THE ESSENTIAL CONTRADICTION

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ABSTRACT. What does digital humanities share *intellectually* with the humanities? This is a crucial question: if the new discipline has no productive response, then its survival as a coherent field of enquiry is in doubt. In this lecture I centre on the contradiction implicit in representing human culture digitally. I argue that through such representing digital humanities raises and helps us to understand the ancient question of the human in the endlessly novel forms made possible by the dominant engine of 21st-century culture. Thus it finds intellectual common ground with the humanities.

KEYWORDS. Digital humanities; human; humanities; arts; engineering; sciences; computing; computer science; robotics; Turing.

1. Looking into the black box

In May of this year an Australian immigration officer at the Kingsford Smith airport in Sydney asked me what I do. "I'm a professor", I replied. "Of what?" she asked. "Digital humanities", I answered. "Isn't that an oxymoron?" she said, smiling. "I like oxymorons", I replied. "Yes", she agreed, "sort of like a friendly immigration officer."

She was not just friendly. She was also quick-witted enough to see past the dazzle of something new to an essential contradiction. Many have dismissed this contradiction as a sign of a passing phase in the cultural assimilation of computing. For decades colleagues have argued that all the disciplines will one day simply become digital, and then no one will give it special attention. Brian Cantwell Smith remarked a decade ago that the genius of computing is to render the fact of digital representation irrelevant [1]. Just this year David Berry has argued that the progressively irrelevant distinction between digital and non-digital resources mark our entry into a post-digital age [2].

But the matter isn't so simple. First, in practical terms, no scholar has the time and few the background to deal with a technology that is designed for change: metamorphic, radically adaptive and recursively embedded in our habits of work and thought. Second, pronouncements about it aren't absolute but relative to the point of view from which they are made. Thus digital representation does not matter to the person interested only in output or effects. But it is crucial to the person, like me, who wants to know what is lost in translation, and more importantly what that loss illumines. Third, motivations for proclaiming this or that about the digital are trickier

because they are seldom explicit and so must be inferred. Declaring that a new age is upon us does strike me as better serving the agenda of a social revolutionary than that of a cultural historian or a social scientist. Such a declaration is presumptive and imperative, not descriptive. This one suggests to me what the early history of computing in the humanities attests: a desire to turn away from direct engagement with the increasing presence of the techno-sciences in scholarly and daily life. Foregrounding the digital provokes such reactions. Recognizing it as a clue to the significance of digital humanities requires more thought. This sort of thought occupies me here.

In the first instance I turn for help to the arts because like digital humanities they are experimental and materially innovative. They are also older, more mature. From them I take as guide what Robert Hughes has called "the shock of the new" [3]. This leads me e.g. to Viktor Shlovsky's argument of 1917 on the value of this shock for *defamiliarizing* things in order to see them as they are, "to impart the sensation of [them] as they are perceived and not as they are known" [4]. It leads me also to Bruno Schulz's comparison of the work of art to a baby *in statu nascendi,* in the midst of being born. "The role of art", he wrote in 1935, "is to be a probe sunk into the nameless" [5]. It seems to me that a huge promise of digital humanities is like that: to use the manifest otherness that computing reveals to unseat received knowledge, to look afresh at what we most care about – before familiarity puts us to sleep.
I said the arts share with digital humanities two defining characteristics: making and experimenting. Experiment connects both to the sciences; I'll return to them later. Making connects them to engineering. At a similar point in the history of computer science, engineer Richard Hamming argued on behalf of his discipline that if the machine were abandoned for the science, as some were then recommending, "almost all of what we do", he declared, "would become idle speculation" [6]. His point was not that speculation in itself is *idle*, rather that in computer science speculation must not be; it must be grounded in engineering practice. Digital humanities is much the same, I think.

So I ask, and recommend that you ask, not only what lies behind the user-friendly interface, rather more what happens in every self-aware moment of digital making. I recommend that you set your sights as much or more on the actual struggle of translating cultural artefacts into digital form than on the end-product, because from an intellectual perspective the struggle is ultimately the point of it all [7]. Scholarship happens there, in that hugely influential act of translation, not merely

afterward in use of the product.

