INTERFACE

Branden Hookway

CONTENTS

2

THE FORMING OF THE INTERFACE

The interface as that which defines the fluid

The word *interface* was coined in the nineteenth century by the engineer James Thomson in his influential work on fluid dynamics. It denoted a dynamic boundary condition describing fluidity according to its separation of one distinct fluid body from another. The interface would define and separate areas of unequal energy distribution within a fluid in motion, whether this difference is given in terms of velocity, viscosity, directionality of flow, kinetic form, pressure, density, temperature, or any combination of these. From difference the interface would produce fluidity. As a boundary condition it would be inherently active. While imperceptible in itself, it would be inferable according to its effects. It would be the site of both continuous contestation and the resolution of competing pressures. It would be both internally situated as an existential condition of fluidity and externally directed in the production and harnessing of dynamic form. From its emergence within fluid dynamics, the interface would take on a conceptual affinity with fluidity that extends to all of its subsequent contexts and instantiations.

In notes written in 1869, Thomson describes the formation of the interface as two expansive territories come into contact: "[It is] as if the fluid everywhere possesses an expansive tendency, so that pressure must everywhere be received by the fluid on one side of a dividing surface (or as I call it *interface*) from the fluid, or solid, on the other side, to prevent the fluid from expanding indefinitely, or to balance its expansive force."[1] Here *interface* and *fluid* meet in mutual self-definition. As a technical term *interface* avoids the semantic confusion of "dividing surface," where

the use of *surface* immediately brings up the question of how a surface may belong to two fluid bodies at the same time. While *surface* may denote a bounding or enveloping, it does so with a concomitant establishing of an inside and an outside to that bounding. By way of contrast, the bounding denoted by *interface* may be viewed in either of two ways. First, as an internalization of what was previously a boundary facing toward an externality; for example, when what was first given as the external boundary of a thing or condition is internalized as a relation that determines the behavior of a larger flow, assemblage, or system. Second, as an externalization of a facing toward an interiority; for example, when an internal boundary condition that produces the dynamic form or trajectory defining a system becomes either a means of accessing that system from outside it, or a site of influence over a thing outside or over the environment within which it operates.

Further, in opening up an externality within an internal condition, the interface produces, if not a specific form, the potentialities by which a forming may occur. This is just as the phrase *dividing surface* suggests the opening up of a space within the surface itself, within which the potential of division is situated. This forming is a behavior or activity that produces form dynamically in space and time, yielding a static form only if the results of its activities are in some way frozen in time and place. For Thomson the interface would become essential to any description of a fluid or fluid form. His description of the form taken by a flow of water from an orifice focuses on the role of the "bounding interface" in "separating the region of flow with important energy of motion from the region which may be regarded as statical, or as devoid of important energy of motion."[2] Likewise, Thomson relies upon the interface to describe the forming of columnar basalt out of the congealing of cooling lava. This distinctive columnar rock formation, whose regularity could seem the work of a preexisting design, is essentially a random cellular network whose exact form is shaped by factors including the composition of the lava and its rate of cooling. In Thomson's words, the "jointed prismatic structure" of this columnar form follows "a tendency to proceed perpendicularly to successive isothermal interfaces in the cooling mass."[3]

