CHAPTER 8

The Technological Imaginary in Education

Myth and Enlightenment in 'Personalized Learning'

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Enlightenment, understood in the widest sense as the advance of thought, has always aimed at liberating human beings from fear and installing them as masters.

Yet the wholly enlightened earth is radiant with triumphant calamity.

Horkheimer & Adorno, *Dialectic of enlightenment* (1947/2002: 1)

Introduction

From the printing press to personalized learning, new pedagogies and technologies, each in their time, have been configured in remarkably similar ways in educational discourse: they are seen as overcoming political compromises, human failings, even the 'dark' ways of the past; and they are regarded as ushering in

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a kind of pedagogical utopia of natural, authentic, even playful teaching and learning. This in turn gives *the present* a sense of urgency. *It*, in turn, is portrayed as a time when action, investment and change—often unprecedented in scope and scale—are all urgently needed. And just as the past is described in terms of its failings, brokenness and incompletion, the future is characterized by its totality, completion and finality. Consider a 2014 report of The Learning Analytics Workgroup: *A report on building the field of learning analytics for personalized learning at scale* (the 'LAW Report'). Early on, it accuses 'educational institutions (at national, state, district, institutional, departmental, and course levels)' of '"driving blind," with weak feedback loops to evaluate the impact of ongoing practices or changes that are implemented in their practices' (2014: 16). At the same time, however, it emphasizes that there 'are urgent and growing national and global needs for the development of human capital, research tools and strategies, and professional infrastructure in the field of learning analytics and education data mining' (2014: 17). It concludes these and other arguments by stating: 'The endgame [for these efforts] is personalized cyberlearning at scale for everyone on the planet for any knowledge domain' (2014: 17).

The personalized 'cyberlearning' technologies promoted in this report promise to customize instruction for individual learners using 'analytics'—the automated analysis of vast quantities of user data—much like Facebook and Google customize their feeds and results based on *their* users' histories and profiles. Such technologies are first seen as urgently needed to fix the outmoded management and practices of educational institutions at various levels. Elsewhere in the report, personalized learning technologies are portrayed as helping to meet the first of a handful of 'grand challenges' identified by the National Academy of Engineering (NAE 2020) as necessary 'to sustain and improve the human condition' (2020: 12): 'Given the diversity of individual preferences, and the complexity of each human brain', the NAE writes, 'developing teaching methods that optimize learning will require engineering solutions of the future' (NAE 2020: 45). Significantly, such 'teaching methods' are seen not as matters for teachers or even for education as a whole to address, but as a problem for engineering to 'solve'. And such engineering problems demand unprecedented action, as the Law Report has already emphasized. It continues: 'Failure to support this effort or delaying its initiation will [result in] losses to the intellectual diversity and value of our graduates to the workforce and society at large' (LAW 2014: 12).[1] The vision for the future that these technologies promise to fulfil, moreover, could not be any more total: their global availability to every man, woman and child, and for any topic that they might wish to learn.

Very similar hopes were held out for books and the printing press after Gutenberg's groundbreaking invention almost 500 years ago. Johann Amos Comenius (1592–1670), little known in the English-speaking world, but seen elsewhere as 'the father of modern education', sounded even more extreme than the LAW Report (if that is possible). First, Comenius emphasized that as a result of the Thirty Years' War (1618–1648), he had seen his 'country, her churches and schools all in ruins' (1668/1938, p. 4). But Comenius was overwhelmingly

optimistic, enormously inventive and influential (so much so that he was said to have been invited to be President of Harvard University[2]). Like many of his contemporaries, Comenius saw the book, recently made much cheaper and more plentiful by the printing press, as the paradigmatic technology for both knowledge and learning. In fact, he had an impressive plan to compose the *ultimate* book—one that would meet the 'grand challenges' of his own difficult time. This book would accomplish the ultimate goal for Comenius, expressed via the Latin phrase *omnes omnia docere*. This is the 'pansophist' (*pan*: all; *sophia*: knowledge) belief that *everyone* is to be taught *everything*:

> This book will be nothing else than a transcript duly arranged of the books of God, of Nature, of Scripture and of the Notions innate in the mind: so that whoever shall read and understand [it] shall at the same time read and understand himself, the nature of the world, and God. Accordingly, it will be a book of the most universal kind[,] setting forth for all men to see all things that are necessary for man for this life and the future life to know, to believe, to do and to hope … In effect, [this] book of Pansophia must be so full and complete that beyond its limits there can be nothing, and nothing can be conceived to be. (1668/1938: 148–149)

In Comenius' time, the world as a whole was generally understood in terms of real and metaphorical 'books'—books of God, of nature and of humankind (see e.g. Foucault 2005: 38–46). Comenius believed that the combination of these books into the ultimate tome would achieve nothing less than the advancement of 'the minds of men' from the 'darkness' of his own time into 'the light … into the one simple way of Eternal Truth' (1938: 4). Needless to say, however, Comenius never completed the fantastic volume he describes in the quote above—although he published a great many others.