2. Prelude to history

Belief in the struggle, which I learned during 15 years of encoding Ovid's Metamorphoses, moved me to use an even more obvious oxymoron than "digital humanities" for the title of my 2005 book, *Humanities Computing* [8]. Unfortunately my favourite oxymoron did not survive competition with the term "digital humanities", which began to overtake it in 2004 with publication of Blackwell's *Companion to Digital Humanities* [9]. The *Companion* was a landmark for the field [10]. Some regard it as marking a decisive sea-change in the discipline, which in a sense it did by coming at a time when the World Wide Web stopped being novel and became part of the furniture. But we tend to think that the Web changed digital humanities more directly than it did because the flood of resources that it brought washed from memory the weak, troubled past of the discipline, from ca. 1949 until the Web's public release in August 1991. (The Web did not begin to affect scholarly research until the mid to late 1990s, but its release almost simultaneously with the dissolution of the Soviet Union and end of the Cold War makes 1991 in retrospect a defining moment.) Today, if the incunabular period is referenced at all in the context of digital humanities, it is dismissed with a casual readiness which suggests confusion of technological progress with historical change.

Why should we care about that past? An immediate reason lies in the fact that the discipline's antediluvian troubles were not overcome or made irrelevant but have resurfaced. Their recurrence suggests deeper problems that knowledge of the past would illumine and so help us solve. We have good reason to believe the period was formative, as childhood is to the adult. Recovering the past thus offers the means to discern a trajectory for the discipline, and so more intelligently to plan for its future – and so for the future of all disciplines affected by computing. I will return to this recovery in a moment or two.

Chief among those resurfaced problems is the lack of a language or "normal discourse" (Richard Rorty called it [11]) with which to flesh out the details of computing's role in the humanities beyond a merely instrumental relation of service. We do have a start, however, in Martin Heidegger's "Die Frage nach der Technik" to confirm a sense that digital humanities, in its oxymoronic position, is in the right place. In 1954 Heidegger wrote that, "Because the essence of technology is nothing technological, essential reflection upon technology and decisive confrontation with it must happen in a realm that is, on the one hand, akin to the essence of technology and,

on the other, fundamentally different from it" [12]. That the confrontation he describes is urgent I take to be obvious and so will not argue. I also take as obvious the fit of digital humanities to the role he describes. But the devil is in the detail: what does this fit require, what exactly does it involve?

The first detail to address is the referent of this collective noun "humanities": what common concern do these disciplines have that digital humanities might share? Lack of both time and competence means that the best response I can give now is to turn to Immanuel Kant's definition of philosophy in the *Jäsche Logik* (1800) as the set of four questions into "the ultimate end of human reason". The last of these, which I take as my answer, is the anthropological question that, he said, includes them all: "Was ist der Mensch?" [13]. Thence I go e.g. to Roger Smith's *Being Human: Historical Knowledge and the Creation of Human Nature* (2007) [14], to Giorgio Agamben's sketch of the "anthropological machine" at work across the millennia in his short but powerful book *The Open: Man and Animal* (2002) [15] and to Anthony Giddens' demonstration of the anxious construction of the self moment by moment in *Modernity and Self-Identity: Self and Society in the Late Modern Age* (1991) [16].

3. The incunabular period

So, I say, we have a common ground. To get computing onto it I begin, as I've said, with its formative, incunabular period, when scholars encountered computers without ready-made answers. I show that their encounter had existential implications, that for them it raised the Kantian question. Then, to bring it into the present, I ask how their struggle relates to our own.

