ROUTLEDGE HANDBOOKS

The Routledge Handbook of Shakespeare and Interface

Edited by Clifford Werier and Paul Budra

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ACKNOWLEDGMENTS

Work on this volume began just before the Covid-19 pandemic exploded, but shortly thereafter its influence profoundly shaped every element of the workflow of both authors and editors. Most of the contributors to this volume are academics who had to pivot quickly and become online teaching experts while juggling their research and writing projects and shifting personal circumstances. As a consequence, everything about this volume was delayed from our original timeline, as evolving circumstances forced us to request extensions. At the same time, these unprecedented events became a unique feature of several chapters in this collection as interfaces (such as Zoom) evolved to meet changing performance conditions.

We would like to thank our authors for their commitment to this collection, despite the profound personal and professional challenges of lockdowns. We also want to acknowledge the risks that some authors took in undertaking an examination of Shakespeare through a new critical lens with which they were initially unfamiliar. The results are truly gratifying.

Finally, we extend special thanks to Bryony Reece at Routledge, for her patience and unflagging belief in Shakespeare and Interface, notwithstanding our emails pleading for more time. We hope it was worth the wait.

A version of Erika Boeckeler's chapter, "The Hamlet First Quarto (1603) and the Play of Typography," first appeared in *Early Theatre: A Journal Associated with the Records of Early English Drama*, vol. 21, no. 1, 2018, pp. 59–86.

INTRODUCTION

Clifford Werier and Paul Budra

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The inspiration for this collection began with a seminar on "Media, Interface and Cognition" which we led at the Shakespeare Association of America (SAA) conference in Los Angeles in 2018. At the 2019 conference in Washington, DC, Meaghan Brown offered a seminar on "Navigating Early Modern Interfaces," while at 2020's virtual conference Lauren Shohet led a seminar on "Shakespeare Studies and the Idea of Interface." This unprecedented consideration of interface at three successive SAA conferences suggested to us that interface had found its moment in Shakespeare studies. After successfully proposing a collection on Shakespeare and Interface to Routledge, we put out a call for papers to a diverse assortment of scholars—none of whom had written previously on the topic of interface—and were delighted by the enthusiastic response. Clearly, the idea of approaching Shakespeare through interface theory had ignited imaginations, although many authors needed guidance in the initial phases of their thinking because interface, as we discovered, can be difficult to define and conceptualize.

In our initial call, we asked our authors to differentiate media from interface, as we recognized that the distinctions between these two categories were crucial to the unique approach of the collection. Past scholars had considered how Shakespeare manifests across traditional and new media, but little scholarly attention had been paid to the ways in which cognition and design cohere in a user's engagement with those media. The mediating function of the Shakespearean interface—that elusive liminality between media and cognition—had, in all its multifarious forms, been largely ignored. For this reason, almost every chapter in the collection begins with its author attempting to define and theorize what is meant by interface, to offer some reflections on interface theory generally, and to distinguish interface from a more traditionally mediacentric approach, such as Shakespeare and the book, Shakespeare on film, or digital Shakespeare. Interface, an established field of inquiry in media studies, gave our authors an innovative theoretical lens that allowed them to reconsider both the Shakespearean media artifact or performance space and the corresponding user experience.

Prominent interface theorists such as Alexander Galloway, Branden Hookway, and Joanna Drucker are cited throughout the collection, as all our authors gesture toward working definitions of interface before applying them to examples of Shakespearean media. The reader of this collection should gain a deep understanding of interface theory just by reading the discussions which begin every chapter. *This* introduction, therefore, will not attempt to summarize the many complex definitions of interface offered in the collection, except to establish the following general principles which should apply to every example:

1. Interfaces condition every contact with Shakespeare.
2. Interfaces represent and/or activate media containers, both explicit and hidden.
3. Interfaces provide a mediating function that conditions users' access to media.
4. Interfaces are activated where design meets cognition.
5. Interfaces are never neutral.

It may be useful to note the active verbs which structure this list of principles, such as "condition," "mediate," "represent," "activate," and the noun "access," confirming what Alexander Galloway has called "the interface effect." According to Galloway, "Interfaces are not things, but rather processes that effect a result of whatever kind" (vii). The list of principles above describes the actions and conditions of the interface, confirming Galloway's contentions by describing what it does, but not what it is.

Part of the pleasure of applying an interface approach to Shakespeare begins with a recognition of how interface functions grammatically as both noun and verb; demonstrating the rhetorical trope of anthimeria, one can interface with an interface, but this linguistic flexibility serves only to make things more complex. The original meaning of the noun derives from nineteenth-century physical sciences: "The term *interface* denotes a face of separation, plane or curved, between two contiguous portions of the same substance" (*OED*). The word was first used figuratively to denote "A means or place of interaction between two systems, organizations" (*OED*) by Marshall McLuhan in his book, *The Gutenberg Galaxy* (1962). It began to be used as a verb in the late 1960s to describe the connection between pieces of technology, such as Selectric typewriters and computers. As we shall see, to this day, much interface theory is largely driven by technological (and especially digital) innovation, though the figurative use of the word has crept into the vocabulary of university administrators and business leaders. A Shakespeare scholar might be more inclined to observe how the prefix "inter" combined with the root word "face" suggests both apparent surfaces and literal human faces which are interconnecting or participating in an act of mediation between or among objects—an apt description for points of contact between the Shakespeare media artifact/experience and the face/senses of the user.

The first principle described above—interfaces condition every contact with Shakespeare—emphasizes the necessary (but sometimes hidden or seemingly invisible) function of the interface as the point of access. Any Shakespeare media example will serve to illustrate this point—whether in live theater, cinema, books, or digital instantiations, now or in the past. Each media type, considered as both a technology and a user experience, utilizes an interface to condition access to the multifarious manifestations of Shakespeare's works, both as static objects and animated expressions. As Brandon Hookway suggests, "the interface is the zone of relation that comes into being between human beings and machines, devices, processes, networks, and even organizations" (39). This "zone of relation" can also be understood as both a point of contact and an invitation to initiate an effect, for while the interface is a way "into" a medium, it can also anticipate predictable outcomes created by shifts of attention or other cognitive habits through the activation of interface features.

From another perspective, Shakespeare's plays as both artifact and performance are always accessed through a technology which requires a point of contact for human users. Understood in this way, the interface functions as a cognitive activator which opens access to Shakespeare: without the interface and the media containers that it controls, there is no Shakespeare, or to use a visual metaphor, Shakespeare is always viewed via the lens of the interface through which the user's access is necessarily channeled. To paraphrase McLuhan, the medium may be the message, but that message is mediated through the interface. Take the book page from a typical scholarly edition as a working example of this hypothesis. The Shakespeare play and accompanying paratext are laid out in page spaces designed with the anticipation of user requirements, such as the playtext, footnotes, marginal word glosses, collations, headers, and other interface page features, some of which require specialized kinds of interface literacy in order for them to be useable. Somewhere, seemingly "behind" the interface, lie multiple Shakespeare containers —such as source texts and previous editions—which the interface represents using a collation shorthand which can be activated by shifts in the user's attention between text and paratext (for more detail, see Werier's Chapter 1 in this volume). The interface holds all of these elements together by virtue of its design features based on assumptions about the user's desire to experience the plays and access supplementary information along the way.