The Dream of Education and the Technological Imaginary

Comenius, like the LAW Report after him, thus proposed nothing less than what contemporary educationist Christoph Wulf refers to as 'the dream of education'—'a vision of total educability and formation [which] reached its full development since the start of the modern era' (i.e. in Comenius' time). Wulf continues:

> Human self-empowerment and a growth in human autonomy [are] … the aims of the dream of education; education was first seen as a service to God; later it was to contribute to His effacement. This process was accompanied by an increase in rationality, modernization, and civilization … (2002: 270)

Despite the rationalization, modernization and relative secularization of the world since Comenius' time, the similarities between Comenius' dream of 'everyone learning everything' and contemporary aims to achieve 'personalized

cyberlearning at scale for everyone on the planet' are significant. From the printing press though correspondence education, to our age of the MOOC and personalized learning, the hope that education—via the latest advancements—can meet each and every learner's needs has been expressed in various ways by educators and technologists for centuries. As the examples of Comenius and the Law Report show, this idea was once rooted in a belief of a Christian God, but it has now been secularized through the technological and managerial jargon of 'cyberlearning', 'human capital' and 'feedback loops'.

As they gradually change and evolve, these patterns of thought and belief can be seen to form what has been called an educational and technological 'imaginary' (e.g. Punt 2000; Griffin 2002). This refers to a repertoire of images, visions and dream elements that are seen as a part of a general 'solution' to the 'problem' of education. The 'imaginary' in this sense has been defined as 'affectively laden patterns[,] images [or] forms, by means of which we experience the world, other people and ourselves' (Lennon 2015: 1). The failings of education—and their broader ramifications for the 'human condition'—are thus understood in the technological imaginary as something that can be concretely addressed, often as *engineering* problems to be *solved* 'at scale'.

At the same time, the imaginary is not just a set of privately held thoughts and beliefs; it is instead a common set of visions, values and meanings, shared either informally or tacitly, or in some cases 'crystallized' or solidified into symbols or slogans. And such visions and meanings, whether of an educational utopia, an institutional mission or a singular national character, can be said to form the basis on which these respective communities are unified—whether they be communities of Comenian 'pansophists', of personalized learning experts or of whole institutions or nations. Theorist Cornelius Castoriadis was the first to define the imaginary in this collective sense:

> Once created … imaginary social meanings … crystallize, or solidify, and that is what I call the *instituted social imaginary*. It provides continuity within society, the reproduction and repetition of the same forms, which henceforth regulate people's lives and persist there as long as no gradual historical change or massive new creation occurs, modifying them or radically replacing them by others. (2007: 73–74; emphasis in original)

Although these social imaginary meanings may achieve material form in a flag, or an inspiring slogan or image, in the case of the educational imaginary, they instead often appear and reappear in the form of what might be called idealized images, metaphors or 'primal' scenes that outline what we hope education could or should be. In this chapter, I trace one of these primal and utopian images and scenarios, I show how it has taken on a distinctively metaphorical function in the age of the computer—and how it ultimately has turned into a 'myth' that has become inseparable from utopian visions of a wholly enlightened world. In so doing, I show how mythological and utopian meanings in

Figure 8.1: Comenius' example of one-to-one dialogic teaching as simultaneously the primal and ideal scene of education.

Source: Wikimedia Commons.

the technological imaginary have regulated a great deal of activity in the area of educational innovation, giving it a kind of repetitive continuity that educational innovators generally see themselves as leaving behind.

The Primal Scene of Dialogue

Comenius, in one of his many books—in fact his most famous multi-century bestseller—opens with an illustration of one idealized image or scene that I will trace in this chapter (Figure 8.1). This shows a single master and a boy, and a *dialogue* taking place between them. The master says: 'Come boy! Learn to be wise!" The boy asks: 'What doth this mean, to be wise?' The master, gesturing and significantly positioned in line with the sun and its light, replies: 'To understand rightly, to do rightly, and to speak out rightly, all that are necessary [sic]' (1887: 1–2). Next, the boy asks' 'How?', and the master explains that he will guide the youth, showing and naming all things for him to see—to which the boy answers: 'See, here I am; lead me in the name of God.'