CHAPTER 2
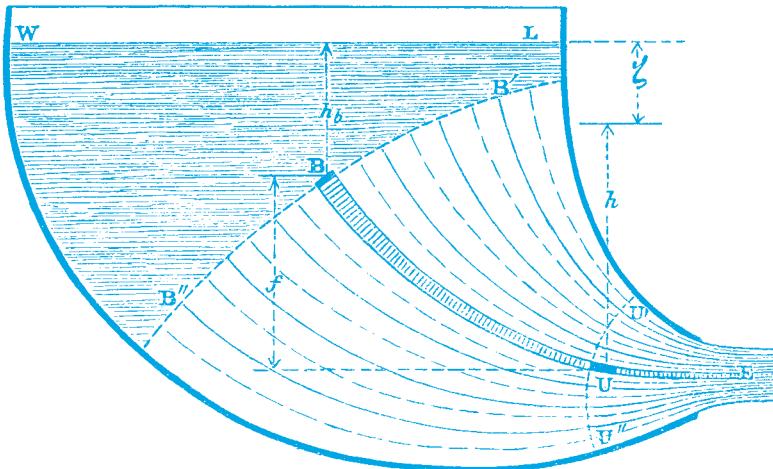
FIGURE 2.1

—

INTERFACE DIAGRAM, 1876. "LET *WL* BE THE
STILL WATER LEVEL, AND LET *B″BB′* BE A BOUNDING
INTERFACE SEPARATING THE REGION OF FLOW
WITH IMPORTANT ENERGY OF MOTION FROM
THE REGION WHICH MAY BE REGARDED AS STATICAL,
OR DEVOID OF ANY IMPORTANT ENERGY
OF MOTION."

SOURCE: THOMSON, *COLLECTED PAPERS IN PHYSICS AND ENGINEERING*, 65.

THE FORMING OF THE INTERFACE
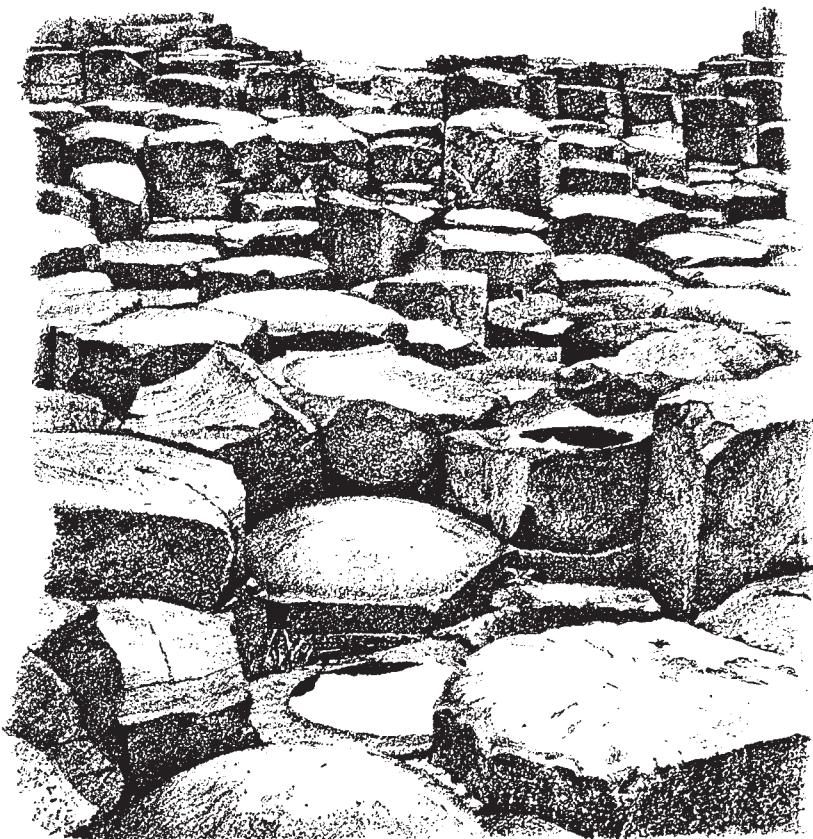
FIGURE 2.2

⎯

INTERFACE AS GEOLOGICAL FORM MAKER, 1877.
"EXCELLENT PHOTOGRAPHS SELECTED BY THE
AUTHOR ON A VISIT TO THE CAUSEWAY WHEN HE
WAS SCRUTINIZING THE STONES THEMSELVES."
PHOTOGRAPH BY JAMES THOMSON OF GIANT'S
CAUSEWAY, IRELAND.

SOURCE: THOMSON, *COLLECTED PAPERS IN PHYSICS
AND ENGINEERING*, 429, QUOTE ON 428.

CHAPTER 2

The resulting pattern of fractures in solidified rock renders legible and permanent the operation of isothermal interfaces within cooling and contracting lava. Here the interface inscribes in solid rock the traces of its operation.