The necessary role of the interface in conditioning the Shakespeare experience is perhaps most obvious in its digital forms, as many of us have become hyper-aware of how the affordances of graphical interfaces operate in our daily interactions with phones, tablets, and computer screens. This idea of interface affordances is another feature of the discussions in this collection. Donald A. Norman defines the actions of affordances as providing "strong clues to the operations of things ... Knobs are for turning. Slots are for inserting things into. Balls are for throwing or bouncing" (9). A well-designed affordance provides a recognizable sign which signals an expected outcome. If you, for example, hover your mouse over an underlined or highlighted word in a Shakespeare digital edition with this design feature, you will activate a word gloss which appears in an accompanying textbox. Once the user recognizes that highlighting activates word glosses, the affordance becomes normalized as a sign which should deliver an expected outcome. In optimal design, such interface fluencies become enmeshed in consciousness and embodied in somatic responses, such as in the seemingly automatic finger gestures of phone operating system navigation. At that point, users may forget that an interface exists at all and assume that their access to the content of the digital container is transparent.

The overarching idea behind this collection is that such assumptions are incorrect. As the first principle listed above makes clear, interfaces condition every contact with Shakespeare. Shakespeare's works cannot be accessed or experienced unless they reside in some kind of media container—whether that container be a book, a website, a live theatrical performance or a cinematic rendering—and the contents of that container can only be accessed through an interface. Alexander Galloway describes the nested effect of such containers within containers and its importance in establishing a theory of interface:

> What is video but a container for film. What is the Web but a container for text, image, video clips, and so on. Like the layers of an onion, one format

> encircles another, and it is media all the way down. This definition is well-established today, and it is a very short leap from there to the idea of interface, for the interface becomes the point of transition between different mediatic layers within any nested system.
>
> *(31)*

In each case, some form of media contains the play within its boundaries, and the interface defines a point of contact through which users can access and experience the overall Shakespeare gestalt or channel attention toward the activation of discrete features. And so an audience member's interface with *The Tempest* at the reconstructed Globe on a sunny afternoon will be very different than the experience of the RSC *Tempest* featuring computer-generated animation of Ariel in an indoor space with access to special effects. In both cases, the spectator's consciousness of the theatrical spectacle is partially conditioned by the fit between cognition and design, just as it would be in the viewing of a virtual reality *Tempest* in which the spectator feels fully immersed in the theatrical illusion projected into the eyes through a headset. Put another way, human users connect with the theatrical container in order to interface with unique cognitive wavelengths, the spectator seemingly plugging into the available frequencies mediated by the interface. Or, as Gretchen Minton demonstrates in her description of a walking outdoor production, in Chapter 21, even a natural setting such as a park can function as a theatrical interface which channels theatrical and ecological cognition and attention.

While it may seem as if the source texts which provide the content of any Shakespeare version function as a kind of pure Platonic form which are mirrored by the cave-like shadows of various containers, even the source texts themselves are media objects which display interface features designed to channel cognition. The First Folio, with its two columns and large, unwieldy size manifests an interface conditioned by the manufacturing standards of early modern paper production, printing house technologies, market economics, and user demand. It is not an interface that supports portability, for example, nor can it be read easily in bed or even while sitting on a chair, as it requires a table or lectern. And presumably Shakespeare's original manuscripts were conditioned by the interface constraints of goose-quill pens, ink, and paper, as were the various copies used by compositors of the quartos who set the type. In every case, modern and contemporary, the Shakespeare container is held, interpreted, and accessed through interface signs, including such seemingly neutral apparatus as lists of *dramatis personae*, stage directions, and speech prefixes.

An interface approach takes these often-normalized features of Shakespeare cognition and makes them problematic; or, put another way, it recognizes that the experience of Shakespeare depends on the fit between the user and the container of Shakespeare, and that the interface will always channel cognition in order to facilitate a user experience which anticipates the fulfilment of desire. This is what we mean when say that "interfaces are never neutral." An unprofessional reader encountering the First Folio today would likely experience serious difficulties with the interface because of its archaic spelling, punctuation, lack of act and scene divisions, and missing annotations which have come to be an expected feature of Shakespeare comprehensibility. Without the crutch of the modern paratext, most

amateur readers will stumble as they attempt to make the plays meaningful in the act of reading. Likewise, a print edition which makes lavish use of illustrations from past productions will inspire the reader to imagine a relationship between silent reading and theatrical and cinematic possibilities. In both cases, the user's experience of Shakespeare is profoundly conditioned at the point of contact between an interface which mediates cognition and the play itself.

The theoretical approach that we have presented in this Introduction is influenced by cognitive criticism, an area of Shakespeare theory that began in the early 2000s and was shaped by the works of scholars such as Evelyn Tribble, John Sutton, Mary Thomas Crane, and Amy Cook who pioneered the idea that cognitive engagements with literary objects are legitimate areas of critical inquiry. In Evelyn Tribble and John Sutton's influential paper, "Cognitive Ecology as a Framework for Shakespeare Studies," for example, the authors describe how systems of distributed cognition can reveal something new about the ways in which early modern performances were mounted through a shared collective consciousness: "Cognitive ecologies are the multidimensional contexts in which we remember, feel, think, sense, communicate, imagine, and act, often collaboratively, on the fly, and in rich ongoing interaction with our environments" (94). And Mary Thomas Crane, in her seminal book, *Shakespeare's Brain*, argues "the brain constitutes the material site where biology engages culture to produce the mind and its manifestation, the text" (35). In a previously published collection, *Shakespeare and Consciousness*, we took up one strand of cognitive criticism in order to investigate how the study of consciousness could generate new ways of approaching Shakespeare:

> Because consciousness, neuroscience, the brain, mindfulness, and other cognitive categories are ubiquitous in today's print and electronic media—and cognitive science continues to capture the attention of scholars across disciplines—we hoped to harness some of this energy by deploying Shakespeare and consciousness together, allowing scholars to explore the synergies that emerged.
>
> *(3)*

One feature of cognitive literary criticism that ties it to theories of consciousness and neurocognition is an emphasis on phenomenological descriptions. Phenomenology offers scholars another way to observe media-specific reading practices. Bruce R. Smith recently undertook a phenomenological consideration of a text read through Early English Books Online (EEBO) and the same physical book accessed at the Huntington Library:

> The attention that I have devoted here to the differing configurations of space and time between encountering a text on EEBO and encountering it in a library is a concern with the phenomenology of knowledge: its texture, its temporality, its relationship to me as the possessor of a body as well as a mind, its relationship with perceptions communicated to me by other people.
>
> *(29)*

An interface approach naturally moves toward the phenomenological and cognitive because it coheres around an experienced effect or process—"the differing conditions of space and time"—which can best be captured descriptively, and this arises in almost every case study of a Shakespeare interface observed in this collection, whether it be a book, a video game, a digital edition, or a live performance. This tendency toward the observation of human beings engaged productively with the Shakespeare interface also aligns with the movement known as User Experience Design (UX or UXD), which has been ubiquitous in the design and testing of software applications. A user experience approach assumes that the user will make choices linked to interface affordances which activate particular results, and that the interface can be refined and improved through testing and observation. This approach is taken up in this collection by Kurt Daw, in Chapter 15, who describes the design assumptions and processes of making a digital Shakespeare version of *A Midsummer Night's Dream* that meets the multiple needs of theater practitioners by applying UX principles. Likewise, in Chapter 17, Eric Johnson and Stacey Redick describe how the Folger Shakespeare uses UX processes to test interface prototypes and assess usability.

