculative Grammar*. His logical triad follows upon his ten recombinant classes of signs, but he does not specify the connection of abduction to any of the sign classes. Charles Sanders Peirce, *Collected Papers of Charles Sanders Peirce*, vol. 2 (Cambridge, 1960), 152–53.

⁵⁰ This mapping is, admittedly, a generalization. Peirce's semiotics and logic are complex, and the classes of signs permute and recombine in ways that make such a generalization reductive, but it is also quite operative. His descriptions of icons often mirror and rhyme with his descriptions of inductive thinking, as do his descriptions of symbols and deduction. For example, Peirce calls deduction a "habitual" form of logic, and says that symbols are understood by "force of habit." Symbols signify by means of agreed-upon meanings, rules, and laws, and deductions are the

applications of rules and laws. Icons signify by means of resemblance and similarity of characters; induction is reasoning by likeness and analogy. Since abduction is the first process stage of any logical process, it is often overlooked as a kind of thought. One might need an abductive inference to see the similarity of characters in an inductive process, and so on.

⁵¹ Peirce, *The Essential Peirce: Selected Philosophical Writings, Volume I (1867–1893)*, 192.

⁵² *Ibid.*, 189.

⁵³ Charles Sanders Peirce, *Collected Papers of Charles Sanders Peirce*, vol. 8 (Cambridge, MA, 1960), 209.

⁵⁴ Peirce, *The Essential Peirce: Selected Philosophical Writings, Volume I (1867–1893)*, 189.

⁵⁵ *Ibid.*, 189.

⁵⁶ Abduction begins with a “result” or clue and infers a rule and a case that would explain the “result.” With abduction one begins from the end. Induction operates differently. Induction examines a series of cases and their results to infer a rule. Deduction is the application of a rule or law to a case. The result is already known or assumed. *Ibid.*, 188.

⁵⁷ The *Oxford English Dictionary* gives both the primary definition of “leading . . . away,” and the term’s history in logic, and specifically in Peirce’s writing; *OED*, 3rd ed., December 2011, s.v. “abduction, n.,”

<http://www.oed.com/view/Entry/215?rskey=YLEXpl&result=7&isAdvanced=true>.

⁵⁸ Peirce, *The Essential Peirce: Selected Philosophical Writings, Volume I (1867–1893)*, 152.

⁵⁹ Charles Sanders Peirce, “Guessing,” *Hound & Horn* 2 (April–June 1929): 267.

⁶⁰ *Ibid.*, 282.

⁶¹ Peirce, *Philosophical Writings*, 109.

⁶² Gunning, “What’s the Point of an Index? or Faking Photographs,” 6.

⁶³ Antony Bryant and Griselda Pollock, “Editors’ Introduction,” in *Digital and Other Virtualities*, ed. Antony Bryant and Griselda Pollock (London, 2010), 10.

⁶⁴ *Ibid.*, 11. This collection of essays comes out of the 2005 CentreCATH Conference: *The Politics and Ethics of Indexicality and Virtuality*, in Leeds, England. I first presented this paper, then titled “Abducting the Index,” at this conference.

⁶⁵ Bryant and Pollock, “Editors’ Introduction,” 11.

⁶⁶ *Ibid.*, 11.

⁶⁷ *Ibid.*, 14.

⁶⁸ Anne Friedberg, *The Virtual Window* (Cambridge, MA, 2006), 9.

⁶⁹ *Ibid.*, 11.

⁷⁰ Goldberg’s choice to present the bills as potentially forged was timely as well. It responded to a contemporary set of fears around simulation and seamless reproduction. Goldberg’s bills bore the US Treasury’s new design, which had just been released earlier that year and still looked unfamiliar. The redesign was a tactical move by the mint to confound forgers. Intricate lacework occupied the bill’s borders; dense cross-hatching filled each graphic figure. The new banknotes were nearly impossible to duplicate without error.

⁷¹ Title 18 U.S.C. § 333 (June 25, 1948, ch. 645, 62 Stat. 700; July 16, 1951, ch. 226, Sec. 1, 65 Stat. 121; Pub. L. 103–322, title XXXIII, Sec. 330016(1)(I), Sept. 13, 1994, 108 Stat. 2147). <http://uscode.house.gov/download/pls/18C17.txt>.