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CASE STUDY

## Julian of Norwich and the Digital

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The October 2017 issue of the paradigmatic journal of medieval studies, *Speculum: A Journal of Medieval Studies*, demonstrates that digital humanities and medieval studies have long been intertwined. Many ambitious and/or long-standing projects in digital humanities (such as the electronic *Piers Plowman* project) have indeed been propelled by medievalists.<sup>1</sup> Despite the exciting new developments in the field, such as the creation of medieval digital soundscapes or virtual spaces, theoretically informed projects that foreground gender issues need development, as the authors of the digital supplement to the 2017 *Speculum* issue are the first to acknowledge.<sup>2</sup> Of course, the crucial role of a woman, Ada Lovelace (1815-1852), in the development of the computer has been recognized for some time, and repeated efforts have been made and continue to be made to bring women writers to the fore on the internet.<sup>3</sup> Scholars are now turning their attention to broader gender issues, such as the ways in which gender informs the structures and goals of the digital realm. I would like to contribute to such considerations by looking at the writings of the late-medieval English mystical writer, Julian of Norwich, through the lens of the digital, which surprisingly reveals her recognition of the productive power of the figures that later become so fundamental to digital structures: zero and one. Her far-ranging use of these numbers can help us appreciate how zero and one are far from the definitive numbers they are normally understood to be in the digital realm.

Although Julian's interest in the number three has been recognized, and indeed forms what Nicholas Watson has called Julian's "trinitarian hermeneutic," the productive role that zero and one play in structuring her meditations has not been considered.<sup>4</sup> Julian's understanding of zero and one is quite distinct from the off/on codes that they form in digital computing, but in this speculative inquiry, I would like to propose that her late-medieval understanding of the productive power of these numbers for theological meditation has features in common both with Gottfried Wilhelm Leibniz's seventeenth-century development of the binary mathematics underlying the operations of the contemporary computer and with the democratizing goals of many digital humanists in the twenty-first century. Furthermore, considering contemporary digital issues via Julian's work can help us recover the philosophical and gendered dimensions of one and zero when they are considered not just as numbers, but also as concepts. I am not arguing that Julian's interest in zero and one anticipates digital uses or understandings of the numbers; rather, I am suggesting that there are surprising commonalities between aspects of her thought about the numbers and the development and uses of zero and one in the digital sphere.

The cover of the October 2017 paper edition of *Speculum* is remarkable not only because it presents a modern rather than a medieval image but also because that image presents a picture of two women poring over digital punch cards. This image recalls the role women played in one of the earliest medieval digital projects, the production of the *Index Thomisticus*, during which the man behind the project, Roberto Busa (1913-2011), chose women to digitize the works of Thomas Aquinas onto punch cards. Marco Passarotti, head of the *Index Thomisticus* Treebank project, tells us: “he was used to choosing young women on purpose, because they were more careful than men. Further, he chose women who did not know Latin, because the quality of work was higher than that of those who knew it.”<sup>5</sup>

There is only a slim thread connecting these women to the late fourteenth- and early fifteenth-century mystic Julian of Norwich. Julian, like these women, was marginalized from a dominant field because of gender (that is, as a woman, she could not be a theologian); like them, the fact that she did not know Latin meant she had a specialized relationship to her field—i.e., her contemplations of theology were formulated in English. The two women on the cover of *Speculum* handle material objects that contain zeroes and ones (though, as Sadie Plant points out, in punched cards, a hole is one and a blank is zero).<sup>6</sup> Extending her consideration of her status as a woman, “lewid, febille and frail,” Julian considers what it means to be insignificant and indeed to be nothing—what she calls “nought”—and in doing so creates a theology structured by her contemplation of the meaning of one and nothing.<sup>7</sup> Just as one and zero create meaning through their activation in the machine of the computer, so Julian recognizes the productive power of one and nought when they act as verbs, what she calls “oneing” and “noughting.” Her engagement with these two generative numbers, as we shall see, contributes to her contemplation of issues fundamental to the digital, including mediation, accessibility, and universality.

## Accessibility and Mediation

Julian of Norwich’s writings survive primarily through happenstance. She had sixteen visions over a few days in 1373 and wrote them down, or had someone write them down for her some time afterward, in the version the most recent editors call *A Vision Showed to a Devout Woman*.<sup>8</sup> Some twenty years later she composed—perhaps with the help of a religious advisor—a longer, more theologically cautious version of the same visions with only one additional vision, the text of which is called *A Revelation of Love*.<sup>9</sup> What remains of these texts is one fifteenth-century version of the *Vision*, British Library MS Additional 37790, called the “Amherst MS.” The solitary medieval witness to the *Revelation* is the fifteenth-century Westminster Cathedral Treasure MS. 4 (c. 1500), which contains only a few excerpts. We would not have a full version of her *Revelation* at all except for the fact that Benedictine nuns in Cambrai and Paris copied it at least three times during the seventeenth century. It survives in these three seventeenth-century versions: Paris Bibliotheque Nationale Fonds Anglais MS 40, British Library Sloane MS 2499, and British Library Sloane MS 3705. It is possible that the original versions went into exile with an earlier group of nuns during the Reformation, or that it was sent to Augustine Baker (1575-1641), who in the seventeenth century requested suitable reading matter for the Belgian nuns in his charge. The nuns may have then copied the text in the versions that survive; the original then vanished. We have no authorial or even early complete manuscript of Julian’s writings.<sup>10</sup> Despite the scarcity of copies of her work, Julian, an obscure and self-effacing writer, has a prominent presence on the web, especially on Catholic websites, which indicates the positive role the internet can play in bringing women writers into visibility. Nonetheless, despite the availability of both versions in one text in print versions—most recently that edited by Nicholas Watson and Jacqueline Jenkins—there is still no scholarly edition of *both* versions of her visions on the web.<sup>11</sup>

Popular responses to Julian’s writings often focus not on her theological innovativeness or her stylistic elegance but rather on the simplicity and comfort of her most famous declaration “Alle shalle be wele and alle maner of thinge shalle be wele,” (*Revelation*, chapter 20, p. 27), frequently cited on Catholic websites. The force of “alle,” with its repetition, implicitly underscores the availability of the message to all persons. Indeed, this is Julian’s goal: to make

her privileged revelations available to all. Julian achieves that accessibility through her innovative stylistic use of zero and one, creating a style that achieves an openness that those who write about the digital revolution have claimed as that revolution's particular potential virtue.