Again severe limitations of time force me to summarize the evidence from those early years. So let me say merely that at issue for the majority of scholars, or in the immediate background of their daily lives, would have been the question of having anything at all to do with the machine. Few would have been oblivious to the supposed benefits, extensively promoted in the mass media, and to the importance of computing to scientific discovery. Few would not have encountered the jeremiads of public intellectuals against the mechanization of life. Few would have been unaware of the machine's complicity in Cold War militarism or its threat of massive social disruption. We can suppose that academic decorum would have filtered out most expressions of alarm in the professional literature, though we do find scholars expressing their and others' anxieties about computing's effects. Thus, for example, one American scholar entitled her article, "Fear and Trembling: The Humanist Approaches the Computer" [17], with deliberate yoking of existential angst to the

actual experience a computer-using scholar of the time would have had – a walk from the office to a massive, sequestered, noisy, rebarbative mainframe, often kept in a physics or engineering building behind glass walls and watched over by lab-coated technicians. Other sources confirm that, like factory workers bewildered by automation, scholars were asking the existential question: would there would be a role for them in a world dominated by the "thinking machine".

The scene is obviously very different now. Computing is nearly ubiquitous. We interact with our machines not merely without qualm but in many instances unconscious of their presence, in greeting cards, watches, automobiles, phones, televisions and so on. My argument is not that we harbor hidden fears (though I have no doubt we do), rather that our predecessors' fear of computing is not merely an artefact of that time but a clue to something we must not overlook.

4. The computer & science

Since computer science and digital humanities began more or less at the same time, it is helpful to compare the two as a way of enlarging the historical context. The differences are not clear-cut, but they are revealing.

Very much unlike digital humanities computer science was powered from its beginnings in wartime research by applicability to the concerns of the largely American "military-industrial complex" [18]. During the Cold War, which defined so much of life in the civilized world from 1945 to 1991, military funding of computer development helped produce such things as the hydrogen bomb, nuclear missile control systems and the electronic battlefield of Vietnam. More about the dark side later. On the bright side of theory computer science was and is powered by the fascinating intellectual problems arising from the fusion of mathematics, logic and engineering. Let me cite a single example. In 1947 John von Neumann and Herman Goldstine were attempting to figure out how to code problems for the "electronic computing instrument" they were building at the Institute for Advanced Study in the U.S. In an internal report Goldstine and von Neumann wrote with deceptive simplicity that "coding is not a static process of translation, but rather the technique of providing a dynamic background to control the automatic evolution of a meaning" [19]. Note: not a calculation but a *meaning*. Their implicit analogy (one we know preoccupied von Neumann) was to the physical brain. In other words they were arguing that the fundamental purpose of a computer system is not to automate human work but to simulate human thinking, and so to discover what that is.

Now compare the view of a scholar of similar stature: Fr Roberto Busa, whom we

widely credit with the first work in digital humanities. He had begun in the 1940s as a doctoral student in the conviction that St Thomas' idea of inwardness could only be fully understood by inspecting *all* the occurrences of the preposition "in" and the words to which it is affixed throughout the Thomistic corpus. Hence his turn to the computer for help, and the great *Index Thomisticus* which resulted. In 1976, having by then overseen the processing of 15 million words, he asked why in the study of language "the computer can do so little", given that it has done so much for commerce and the techno-sciences? [20] The problem, he wrote, did not lie with hardware and software but with human ignorance. The purpose of computing for philology, he insisted, was not to offload drudgery onto a labour-saving appliance (though he had much of it to cope with) but to deal with that problem of ignorance: "the use of computers", Busa wrote, "is not aimed towards less human effort, or for doing things faster and with less labour, but for more human work, more mental effort; we must strive to know, more systematically, deeper, and better, what is in our mouth at every moment, the mysterious world of our words." (p. 3)

Recall von Neumann's and Goldstine's aim, then hold this thought: not for release from work through automation but for the intellectual challenge from a simulacrum.

Now go further back in time, to mathematician Alan Turing's paper of 1936 on effective computability, from which digital computing originated [21]. He wrote it to lay to rest fellow mathematician David Hilbert's question of 1928: could there be a mechanical procedure by which any mathematical statement could be shown to be provable? That same year the Cambridge mathematician G. H. Hardy had observed that if there were such a procedure, "we should have a mechanical set of rules for the solution of all mathematical problems, and our activities as mathematicians would come to an end" [22]. Turing showed that mathematics was under no such threat. He began his negative proof with a metaphor: "We may compare a man in the process of computing a real number", he wrote, "to a machine which is only capable of a finite number of conditions…" [23]. Through a long and complex argument he then proceeded to isolate the man's actions and reduce them to the operations of an abstract machine, later known as the Turing Machine. With this machine he demonstrated that in principle mathematics was inexhaustible – and so by extension demonstrated the essential role of the imagination in the life of the mind, or as Busa said concerning philology, in "the mysterious world of our words".