How does this relatively simple, if rather antiquated back-and-forth, represent a utopian scene, an ideal metaphor for education and pedagogical innovation? In what sense does this scenario serve as an ideal, a key reference point for innovation in teaching and learning? This is the case because it embodies an ideal or primal scene not simply for education, but for something even more basic in the human condition—*communication*. Philosopher of media and communication Sybille Krämer explains:

> Dialogue … [can be seen] as the primal scene and established norm of communication, and the goal of dialogue is understanding. Here

> communication is considered an interaction between people, which is dependent on mutual understanding with the help of symbols that convey meaning … Communication [in this sense] represents the basic process that enables coordinated action, which results in the formation of community. It is conceived as a *reciprocal* process of social interaction. (2015: 22, emphasis in the original)

Dialogue as a reciprocal exchange, as a back-and-forth that aims at mutual understanding, is hardly just an elusive ideal. It is something that we experience every day—and has manifest value in this context. Face-to-face communication is privileged and won at great cost for meetings in business, by professional societies (i.e. at conferences) and in school and university classrooms and lecture halls every day. Significantly for this chapter, dialogue or conversation as a kind of 'ideal' is also enshrined in Alan Turing's infamous 'Turing test', which defines artificial intelligence in terms of a computer's ability to successfully 'imitate' a human interlocutor in a kind of dialogue. Turing originally envisioned this dialogue as taking place through typewritten text, and proposed that if the person receiving such textual responses could not distinguish between those sent by a computer and a human, then the computer could be said to be *intelligent*. The implication with both Turing's test and our everyday desire to engage in face-to-face discussion is that such communication has a special authenticity; it serves as a kind of 'touchstone' in the human experience. Face-to-face communication is valued for arriving at a sense of shared reality and agreement; it is regarded as the best way to get at verifiable 'truth' and 'understanding'—especially *common* understanding. According to Krämer, such communication involves 'fostering agreement and creating a unified society whose goal is precisely to overcome distance and difference. When dialogical communication is successful', Krämer continues, 'those who communicate with one another in a sense become "one"' (2015: 22).

Building off this ultimate outcome, Krämer somewhat sardonically refers to this type of communication as 'erotic'—as ultimately aiming at the figurative coupling or unification of the two, the *dia* with the word *logos*. Krämer goes on to explain that this communicative ideal is embodied in the Western philosophical tradition by one person in particular: the 'gadfly' of Athens, the first moral philosopher, and the philosopher who (as Nietzsche points out), didn't *write*—Socrates.

> [F]or Socrates[,] speech is a kind of erotic encounter: it is specifically directed towards a particular individual recipient, and it attempts to establish an intellectual union: a shared insight, a common grasp of language and a reciprocal understanding thus constitute only the flipside of a mutual desire. This makes dialogue an intimate as well as a unique event. (2015: 70)

Figure 8.2: One-to-one tutorial learning *in situ* in Rousseau's *Emile*: 'Let's run fast! Astronomy is good for something.'

Source: Wikimedia Commons.

Socrates, of course, is famous for his dialogues, generally recorded by Plato, the most well-known of his students, and which number more than two dozen. Through his dialogical *method*, sometimes referred to as his *dialectic*, Socrates was able to stump the most confident of his interlocutors. He was also able to teach the most lowly or ignorant. He insisted on engaging with others through the spoken word, and reviled writing as 'inferior to speech', as a weak and

vulnerable 'bastard son' of knowledge. Socrates, however, was not only a philosopher who embodied the dialogical ideal of communication; through his dialogues he is also seen as being a great—if not *the* greatest—*teacher*. Second perhaps only to Jesus of Nazereth, it is Socrates who is regarded as being the paradigmatic educator of the West. His dialogues not only provide a valued philosophical method of questioning and reasoning; they also exemplify an explicitly 'dialogical' method of teaching, one which seeks to draw out the implicit reasoning of the student or interlocutor. Educators still seek to emulate it to this day (e.g. Birnbache 1999; Oyler & Romanelli 2014).