Numerous digital humanists praise the web's potential for disseminating knowledge to all, regardless of gender, class, or race, as well as its potential to gather and disseminate all knowledge equally and without hierarchy; that is, to provide infinite data for a universal audience without the mediation of authorities.<sup>12</sup> Such a democratic goal, however, as digital humanists are well aware, is impossible to achieve. Access in the digital realm is not only limited to those who own computers but also by the programs that determine what data appears on the screen and in what arrangement. As Marlene Manoff argues, Google's seemingly open and democratizing ambitions to create an archive of the entire world of information is marred by its lack of transparency about the nature of its search engines.<sup>13</sup> William Turkel points out that in 2008, "search engines worldwide were handling about 61 billion searches per month. More than half of these were handled by Google, making its ranking algorithm the most pervasive source of bias in history."<sup>14</sup> Even as the internet makes ever more data available, that data is always subject to mediation of one form or another, by, for example, teams of programmers behind the scenes, who themselves are subject to standards committees that decide how that data will be organized and in what order it will be presented. Mediation is always already present in the digital realm, even as programmers seek to disperse their own authority.<sup>15</sup> Accessibility, then, is at the same time created by and undermined by mediation.

Julian also worries about the interference mediation can create between the viewer and what is viewed. By diminishing her own presence, she aims to bring forward her vision and make it available to all. Her emphasis on the interference mediation can cause brings her dangerously close to heretical Lollard views that argue against the clerical mediation of all Christian knowledge insisted upon by the late-medieval Catholic church.<sup>16</sup> Like the ideal erasure of mediation sought after by some digital utopianists, Julian aims, through her use of particular rhetorical techniques, to strip away her own mediation—to bring it to "nought"—and thereby to grant her reader direct access to the visions she wishes to share with them.<sup>17</sup> Nonetheless, while imparting her urgent desire to do away with her own mediation, she simultaneously acknowledges the inevitability of it. In common with many female mystics of the medieval period in England and the continent, she claims her authority from her encounter with Christ alone.<sup>18</sup> As she states, "it was himselfe that shewed it me, withouten any meen" (*Vision*, section 3, p. 67).

The value of an experience without mediation becomes a thread that runs throughout the text; on the one hand, she wishes to do away with mediation between herself and God; as she says, "For to I am substantiallye aned to him, I may nevere have full reste ne verray blisse; that is to say, that I be so festenede to him that thare be right nought that is made betwyxe my God and me" (*Vision*, section 4, p. 69).<sup>19</sup> On the other hand, she wishes to become one with her audience and to disseminate what would be called in the digital sphere the "data" of her visions to the reader so that they, too, can have an unmediated encounter with Christ. She stresses that her reader should ignore her mediation of these events: "Alle that I saye of myselfe, I meene in the persone of alle mine evencristene, for I am lernede in the gastelye shewinge of oure lorde that he meenes so. And therefore I praye yowe alle for Goddes sake and counsayles yowe for youre awne profit, that ye leve the behaldinge of the wrechid, sinfulle creature that it was shewed unto, and that ye mightilye, wiselye, lovandlye, and mekeleye behalde God, that of his curtays love and of his endles goodnes walde shewe generalye this vision in comforthe of us alle" (*Vision*, section 6, p. 73). She wishes to become one with God and one with her audience, "For it is comon and generale, as we are alle ane... For if I loke singulerye to myself, I am right nought. Botte in generale, I am in anehede of charite with alle mine evencristende" (*Vision*, section 6, p.73).

In denying her own authority over the material she presents, Julian empowers the reader to become an agent along with her in discovering the meaning of the visions. Just as the internet seeks to grant agency to the user, Julian invites the reader to become equal to her as an agent of encounter. She warns her reader:

*Botte God forbade that ye shulde saye or take it so that I am a techere. For I meene nought so, no I mente nevere so. For I am a woman, lewid, febille and freyllle. Botte I wate wele, this that I saye I hafe it of the shewinge of him that es soverayne techare . . . Thanne shalle ye sone forgette me that am a wreche, and dose so that I lette yowe nought, and behalde Jhesu that is techare of alle. (Vision, section 6, p. 75)*

In adopting a humility topos in this passage, Julian acknowledges that a woman should not be preaching, but she goes beyond merely acknowledging her subjection to the authorities. Instead, she embraces humility as a necessary prerequisite for engagement with Christ and as a stance needed if mediation not only between herself and Christ but between others and Christ is to be diminished. She simultaneously acknowledges her special role as the individual to whom the vision has been shown at the same time that she denies her authority as a mediator. The difficulties Julian faces in making her knowledge available to all, without mediating that knowledge, anticipates some of the problems digital humanists have identified as haunting the internet's claims for universal access. Looking at Julian through the lens of the digital thus brings to the fore her interest in democratizing knowledge and suggests that such an enterprise has a longer history than is usually recognized.