Taken together, the interface and the fluid were essential to nineteenth-century conceptions of dynamic form. Dynamic form is less a form than a *forming*, a process active across space and time, and elusive to formal analysis unless captured in some way. Such capture may occur when dynamic form is fixed in time and place as static form; of greater interest is the capture of dynamic form in another important nineteenth-century concept: that of *work*. In this regard the interface and the fluid were instrumental in the development of thermodynamics, following in particular the work of Sadi Carnot and James Joule. In establishing the relation that holds between the generation of heat and the production of mechanical work, thermodynamics would also need to develop concepts of *system* and *environment*. As in the case of fluid dynamics, the interface may not only be used to describe the internal processes by which a system is defined, but also may be found as the boundary that marks the difference between a system and the environment within which it operates. In doing so the interface constitutes the site where a dynamic process of forming may become visible, legible, knowable, measurable, and available for capture in the production of work.

The interface both defines a system and determines the means by which it may be known. It takes its place as the zone across which all activity must occur in order to possess meaning, force, or power. It demarcates the site from which the parameters that define a system may be measured (whether thermodynamically in terms of volume, pressure, or temperature, or otherwise). It is the generative source from which work may be extracted from the system, and the entryway into the system from which influence or control over that system may be exerted. It denotes that part of a system from which change may spring. In defining *system* and *environment*, an interface is drawn into the cacophony of nature, opening up a wild natural process for identification and taming by producing from within it the surface of a system. Here the interface is

THE FORMING OF THE INTERFACE

first imposed as the interiority of the natural process, before being opened up as a surface that demarcates system as inside and environment as outside. In a thermodynamic system, for example, the crossing of an interface is marked by transfer of energy, whether in the form of heat, work, or matter; this remains the case whether such a transfer is assumed to occur within the internal operation of the system, or whether it is extracted as work or dissipated into the environment as heat.

In fluid dynamics or thermodynamics, the interface is a boundary across which dynamic conditions are held in a state of contestation. It elicits a drive to contestation from that with which it interfaces. Thomson identifies this as an "expansive force" inherent to fluid bodies separated by an interface. As the site within a system from which all changes spring, the interface governs change through a seeking of equilibrium. The equilibrium of the interface is a balancing of forces that press against it from all sides, drawn from the entities that it divides. To produce equilibrium, the interface seeks out differential conditions where bodies come into contact. It defines and channels those differences as at once opposing and reconciled within a moment of equilibration. As a boundary and a facing, the interface is in this sense both persistent as an internal form and contingent as a dynamic equilibrium, one that has only just come into being and will at the next moment be dissolved. Its formal persistence exists only in the dynamics of a continual formation, dissolution, and reformation. Within a dynamic form, the interface is not a form so much as a tendency toward a forming, which proceeds through a seeking of difference and its counterpoise in equilibrium.

Along these lines the interface is its own primary product; that is, the interface is first concerned with maintaining its own existence. It does so through the sustained production of momentary states of equilibrium out of disequilibrium. As such, the interface neither belongs to equilibrium nor to disequilibrium, but draws upon each in measure. It owes its persistence within a dynamic form to the maintenance of active contact with the bodies it separates, and it relies upon each of these bodies for the motive force that brings it into being. It exists only through the contestation and communication of these bodies.

CHAPTER 2

The interface does not in itself produce work, though it produces the occasion whereby work may be extracted. In this extraction of work the interface is momentarily transformed into a surface, opening the system so that energies bound up in its interiority are made available outside the system. In this way, work may be viewed as a secondary product of the interface, as may *entropy*. In thermodynamics, entropy, like work, is an extraction of energy from a system; unlike work, this extracted energy is dissipated as heat rather than harnessed as energy. Together work and entropy represent the total energy that may be extracted from a system. The interface is the means by which that energy may be held or dissipated within a system; it is also the means by which energy may be extracted or dissipated from, or interjected into, a system from outside itself through the transforming of interface into surface. Thus both open and closed systems may be described in terms of the interface, which constitutes the site across which all energy transfer occurs.