Consider, for example, the number of interfaces that a hypothetical user must pass through in order to experience a streaming theatrical rendering of Prospero's famous speech toward the end of *The Tempest*, where he proclaims that he will "abjure" his "rough magic" and "drown [his] book" (5.1.59–51, 57). First, the user needs a machine to access the internet. Let us imagine that our user, after pressing the start button to activate a MacBook Pro, confronts a narrow horizontal window that asks for a password, a security interface that hides but eventually allows access to the computer's desktop with its strip of menu bar icons, all mediated by the hidden and visible elements of the Apple operating system. From a somatic perspective, fingers must interface with the computer, by typing a password but also through trackpad gestures that have already created familiar pathways which allow easy access to cursor movements and associated "click" activations. The user's eyes find the Chrome browser icon which, after clicking, opens to reveal a home screen—perhaps the familiar Google search web page. After entering the URL for a university library and pressing "return" to navigate there, the home screen from the library provides a number of search options, including one for databases. Into yet another search window, the user enters "Bloomsbury Drama Online," knowing that it is a service which is available. After activating a link button, the user "arrives" at the Bloomsbury Drama landing page, where the "Plays" link gives access to both the Globe on Screen and RSC Live streaming services. Having clicked the RSC Live button, the user chooses *The Tempest* from a range of play links, which open to a small viewing window (that can be maximized with another click on the appropriate icon), where (after some trial and error) the user activates the slider bar at the bottom in order to fast forward to the 1 hour, 59 minute and 42 second position, where Prospero prepares to drown his book and break his staff.

The user, then, passes through multiple interfaces with associated nested containers in order to access streaming Shakespeare: the computer operating system, browser architecture, library website applications, specialized database designs, and the window through which a digitized Shakespeare performance is finally accessed, all contained within the rectangular frame and bezel of the computer screen (rectangular containers are a crucial feature of most interface

design, whether it be a codex or digital page, a theatrical proscenium or a computer monitor). All Shakespeare artifacts and performances must be contained or channeled through a technology, and the interface defines the point of contact through which the human body, mind, and senses establish access to those artifacts and performances. Every encounter with Shakespeare, then, should be understood as requiring an interface or functioning by virtue of the interface's role in mediating cognition "into" the Shakespearean media object or experience. And hence the Parts in this Handbook which all describe interactions between Shakespeare and the user as mediated by an interface or nested series of interfaces, and which all recognize an active cognitive engagement with both surface features and underlying operations that channel the user's intention.

For example, Part I, "Media and the Embodied Mind" considers the implications of how bodies and senses make contact with a diverse range of Shakespearean media, or, in the case of Bruce R. Smith's Chapter 4 on "Voice as Interface," with the energizing power of the human voice to fill spaces within bounded environments which condition such vocalizations. As Smith argues, "thinking of the voice as an action catches the transactional nature of interface" across and within bodies and worlds, such as theater buildings and their acoustic spaces and the ways in which characters construct and understand their own vocalizing. Likewise, in Chapter 2, Rebecca Bushnell and Michael Ullyot consider how Shakespearean media and associated interfaces—in theater, cinema, and virtual reality—negotiate and manage space differently. Unlike the bounded theatrical proscenium or film screen, VR's frameless interface creates opportunities for audience engagement which are conditioned by the limitations and design specifications of a technology and associated programming, but which, nevertheless, allow for agency and immersion in a more open and user-centered space mediated by the VR headset. The point of contact between the mind, body, and interface is similarly discussed in Chapter 3, in Mark Kaethler's consideration of the videogame controller and the ways in which a user's choices are mediated by the constraints of the game and its opportunities for the user to exercise volition at key junctures. Unlike the more passive spectating associated with traditional media, the videogame controller allows the player to interface with the Shakespeare game world directly, providing somatic points of contact, but more importantly, allowing for opportunities to make choices which not only influence game play but also highlight the ethical implications of what might happen if a button is pressed. The notion of the user's volition is also featured in Clifford Werier's Chapter 1 on the cognitive load associated with reading the sometimes overwhelming scholarly Shakespeare page, with its interacting textual and paratextual spaces. Unlike a videogame controller, the affordances of a Shakespeare media object designed for codex reading are accessed through recursive shifts of attention between various page fields which may create an extraneous cognitive load that disrupts reading fluency. In all of the chapters in Part I, spaces and boundaries are mediated by the interface, whether it be the acoustical properties of voice in a theatrical machine, the seemingly open world of the virtual reality performance, the ways in which a user interacts with a game narrative through a controller, or the reader's cognitive engagement with digital and codex page frames and affordances.

Our contention that "interfaces are never neutral" is emphasized by the authors who contribute to Part II, "Apparent Designs and Hidden Grounds." The contrast

between apparent surfaces and operations which happen seemingly underneath or beyond interfacial contact points is explored by Daniel Fischlin, in Chapter 5, who offers a political reading which reminds us that the designs of the interface are often self-serving, such as the friendly Google search field which hides a network of data collecting algorithms that mines personal information for profit. The *Shakespeare Effect*, defined by Fischlin as a "vast swathe of adaptive uses of Shakespeare in which material objects and aesthetic re-devisings ... overtake the flesh-and-blood authorial source with an ever-expanding simulacrum of distributed authorship(s)," may resist such exploitation by manifesting sites and associated interfaces which sustain difference and promote a more transparent and accessible engagement. The argument for accessibility is echoed by Gabriel Egan, in Chapter 6, who also considers the "power relations that modern technologies are made to serve." The hidden grounds of coded zeros and ones which capture stored information and associated processes are channeled by creators whose interface designs condition access and utility. After describing the history of interfaces, Egan supports the Open Access movement which includes both open-source software and open standards as a way of making interfaces more durable and democratic.

The distinction between apparent designs and hidden grounds is given a very different twist in Chapter 7, in Gary Taylor's reflections on the role of the Shakespeare editor in the design process of creating a critical edition. While Taylor reminds us that "editing has always involved re-designing old forms," editors often "do their work in a volume, or series, that has been designed by someone else." Taylor tells the story of his 40-year involvement with editing and designing Shakespeare containers and interfaces, emphasizing how evolving designs respect the editorial tradition while adapting to the requirements of contemporary users. Similarly, in Chapter 8, Jonathan Lamb and Suzanne Tanner consider Shakespearean abstractions as under-appreciated containers that represent the "Shakespeare system" and make it accessible. Lamb and Tanner identify abstracted frames, such as "prefaces, playbills, introductions, footnotes, summaries, diagrams, cartoons, illustrations, videos, adaptations, and many more" as examples of such abstractions. These abstracted forms and associated interface gateways may be dismissed as inauthentic, but in reality they serve the needs of users who require partial access to the overall system, such as students who access plot summaries or theater-goers who read a playbill before the performance. In both examples, the abstracted information of the summary and its hidden ground functions as an interface which gives access to the apparent design of the play as a whole and makes it more comprehensible.

In Part III, "Surfaces and Depths," authors consider both the visual play of typography in early modern printed works and the underlying codes that express, support, and catalogue digital Shakespeares. In Chapter 9, Erika Boeckeler examines how orthography and typography "generate textual dynamism that conditions readers' encounters with the text" by looking closely at Q1 *Hamlet* and the ways in which the early modern eye was influenced by such things as orthographic puns which would be lost in a modern version with corrected spelling. Likewise, in Chapter 10, Simon Ryle observes how typographic interfaces can be read as participating in a "poetics of the material letter that charts and contests the newly emergent subjectivities of the print era." Ryle considers Geofroy Tory's manual of typographic design, *Champ Fleury*, observing how the interface of letters maps onto

the human form and the world of things. In this regard, Ryle, echoing Tory, isolates the individual letter, exploring this basic interfacial unit of typography and its ability to carry multiple meanings and associations. This concern for the letter is also applied to V and A in Shakespeare's *Venus and Adonis*, as letters, bodies, and sexual violence are figured in typographical signs. While Ryle's chapter focuses on the smallest unit which constitutes the printed surface of the early modern book, in Chapter 11, Sarah Connell focuses on markup systems, such as XML, which usually function as the code that resides beneath the digital edition or database but which can be productively read in its own right as a container that holds and displays information. Readers who possess a fluency with TEI markup standards can read its signs as if it were "a direct interface for reading" while also making use of the computational potential of searching and cataloguing that we usually associate with such editions.