Julian advocates a communal form of knowledge production that anticipates some of the ways knowledge can be produced by the web. The displacement and reorganization of authority that forms the basis of the creation of a collective experience of knowledge is, as David Theo Goldberg has argued, characteristic of the forms of knowledge production the web offers.<sup>20</sup> While acknowledging that the claims that have been made in the past concerning major epistemological breaks between the “ancients” and the “moderns” rest on faulty assumptions, Goldberg nonetheless claims that the web presents a “new” way of organizing knowledge, a mode of understanding—that of the “Webbies.” He writes, “So Webbies pay deference to virtual community, to participation, to co-creation and re-creation. If moderns release the subject from governance by others, they do so only under the authority exercised by knowledge, by a universal truth ever outside the subject. Webbies, by contrast, take the truth as made, co-created or co-produced, as crowdsourced. Knowledge is crafted together, the truth metaphysically made, and remade collectively.”<sup>21</sup>

Perhaps this form of knowledge production is not as new as Goldberg suggests. Julian also asserts that an understanding of her visions should be continually co-created by herself and the reader. As she says, at the end of the *Revelation*: “this boke is begonne by Goddes gifte and his grace, but it is not yet performed,” (*Revelation*, chapter 86, p. 379) suggesting not only that that her search for meaning will never be perfected but also that a quest for understanding must constantly be repeated. Furthermore, throughout her text she invites everyone to join with her in this never-ending quest for meaning. Where Goldberg emphasizes a form of knowledge that is ultimately relative Julian's form of knowledge is eternal, unchangeable, and cannot be created by humans, even though an understanding of that knowledge can be co-created by humans. Julian's co-creation is thus significantly different from that suggested by Goldberg. Nonetheless, she shares with Goldberg a commitment to a communal experience of knowledge-seeking that is always incomplete.

Julian's commitment to the community is signaled by her repetition of a word whose significance is easy to overlook —“general”—a word that signifies to her the potentially boundless community of those who love and who love God. She offers her understanding of God's love to all readers and in doing so asserts the possibility of universal salvation

for all, a concept that borders on the heretical. Goldberg concludes that the web in its “promiscuity . . . ultimately challenges the boundedness of traditional religion, its capacity to control or at least determine message and morals, canon and conduct.”<sup>22</sup> Julian understands there to be no boundaries. The infinite unboundedness of God’s love is precisely what she seeks to celebrate and to recreate both in theme and in the form of her dilatory writing—although it should perhaps be stressed that she was frustrated at not being able to achieve this openness, as she says in chapter nine, “Botte the gastelye sight I maye nought ne can nought shewe it unto yowe als oponlye and als fullye as I wolde” (*Vision*, section 7, p. 75).<sup>23</sup> Perhaps Julian’s impulses toward knowledge that is discovered communally, the dissolution of her own authority, and her emphasis on inclusivity and universality with the expectation of the agency and consciousness of “alle” are precisely those aspects of her meditation that made them dangerous enough for her writings to have vanished in England after the Reformation.

## Nought and One or One and Zero

In the first section of this essay, I have argued that the medieval mystic Julian of Norwich shares with digital humanists a concern about the limiting role mediation can play in the dissemination of knowledge as well as a desire to make knowledge equally accessible to all. In the second half of this essay, I will show that Julian creates accessibility through her use of the very numbers that are foundational to the creation of the computer and the digital realm—one and zero. I will then place her thoughts about these numbers within a brief history of the development of the concepts of one and zero in western thought. I shall conclude by focusing on the ways in which Leibniz brought the philosophical and theological implications of the two numbers to bear on the creation of the practical binary mathematics that is foundational to modern day computing. In formulating the binary mathematics that becomes foundational to the day to day operations of the computer, while also recognizing the philosophical and theological concepts the numbers evoke, Leibniz, then, becomes a mediating figure between the middle ages and the contemporary digital age. Leibniz articulates the functionality of one and zero in mathematical terms that the earlier Julian of Norwich only intuited in her own attempts to disseminate knowledge by utilizing zero and one to structure her thought.

As I have observed, Watson has demonstrated the pervasiveness of the number three in her writings in describing what he calls Julian’s her trinitarian thought, but her use of one and nought is equally pervasive.<sup>24</sup> Christine Cooper-Rompato has shown that the use of mathematics to approach the divine was common in mystical texts, but Julian’s meditations on zero and one probe more deeply into the implications of these numbers than do most mystics; indeed, at times her thoughts about these numbers border on the heretical.<sup>25</sup> Her use of zero, which she calls “nought,” and one shows her sophisticated understanding of implications the numbers have in relationship to the void and the infinite. In the late Middle Ages, orthodox thinkers eschewed the concept of the void. In the realm of the digital, because one and zero are associated with on and off, they suggest definitive static states. But even in basic mathematics, the two numbers have distinctive dynamic functions: additive and multiplicative identities. Zero is an additive identity in that if you add anything to zero the number remains the same; one is a multiplicative identity because if you multiply any number by one it remains the same.<sup>26</sup> Zero has further troubling characteristics, and for a long time in the West was a number that was repressed. As Brian Rotman writes, “responses to ‘nothing’ within the discourse of orthodox European Christianity characterized it as the locus of what was irredeemably negative and evil; a place where the presence of God was constantly in danger of being emptied out, denied, nullified, repudiated through apostasy, heresy and unbelief; a place of void to be religiously ‘avoided.’”<sup>27</sup> Zero has the potential, as Charles Seife has explained, to undermine logic; he writes, “multiplying by zero collapses the number line but dividing by zero destroys the entire foundation of mathematics.”<sup>28</sup> As Rotman has explained, once zero is brought back into the Western tradition it leads to the development of perspectival art and a

money economy, on the one hand, and binary mathematics and calculus on the other.<sup>29</sup> In the modern world, zero and one are fundamental to the computer, to the latest understanding of the creation and potential collapse of the universe.