In this regard the equilibrium produced by the interface is not a cessa-tion of activity but rather a moment-by-moment balancing of constant contestation. Here, for example, may be cited the "definition of a fluid" proposed by the physicist and mathematician James Clerk Maxwell—a figure whose singular eminence in nineteenth-century science follows the central role he played in both of the major developments in theoretical physics of that century, electromagnetism and thermodynamics. In the fourth and subsequent editions of his seminal *Theory of Heat* (1875 and following), Maxwell defines fluid as that which contains within itself an opposition of forces played out across an interface: "A fluid is a body the contiguous parts of which act on one another with a pressure which is perpendicular to the interface which separates those parts."[4] This defini-tion is identical to those given in previous editions of *Theory of Heat*, with the sole exception that between the third edition (1872) and the fourth Maxwell substituted "interface" for the previously used "surface."[5] Yet neither Maxwell nor Thomson found it necessary to produce a definition of the interface; what the interface was of itself, and the implications of the relations denoted by the interface, would remain tacit within the defining of the dynamic systems (hydrodynamic, thermodynamic, and so on) within which the interface was found to operate. If Maxwell's defini-tion of *fluid* offers what is likely the first scientific definition to include the word *interface*, and the first in which the description of a material state is based upon the concept of the interface, it is perhaps fitting to take as an originary definition of *interface* an inversion of that definition, where the interface is in turn defined with reference to the fluid. Such a definition might read: *An interface is a boundary condition that both separates and holds contiguous as one body those parts whose mutual activity, exerted from each part onto the other, is directed into and channeled across that boundary condition in such a way as to produce a fluidity of behavior.*

[...]

THE SUBJECT OF THE INTERFACE

The interface as form of relation

Inasmuch as the range of human experience and performance is more and more defined and conditioned through the forces of technological development, the interface holds a familiar albeit indeterminate and even spectral presence. For while the interface might seem to be a form of technology, it is more properly a form of relating to technology, and so constitutes a relation that is already given, to be composed of the combined activities of human and machine. The interface precedes the purely technological, just as one encounters a mirror image before the mirror itself. Likewise, the interface describes the ways in which humanness is implicated in its relation with technology. For even at the moment human and machine come into contact, their encounter has already been subject to a mediation. Both the actions performed upon the interface and the agency of their performance are to a critical extent already anticipated.

Nonetheless, it is the interface that most actively determines the human relation to technology and delimits the boundaries that define human and machine. Increasingly the interface constitutes the gateway through which the reservoir of human agency and experience is situated with respect to all that stands outside of it, whether technological, material, social, economic, or political. It is more and more unavoidably the means of representing that which is otherwise unrepresentable, or of knowing that which is otherwise unknowable. If the interface is now ubiquitous and pervasive, it is so with respect to a proliferation of ever more complex devices and networks. If it is indeterminate and elusive,

it is so in that it channels the activities under its influence toward a resolution within a common protocol, while at the same time opening up new vistas and capabilities to a now-augmented human sensorium.

The interface is defined here as a kind of theoretical construct whose essential characteristics and operations are common to each of its various realized instantiations. Specifically, the interface is treated here as a *form of relation*. This is to say that what is most essential to a description of the interface lies not in the qualities of an entity or in lineages of devices or technologies, but rather in the qualities of relation between entities.

4 Such a relation possesses its own qualities and characteristics that are attendant on but otherwise independent of the entities brought into relation; the persistence of this relation in time and space is such that it may be described as possessing a kind of form. A preliminary definition of *interface* might then be as follows: the interface is a form of relation that obtains between two or more distinct entities, conditions, or states such that it only comes into being as these distinct entities enter into an active relation with one another; such that it actively maintains, polices, and draws on the separation that renders these entities as distinct at the same time as it selectively allows a transmission or communication of force or information from one entity to the other; and such that its overall activity brings about the production of a unified condition or system that is mutually defined through the regulated and specified interrelations of these distinct entities. Or again: the interface is that form of relation which is defined by the simultaneity and inseparability of its processes of separation and augmentation, of maintaining distinction while at the same time eliding it in the production of a mutualism that may be viewed as an entity in its own right, with its own characteristics and behaviors that cannot be reduced to those of its constituent elements.