In Part IV, "Display, Navigation, and Functionality," authors continue to emphasize the non-neutrality of the interface, observing how its design features and affordances control browsing, searching, and reading. In Chapter 14, Heidi Craig and Laura Estill consider the functionality of *The World Shakespeare Bibliography* as a case study in interface usability. After surveying browsing and searching as traditional categories of information retrieval, Craig and Estill describe the ways in which the *WSB* interface has evolved to reflect "the changing state of Shakespeare studies" by expanding topic categories and taxonomies to include new areas of inquiry and specialization. This interface always shapes available results. In using a searchable interface to harvest information about Shakespeare, how granular can we expect the results to be? In Chapter 12, Rebecca Niles investigates "the systems that we use to interact with increasingly minute particles of Shakespeare's texts, and the editorial decisions that shape these systems." Modern textual indexing systems have the potential to account for and measure increasingly fragmented bits of text, while historically the plays have resisted such attempts, as the earliest versions lacked even rudimentary navigation systems such as act, scene, and line numbers. However, a computer's ability to manage minute fragments may create an information overload that must be mediated by an interface mechanism which makes such tiny units comprehensible.

Digital editions, of course, are conditioned by the technologies that underlie their display and the programming that captures the early modern artifact and makes it legible and searchable. This often requires designers to develop a template or standard which becomes the interface for all future editions, but what happens when a play does not fit the data model? This question is posed by Meaghan Brown, in Chapter 13, who describes the development of the Digital Anthology of Early Modern English Drama (EMED) developed at the Folger Shakespeare Library, and the ways in which Ben Jonson's *Bartholomew Fair and The Staple of News* breaks or resists this standard. A one-size-fits-all interface cannot always handle typographical outliers. In all of the chapters in Part IV, display and functionality figure prominently, as interface designers grapple with the kinds and quantities of information required by users and the ways it is displayed and navigated.

A similar concern with functionality is explored in Part V, "User Experience." This section begins with Chapter 15, Kurt Daw's case study of a Shakespeare interface design for a digital edition of *A Midsummer Night's Dream* which meets the needs of theater practitioners. After surveying the limitations of existing print editions, Daw

describes the steps employed by User Experience Design (UX), that begins with empathy for the user's requirements, moves toward a detailed definition of the user's needs, continues through the ideation of problems inherent in existing versions, and culminates in the development of a testable prototype. Daw provides examples of a new digital text and an associated interface that attempts to meet the unique needs of an under-served demographic of readers. In Chapter 17, Eric Johnson and Stacey Redick mine similar ground in their examination of the Folger Shakespeare website and how it displays and makes available a range of digital texts. Digital Experience Design (DX) is another way of managing UX principles, as designs tested against user needs and expectations are an essential element of a development cycle that incorporates interaction design, information architecture, and user experience/usability. The evolution of the Folger Shakespeare interface benefits from a wealth of data that captures users' interests and which helps to shape the development of future prototypes. The complex requirements of displaying information in useable formats is also highlighted by the work of Anne Burdick, Katayoun Torabi, Bryan Tarpley, and Laura Mandell, in Chapter 16, who tell the story of the open-access digital version of *The New Variorum Shakespeare* (and its complex design challenges) as the visually dense and complex presentation of information in the print version was translated into a digital medium with user-friendly web pages. Like Daw, Johnson, and Redick, the authors describe a process which results in a useable interface and the ways in which the digital medium can handle complex information better than the static printed page. This is accomplished in a dynamic interaction between the back-end database (Corpora) which contains and manages information and the front-end display (Variorum Reader) that provides the search functionality. In such complex digital interface spaces, editors and users must learn a new type of fluency that takes advantage of such increasingly sophisticated remediations.

While digital humanities scholars appear to understand an interface approach intuitively—as people working in digital environments have used some form of interface language since the earliest days of computing—the fit between interface theory and theater may not be as immediately apparent. The contributors to Part VI, "Staging the Interface," consider the implications of performance and associated spaces, properties, languages, and theatrical conventions. In Chapter 18, Laurie Johnson attempts to bridge this gap in his comprehensive analysis of early modern theatrical spaces as interface access points for audience engagement with the plays. Johnson emphasizes the embodied experience which conditions individual access to theatrical systems and "the full array of sensory stimuli that audience members experience in fitting their bodies to the playhouse environment." To access the early modern theatrical spectacle, the user becomes self-consciously enmeshed in a matrix of interconnected interfaces that includes the body, the physical properties of the theatre, and the sounds and smells of the world beyond. Similarly, in Chapter 20, Shoichiro Kawai compares the bare thrust stage of an early modern theater, such as the Globe, with the property-less stage experience of Japanese Noh and its accompanying comic theater, Kyogen. Kawai considers the ways in which playwrights and actors adapt to the minimal stage interface by using vocal and gestural conventions that establish location and movement from place to place in order to cue audience imagination. Shakespeare and Kyogen come together in translated productions that adapt Shakespeare to the Kyogen form and utilize the

bare thrust stage in both new and traditional ways. Unlike Johnson and Kawai's emphasis on embodiment and performance, in Chapter 19, Lauren Shohet aligns interface theory with textual scholarship in her reading of *Cymbeline*, comparing the mediating heuristics of digital interfaces with linguistic structures, such as rhetorical figures, that also exist on the boundaries where different systems of meaning cohere. Focusing on Drucker's notion of the interface as an "in-between space ... where two worlds, entities, [and] systems meet" (n.p), Shohet offers the example of the trunk where Iachimo emerges to spy on the sleeping Innogen, an interface connecting the disparate realms of Roman Britain and Renaissance Italy, as one example of a theatrical object that can be understood as a mediating heuristic between worlds.

A consideration of such shifting worlds figures prominently in Part VII, "Interfacing with Performance," where contributors grapple with the implications of human users accessing a variety of performance media through embodied points of contact with interface gateways, sometimes under the disorienting conditions of the global pandemic. In the summer of 2020, Gretchen Minton helped to mount "Shakespeare's Walking Story," a production that integrated the performance of selected speeches from Shakespeare's plays at fixed stations, focusing on the theme of imprisonment and freedom, with a guided walk in a city park in Bozeman, Montana. Taking its inspiration from open-ended, site-specific performances like *Sleep no More*, "Shakespeare's Walking Story" was "intended to offer a much-needed space for reflection" on what being-in-the-world means in the Covid-restricted summer of 2020. In Chapter 21, Minton provides a detailed description of the user's experience and the influence of an ecological interface—such as the weather—that becomes a crucial yet unpredictable feature of the experience and its spaces for reflection. Likewise, Paul Budra describes the proliferation of online Shakespeare productions during the height of Covid lockdowns, focusing on the use of the Zoom platform as a performance interface. In Budra's Chapter 24, all of the principles identified in this Introduction are in evidence, especially in the places where the interface's design limitations and mediating functions condition a spectator's cognitive engagement. Here the notion of media containers bounded by interfaces is explicitly rendered in the Zoom grid and its associated boxes that frame both performers and spectators. In order to engage with such an interface, Zoom theatre "requires new and unfamiliar cognitive processes" that force audiences to imagine and interact with Shakespeare in new ways.