Zero and one also have gender implications; as Plant writes: “the zeros and ones of machine code seem to offer themselves as perfect symbols of the orders of Western reality, the ancient logical codes which make the difference between on and off, right and left, light and dark, form and matter, mind and body . . . Man and woman, male and female, masculine and feminine: one and zero looked just right, made for each other: 1 the definite upright line; and 0 the diagram of nothing at all: penis and vagina, thing and hole . . . hand in glove. A perfect match.”<sup>30</sup> Alexis Lothian urges us to think carefully about the gendered language associated with the digital: “the ‘digital’ of digital humanities is signaled, at its most basic level, by a binary difference in electrical currents: on or off, yes or no . . . [but] the logics of binary difference have a genealogy intimately entwined with gender.”<sup>31</sup> The binary difference of the electrical currents on or off, one or zero, is oddly definitive, she suggests, given that the person most associated with its creation, Alan Turing struggled to align his sexuality with the heteronormative binary of the time. Indeed, Turing begins his famous “imitation game,” his experiment to determine whether or not machines can think, by showing how difficult it is for an interrogator to determine the gender of a speaker when a man and a woman to be questioned about gender identity are placed in separate rooms and their voices are disguised.<sup>32</sup>

Julian has a capacious understanding of the potential meanings of one and nothing, and her acute sensitivity to that potential may well have emerged from her consideration of her position in medieval society as a woman. She begins her meditation by exploring the meaning of the identity her culture assigns her—as insignificant, indeed as nothing; she repeatedly states “I am nought” (e.g., *Vision*, section, p. 73). While such assertions are common in Christian expressions of humility, they are particularly in the foreground in texts by or for Christian women, whose humility is considered to be innate, as numerous scholars of medieval female mystical writing have observed.<sup>33</sup> Julian finds hope for her own quest for union with God in the Virgin Mary, another seemingly insignificant, lowly woman raised up by God. In her self-negation, however, she joins with everyone and everything, an “all” that is ultimately God. Far from being definite markers as nouns, one and zero, for her, are verbs: as we have seen above, she speaks of “oneing” herself with God and as we shall see below she uses “nought” as a verb in a number of ways, including her assertion that she wishes to “nought” herself in order to join with all around her and with God. Her rhetoric explores and also exhibits the expansion and contraction afforded by the concepts of nothing and one as she swings from one extreme—the little, and from the little to nothing—to the other—everything (the universal: all).

Julian demonstrates such a range in her contemplation of a little thing no bigger than a hazelnut, which she then links to the Virgin Mary. Her deepening contemplation of this little thing then leads her to describe it as not singular and insignificant but instead as everything “It is alle that is made” (*Vision*, section 4, p. 69). Her meditations while offering a structure of the world that is multiply gendered, with a God who is both male and female at its pinnacle, thus begins with a meditation on gendered objects and people—a seed that has multiple significations (an object like a hazelnut stimulates her to contemplate the seeds of gestation) and the Virgin Mary. Her rhetorical mode of expansion and contraction—here and throughout her meditations—can be linked to her gendered knowledge, if not experience, of gestation: that of the Virgin Mary; that of women in general; and perhaps even that of herself.

Julian dwells on the meanings of nothing and everything (described as either one or all) throughout her *Vision*, and her quick swings from one to another can be dizzying. Consider the range of meanings she produces in her contemplation of nothing, at the end of her meditation on the hazelnut:

*In this blissede revelation God shewed me thre noughtes, of whilke noughtes this is the firste that was shewed me. Of this nedes ilke man and woman to hafe knowinge that desires to lyeve contemplatifelye, that him like to nought all thinge that es made for to hafe the love of God that es unmade. For this es the cause why thaye that er occupied wilfullye in erthelye besines, and evermare sekis warldlye wele, er nought all in ese of herte and in saule; for thaye love and seekes here reste in this thinge that is so litille, whare no reste is in, and knawes nought God, that es alle mighty, alle wise and alle goode. For he is verraye reste. God wille be knawen, and him likes that we reste us in him. For alle that ar benethe him suffices nought to us. And this is the cause why that na saule is rested to it be noghted of alle that is made. When he is noughtid for love to hafe him that is alle that is good, than es he abyllie to resayve gostlye reste (Vision, section 4, p. 71).*

In this passage, Julian begins with a fairly conventional observation that those who wish to pursue the contemplative life should turn away from the world and see it as nothing. This is similar to the directions provided by the anonymous author of the fourteenth-century *The Cloud of Unknowing*, who asks the contemplative to do away with all earthly things by putting them under a cloud of unknowing.<sup>34</sup> Julian goes further to consider a psychological dimension of nothingness that suggests a Boethian understanding of worldly success: those who have such success have nothing within and furthermore can never find the rest they seek, which is found only in God, “that is alle that is good.” Seeking worldly pleasures “suffices nought.” She pits “all that is made” against “all that is unmade,” yet all that is made is made by God. She uses “nought” as a verb, “to nought all thing,” “to be noughted,” and as a negation “knawes nought God.” Unlike the author of the *Cloud*, however, Julian negates the things of the world only to bring them back into the fullness of God. The desire for worldly things proves to be a displaced desire for the one thing that can overcome nothingness: love. The nothingness of worldly goods mutates into a lack in the self that then becomes more defined as a lack of knowledge and then a lack of rest, which in turn becomes a longing for God’s fullness. Material, psychological, and spiritual satisfaction can only be found, then, in God who is everything and is love.

Julian’s assertion of God’s ever-present love leads her to reduce sin to nothing: “Whate es sinne? For I sawe trulye that God dothe alle thinge, be it nevere so litille ... Wharefore it behovede nedes graunte that alle thinge that es done es wele done, for our lord God doth all. And I was seker that God dose na sinne. Therefore it semed to me that sinne is nought” (*Vision*, section 8, p. 77). While this is an orthodox view present in Augustine and Boethius, the contemplation of nothing leads to a minimization of sin that could be heretical. It then leads to further problematic ideas such as the idea of creation ex nihilo, a view that in a period when theology was governed by the Aristotelian rejection of the void, was again potentially heretical.