The interface is defined in its coupling of the processes of holding apart and drawing together, of confining and opening up, of disciplining and enabling, of excluding and including. The separation maintained by the interface between distinct entities or states is also the basis of the unity it produces from those entities or states. While the constituent entities and processes of the interface may be examined individually,

CHAPTER 1

such analysis yields only a partial view of the interface and addresses only aspects or derivations of its full functioning. Such derivations of the interface include the surface, the test, and the simulation. The theory of the interface presented here investigates the interface both in part and in full, including the processes by which the interface comes into being, the behaviors and activities that it both draws upon and produces, and the status it ascribes to the discrete elements it brings into relation and the mutually directed entity or system that is the result of its operations. In this analysis, the interface entails implications for notions of control and intelligence as well as regarding those entities that are both its constituents and its products. These include the *system* and, perhaps most relevant to this study's focus on the human relation to technology, the *subject* and its production through processes of subjectification. The subject of the interface finds as its counterpart the user of the interface, just as the user's learning or mastery of the interface is at the same time a kind of subjectification. That the user of the interface is also its subject follows the notion of the interface as that which at once separates and draws together in augmentation. Likewise, *agency*, or the will and means to action, is a capacity at once mediated by and produced upon the interface.

The human-machine interface is neither the first interface nor the only type of interface that may be defined as a form of relation. The concept of the interface was developed for use in the field of fluid dynamics. Fluidity provides a powerful metaphor for the operation of the interface, as well as for associated processes of mediation and control. To engage an interface is also to become a constituent element within a kind of fluidity. Likewise, subjectification may be described as a process of becoming fluid.

The interface is a liminal or threshold condition that both delimits the space for a kind of inhabitation and opens up otherwise unavailable phenomena, conditions, situations, and territories for exploration, use, participation, and exploitation. Often the territories it opens up constitute in themselves further threshold conditions. This reflects what may be taken as axiomatic: that the interface is at every stage of its operation

THE SUBJECT OF THE INTERFACE

concerned with the liminal. Not only does the interface constitute in itself a threshold condition, but it also operates through the seeking out, identification, and development of thresholds of various kinds. These thresholds are guarded, regulated, and maintained in place by the interface both in its internal organization and in the relation or effect it produces with respect to the externality with which it interfaces. The relation of an interface to its external condition, a relation that is the primary product of its operation, may be described as control. Insofar as the interface serves as a locus and condition of control, control could also be said to pertain to the liminal, in that it describes a way of operating upon and through threshold conditions; this is to say that, at least in relation to the interface, control proceeds *a limine*, or out of a threshold. It is axiomatic of control as well, then, that it both occurs upon a threshold and proceeds from a threshold; control may even be said to define the threshold to the extent that it seeks out those moments, or tipping points, at the onset of a transition from which a difference may be most easily effected. To the extent that the identification of difference is essential to the operation of the interface, the interface is aligned with the test; and to the extent that the interface occupies the threshold that governs the change from one state to another, the interface may be said to possess a tendency to come into being, operate within, and express its character with reference to the transformative or transitional.

This is borne out in the history of the human-machine interface from the early twentieth century to now. During this period the interface has become a prevalent means of testing and simulation, has served as a testing ground for transformations in self-identity, and has been the site from which complex technological processes are governed, from the control of machinery to the design of environments to the modeling of complex physical processes. In each of these settings, and whether as a general theoretical construct or within a specific instantiation, the interface carries with it a third major tendency, along with the identification of differences and the facilitation of transformations; this is a tendency toward a seeming transparency and disappearance, even as it is undoubtedly a condition that demands to be worked through. While promising an