I hinted earlier that Turing did not invent *the* computer in any sense; he

invented a scheme for the invention of an indefinite number of computings, limited only by the human imagination. This is why the phrase "*the* computer" is so misleading – it implies that what our physical machines now do is computing as it always will be. Understanding the open-endedness of Turing's scheme means, for example, that design ideas from the humanities, or from any aspect of life, can have significant effects on the future of computing. Indeed, we humanists must always be asking: How far can current computing go with our problems? What are its limits? Where does it fail? What new computings do its failures point toward? As our colleagues in AI like to say, there is no evidence whatever that computing will not continue to advance on human intelligence. Bring it on, they say. But (here we get to the nub of the matter) there is similarly no evidence that human intelligence is fixed, though we do have evidence that it can be very different.

So what we have is a game, a contest – not the Turing Test but something far more consequential.

4. The existential question

Computing advances on us in two ways: by *modelling* how we reason about our problems, and by *simulating* how we might reason about things we cannot observe or predict from law-like behaviour. Modelling covers most of what digital humanities does now. It works epistemologically as a kind of competition between the modeller and the model, which spurs on conjecture by imitating the modeller's idea of something. Thus it continually raises the question of how humans do what they do or how they know what they know. Simulation is less common – it requires more explicit knowledge of how we construe the object of study than we usually have. Where it is possible, (to use an early digital humanist's metaphor) it acts as a "telescope of the mind" [24], allowing the researcher to see what would otherwise not be visible, hence underscores the limitations of unaided humanity. In a sense, neither modelling nor simulation are novel; both correspond to unassisted modes of reasoning, but physical instantiation in a computing system gives them autonomy, and so rigour, as well as makes them discrete. Attach motive power and they become robotic, and if we choose (as we do), visibly anthropomorphic.

Modelling and simulation are significant in my terms because they demonstrate the power of computing to raise the existential question that so worried our predecessors – and should worry us. We know that computational technology *progresses*, that its devices get ever better at doing whatever they do. That alone would not affect us existentially. But the alignment of computing with epistemology

gives it existential force. Turing's machine began as a scheme for demonstrating what a mathematical machine could *not* do that humans can. But very soon after his paper was published, the Turing Machine took on a life of its own, becoming a model *for* mind, and so became a tempting candidate for arbiter of knowledge. Many yielded to that temptation.

By 1943 Turing's machine had become the basis for a neurophysiological model of the brain and so joined the long tradition of what a U.S. National Library of Medicine exhibition entitled "dream anatomy" [25] – speculation since antiquity about "what happens beneath the skin" and its microcosmic likening to the macrocosm, thus also to machinery. By the time of Descartes in the 17th Century and then La Mettrie in the 18th analogizing had become a troubling equation of the machine first with the animal, then with the human [26]. Descartes, you may know, had identified the animal, and so animal nature, as a kind of machine – perhaps as defense against the most corrosive evidence of his age, discovery of the great apes. These were so physiologically similar to humans, physician Nicolaes Tulp wrote in 1641, "that it would be difficult to find one egg more like another" [27]. The anxiety of that discovery came to a powerful focus in Jonathan Swift's portrait of Lemuel Gulliver driven insane by having to own up to his own bestial nature before the creatures of perfect reason whom he emulated.

For us now the locus of confrontation has shifted across the bridge Descartes provided, from the animal to the machine. I say "*the* machine", but again qualification is required. "We have become used to machines that are more powerful, more durable, more accurate, and faster than we are," physicist and industrialist John H. Troll wrote in 1954, "but machines that challenge our intelligence are hard to take. At this point the competition becomes uncomfortable" [28]. Or as Marvin Minsky has pointed out, we must now use the word "machine" in a very different sense than before – in Turing's sense [29].