Her meditations on the nature of one are similarly expansive. She tells us her showings are “comon and generale, as we ar alle ane” (*Vision*, section 6, p. 73). Nothing becomes one or, alternatively, everything, all: “For right as the blissed trinite made alle thing of nought, right so the same blissed trinite shalle make wele alle that es nought wele” (*Vision*, Section 15, p. 97). Her nothingness is countered by becoming one with the Church: “I am right nought. Botte in generale, I am in anehede [oneness or unity] of charite with alle mine evencristende. For in this anehede of charite standes the life of alle mankind that shall be safe. For God is alle that is goode” (*Vision*, section 6, p. 73). Her notion of unity leads her close to a belief in universal salvation, another potentially heretical belief: “God . . . loves alle that shalle be safe, as it ware alle a saule” (*Vision*, section 17, p. 99). Julian, like numerous female mystics, protects herself from charges of heresy by presenting these various views as spoken to her directly by Christ.

Thus, the range of Julian’s thought about nothing and one suggests she is thinking not only about the numbers but also about the ends to which such numbers lead. Julian’s thinking, which David Aers has praised for its rationality, is therefore rational in a particular way; that is, what we see in Julian is a profoundly mathematical mind at work, or one that is at least highly sensitive to the complex ramifications of the numbers zero (or nought) and one.<sup>35</sup>

Julian’s thoughts about zero and one were ahead of her time and might well have been considered to be theologically inflammatory. That Julian’s meditations on one and nought bordered on the heretical is suggested by the fact that they are reduced in the revised long version. Julian’s *Vision* is sprinkled with a variety of meditations on the nature of one and nought. Julian’s use of nought and one are much less prominent in her more restrained and ostensibly more orthodox *Revelation*. The two numbers no longer structure her meditations, nor do we see her mind follow the logic of nothing that leads either to infinity or to the void that so troubled medieval mathematics and theology. Perhaps her ideas moved too closely to the dangerous ideas that Charles Seife and others have shown zero posed for centuries and her advisors encouraged her to curtail their heretical potential.<sup>36</sup>

The history of zero can help us understand how innovative was Julian’s use of the idea of zero. Because orthodox theologians, until Nicholas of Cusa in the fifteenth century, clung to Aristotle’s denial of the existence of the void, the number zero was eschewed in Western European medieval theology. Zero of course had been in use in the East for centuries, which perhaps helps explain the prominent role nothingness plays in Eastern religions. Zero was well established in Babylonian counting systems but seems to have entered Western thought through Arabic mathematics; indeed the name for zero comes from the Arabic word for “cypher.”<sup>37</sup> It was Leonardo de Pisa, also known as Fibonacci, who in the thirteenth-century, drawing on the Muslim mathematics he had learned, showed how useful the idea of zero was for complex calculations. In 1277, Bishop Étienne Tempier tried to dismantle Aristotelian ideas, but his efforts were overturned, and calculations based on zero continued to be considered heretical until the Reformation. Zero ultimately crept into Western thought not through theology but through economic transactions: although numerous efforts were made to suppress the use of zero, businessmen found that counting with zero enhanced their business practices.

Like Julian, Leibniz, the person who developed the binary mathematics fundamental to the function of today’s computers, also perceived one and zero as numbers with profound theological and metaphysical significance. For those who are not acquainted with the binary system, which is a generalization of our more familiar numbering system that is based on powers of 10, it seems worthwhile to at least see how it may be used to represent any whole number. Leibniz’s binary system depends on the observation that every whole number may be expressed as a sum of powers of 2 (if we allow the use of  $1 = 2^0$ ). To see how these representations using powers of 2 work, consider the following table:

Ordinary Representation			Binary Representation
1	=	$2^0$	= $1 \times 2^0$ = 1
2	=	$2^1$	= $1 \times 2^1 + 0 \times 2^0$ = 10
3	=	$2^1 + 2^0$	= $1 \times 2^1 + 1 \times 2^0$ = 11
4	=	$2^2$	= $1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0$ = 100

So the last column, where the binary representations of the number are given, is simply keeping track of the powers of 2 to use to yield the number. For example, the “value” of the binary number 10011 can be determined by reading right to left and working backward:

$$10011 = 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 16 + 2 + 1 = 19$$



All numbers, however long and complex, can be expressed through one and zero alone.<sup>38</sup> Leibniz, in keeping with the intellectuals of his age, was, as James Ryan tells us, searching for a “universal language,” one guided by the principles of “economy and simplicity” that Leibniz considered fundamental to science.<sup>39</sup> As we have seen, Julian also sought a language using one and zero that expresses universality, simplicity, and generality.

A version of that language becomes the basis of computer technology. Computer scientists recognize the importance of Leibniz’s base-two mathematics to the development of computer technology, which they find “very impressive though much more confined in scope than [Leibniz] claims.”<sup>40</sup> Following the history of zero and one opens up the functionality of zero and one that is of interest to Julian in her acknowledgment of the power of one and zero as verbs and that is fundamental to computer design. A computer engineer explained to me that binary mathematics offers computer designers simplicity because they only have to be concerned with the two states of zero and one.<sup>41</sup> Electronic circuits that have only two states are called “digital electronics” as opposed to “analog electronics,” which have many possible states; a flip-flop is the classic circuit that stores a 1 or 0 and which has logic inputs (to set or reset the flip-flop) and an output so the state of the flip-flop can be used. Optimizing integrated circuit technologies for binary logic has allowed large increases in computational capability at a fraction of the power (and cost). There are well-known techniques for generating binary logic designs. Theoretically, one could build a computer using three, four, five, or more logic levels, but such systems would be much more difficult to design and build. A computer can be implemented in many different ways, but a binary computer, with today’s technology, creates the simplest and the largest computational capability.