6

CHAPTER 1

illusory effortlessness and seamlessness in its provision of an augmentation, the interface nonetheless requires an extraction of work and for this work a cost must be paid. This cost is extracted both in terms of energy and in the confinement and channeling of these energies into a form compatible with the interface, even as the cost of working through the interface is hidden from the perspective of its having been worked through. In its occupation of the threshold, the interface is both the conduit through the threshold and the judge sitting upon the threshold to determine what may pass through and the manner of its passing. Both of these aspects of the interface constitute a kind of friction upon the threshold that requires work or the exertion of energy to overcome. What occurs within the interface, the kind of relating across a threshold that is often described as interaction or interactivity, may also be described as a transaction, in the sense of a cost being extracted and compensation being given in exchange. This transaction also reflects the reconciliation of the interface as a space that is both inhabited and worked through; here the transaction is a confinement endured for the granting of an enhancement.

Between faces and facing between

The etymology of *interface*, a word first used in the description of fluid behavior, suggests how the interface may be opened up to theoretical description even as it resists such description. The prefix *inter-* connotes relations that take place within an already bounded field, whether spatial or temporal. It pertains to an inward orientation, an interiority. As an interiority of relations, *inter-* encompasses relations that may occur between, among, or amid elements insofar as they are given as bounded within the space of their relating, or of events insofar as they are bounded in time. *Inter-* holds its bounded condition as already given, as a priori to the relations it describes. It does not exclude that which is exterior to it, since it has already been separated out as an interior. This reading of *inter-* would suggest an interface that does not define its bounding entities but is rather defined by them. The interface thus would be an interior condition, whose activity and influence is constrained within the

boundaries given by its defining entities. If used as a form of communication between these entities, the role of the interface would be limited to the translation or transmission of that which its bounding entities project into it. While the specific means of this communication belong to the interface, the interface would otherwise always refer back to its bounding entities. Its influence would not extend into the bounding entities that confine it, but would rather be constrained to the relations that occur between them. The interface would be defined according to its betweenness, its amongness, its duration-within.

Against this reading of the interface as an interior condition, the etymology of *face* points toward an outward orientation and an exteriority. *Face* is derived from the Latin *facies*, meaning like the English *face* a visage or countenance, as well as an appearance, character, form, or figure; *facies* in turn is derived from the verb *facere*, meaning to act, make, form, do, cause or bring about. A face, then, is the aspect of a thing by which it presents itself. From *facere*, this is an active making of a presence, or a presencing. A face is not that by which a thing looks at itself, as into its interior; it is rather the focus of a relation of a thing to what is outside itself, to an exterior. In this way a face not only forms the outer boundary of a thing, but is also the means by which that thing may project itself forward and outside itself, and so by which it may enter into relation with something outside itself. The face of a thing is what is given as available for a reading; from its face one may determine the character or nature of a thing. As a verb, *to face* may broadly be said to have two meanings. First, *to face* is to give a thing the properties of possessing a face, such that it both becomes capable of projecting qualities and energies outside itself and is opened up as accessible to a kind of reading, just as a text is available to be read. This meaning of *to face* may be found in the concept of facing a building with marble or facing (making smooth) a block of stone to prepare it for use in building; in both cases *to face* is to produce a face through which an entity may present qualities outside itself in order to be read. Second, *to face* is to be oriented toward, or to confront with persistence and determination, as in an adversarial situation. Here, *to face* is not yet to enter into a relation, but rather to marshal

CHAPTER 1

energies from an interior toward an exterior. The face is the threshold for this marshaling; it is the site from which the qualities of an interior are translated into a communicative or combative form, so that they may be projected outward onto an exterior.

The combining of *inter-* and *face* makes of the interface the embodiment of a contradiction, which may be seen in two possible readings of the term. First, as "between faces," interface would suggest activities within a circumscribed field or an enclosure. Second, as "a facing between," interface would suggest a boundary or zone of encounter that actively extends into and conditions that which it separates. In combination, the interface is both an interiority confined by its bounding entities and a means of accessing, confronting, or projecting into an exteriority. It is defined by its bounding entities at the same time that it defines them. In encompassing interiority and exteriority, passivity and activity, the interface governs transformations from interior state to exterior relation, from inward to outward expression. Each successive state of such transformation belongs to the interface, as does the overall event of transformation itself. The interface, then, is at the same time "between faces" and "a facing between." Either reading may constitute a valid approach to the study of the interface, although both remain partial and provisional descriptions. The interface comes into being in the maintenance of its contradictions. It is only by maintaining these contradictory readings that the entire range of activity that may occur within and through interfaces may be addressed as belonging to a single theoretical concept.