This machine, our machine, in the form of computational simulation and modelling has for the physical and life sciences become *sine qua non.* As a result, in the shocking words of philosopher Paul Humphreys, "scientific epistemology is no longer human epistemology". It gets worse. "The Copernican Revolution", he declares, "first removed humans from their position at the center of the physical universe, and science has now driven humans from the center of the epistemological universe" [30]. What I want you to heed here is not the truth-value of what he says but

language he uses to say it. Oddly, significantly, this language echoes the biblical story of Adam and Eve's expulsion from Paradise after eating from the fruit of that epistemological tree.

Humphreys is not alone. For one thing he is echoing Sigmund Freud's declaration twice in 1917 that scientific research had precipitated three great crises in human self-conception, or as he put it, three "great outrages" to human self-love [31] [32]: first, by Copernican cosmology; then by Darwinian evolution; and finally by his own psychoanalysis, which showed we are not even masters of own house. Freud is not merely being the physician here, rather also an inheritor of the whole moral tradition of the physical sciences. At least from Bacon and Galileo in the 17th Century this tradition had identified the cognitively and morally curative function of science acting against fanciful or capricious knowledge. Science for them was not (we now know) anti-religious but conceived as a corrective force with promise to restore us to unclouded Adamic intelligence [33]. Scientists no longer talk like that, but the moral imperative remains. Freud's series of outrages is thus radically incomplete: they do not stop with him because the imperative to set us right is integral to the scientific programme.

What seems undeniably good becomes dark when the scientific perspective is taken as absolute, and so reduces human imagination to narcissism on a cosmic scale. One need only consider, for example, cosmologist and Nobel Laureate Steven Weinberg's sentence "that human life is… a more-or-less farcical outcome of a chain of accidents reaching back to the first three minutes" after the Big Bang, or the words of geneticist and Nobel Laureate Jacques Monod, who proclaims "that, like a gypsy, [man] lives on the boundary of an alien world that is deaf to his music, and as indifferent to his hopes as it is to his suffering or his crimes" [34]. These two and many others are indicative of a mounting attack of ourselves as scientists upon ourselves as humans, summed up by biological anthropologist Melvin Konner: "It would seem", he concludes, "that we are sorted to a pulp, caught in a vise made, on the one side, of the increasing power of evolutionary biology… and, on the other, of the relentless duplication of human mental faculties by increasingly subtle and complex machines." He asks, "So what is left of us?" [35]. (1991: 120). What indeed?

In 1970 the Japanese roboticist Masahiro Mori proposed that as robots become more recognizably anthropomorphic we react more favourably to them until suddenly their resemblance to us becomes uncanny and so provokes a strongly negative reaction. He called this plunge into fright "the uncanny valley phenomenon" [36].

Then and in a recent interview Mori has emphasized the benefit of remaining deliberately in the uncanny valley, so as better to know what it means to be human [37]. Evidence is all around us that Mori's uncanny valley is where we are imaginatively and keep getting glimpses of. Consider, for example, evidence from the cinema, e.g. from the American film *Blade Runner* (1982) to the Bollywood *Enthiran* (2010), the Spanish *Eva* (2011), the Swedish *Äkta Människor* (2012) and "Be Right Back" from the British *Black Mirror* (2013).

5. The question for digital humanities

And so I come at last to the question for which the foregoing has been preparation: how does the confrontation with computing, hence the bond with the humanities in questioning the human, actually play out in digital humanities? I answer with an example from the area I know best: text-analysis for literary criticism.

In its simplest, least technical form, analysis is carried out by marking up a text manually to render elements of it computationally tractable. Standardization of markup has had a majority of the attention, but my concern is different: whatever the standard, or whether there is one, I want to point you to what happens when a computationally intractable element of a text is translated into something algorithmically tractable by inserting a metalinguistic tag into the text.