Leibniz not only sought an efficient and optimal system for computation but also one that reflected his understanding of both the natural world (a scientific understanding) and his idea of God (a theological understanding), and in this regard his thinking is not dissimilar to Julian’s. In setting out his binary mathematics, Leibniz praised the “wonderful order” it produced.<sup>42</sup> As Ryan states, “Leibniz’s way of doing philosophy was not entirely analytical, but to some extent drew upon powerfully intuitive associations—correlations—among metaphysical ideas and natural phenomenon.”<sup>43</sup> Leibniz’s search for a universal mathematics that would describe both nature and God was based on his assumption that the binary system “reflects the generation of things from one, God, and zero, nothing.”<sup>44</sup> Leibniz saw the affinities between his system and those of ancient Chinese philosophers: “What is amazing is that this arithmetic by 0 and 1 is found to contain the mystery of the lines of an ancient King and philosopher named Fuxi.”<sup>45</sup>

Leibniz’s investment in the metaphysical properties of one and zero led him into a protracted correspondence with a Jesuit working in China, Joachim Bouvet (1665-1730), who argued that Leibniz’s method of organizing all knowledge through binary systems was similar to the fundamentals of the powerful Chinese philosophical system, the *I Ching*.<sup>46</sup> The major theorist of the metaphysical implications of the sixty-four hexagrams of the *I Ching* was the eleventh-century philosopher Shao Yong, who argued that “the sixty-four hexagrams in the binary system order are derived from the division of the original Absolute, the Great Ultimate (taiji) into the two complementary forces of creation, yin and yang—the female and male, the dark and light, the passive and active, and so forth.”<sup>47</sup> Bouvet sought to demonstrate to Leibniz the affinities between the two systems of thought.

Leibniz, whose work is so fundamental to today’s computer designs, was not only interested in streamlining the functions of the numbers but also in considering their philosophical and theological implications. These implications are not only similar to those found in Chinese philosophies such as that underlying the *I Ching*, but also to Julian’s much earlier meditations. Like Julian, Leibniz saw one and zero, especially in his binary system, as “a representation of creation *ex nihilo* by God, in which each thing is constituted by some permutation of one (i.e., God) and nothing.”<sup>48</sup> And furthermore, like Julian, Leibniz “aligned himself with the Augustinian theology of evil as privation of being.”<sup>49</sup> One and zero, then, are powerful numbers not only for creating technological productivity but

also for generating ideas about the nature of the universe and God. As Ryan points out, “Shao and Leibniz shared the view that the cosmos was created according to the binary system, which is reflected in all things and discoverable by human beings.”<sup>50</sup> Even without a concept of binary mathematics, Julian of Norwich reached extraordinary philosophical depth through her untutored meditations on one and nought alone.

By looking at the writings of Julian of Norwich through the lens of the digital and vice versa, I have argued that there are suggestive commonalities between the two realms. There are of course numerous differences. A fundamental difference resides in Julian’s understanding of the relationship between data acquisition and knowledge. Although the origin of the hierarchy is not known, information scientists point frequently to what is known as the DIKW hierarchy to describe the transformation of information into higher forms of knowledge: data, information, knowledge, wisdom.<sup>51</sup> The internet provides ever-increasing amounts of data, which can in turn be formulated into information that challenges received paradigms. For example, having much more data about what kinds of animal formations exist in the world can alter the contours of Darwin’s model of the development of species. Julian advocates a very different method for the acquisition of wisdom, one that relies not on the acquisition of more data but on the deeper consideration of the data that is there. Julian seeks to understand the content of only two visions. With the exception of describing the content of one further “showing” (the word she uses to describe her visions), the longer version of her showings provides no further data but rather a dilated consideration of the implications that can be drawn from what she has seen. Furthermore, she casts the responsibility of meaning-making on the reader and stresses that meaning comes from repeated performance. For her, wisdom is achieved not by the acquisition of an infinitely expanding amount of data but rather through a complete immersion into one piece of data that yields infinite access to the one piece of knowledge that can only be known performatively: God is love.<sup>52</sup>



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### FOOTNOTES

1. In my own department at the University of Glasgow, a medievalist, the late Desmond O’Brien, was instrumental in the establishment of digital humanities on campus. He was one of four people who established the STELLA lab (Software for Teaching English Language and Literature, and its Assessment) in 1986 and was also one of the very first scholars to produce an electronic version of *Piers Plowman* in the early nineties. [D]
2. See the discussion of the state of the field in David J. Birnbaum, Sheila Bonde, and Mike Kestemont, “The Digital Middle Ages: An Introduction,” in “The Digital Middle Ages,” ed. Birnbaum, Bonde, and Kestemont, supplement to special issue, *Speculum* 92, no. S1 (October 2017): S1-S25, <https://www.journals.uchicago.edu/toc/spc/2017/92/S1> (<https://www.journals.uchicago.edu/toc/spc/2017/92/S1>). [D]
3. For a discussion of the status of a variety of gender-oriented digital projects see Laura Mandell, “Gendering Digital Literary History: What Counts for Digital Humanities,” in *A New Companion to Digital Humanities*, eds. Susan Schreibman, Ray Siemens, and John Unsworth (Chichester: Blackwell’s and John Wiley and Sons, Ltd., 2016), 511-23. As Mandell points out, most of the projects are oriented toward the recovery of women writers and need continual support and renewal. Diane Watt is the lead for a new major project on Women’s Literary Culture and the Medieval Canon, [https://www.surrey.ac.uk/womens-literary-culture-medieval-canon?\\_ga=2.36319973.475504902.1512038981-483790412.1477403311](https://www.surrey.ac.uk/womens-literary-culture-medieval-canon?_ga=2.36319973.475504902.1512038981-483790412.1477403311) ([https://www.surrey.ac.uk/womens-literary-culture-medieval-canon?\\_ga=2.36319973.475504902.1512038981-483790412.1477403311](https://www.surrey.ac.uk/womens-literary-culture-medieval-canon?_ga=2.36319973.475504902.1512038981-483790412.1477403311)). [D]