One between-faces approach to the interface would be to treat it as if it were a closed system. The interface could then be characterized according to the bounding entities (or faces) that delimit it, and by the relations that take place within this delimited field. A human-machine interface, for example, would be fully bounded by the "faces" of human and machine. Its study would concern only the relations that take place between human and machine, and its operation would be delimited as acts of transaction and translation between these two entities. The view of the interface as an instrumental technology is such a between-faces approach. Here, the interface becomes a discrete object or apparatus

9

THE SUBJECT OF THE INTERFACE

available for use, or a technical problem constrained within the criteria of its design and production. A standard definition of the human-computer interface—"the means of communication between a human user and a computer system, referring in particular to the use of input/output devices with supporting software"[1]—reflects this instrumentalist approach. Defined by an already-given accessibility to the designated methods and tools of a specialized discipline, the interface is posed as a design problem that aligns seamlessly with the technical means of its solution. Its bounding entities, human and machine, are treated as constants rather than variables themselves subject to the operations of the interface. While the instrumentalization of the interface is of use in analysis or design, just as one element of a highly complex open system may be singled out and viewed as a closed system, it provides only a partial view. To address what is at stake in the historical emergence of the interface, or the role of the interface as a cultural form, a countervailing reading of interface as a facing between—as an active and contested boundary condition—is needed.

At the same time, the reading of the interface as between faces reveals those aspects of its operation where it delimits, encloses, or produces an interiority. This is not only the interiority of the closed system, but also a form of interiority that defines the subjective experience of control interfaces, or of media of control. Here, the interface opens up a space of inhabitation, within which the use of a control interface and its exertion of control are reconciled within user experience. In this reconciliation, the operator of a control system projects agency through an interface, with the actual operations on the interface performed at a tacit or subliminal level of awareness with respect to the conscious exertion of control over an environment. Thus, a video gamer internalizes the use of controls to project an agency or selfhood into the world of a game, or the user of social media internalizes the protocols of the social network in adopting a social identity. These inhabitations are only ever partial and contingent; they remain fully reliant on the act and apparatus of projection even as they obscure that projection. The partial self that inhabits the game world is a kind of abstraction within the full operation of the

CHAPTER 1

interface, just as the closed system is an abstraction of the open system from which it is separated.

As a facing between, the interface is no longer defined by enclosure but rather actively faces that which it encounters. In this sense the interface defines its own interiority in exclusion of its bounding entities, and so possesses its own specific qualities and tendencies beyond those derived from its bounding entities. In possessing its own faces, the interface also possesses the agency by which it is capable of facing. This agency may be expressed as dynamic form, behavior, or intelligence. Here the interface is more than a means of communication between its bounding entities. It holds its own identity, from which it influences and defines the entities that stand in relationship to it as much as those entities influence and define the interface itself. In actively facing its bounding entities, the interface defines them according to the relation brought into being by that facing. The interface binds together its bounding entities and mobilizes them as constituent elements of a unified condition whose interiority is the interface. The interface is at the same time constitutive of this unified condition, in defining its interiority, and exterior to that condition, in that it continues to present a face to its constituent elements. In this way the interface describes a form of agency within a given condition that yet is not encompassed by that condition.

In exerting a form of agency at once interior and exterior to a condition, the interface also manifests the potential availability of that condition to control. The agency of the interface cannot yet be termed control, though it opens up the opportunity of control. The interface comes into being prior to control; while it does not necessarily entail control, it is the conduit of control, and control always takes place across an interface of some kind. Control recapitulates the binding together of entities by the interface, albeit in an implicit modeling of the interface as an exterior means of access to the interior processes of a condition. In this way control draws a loop diagram connecting the interior state of a condition and an exterior means of reference that models that condition. Yet the interface is not reducible to control, even as control implicitly seeks out the interface as underdeveloped territory to be explored and colonized.