Even familiar Shakespearean media, such as cinema, can be reframed as Alexa Joubin does in Chapter 22, in her consideration of the meta-cinematic power of screens within screens, tracing complex interfaces and fragmented renderings through which old and new media and past and present performances are juxtaposed, integrated, and disrupted. In Almereyda's *Hamlet*, for example, a series of filmic intertextual screen echoes continually intrude on the action, as Hamlet is portrayed as a film maker, film watcher, and screen aficionado. Audiences interface with the cinema screen on which *Hamlet* is projected, but also on the other screens which proliferate within it. While Joubin describes diverse styles of connection with Shakespeare, her examples are mostly passive: the user is a consumer who experiences Shakespeare through a screen interface, whether at the cinema or at home. Mary Hartman, on the other hand, offers a more immediately engaged version of the Shakespeare interface in her Chapter 23 on enactment, as she asks the

question, "what happens when we shift our perspective from that of passive observer to that of active participant?" As a theater practitioner, Hartman has trained many non-professionals to experience Shakespeare directly, unhindered by the need to prepare and mount a performance. As Hartman suggests, "When our own bodies become the container for Shakespeare's text and our understanding comes through enactment, that is the bringing of text to life by actively personating it." In this way, participants become the interface and the performance simultaneously, as their somatic and immediate immersion provides direct contact with all that is signified by "Shakespeare." Unlike Hartman's fully embodied enactments, many of the interfaces investigated by the authors in this collection can be classified as screens or frames which somehow hold or contain Shakespeare and provide points of contact for the user, whether a cinema screen, a computer screen, a Zoom grid, a book page, or a theatrical proscenium. Looking into a framed lens, like a pair of glasses, alters vision and shapes perception. It is our hope that the concept and experience of the interface allow a diverse collection of authors to cast a fresh look on Shakespeare and imagine how design choices and interface interventions provide differing points of access into Shakespeare. Whether through an embodied engagement with a performance medium or in the searching and accessing of textual artifacts and digital platforms, the idea of the interface illuminates the sometimes invisible power of the mediating structures that condition our understanding of reality. We hope that this collection generates much thought and conversation, and that whether you are reading this in a book or on a computer or tablet screen, you never again take that interface for granted.

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PART I
Media and the embodied mind

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1
READING SHAKESPEARE
Interface and Cognitive Load

Clifford Werier

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When I first studied Shakespeare as an undergraduate in the late 1970s, my professor assigned plays to be read from our massive textbook, *The Riverside Shakespeare*, which I dutifully lugged to class twice each week. So when I began my career as a Shakespeare teacher, I automatically ordered the same textbook with which I had become so familiar. I gave little thought to its size, its editorial policies, or its two-column playtext interface with footnotes, assuming that it would serve my students' needs. These days, however, choosing an edition for undergraduates has become more nuanced, as I factor in the specialized styles of cognition and strategies of information processing which structure their reading experience.[1] This, of course, applies to any reading act, as successful users must adapt to both the difficulty of the content and the interfacial presentation of words in pages or on screens whose cognitive load conditions learning and presumably establishes a cognitive fit which serves the reader's preferences and requirements. For example, while I use a Kindle e-reader for fiction, I prefer codex paper books for research and non-fiction reading, and I tend to print important PDF articles rather than read them onscreen. Likewise, I still collect a paper edition of the *Globe and Mail* ("Canada's National Newspaper") from my front step, while my wife prefers to read the same *Globe* on her iPad. In each case, the chosen medium and associated interface establish a personal cognitive fit between mind and words. As Maryanne Wolf reminds us, "each reading media advantages certain cognitive processes over others" (7) and each demographic has a history of differing media, interface and reading practices.

Increasingly, my first Shakespeare class focuses not only on what we read—including theories of transmission that have resulted in the textbook editors' choices—but more importantly on how we read, or on the cognitive processes through which we make the text meaningful and access supplementary information which promotes understanding. This chapter will consider both the cognitive fit and cognitive load imposed by the Shakespeare reading interface as an under-theorized and under-valued feature of understanding and enjoying the plays. Both interface theory and cognitive load theory illuminate how the plays, understood as information mediated by an interface, make specialized cognitive demands on a user who is attempting to make them comprehensible. The challenges of such

cognitive operations are a function both of the inherent difficulty of reading drama —as the medium of text attempts to represent the medium of performance by facilitating the construction of a play within the reader's mind—but also of the difficulties associated with the historical, poetic and editorial elements of Shakespearean drama and with the need for paratextual materials to facilitate comprehension or provide scholarly supports which can be productively accessed while reading the playtext.

Interface and Cognitive Load Theory

The design features of the page interface anticipate the unique cognitive and imaginative challenges of reading drama.[2] The minimalist conventions of dramatic typography condition the reading experience: speech prefixes denote speakers, indented text indicates speeches, and stage directions describe settings, contexts, entrances, exits, speech directions (who is speaking to whom), and other actions. While reading drama, the stage directions, speech prefixes, and speeches structure the reader's imagined performance, in which voices, bodies, spaces, and properties held in the reader's mind interact to create the play.[3] The process of reading drama is uniquely active because the descriptive cues are minimal, unlike the explicit and sometimes lavish world-building of prose fiction. If the reader has seen the play performed previously, then the reading act may be strongly influenced by the memory of a past production, and the voicing of characters in the mind may be imagined more fully. However, the challenge of reading a play for the first time is greatly amplified if we have never seen it performed. In the successful reading act, we may become actors, directors, costume, set, and lighting designers, and stage managers, although the inexperienced reader may need to be trained in order to imagine these elements. In the act of reading one speech followed by another, our imaginations must bridge the many gaps created by the interface of the playtext which, in most cases, does not indicate mood through any explicit narrative cues, except in the occasional aside, soliloquy or reflective comment, in addition to the usual interpretive challenges associated with the decoding of language and rhetorical figures. Thus, the reader of Shakespeare is situated in a paradoxical cognitive space, as both actor and audience, director and spectator, reader and auditor.[4]

While an enthusiastic reader may simply dive into the reading experience of the playtext and ignore the accompanying notes, most readers will take advantage of the many paratextual elements which editors have included in order to help mitigate difficulties or provide supplementary information. Gérard Genette describes the paratext as a "threshold," "vestibule," or "fringe" which functions as "a zone between text and off-text, a zone not only of transition but also of *transaction* ... at the service of a better reception for the text and a more pertinent reading of it" (2). As Thomas L. Berger and Sonia Massai have demonstrated, the paratexts of early printed drama in English include such extra-dramatic features as "title-pages, dedications, addresses to the reader, lists of dramatis personae, prologues and epilogues, stationers' notes and errata lists" (xi). However, the paratextual features which contemporary readers have most come to rely on are the accompanying notes and glosses which explain or interpret difficulties—features which have become normalized as an essential part of the Shakespeare reading interface.

The special place of the editor as mediator, interpreter and authenticator hinted at in Heminge and Condell's preface to the First Folio is taken up by the editors of the great eighteenth-century Tonson editions, who began to regularize editorial concerns through recognizable interface features. For example, Samuel Johnson's 1765 *Works* has been characterized as "the first variorum edition" (Walsh, "Editing and Publishing," 31), a term that has come to be associated with comprehensive editorial collations of previous editions, including chronologically arranged textual variations and explanatory annotations, usually featured in extensive footnotes or endnotes. Marcus Walsh emphasizes how eighteenth-century editors "thought of themselves as interpreters, who set out to construe and communicate the author's sense, and who developed, often consciously, a theory and practice of interpretation" (Walsh, *Shakespeare*, 29). Johnson describes categories of difficulty which the editor must address and the ways in which his text and annotations offer editorial or interpretive interventions which respond to the reader's potential perplexity: "The notes which I have borrowed or written are either illustrative, by which difficulties are explained; or judicial, by which faults and beauties are remarked; or emendatory, by which depravations are corrected" (lviii).