The primal and ideal scene both of communication and of teaching, the dialogue has been developed in many different ways since its emergence in ancient Athens and its reaffirmation in Comenius' time. It is famously revisited by Jean-Jacques Rousseau in the era of Romanticism and the Enlightenment. And it is Rousseau who perhaps did the most to 'modernize' this utopian image, to make it readily recognizable to us today. Rousseau accomplished this in his 1762 novel *Emile: or on education*. It shows how the young Emile learns, not in a classroom or through explicit instruction, but in the countryside by experiencing things of nature directly for himself, as they are relevant to his immediate desires and interests. In all of this, Emile is accompanied by Jean-Jacques, a patient and all-knowing tutor, based on Rousseau himself. The master is always ready for dialogue with Emile, and this often takes place in the most varied contexts—in his village, in the garden and, in one famous instance, in the woods. In the latter, Emile loses his way while walking in a forest with his master (Figure 8.2). As hunger starts to overtake him, Emile begins to cry. His tutor responds: 'Crying isn't what has to be done. What we have to do is find ourselves' (1979: 181). Jean-Jacques then reminds Emile of an earlier conversation on astronomy where they learned about the direction of shadows cast by the sun. They had also learned about the relative position of the forest vis-à-vis the town. Emile then works out the direction of the town, and catching sight of it, cries: 'There it is straight ahead of us in full view. Let's have lunch! Let's dine! Let's run fast! Astronomy is good for something' (1979: 181).

Rousseau's emphases here are not very different from those of today's experiential, discovery and authentic methods of teaching and learning. They are also reminiscent of contemporary constructivist or even 'gamified'[3] education: in all cases, the student learns in an authentic setting, through free exploration, based on what is of immediate interest to him or her. Constructivists would say that Emile is effectively constructing knowledge based on his personal experiences to solve authentic problems. Gamification advocates would approve of the immediate reward he receives for his success: a warm dinner. In this sense, Rousseau captures what today is still a utopian ideal of education—one that many teachers regard as most desirable for their students, and that technologists would like to see as the outcome of their research and designs.

The problem with this ideal, of course, is the fact that it is not, in contemporary terms, 'scalable'. Parents and educational systems generally cannot afford

to have a learned master with a single child, patiently waiting for the right moment to teach one lesson, and constantly adjusting to the child's mood, inclination and desires. Rousseau's vision was for an elite few—if it was intended for direct implementation at all. Others coming after Rousseau can be seen to have tried to address this challenge. Perhaps most famously in the first half of the 20th century, John Dewey advocated for the inclusive and democratic education of the masses. And he can be said to have done so specifically by expanding the idea of dialogue to encompass the whole classroom or school, which he believed should be manifest as 'a genuine form of active community life, instead of a place set apart to learn lessons' (1915: 11).

Educational Dialogue as Metaphor: The Advent of the Computer

Despite Dewey's enormous productivity and influence in the first half of the 20th century, the image of dialogue was to reappear with a vengeance only in the *second* half of this century. This happened specifically with the advent of the electronic computer. This new technology came to prominence mid-century with the Second World War, where computers had helped break secret codes and calculate the trajectories of rockets and other ballistics. At this time and in the decades that followed, computers took the form of 'mainframe' behemoths, filling entire rooms, accessed through one or more terminals. They were perceived in the general public as electro-mechanical 'giant brains', capable of incredible feats of mental power (see e.g. Edwards 1996: 158–165).

It didn't take very long for researchers to begin to imagine the educational potential of these giant brains. As one might expect, the very first visions of the computer's role in this context reflected the dominant instructional doctrine of the time. This was *behaviourism*, and its most prominent advocate was B. F. Skinner, who had been working on what he called 'teaching machines'. Before mainframe computers became readily available to researchers, Skinner (and other innovators) had developed complex tabulation-style machines with gears, pulleys, paper disks and 'ticker tape' that would ask students questions and would allow the student to progress only with the correct answer. Based on his theories of stimulus and response, Skinner hoped these machines could teach students the widest variety of school subjects—ultimately rendering most of teachers' instructional activities obsolete.

At a 1958 conference entitled 'The art and science of the automatic teaching of verbal and symbolic skills', however, Skinner and a range of other 'teaching machine' enthusiasts learned of a different and much more flexible 'machine' for teaching. They learned how an IBM computer had been used to 'simulate' the functions of the teaching machine and that it could simulate many other similar interactions. And it did all of this, moreover, without the many complex moving parts of a literal 'machine' (see e.g. Dear 2017: 22). This flexibility and

the wider perception of computers as giant brains soon led other researchers and developers to imagine these devices not as machines for teaching, but as teachers or tutors in their own right. The computer, researchers came to see, could take the place of Rousseau's responsive tutor, of Comenius' wise master, and of the patient but agile questioning of Socrates. This was clear from the names or acronyms they gave their projects—ones which could not have been any more primal or archetypal in their allusions. They borrowed the names of the great thinkers and teachers of ancient Greece, most prominently PLATO (standing for: Programmed Logic for Automatic Teaching Operation), Plato's own student, Aristotle (who in turn taught the military genius Alexander the Great) and, of course, SOCRATES (System for Organizing Content to Review And Teach Educational Subjects) himself. Through names like these, researchers and advocates can be said to have elevated the primal scenario of the patient tutor and the learner to the level of a dream for what was then high-technology education, and to have turned it into a potent *metaphor*. It no longer had to be a literal tutor or questioner: through the computer, the image of the educational dialogue was freed to be applied to the wisest range of experiences and procedures.