4. See Nicholas Watson and Jacqueline Jenkins, *The Writings of Julian of Norwich: A Vision Showed to a Devout Woman and A Revelation of Love* (University Park, Pennsylvania: Pennsylvania State University Press, 2006). [↗]
5. Quoted in Birnbaum, Bonde, and Kestemont, "The Digital Middle Ages: An Introduction," 52. [↗]
6. Sadie Plant, *Zeros and Ones: Digital Woman and the New Technoculture* (London: Fourth Estate, 1997), 56. [↗]
7. For Julian's words see Watson and Jenkins, *The Writings of Julian of Norwich: A Vision*, 75. This is the name given to what was previously known as the *Short Text* by Watson and Jenkins in their edition. They name what was formerly called the *Long Text* instead *A Revelation of Love*. I will follow their nomenclature here. All further quotations from Julian will be taken from this edition, and the text name in short form (*Vision* or *Revelation*), chapter, and page numbers will be given in parentheses in the body of my text. For a discussion of the ways in which gender informs Julian's writings see Elizabeth Robertson, "Medieval Medical Views of Women and Female Spirituality" in *Feminist Approaches to the Body in the Middle Ages*, ed. Linda Lomperis and Sarah Stanbury (Philadelphia: University of Pennsylvania Press, 1993), 142-67, and "Julian of Norwich's Modernist Style and the Creation of Audience" in *A Companion to Julian of Norwich*, ed. Liz McAvoy (Cambridge: D. S. Brewer Press, 2008), 139-53. See also Liz McAvoy, "'For we double of God's making': Writing, Gender and the Body in Julian of Norwich," 154-65 in her *Companion*, as well as her book-length study, *Authority and the Female Body in the Writings of Julian of Norwich and Margery Kempe* (Cambridge: D.S. Brewer, 2004). [↗]
8. See Watson and Jenkins. [↗]
9. The degree to which Julian depended on male advisors for help in producing her writings is unknown. For an argument that she had help from her spiritual advisor, see Felicity Riddy, "Julian of Norwich and Self-Textualization," in *Editing Women: Papers Given at the Thirty-First Annual Conference on Editorial Problems, University of Toronto, 3-4 November, 1995*, ed. Ann M. Hutchinson (Toronto: University of Toronto Press, 1998). [↗]
10. For a discussion of Julian's manuscripts see "Manuscript Tradition and Interpretation" in Liz McAvoy, *A Companion to Julian of Norwich*, 101-218. For earlier discussion of the manuscripts see Nicholas Watson, "The Composition of Julian of Norwich's Revelation of Love," *Speculum* 68, no. 3 (1993): 637-683, and the introduction to his and Jenkins's *Vision*. [↗]
11. The TEAMS edition of Julian available online contains only the *Long Text*. For the most recent print edition that contains both texts, see Watson and Jenkins. [↗]
12. For works that praise the democratizing impulse of the internet, see, for example, Clay Shirky, *Here Comes Everybody* (New York: Penguin, 2008) and Alex Mueller's "Wikipedia as *Imago Mundi*," *Studies in Medieval and Renaissance Teaching* 17, no. 2 (Fall 2010): 11-25. Dr. Mueller also shared with me his "Cybermedieval Rhetoric: A Prehistory of Digital Textuality," a chapter of his forthcoming book on the commonalities between medieval methods of organizing knowledge and those of the digital realm. [↗]
13. Marlene Manoff, "Archive and Database as Metaphor: Theorizing the Historical Record," in *portal: Libraries and the Academy* 10, no. 5 (2010): 385-98. [↗]
14. William J. Turkel, "Relevance Feedback," *Digital History Hacks: Methodology for the Infinite Archive* (2005-08) (blog), January 20, 2008, <http://digitalhistoryhacks.blogspot.com/2008/01/> (<http://digitalhistoryhacks.blogspot.com/2008/01/>). [↗]
15. For a helpful theoretical discussion of media and mediation that links digital mediation with mystical experience, see Alexander R. Galloway, Eugene Thacker, and McKenzie Wark, *Excommunication: Three Inquiries into Media and Mediation* (Chicago: University of Chicago Press, 2014). [↗]
16. For Julian's potential affinity with Lollard views, see Watson, "Composition." [↗]
17. For a more detailed discussion of the innovativeness of Julian's style, see my essay, "Julian of Norwich's 'Modernist Style' and the Creation of Audience." [↗]
18. Sarah Beckwith has discussed the effectiveness of such authorizing strategies for female mystics in her essay, "Problems of Authority in Late Medieval Mysticism: Language, Agency and Authority in *The Book of Margery Kempe*," *Exemplaria* 4, no. 1 (1992): 177-99. [↗]
19. For an essay that discusses Julian's almost filmic concern to do away with mediation, see Barry Windeatt, "Julian of Norwich," in *A Companion to Middle English Prose*, ed. A. S. G. Edwards (Cambridge: D. S. Brewer, 2004), 67-82. See also Windeatt, "The Art of Mystical Loving: Julian of Norwich," in *The Medieval Mystical Tradition of England* [Exeter Symposium I], ed. Marion Glasscoe (Exeter: University of Exeter, 1980), 55-71. [↗]
20. David Theo Goldberg, "Praise the Web," *PMLA* 126, no. 2 (March 2011): 448-54. [↗]
21. Goldberg, 452. [↗]
22. Goldberg, 453. [↗]
23. I discuss her dilatory style in my essay, "Julian of Norwich's Modernist Style." See also Windeatt, "Julian of Norwich." [↗]
24. Nicholas Watson, "The Trinitarian Hermeneutic in Julian of Norwich's *Revelation of Love*," in *Julian of Norwich: A Book of Essays*, Garland Medieval Casebook 21, ed. Sandra J. McEntire (New York: Garland, 1998), 61-90. [↗]