Markup varies from straightforward tagging of unambiguous but algorithmically unidentifiable elements, such as titles and chapter headings, to attempts at tagging elements that require a high degree of interpretation, such as literary tropes. My interest is with the latter. Here markup fails utterly: the translation it demands, absolutely consistent across the text and totally explicit, is an impossible goal. But it is an exercise of great value for the hermeneutical agony it leads to: it raises the epistemological question, how do you know what you know, in an intellectual world that has for a long time, increasingly since computing, privileged explicit and consistent knowledge. The strong sense of illegitimacy in imposing law-like rules on the role played by the scholar points exactly to the human-*versus*-digital confrontation I have in mind.

The other form of analysis is algorithmic from the outset. It poses the question of whether patterns in a literary text can be detected independently of metalinguistic intervention. Here the greatest and most disturbing success has been achieved in computational stylistics, which depends on statistical analysis. Its principal exponent, the Australian literary scholar John Burrows, has noted that "mounting evidence" accumulated over the last several decades strongly suggests

that literary style is probabilistic [38]. This implies that reader recognizes author and the author writes in (one must say, roughly) the same way as we think the natural world and human populations operate. I ask you to pause and think about what that means. Meanwhile, consider Maurice Kendall's humorous but accurate view of 1942: statisticians, he wrote, "have already overrun every branch of science with a rapidity of conquest rivalled only by Attila, Mohammed and the Colorado beetle. They have ousted mathematics from its position as the matrix of the sciences, and they are beginning to appear among the arts" [39]. He cites work in computational stylistics as his example.

This is as far as I go now. There is the question of how computing moves beyond its failures in markup and algorithmic processing to the more serious challenge to the human that should be the digital humanities' supreme desideratum, at least for now: a conversational interlocutor. But that is for another time and place.

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[1] Brian Cantwell Smith. "Digital Future: Meaning of Digital". Lecture for The John W. Kluge Center, U.S. Library of Congress, 31 January 2005. http://c-spanvideo.org/program/FutureM.

[2] David Berry. "Post-Digital Humanities". http://stunlaw.blogspot.co.uk/2013/10/post-digital-humanities.html, 18 October 2013.

[3] Robert Hughes. *The Shock of the New: Art and the Century of Change*. Enl. edn. London: Faber and Faber, 1991.

[4] Viktor Shlovsky. "Art as Technique". In: *Russian Formalist Criticism: Four Essays*. Trans. Lee T. Lemon and Marion J. Reis. Lincoln NB: University of Nebraska Press, 1965, p. 12.

[5] Bruno Schulz. "An Essay for S. I. Witkiewicz". In: *The Collected Works of Bruno Schulz*. Ed. Jerzy Ficowski. London: Picador, 1998, pp. 367-70.

[6] R. W. Hamming. "One Man's View of Computer Science". 1968 ACM Turing Lecture. *Journal of the Association for Computing Machinery* Vol. 16(1) (1969) 5.

[7] Julia Flanders. "The Productive Unease of 21st-century Digital Scholarship". *Digital Humanities Quarterly* 3(3) 2009. http://www.digitalhumanities.org/dhq/vol/3/3/000055/000055.html.

[8] Willard McCarty. *Humanities Computing*. Basingstoke UK: Palgrave, 2005.

[9] Susan Schreibman, Ray Siemens and John Unsworth, eds. *A Companion to Digital Humanities*. Oxford: Blackwell, 2004. http://www.digitalhumanities.org/companion/.

[10] See *Humanist* 26.435 (for 29 October 2012), www.dhhumanist.org/.

[11] Richard Rorty. *Philosophy and the Mirror of Nature*. Princeton NJ: Princeton University Press, 1979, p. 320.

[12] Martin Heidegger. *The Question Concerning Technology and Other Essays*. Trans. William Lovitt. New York, Garland Publishing, 1977, p. 20.

[13] Immanuel Kant. *Lectures on Logic*. Trans. J. Michael Young. Cambridge: Cambridge University Press, 1992, p. 538.

[14] Roger Smith. *Being Human: Historical Knowledge and the Creation of Human Nature*. New York: Columbia University Press, 2007.

[15] Giorgio Agamben. *The Open: Man and Animal*. Trans. Kevin Attell. Stanford: Stanford University Press, 2002.

[16] Anthony Giddens. *Modernity and Self-Identity: Self and Society in the Late Modern Age*. London: Polity, 1991.