In re-engineering Shakespeare, Johnson and subsequent variorum editors created a new category of difficulty based on the reader's cognitive challenge of navigating the page and interpreting its interface spaces. All readers of scholarly Shakespeare must determine a strategy of attention, as the eyes move from text to footnotes or glosses and back again in a potentially disruptive process. Johnson anticipated this cognitive difficulty by reflecting on the choice to either read the notes or ignore them, a process that applies equally to today's readers:

> Notes are often necessary, but they are necessary evils. Let him that is yet unacquainted with the powers of *Shakespeare*, and who desires to feel the highest pleasure that the drama can give, read every play, from the first scene to the last, with utter negligence of all his commentators. When his fancy is once on the wing, let it not stoop at correction by explanation ... And when the pleasures of novelty have ceased, let him attempt exactness, and read the commentators.
>
> *(lxix–lxx)*

I have already alluded to the more general difficulties associated with reading drama, and the need for readers to manage the imaginative challenges of translating printed play texts into a coherent reading experience. M. J. Kidnie suggests that "readers still need to be trained to engage with scripts not as fiction but specifically as drama—as dialogue existing in space and time" ("Text, Performance," 466). But the interface features of critical editions, influenced by Johnson's variorum-style division between the play above and notes below, create a new type of difficulty based on the need to scan and process multiple fields of information while potentially being overwhelmed by the cognitive load. In later variorum editions, the playtext itself is invaded by collations and annotations which take over the page; scholarly apparatus in this case may subsume dramatic content, as in the great variorum collection of Furness, or even on many pages of third series

Ardens. The relationship between editorial intention, as set out in the preface, and interface design is described by Paul Eggert:

> The edition's condition as text-critical argument soon unfolds, for the editor, into the strategic question of the architecture and interface of the volume. The edition's internal organization, declared conventions, and page layout become the systematic embodiment of the editorial argument.
>
> *(97)*

In such cases, the editor's intention to mitigate difficulty by providing annotations and collations may result in a paradoxical increase in difficulty driven by the cognitive challenge of navigating the page. As Kidnie suggests, understanding the busy page of a critical edition requires a specialized kind of training, especially when pages are divided between text and notes. Some elements, such as the obscure editorial abbreviations found in collations, cannot be understood by the lay reader, as they are intended for trained specialists.

Whether Shakespeare is consumed through codex books, digital screens, or performance structures, users must engage with a technology through its associated interface, and that interface inevitably mediates cognition. Such a consideration echoes N. Katherine Hayles' call for a "media specific analysis" which recognizes "literature as the interplay between form and medium," observing how "the materiality of those embodiments interacts dynamically with linguistic, rhetorical, and literary practices to create the effects we call literature" (69–70). Such material interplays always require structures to make accessible the words, images, and dramatic phenomena which constitute a literary artifact, such as the plays of Shakespeare, and whereas editorial theory concerns itself mainly with questions related to the recovery, reconstruction and transmission of Shakespeare's plays, an interface approach begins with the assumption that the mediating designs and affordances that channel cognition necessarily impact access to content, and shape/direct interpretation and understanding.

The question of what constitutes an interface and its crucial relationship to media has not been a feature of Shakespeare studies, as such considerations have mostly been in the purview of human computer interaction (HCI) specialists, user experience (UX) analysts, program and page designers, and media theorists who may function outside of the usual range of theoretical inquiry. Branden Hookway reminds us that the etymology of interface "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" (7). The "inter" in interface always implies a mediating position: "The interface would be defined according to its between-ness, its amongness, its duration-within" (8). By contrast, "the etymology of *face* points toward an outward orientation and an exteriority ... it is also the means by which that thing may project itself forward and outside itself" (8). Hookway brings these two halves together in a consideration of the interface's simultaneous looks in both directions: "In combination, the interface is both an interiority confined by its bounding entities and a means of accessing, confronting and projecting into an exteriority. It is defined by its bounding entities

at the same time that it defines them" (9). These paradoxical notions of interiority co-existing with exteriority are further complicated by the grammatical flexibility of interface functioning as both noun and verb. For example, it is possible to interface with an interface, to interconnect the human face and its senses with technologies which mediate a connection between a surface and something that exists seemingly beneath. This "site of contestation between human beings and machines" (ix) is further described by Hookway as "a form of relation that ... only comes into being as these distinct entities enter into an active relation with one another" (4).

Hookway's emphasis on interface as "a form of relation" involving humans and machines is echoed by Alexander Galloway, who interrogates the idea of the interface as a doorway or window into something else, rather than just a border or surface: "an interface is not something that appears before you but rather is a gateway that opens up and allows passage to some place beyond" (30). Galloway also considers the problem of differentiating media from interface, as the two are often bound together, yet a close analysis reveals key distinguishing features. Echoing McLuhan, Galloway describes a remediated model of media "wherein media are essentially nothing but formal containers housing other pieces of media." The interface exists "at the point of transition between different mediatic layers within any nested system" (31), always functioning in a liminal capacity:

> The interface is the state of "being on the boundary." It is that moment where one significant material is understood as distinct from another significant material. In other words, an interface is not a thing, an interface is always an effect. It is always a process or a translation.
>
> *(33)*

Similar to Hookway's insistence that the interface allows "distinct entities" to be in "active relation with one another," Galloway captures this crucial interface function in a pithy dictum: "not media but mediation" (36). Thus, the door or window model of interface is inadequate to explain the embedded function of something that activates something else and exists as a part of the thing that it opens or sets in motion, leading Galloway to conclude that "the interface is a palimpsest" because it functions through a "reprocessing of some other media that came before," while "the layers of the palimpsest themselves are 'data' that must be interpreted" (45).

Johanna Drucker also resists a mechanistic theory of interface, eschewing the simplistic door or window analogy used by HCI specialists in favor of a humanist approach which substitutes "the idea of a 'user' for that of a 'subject' whose engagement with interface in a digital world could be modeled on the insights gained in the critical study of the subject in literary, media, and visual studies" ("Humanities Approach," 1). Drucker uses the graphical reading practices of Scott McCloud, the frame analysis theories of Erving Goffman, and constructivist theories of perception to question the intimate connection between "the future of reading and the nature of interface" (15): "Interface theory has to take into account the user/viewer, as a situated and embodied subject, and affordances of a graphical environment that mediates intellectual and cognitive activities" (8). In this, Drucker explicitly references reading and the active role of the interface in mediating the

reader's ability to access information, calling the interface "a dynamic space, a zone in which reading takes place" (9). Like Galloway, Drucker sees the interface, not as a mechanistic operation, but as a threshold of access or potentiality: "Interface *is what we read* and *how we read* combined through engagement. Interface is a provocation to cognitive experience" (9). According to this model, the interface is not neutral: it is not simply a button that activates something or a frame that passively reveals: "We know that the structure of an interface *is* information, not merely a means of access to it" (9). Drucker applies this insight to the question of reading through or by means of an interface, arguing that "interface and its relation to reading has to be theorized as an environment in which varied behaviors of embodied and situated persons will be enabled differently according to its many affordances" (12).