25. See Christine Cooper-Rompato, "Numeracy and Number in the *Book of Margery Kempe*" in *The Medieval Mystical Tradition in England: Papers Read at Charney Manor, July 2011* [Exeter Symposium 8], ed. E. A. Jones (Cambridge: Boydell and Brewer, 2013) and *Mathematics and the Divine: A Historical Study*, eds. T. Koestler and L. Bergmans (Amsterdam: Elsevier, 2005). [↗]
26. I thank Terry Lippman for describing the basic functions of zero and one. [↗]
27. Brian Rotman, *Signifying Nothing: The Semiotics of Zero* (Stanford: Stanford University Press, 1987), 69-70. [↗]
28. Charles Seife, *Zero: The Biography of a Dangerous Idea* (London: Souvenir Press, 2000), 23. [↗]
29. Plant provides a succinct summary of the history of zero in *Zeros and Ones*, 51-55. See also Rotman, Seife, and also Robert Kaplan, *A Natural History of Zero* (London: Penguin, 1999) and John D. Barrow, *The Book of Nothing* (London: Vintage, 2001). [↗]
30. Plant, 34-35. [↗]
31. Alexis Lothian, "Gendering the Digital Humanities," in *The Cambridge Companion to Digital Humanities*, (Cambridge: Cambridge University Press, forthcoming). I thank the author for sharing her manuscript with me. [↗]
32. A. M. Turing, "Computing Machinery and Intelligence," *Mind* 49, no. 236 (1950): 433-460. I thank Paul Sen for discussing this essay with me. Lothian brings up this essay in her discussion as well. [↗]
33. Caroline Bynum wrote the paradigmatic account of the ways in which gender informs female spirituality in her book, *Holy Feast and Holy Fast: The Religious Significance of Food to Medieval Women* (Berkeley: University of California Press, 1987). [↗]
34. *The Cloud of Unknowing and Other Works*, ed. and trans. A. C. Spearing (London: Penguin, 2001). [↗]
35. See David Aers, "The Humanity of Christ: Reflections on Julian of Norwich's *Revelation of Love*," in David Aers and Lynn Staley, *The Powers of the Holy* (University Park, Pennsylvania: Pennsylvania State University Press, 1996), 77-106. [↗]
36. Charles Seife, *Zero: The Biography of a Dangerous Idea* (London: Souvenir Press, 2000). [↗]
37. The association of the word "cipher" with encryption has its origins in this early period when businessmen continued to use zero in their calculations but did so secretly. See Seife, 81. [↗]
38. For a discussion of Leibniz's development of the base-two binary system and its implications for the histories of both mathematics and philosophy see Richard Swiderski, "Bouvet and Leibniz: A Scholarly Correspondence," *Eighteenth Century Studies* 14, no. 2 (1980-81): 135-50 (see p. 143 for a description of base-two binary mathematics) and James A. Ryan, "Leibniz' Binary System and Shao Yong's 'Yijing'" *Philosophy East and West* 46, no. 1 (1996): 59-90 (see p. 60 for a more extensive binary table). I thank the mathematician, Robert Tubbs, for discussing binary mathematics with me. [↗]
39. Ryan, 64 and 65. [↗]
40. Ryan, 65. [↗]
41. My summary of the role binary mathematics plays in computer engineering is based on an email exchange with an experienced computer engineer, Jay Stepleton, vice president and general manager of Vision Research Materials Analysis Division, Ametek. [↗]
42. G.W. Leibniz, "Explanation of Binary Arithmetic," in *Die mathematische schriften von Gottfried Wilhelm Leibniz, Vol. VII*, ed. C. I. Gerhardt, 223-27 (translated from the French and published in the Memoire de l'Academie Royale des Sciences). Thanks to Robert Tubbs for drawing my attention to this passage. [↗]
43. Ryan, 67. [↗]
44. See Leibniz's discussion of zero and one in his letter to Bernoulli, Letter CXXVIII in Georg Heinrich Pertz, *Leibnizens gesammelte Werke*, (Halle: Druk and Verlag, 1855), 661, where he states that others have recognized the profound religious significance of his ideas: "Serenissimo Duci Rudolpho Augustus ante aliquot annos quum monstrarem, adeo placuerat haec, ut ipse videbatur imago creationis seu originis omnium rerum ex nihilo per Deum, ut numerorum ex 1 and 0 ut etiam gemmae cuidam insculpi curare ) et 1, qua sigillitas literas mihi mittere solet." ("When I showed this, some years ago, to the Serene Duke Rudolph Augustus, it so pleased him that the numbers coming from 0 and 1 seemed to him to be an image of God's creation or the origin of all things ex nihilo—so much so that he had 0 and 1 carved onto a signet ring and would use it to send me embossed letters.") With thanks for Robert Tubbs for alerting me to these letters and to Robert Pasnau for help in translating this passage. [↗]
45. Leibniz, "Explanation," 3. [↗]
46. See Swiderski for a description of their correspondence. [↗]
47. Ryan, 66. [↗]
48. Ryan, 61. [↗]

49. Ryan, 68. [↗]

50. Ryan 59. [↗]

51. I learned of this pyramid on Wikipedia entry for DIKW pyramid. For further discussion see Jennifer Rowley, "The Wisdom Hierarchy: Representations of the DIKW Hierarchy," *Journal of Information and Communication Science* 33, no. 2 (2007): 163–80 and David Weinberger, "The Problem with the Data-Information-Knowledge-Wisdom Hierarchy," *Harvard Business Review*, February 2, 2010, <https://hbr.org/2010/02/data-is-to-info-as-info-is-not> (<https://hbr.org/2010/02/data-is-to-info-as-info-is-not>). [↗]

52. I was invited to reflect on Julian of Norwich within a digital frame by Andrew Prescott for a session on digital humanities that took place at the Medieval Institute Meetings in Kalamazoo in May 2016. As a complete outsider to digital humanities, I have been dependent on Professor Prescott's extensive knowledge of the field as I developed this argument. Professor Robert Tubbs generously helped me to track down Leibniz sources and to clarify my summary of binary mathematics. I am also deeply indebted to Professor Alex Mueller for continual advice and suggestions about ways in which I might follow up on my intuitions. That said, this discussion at this stage is meant to be a thought experiment that asks for a much deeper engagement with the field of digital .humanities, the history of zero and one in mathematics, and with Julian's highly imaginative use of both numbers. I am also very grateful to Jeffrey Robinson for valuable editorial feedback as well as inspiring conversation about these matters. [↗]

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