[17] Ellen W. Nold. "Fear and Trembling: The Humanist Approaches the Computer". *College Composition and Communication* 26(3) 1975 269-273.

[18] Dwight D. Eisenhower. "Presidential Farewell Address", 17 January 1961. http://www.eisenhower.archives.gov/research/online_documents/farewell_address.html.

[19] Herman H. Goldstine and John von Neumann. *Planning and Coding of Problems for an Electronic Computing Instrument*. *Report on the Mathematical and Logical aspects of an Electronic Computing Instrument, Part II, Volume I*. Princeton NJ: Institute for Advanced Study, 1947, p. 2.
[20] R. Busa, S.J. "Why can a computer do so little?" *ALLC Bulletin* 4(1) 1-3.
[21] A. M. Turing. "On computable numbers, with an application to the Entscheidungsproblem". *Proceedings of the London Mathematical Society*, 2(42) 1936-7 230-265.
[22] G. H. Hardy. "Mathematical Proof". *Mind* 38(149) 16.
[23] Note [21], pp. 59, 49.
[24] Margaret Masterman. "The Intellect's New Eye". *Times Literary Supplement* 284 27 April 1962.
[25] *Dream Anatomy*. U.S. National Library of Medicine. http://www.nlm.nih.gov/dreamanatomy/.
[26] James J. Sheehan. "Introduction", Part I, Humans and Animals; "Introduction"; Part II, Humans and Machines. In: *The Boundries of Humanity: Humans, Animals, Machine*. Ed. James J. Sheehan and Morton Sosna. Berkeley: University of California Press, 1991, 27-35, 135-141.
[27] "cum homine similitudinem: ut vix ovum ovo videris similius". Nicolaes Tulp. *Observationum Medicarum libri Tres.* Amsterdam: Ludovicus Elzevirium, 1641, pp. 274-5.
[28] John H. Troll. "The Thinking of Men and Machines". *Atlantic Monthly* July 1954 62-65; rpt in: *Modern Rhetoric*, ed. Cleanth Brooks and Robert Penn Warren. 2nd edn. New York: Harcourt, Brace and World, 1958, 482-9.
[29] Pamela McCorduck. *Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence*. San Francisco CA: W. H. Freeman and Company, 1979, p. 71.
[30] Paul Humphreys. *Extending Ourselves: Computational Science, Empiricism, and Scientific Method*. Oxford: Oxford University Press, 2004, pp. 8, 156.
[31] Sigmund Freud. "Eine Schwierigkeit der Psychoanalyse". *Imago* 5(1) 1-7; "One of the Difficulties of Psychoanalysis". Trans. Joan Riviere. *International Journal of Psychoanalysis* 1 17-23, p. 20.
[32] Sigmund Freud. *Vorlesungen zur Einführung in die Psychoanalyse*, Berlin: Internationaler Psychoanalytischer Verlag, 1917; *A General Introduction to Psychoanalysis*. Trans. G. Stanley Hall. New York: Boni & Liveright, pp. 246-7.
[33] Willard McCarty. "The Residue of Uniqueness". *Historical Social Research / Historische Sozialforschung* 37(3) 24-45, p. 33.
[34] Note [33], pp. 34-5.
[35] Note [33], pp. 25-6.
[36] Masahiro Mori. "The Uncanny Valley". Trans. Karl F. McDorman and Norri Kageki. *IEEE Robotics and Automation Magazine* 19.2 (June 2012): 98-100.
[37] Norri Kageki. "An Uncanny Mind". *IEEE Robotics and Automation Magazine* 19.2 (June 2012): 106-108, 112.
[38] John Burrows. "Never Say Always Again: Reflections on the Numbers Game". In: *Text and Genre in Reconstruction: Effects of Digitalization on Ideas, Behaviours, Products and Institutions*. Ed. Willard McCarty. Cambridge: Open Book Publishers, 2010, pp. 13-35.
[39] M. G. Kendall. "On the Future of Statistics". *Journal of the Royal Statistical Society* 105(2) 1942 69-91, p. 69.