For example, in 1966, Stanford philosopher Patrick Suppes published an article in *Scientific American* entitled 'The uses of communication in education'. Suppes began by explaining that 'the truly revolutionary function of computers in education' lay 'in the novel area of computer assisted instruction' (1966: 1581). At this time, this involved ordering information and questions presented to the student through a type of branching 'teaching logic' (Bitzer, Lyman & Easley 1965: 1) in which either the student or the system would select various paths through a lesson (Figure 8.3). Material would be presented (e.g. using the electronic 'book' or slide selector in Figure 8.3) and questions asked and answered (using the 'electronic blackboard'). Different paths or options were made available for accelerated progress, moments of review and remediation, and more. Anticipating later visions of 'personalization' experts, Suppes emphasized that his vision of the function of computers in education was ultimately about the *individualization* of instruction:

> The single most powerful argument for computer-assisted instruction is an old one in education … individualized instruction … [I]ndividualized instruction became the core of an explicit body of doctrine at the end of the 19th century, although in practice it was known some 2,000 years earlier in ancient Greece … It is widely agreed that the more an educational curriculum can adapt in a unique fashion to individual learners—each of whom has his own characteristic initial ability, rate and even 'style' of learning—the better the chance is of providing the student with a successful learning experience. (Suppes 1966: 207–208)

Referring specifically to the great philosopher Aristotle and his tutoring of the young Alexander the Great, Suppes boldly predicted that 'in a few more years

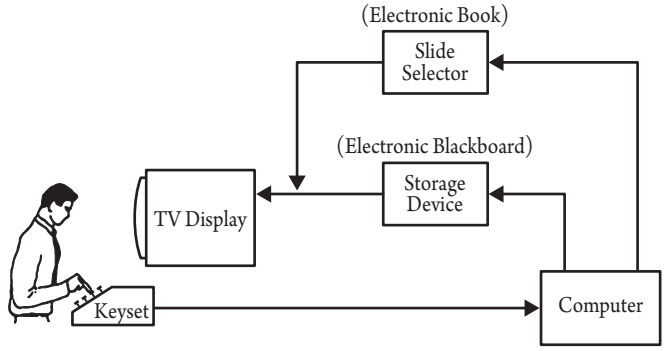

Figure 8.3: Individualized Instruction in PLATO in 1960.

Notes: 1960 diagram showing one user interacting or 'dialoguing' with the multi-user PLATO tutorial system: 'The rules governing the teaching process [are] referred to as a "teaching logic."' One of these was known as an 'inquiry logic' which 'permit[ted] dialogues between the student and the computer … To solve [the problems presented, the student] must request and organize appropriate information from the computer.' (Bitzer, Lyman & Easley 1965: 1–2).

Source: Author's reconstruction based on diagram provided in Dear (2017: 62).

millions of schoolchildren will have access to what Philip of Macedon's son Alexander enjoyed as a royal prerogative: the personal services of a tutor as well-informed and responsive as Aristotle' (1966: 207). Suppes' vision came to be crystallized or solidified in the phrase an 'Aristotle for every Alexander', and—given Alexander's remarkable military successes—this phrase is one that has had particular longevity in discourses of military training. For example, a 2011 article on the ADL (Advanced Distributed Learning, an ongoing international research and development project led by the US military) speaks glowingly of the possibility of 'an Aristotle for every' warfighting 'Alexander'. The article also envisions this technology 'evolving to a future, envisioned by researchers in the 1960s … [in which l]earners and the computer in this future will engage in dialogues not unlike those used for the first 100,000 years or so of human existence' (Fletcher 2011: 152). Here, again, the primal and ideal scenario of an intimate interaction, a mutual interchange between two individuals—whether literal or metaphorical—serves as the basis for imagining the potential of high tech for education.