While such ideas may be more obviously applied to reading hyper-mediated digital texts, the same principles apply to the codex book. Like digital screen interfaces, book pages display a number of objects which invite attention. According to Drucker, "The purpose of headers, footers, page numbers, margins, gutters, indentations, tables of contents, indices, and every other bit of text and paratext is to structure our reading" (*Graphesis*, 162). Both Johanna Drucker in *Graphesis* and Bonnie Mak in *How the Page Matters* examine the evolution of the page, from manuscript to codex to digital instantiations, and the ways in which the principles of organization and cognition transfer from interface to interface. Bonnie Mak's comments about page design are particularly instructive:

> The architecture of the page is thus a complex and responsive entanglement of platform, text, image, graphic markings, and blank space. The page hosts a changing interplay of form and content, of message and medium, of the conceptual and the physical, and this shifting tension is vital to the ability of the page to remain persuasive through time.
>
> *(5)*

The organization of page information is also entangled in the cultural systems which produce it, as Peter Stoicheff and Andrew Taylor remind us that page architectures "are related to the ideologies that otherwise structured the cultures that designed and read them" (4). Thus, the page reflects both designers' assumptions about users' requirements and the historical conditions of a particular moment which may include questions related to literacy and accessibility.

The theories of Hookway, Galloway, and Drucker are based on the experiences of human users who engage with or activate the interface, however it is imagined, understood, or engineered. Every interface activation is a cognitive act which requires the resources of mind and memory in order to generate an expected effect. When I use the trackpad to move the cursor-arrow and click the ABC icon at the top of my Word screen, I expect the activation of spell-checking processes, based on my memory that this is the correct sequence for a previously learned outcome. When I encounter a difficulty in trying to interpret a passage of Shakespeare while reading, I consult the notes at the bottom of the page interface in the expectation that I will find information to help mitigate the problem, before shifting attention back to the text. Thus, every engagement with the reading interface is a complex cognitive act which harnesses limited resources of memory and other forms of information

processing and learning. Whether we understand the interface as a window, a gateway, container, or an effect, it mediates or activates Shakespeare in the reader's immediate experience—it is the design of information that presents and supports understanding and enjoyment. Correspondingly, when the interface is poorly designed, it can impede not only the reading experience but cognition itself.

Cognitive load theory (CLT) offers an explanation of why learning sometimes is impeded by poorly designed interfaces or instructional design elements. It considers how the cognitive capacity of working memory (formerly called short-term memory) "is limited, so that if a learning task requires too much capacity, learning will be hampered. The recommended remedy is to design instructional systems that optimize the use of working memory capacity and avoid cognitive overload" (de Jong 105). The "human cognitive architecture" described by CLT "refers to the manner in which the components that constitute human cognition such as working and long-term memory are organized" (Sweller et al. 15). Kalyuga describes how the interplay of working memory and long-term memory function together to structure learning and facilitate understanding. Working memory has a "limited capacity and duration" because "we can consciously process no more than a few items at a time for no longer than a few seconds. If these limits are exceeded, working memory becomes overloaded and learning inhibited" (1). Long-term memory, on the other hand, "acts as a very large store of information" contained in schemas, "a cognitive construct that permits us to classify multiple elements of information into a single element according to the manner in which the multiple elements are used" (Sweller et al. 22). For example, when we are learning to read, we begin by processing the sounds associated with individual letters: "With increasing practice, we acquire automated schemas for individual letters but still may need to consciously process the groups of letter that constitute words" (23). Thus, learning can be understood as an interaction between the limited resources of working memory and an unlimited long-term memory, as successful instruction uses the resources of working memory to "increase the store of knowledge in long-term memory" and its schemas (24).

Cognitive load theory has developed a classification system which recognizes three main types of cognitive load imposed on working memory: (1) intrinsic cognitive load; (2) extraneous cognitive load; and (3) germane cognitive load. Intrinsic cognitive load "is defined by the intrinsic complexity of information that is to be learned. It depends on the interactivity of elements" (Hollender et al. 1279). Such interacting elements are features "that must be processed simultaneously in working memory because they are logically related. An element is anything that needs to be learned or processed" (Sweller et al. 58). Hollender gives the example of learning a foreign language as a task with high element interactivity, "as it requires an understanding of different parts of speech and their sequencing" (1279). Extraneous cognitive load "is caused by an inappropriate presentation of the learning material or by requiring students to perform activities that are irrelevant to learning" (1279). Finite working memory resources can be consumed by extraneous features of a poorly designed instructional system or interface, interfering with learning outcomes. Finally, germane cognitive load refers to "working memory resources that are devoted to information that is relevant or germane to learning" (Sweller et al. 57). Germane cognitive load, therefore, recognizes the "effortful construction and automation of organized knowledge structures or schemas and the corresponding cognitive activities that directly

contribute to learning" (Kalyuga 3). For the purposes of this discussion, extraneous cognitive load can be considered as a "bad" load because it diverts "cognitive resources to activities that are irrelevant to learning," whereas "good" intrinsic load "is associated with processing the essential interacting elements of information" (3). As Sweller concludes, "The primary, though not sole, aim of cognitive load theory has been to devise instructional procedures that reduce extraneous cognitive load and so decrease the working memory resources that must be devoted to information that is extraneous to learning" (68).

Cognitive load theory includes a number of observed effects, defined as "an experimental demonstration that an instructional procedure based on cognitive load theory principles facilitates learning or problem solving compared to a more traditional procedure" (87). The cognitive load effects most relevant to a discussion of Shakespeare and interface are the split-attention effect and the expertise reversal effect, although future scholars may wish to revisit the other effects to see whether they can be productively applied. According to Sweller et al., "split-attention occurs when learners are required to split their attention between at least two sources of information that have been separated either spatially or temporally" (111). For example, understanding a chart with explanatory components on another part of the page requires significant working memory resources in order to hold and consolidate two unlinked pieces of information required for learning, resulting in extraneous cognitive load. Roodenrys et al. observe that CLT research has helped to develop "alternative instructional formats that physically locate related information and join them together in order to avoid extensive searching and matching and thus reducing extraneous load" (878). The expertise reversal effect acknowledges that information which may be essential for novice learners has the potential to generate extraneous load for expert learners:

> As learners acquire more expertise in a specific area of knowledge, the information or activities that previously were essential may become redundant, causing increased levels of extraneous cognitive load. As a consequence, instructional technique effective for novices may be become ineffective for more expert learners due to redundancy. Conversely, techniques ineffective for novices may become effective for more expert learners. These changes in the relative effectiveness of instructional procedures according to levels of expertise underlie the expertise reversal effect.
>
> *(Sweller et al. 156)*

Anyone familiar with Human Computer Interaction and User Experience principles will immediately recognize the influence and applicability of CLT to the design of effective user interfaces. In fact, the idea of anticipating and meeting the needs of multiple users and levels of expertise is at the heart of all three approaches. As Hollender et al. observe, "the fact that human working memory can hold only a limited number of items at a certain time is common knowledge in user-interface design," resulting in the desire to "decrease cognitive load for users as much as possible" (1281). As we shall see in the following examples of Shakespeare interfaces, the extraneous cognitive load of the page or screen is often present for readers, as

Shakespeare interface designers must contend with high element interactivity, often resulting in split-attention effects. At the same time, expert users who have been trained to manage the cognitive load may adapt to the split-attention interface which is no longer an extraneous feature of their working memory.