THE SUBJECT OF THE INTERFACE

With respect to control, the interface describes both a possibility and a limit, a capacity and complexity at once available to and beyond control. If control is also a means of understanding or knowing a condition, the interface stands at the limit of that knowing, in that it is the site from which that condition comes into being. It is as well the site from which the entities that are constitutive of that condition are defined as both active and acted upon, just as the interface defines its bounding entities according to the unified condition or mutual activity that it brings into being.

As a zone of encounter between entities, the interface is at once between faces and a facing between, just as it is at once passive and active. It comes into being between faces, constituting the site of encounter between two or more entities as they enter into relation; as much as this relation produces mutually determined activity, the interface operates as a facing between to bind together the actions and reactions of each entity in the production of an overall act. Likewise the interface is at once passive in that it only comes into being when energy is directed into and through it, and active in that it captures that energy as its own, drawing energies from one entity to channel it into another in the production of a mutual activity that only it can fully describe. To return to the human-computer interface, the interface is not only defined by but also actively defines what is human and what is machine. In this mutual defining, which is also both a communication and a contestation, the interface operates as an essentially unbounded condition—one that continually tests and redefines its own boundaries as it comes to face with the entities that face it.

66. Leo Strauss, "Notes on *The Concept of the Political*" (1932, trans. 1965), trans. J. Harvey Lomax, reprinted in Schmitt, *The Concept of the Political*, 105. Italics are in the original.

67. Schmitt, *The Concept of the Political*, 64, 65.

68. Huizinga, *Homo Ludens*, 210.

69. Schmitt, *The Concept of the Political*, 66, 67.

70. Ibid., 67.

71. Strauss, "Notes on *The Concept of the Political*," 106.

72. Caillois, *Man, Play and Games*, 14, 17, 23, 19.

73. Roger Caillois, "Mimicry and Legendary Psychasthenia" (1938), trans. John Shepley, *October* 31 (Winter 1984): 23. Italics are in the original.

74. Ibid., 31, 30. Italics are in the original.

75. Ibid., 28. Italics are in the original.

76. Caillois, *Man, Play and Games*, 27, 13, 56, 33, 27.

2 THE FORMING OF THE INTERFACE

1. James Thomson, *Collected Papers in Physics and Engineering*, ed. Joseph Larmor and James Thomson (Cambridge: Cambridge University Press, 1912), 327. This quote is taken from a section dated May 10, 1869, under the heading "Notes and Queries—On Gases, Liquids, Fluids: Unpublished notes bearing on [chemist and physicist Thomas] Andrews' experiments."

2. Ibid., 65. This quote was originally published in 1876 in a paper titled "Improved Investigations on the Flow of Water through Orifices with Objections to the Modes of Treatment Commonly Adopted."

3. Ibid., 424. This quote was originally published in 1877 in a paper titled "On the Jointed Prismatic Structure in Basaltic Rocks."

4. James Clerk Maxwell, *Theory of Heat*, new imprint (London: Longmans, Green, 1902), 95.

5. Cf. Maxwell, *Theory of Heat*, 3rd ed. (London: Longmans, Green, 1872), 95; and 4th ed. (London: Longmans, Green, 1875), 95.

6. James Thomson, "On the Flow of Water in Uniform Regime in Rivers and Other Channels," *Proceedings of the Royal Society of London* 28 (1878–1879): 121.

7. Ibid., 121n.

8. This correspondence between James Clerk Maxwell and William Thomson (Lord Kelvin) may be found in A. T. Fuller, "Maxwell's Glasgow Transcripts: Extracts Relating to Control and Stability," *International Journal of Control* 43, no. 5 (May 1986): 1594. The original source is a letter from James Clerk Maxwell to William Thomson dated November 24, 1857, found as a manuscript at the Glasgow University Library, Kelvin papers, box M10.