PLATO, a multi-decade project starting in 1960 and reaching to the mid-1980s, was the largest and most successful of these 'visions' for the use of the mainframe technology in education. The way that PLATO was conceptualized and promoted closely fits the pattern set by Comenius in the 17th century and that reappears in our own time in discussions of personalized learning. Daniel Alpert and Donald Bitzer, who founded the project in 1960, wrote in *Science* that there

> … are growing demands for more mass education over a larger fraction of the human life-span, and demands for more individualized instruction tailored to the specific preparation and motivation of a given student. However, these expanding educational needs have not been matched by increases in the productivity of the educational process. Rather, the costs per student at all levels and in various types of institutions have been rising so rapidly as to cause serious concern for the future. (1970: 1582)

For Alpert and Bitzer, as for Comenius and later, the Law Report, the recent past represents a time of need—a time when the solutions envisioned for the future were either impossible or prohibitively expensive. Contemporary technological developments, in this case, computer-aided instruction, was seen to offer an opportunity to rectify this: 'Computer-based education absorbs the attention and encourages the total involvement of students at all age and grade levels. Its interactive nature has captured the enthusiasm of students and teachers', Alpert and Bitzer boast (1970: 1581). The future, moreover, offers even greater possibilities for education, culminating in a technologically enabled utopia of large-scale individualized tutoring and learning, as Bitzer confidently predicted in 1975: 'My forecast, based on our present plans, calls for, by 1980–1985, a million-terminal network, consisting of two hundred fifty central processing systems all tied together [and] communicating with each other' (as quoted in Dear 2017: 401). Needless to say, Bitzer's ambitious vision of a networked million-user educational utopia was not to be. By the time the 1980s arrived, it was the *microcomputer* rather than the mainframe that was capturing the imagination and enthusiasm of educational technologists and the general public (e.g. Papert 1986). The attention of the educational technology field and its funders and educational technology projects and funding followed suit.

SOCRATES, finally, is a short-lived project that was developed as an alternative to the then-dominant PLATO model. As Brian Dear writes in his history of the PLATO system, the use of the name 'Socrates' for this competitor was very deliberate: 'a more blunt statement about PLATO is hard to imagine: in ancient Greece, Socrates was Plato's "*teacher*"' (2017, p. 112, emphasis added). 'The developer of SOCRATES, Larry Stolurow, developed SOCRATES as a result of the frustrations [he] had with PLATO' (Dear 2017: 112, see also 113–115). Despite Stolurow's own substantial plans for the project, the very ambition and complexity of its technological and pedagogical designs brought it to a relatively rapid end.

Tutorial Dialogue and the '2-Sigma Experience'

Common to all of the projects and predictions described up to this point are visions of legendary, and in a sense, mythological teachers and their teaching, of the primal educational power of dialogue and the ability of the computer to

simulate or mimic these. In the context of these efforts, 'repetition and continuity', to borrow Castoriadus' terms, are not only evident over the decades, but one could say, also over the centuries and millennia that connect them with the cultural and historical 'mythology' of Socrates, Plato, Aristotle or Alexander the Great. And despite the ambitions of figures like Suppes, Bitzer and Stolurow to envision a radically different future based on the latest technologies, age-old continuities still can be shown to 'regulate [these] peoples' lives' and thinking, as Castoriadis put it (2007: 96). The computer is envisioned in these cases, for example, neither as an environment for programming or 'computational thinking', nor primarily as one for communication or social learning (as John Dewey might have preferred). Instead of these and myriad other possibilities being brought to the fore, it is the age-old scenario of tutorial dialogue that can be said to capture and even confine the understanding of the computer's potential in education among these technological innovators.

However, as Castoriadis also observes, these 'repetitions and continuities' may 'persist … as long as no gradual historical change … modif[ies] them' (pp. 73–74). One gradual and slight modification in the metaphors or vocabulary of the technological imaginary of education is indeed important. It can be said to date back to an article published by Benjamin Bloom (of Bloom's taxonomy) in 1984. Here, Bloom compares the findings of two dissertation studies undertaken by his own students. Both of these studies compared three different 'conditions of instruction': the 'conventional' classroom, 'mastery learning' (in which formative assessment is combined with conventional conditions) and, finally and most importantly, individual or small-group 'tutoring'. In this last context, students 'learn the subject matter with a good tutor for each student … [giving] feedback-corrective procedures and parallel formative tests' (Bloom 1984: 4). As might be expected, the results for tutoring appeared to be notably better than what 'conventional' conditions of instruction were able to produce. In fact, these results were '2 Sigma' or two standard deviations higher than the alternatives. Although the rigor of the dissertations cited by Bloom and the validity and relevance of his 'two sigma' finding are now widely questioned,[4] Bloom characterized his finding as being of the greatest imaginable importance:

> The tutoring process demonstrates that *most* of the students do have the potential to reach this high level of learning [i.e. two standard deviations better than conventional achievement]. If the research on [this] problem yields *practical methods* … it would be an educational contribution of the greatest magnitude. It would change popular notions about human potential and would have significant effects on what the schools can and should do with the educational years each society requires of its young people. (Bloom 1984: 4, emphases in original)

Bloom himself did not speculate on exactly what kind of 'practical methods' could be used to address this grand research challenge. However, it did not take educational technologists long to see how new tutorial programs and related

technological innovations could provide the kind of instructional methods Bloom was calling for. Thousands of publications have cited Bloom's article since it first appeared. But it is especially in recent years that Bloom's expansive declarations have been come to play a pivotal role in the discourse supporting the implementation of personalized learning.

One notable example is an article from the McKinsey Institute, which presents a strikingly revisionist history of the role of Bloom's famous article in the study of individualized or personalized learning:

> Research into personalized learning first emerged in 1984 when the educational psychologist Benjamin Bloom challenged the academic community to replicate, at scale, the effectiveness of one-to-one or small-group tutoring. As technology has become more effective and less costly, Bloom's ideal seems, for the first time, attainable for all students. (Rawson, Sarakatsannis & Scott 2016: n.p.)

Although it is clear that attention to 'personalized' learning in any generic sense began long before 1984, Bloom's findings now have a foundational, paradigmatic role in discourses of personalized learning. Facebook's 'Chan-Zuckerberg Initiative' (CZI), for example, is spending hundreds of millions of dollars to adapt their social media platform to personalized learning. In this effort, their spokespersons have referred regularly to Bloom's challenge as the two sigma 'benefit', the two sigma 'opportunity' or even the two sigma 'experience': 'How do we create these kind of [two sigma or tutorial] learning experiences and these kind of learning environments at a scale, at a cost we can afford?' as one CZI advocate recently asked. 'The core question of personalized learning' in this case, is simply 'how to scale that kind of two sigma benefit' (as quoted in Vander Ark 2017 n.p.). Here, the ideal, the dream of the effective tutorial dialogue, has been effectively 'solidified' or 'crystallized' in the form of a phrase that has been stripped of any cultural-historical specificity, but which is buttressed by its association with Bloom and by an aura of statistical and scientific certainty. Indeed, there is even one initiative that has taken on this crystallization as its own name. It is called '2 Sigma Education', and it seeks to achieve 'a high level of one-on-one instruction—without additional staff'—for example, through the use of 'proven, personalized learning software [and] real-time tracking of student progress' (Hebrew Academy 2018).

Conclusion: Myth and Enlightenment

The repetition and variation of the ideal situation of the one-to-one communication of tutor and student, of a dialogue between a learner and a wise master, has thus appeared and reappeared for millennia in the imagination of educational reformers and innovators. Socrates refused to use writing and instead

insisted on engaging with others more directly in his dialogues. His method was recorded by Plato, and has been studied and emulated over centuries of Western history—with teachers today still regarding it as important and valuable. Over time, this dialogic scenario has come to take the form of a kind of ideal case, a utopian image, a ready point of reference for thinking about what education could or should be like. Through the simple act of its repetition, one could say it has come to be surrounded by an aura of reverence and even mystique.

Experience readily confirms that face-to-face communication, as mentioned above, is indeed the way in which we arrive at agreement, unite in common understanding and get at 'truth' that can be verified and shared. Perhaps Sybille Krämer's idea that there is something 'erotic'—a desire for direct and embodied presence—associated with this communication is in some senses not so far off. The paradigmatic and ubiquitous phenomenon of conversational communication has been widely studied, both in education and elsewhere. It has been studied in classrooms, in everyday life, in terms of the pragmatics of information transmission and dialogue simulation, even in philosophical (e.g. Peters 2001) and theological (e.g. Buber 1971) terms. In high-tech settings, specifically in the form of the Turing Test, one-to-one dialogue has even been privileged as the ultimate way to judge whether a computer can be said to be 'intelligent'. But no one approach has explained what happens in dialogue in terms that are entirely quantifiable, or in the form of a predictive or generative theory that stands as any kind of 'final word' on the matter. Dialogue, in other words, cannot be reduced to the requirements and use-cases of engineering nor the certainties and probabilistic measurements of the natural sciences. Yet, we engage in it every day. Dialogue, in short, is a ubiquitous yet irreducible experience.