Application of CLT to Shakespeare and Interface

In the final section of this chapter, I use cognitive load theory to discuss how select Shakespeare interface designs manage Shakespearean difficulty, offering some speculations about the ways in which a reader's working memory and long-term memory engage with the Shakespeare page or screen. This distinction between Shakespeare (paper) page interfaces and Shakespeare (computer, tablet or phone) screen interfaces—between reading a codex book and reading a digital, online version—is crucial, as the interface differently mediates and manages the cognitive load based on the affordances of the particular medium.[5] For example, affordances which are possible in a digital format—such as a button which activates a hypermedia link—cannot function in codex book. This interaction between interface features and media affordances must always condition the reading experience. E-readers, such as the Amazon Kindle, provide a useful example of interface limitations linked to a medium, as the Kindle interface artificially simulates the spatiality of the book and its pages by estimating the time required to finish a chapter, indicated by a small field at the bottom left of the screen interface. If the reader wants to navigate back to a remembered page which has not been previously bookmarked, then he or she must navigate to the Table of Contents and hope that a chapter title will offer a location clue or else engage in a frustrating process of navigating backwards or forwards, screen by screen, in order to find the desired material. While the minimal Kindle interface works well for the simple demands of reading fiction, it does not support the more complex processing needs of scholarly reading which requires controlled movement between separated pages. Codex books, on the other hand, are a fast, efficient, and proprioceptive medium, as hands and eyes experience the book's material gestalt and manipulate its physical information spaces with practiced ease (e.g. with two fingers in different sections), or the book's binding may simply open fortuitously to the previously consulted page.

Notwithstanding interface differences linked to discrete media affordances, certain interface features have evolved across all Shakespeare media to mitigate a reader's experience of difficulty, most obvious in the dynamic relationship between text and paratextual annotations. If the reader did not require supplementary information, then the playtext could be enjoyed independently without supports, the reader presumably encountering no major difficulties to disrupt the reading. But because Shakespeare poses so many vocabulary and interpretive challenges to modern readers, paratextual information has become a requirement for structuring comprehension and supporting a complex learning task, resulting in the normalization of cognitively busy interfaces in most Shakespeare editions. The four main paratextual components which have been a feature of the Shakespeare interface since the Tonson editions are (1) explanatory notes; (2) word glosses (often incorporated with the notes); (3) editorial collations; and (4) act, scene, and line numbers or other navigational features.

A quick scan of a typical codex Shakespeare page reveals familiar interface divisions: the playtext is featured in the main block (either single or double column) with footnotes usually underneath and line numbers on the side. Collations may be placed below the footnotes (as in the third series Ardens), immediately following the playtext, at the back of the book in a "textual variants" section, or even in a separate volume, such as *William Shakespeare: A Textual Companion* which provides detailed notes to accompany *The Complete Oxford Shakespeare* (1986), or they may left out entirely. Act, scene, and line numbers may occur in a running header with the play title, while line numbers are typically placed on the right or left side of the page in five-line increments. Marginal spaces may be used for word glosses parallel to a marked word in the text, as in the *Norton Shakespeare*, or for more extensive information, such as the detailed marginal performance notes in *The New Oxford Shakespeare* (Modern Critical Edition). One assumes the need for the same paratextual content in digital versions, but the interface properties of computers and tablets offer the potential for a more dynamic activation based on the interactive affordances of the digital medium. For example, the static codex book interface places paratextual annotations in fixed page spaces: notes can be found at the bottom, in the margin, on a facing page, or at the back, as endnotes. However, in digital versions, the annotations can be activated by a mouse click or touch which may cause them to hover temporarily in a textbox beside or above the passage in question. Likewise, word glosses in digital texts can be activated simply by clicking on or hovering over a problematic word, instantly revealing a definition in a proximate textbox. In fact, the permutations and combinations of digital interfaces offer much more flexibility and design possibilities than the fixed paper book page.

The main Shakespeare interface fields—playtext, notes, glosses, and collations—are accessed on the basis of immediate needs. In reading a codex book, the reader activates the page's interface fields through shifts of attention and ocular focus. Typically, a passage is read serially until a difficulty or interpretive question arises to stop the process, and then the reader's focus may shift away from the playtext to a paratextual field where the reader hopes to find supplementary information to support reading comprehension. At the very least, the paratextual symbol will create a decision point which may briefly interrupt reading fluency, even for a micro-second. According to cognitive load theory, the problem passage and associated difficulty must be held in working memory while the note or gloss is consulted. Reading the annotation requires the user to hold both fields in working memory, possibly by shifting attention back and forth (up and down) between the source text and the note until the information is assimilated temporarily into working memory or until the explanation is integrated into a long-term memory schema.

The split-attention required for this maneuver arises when a lengthy and dense passage defies the reader's comprehension. How can the reader hold both the dense passage and its paratextual explanation in working memory when the two elements are spatially separated? A similar problem arose when I recently taught *Paradise Lost*, a text which holds a particularly high degree of difficulty. I chose the Oxford World Classics, *John Milton: The Major Works*, (Milton et al. 2008) because it was inexpensive, but I neglected to inspect the book prior to assigning it for my class. Unfortunately, my students and I soon discovered that the extensive notes for *Paradise Lost* in this edition are located at the back of the book. While the split-

attention effect is problematic for separated text and notes on the same page, it is almost impossible to manage when the notes are relegated to the back pages. Students must either place a bookmark or finger at the site of the endnotes and navigate back and forth between pages or print the endnotes so that they may be more physically proximate to the passage under consideration. In the case of reading *Paradise Lost* and its significant requirements for reader support, the decision to locate notes at the back creates an extraneous cognitive load that consumes huge resources of working memory. Chuck Zerby, in his history of footnotes, describes this process in detail:

> First you must fix in your mind the number of the footnote, say 27, then you have to remember the page number on which footnote 27 appears, say page 85. Then you must turn to the back of the book, trying to keep your place with an inserted finger, and scan page after page until you discover one headed "Footnotes for Pages 81–107." By this time you have forgotten the footnote number so you must scramble back to the original page and seek it out again.
>
> *(2)*

Zerby observes that the decision to place notes at the back of the book may be chosen by publishers because it is cheaper to produce such books compared to the complex interface features of displaying footnotes on the same page as the primary text, leading to unusable print versions with a significant extraneous cognitive load based on the split-attention effect.

Sometimes the reader is invited to play a guessing game concerning whether the footnote explanation below the playtext will be proffered to match the reader's current difficulty, as many editions do not indicate the expectation of a note with a superscript number. Instead, the common practice (e.g. third series Arden, New Cambridge, New Oxford, and Oxford World's Classics) is to tag footnotes with line numbers while offering nothing explicit in the playtext (such as bolding or superscript numbers) to indicate the expectation of a footnote. Presumably, the reader is invited to remember the line number when a significant difficulty is encountered and to hold both the nature of the difficulty and the content of a potentially lengthy passage in working memory while shifting attention to the note, usually at the bottom of the page (the Folger Shakespeare Library versions offer annotations on the facing page, while the Broadview and Norton versions include superscript numbers in the playtext field matched to matching numbers in the footnotes). Following a line number, the third series Arden footnotes begin with a bolded keyword which helps to signal the expectation of a specific word gloss or as a mnemonic link to the problematic passage above. Presumably the bolded footnote keyword matches the same word held in the reader's working memory, and its bolded interface allows the reader to remember the difficulty which prompted the shift of attention. The split-attention effect remains in play, as information is presented in two separated fields that require significant working memory resources, resulting in extraneous cognitive load.

Certainly, the "as above, so below" cognitive footnote formula has worked for generations of readers who have learned how to activate and hold the two main


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Note: Page references in italics refer to figures.