Given its character as something common yet nebulous, something primal but also potentially high tech, dialogue—at least in the imaginary of educational technology—can be said to have taken on the character of a *myth*: myth, after all, is defined as 'a usually traditional story of ostensibly historical events that serves to unfold part of the world view of a people or explain a practice, belief, or natural phenomenon' (Merriam Webster). Except that in this case, the traditional story of dialogue at the centre of human evolution and Western culture is used not to explain a belief or natural phenomenon, but to justify efforts in the ongoing reform and development in education. It has become part of the 'world view' of successive generations of educational and high-tech innovators and promoters. As Hans Blumenberg (1985) has explained, myths of this kind are based on 'fundamental patterns'—in this case, those of the everyday experience of conversation—underlying 'human existence'. This pattern, Blumenberg says, is

> … simply so sharply defined [*prägnant*], so valid, so binding, so gripping in every sense, that they convince us again and again. [Even further, they] still present themselves as the most useful material for any search

> for how matters stand, on a basic level, with human existence. (1985: 151–152)

This particular understanding of myth is rather different from the 'myths of e-learning' that I and others have identified in the form of incorrect or unproven assertions about technology and learning (e.g. the myth of learning styles or of the millennial learner; see Friesen 2008). Instead, this conception of myth is inextricably intertwined with *enlightenment*—at least when the latter is 'understood in the widest sense as the advance of thought', as Horkheimer and Adorno describe it (1947/2002: 1). Myth in this sense can be said to underpin and legitimize the most scientific, high-tech and in this sense 'enlightened' projects and visions. Defined in this way, enlightenment does not 'dispel myths' or 'overthrow fantasy with knowledge' (ibid.: 1). Instead, enlightenment in these cases turns back on itself in a sense, developing and refining its own mythology to explain and justify what lies beyond that which can be scientifically or technically specified, predicted or modelled. 'Myth', as Adorno and Horkheimer further explain, 'is already enlightenment, and enlightenment reverts to mythology' (ibid.: xviii). Ultimately, they conclude, 'the myths which fell victim to the Enlightenment were themselves its products' (ibid.: 5).

Enlightenment, in other words, which was at first seen as an antidote to mythology and superstition, falls under the spell of 'myths' that it has itself generated, and that for many have become indistinguishable from it. This chapter has shown how this can be understood in the context of dreams of 'dialogue' as a paradigm for education—whether it is explicitly supported by 'high tech' or not. This can also be said to be found in the consumerist 'mythology' surrounding new iPhone releases, or the fascination in educational technology with devices and possibilities 'just around the corner' (e.g. in the form of annual 'Horizon Reports'). High science and high tech, in short, become weavers of myth as much as any Ovid or Homer.

This brings this chapter back to Christoph Wulf's 'vision of total educability and formation' as the modern 'dream of education'. We can now say with Wulf that this dream, this vision or mythology, constitutes a reality that still 'swirls about the realities of life and education. This dream', as Wulf continues, 'supplements reality, corrects it, satisfies its unfulfilled desires' (2002: 278). Going further, he describes this dream as 'penetrat[ing] reality, evad[ing] it, transcend[ing] it; it designs [both] contrafactual modifications and alternatives' (ibid.: 278). Both Wulf and before him, Adorno and Horkheimer, were pointing to a dark secret behind any Enlightenment project—whether it be one of 'total educability' or of 'personalized learning at scale'. As in the case of the latest iPhone or the dream of a fully 'artificial' intelligence, such visions can never be realized in their final or ultimate totality. There is always a better product eventually to be released, or a different human capability to be imitated. In actuality, the total realization of any utopian technological (or other) vision

would only mean radiant and triumphant calamity. Indeed, for education or any other aspect of social activity to fall so completely under the dominance of a total vision of social and technical engineering would be 'totalitarian' in and of itself—at least as Adorno and Horkheimer see it. But this can be said in some ways to only make the utopian beauty of such educational visions all the more fascinating and seductive. Nonetheless, as Wulf emphasizes, there remains a 'permanent gap between [such] dreams and their realization'. And this is precisely 'what saves both the dream and the reality [it] distort[s]'. 'Were this gap to collapse, were dreams and their realizations to coincide', Wulf warns, 'they would implode, and cause perhaps the end of education altogether' (2002: 275).

Notes

[1] Other researchers speak of 'the learning analytics imperative and the policy challenge[s]' it presents (MacFayden et al. 2014). While these grand statements come from a few years ago, they can be seen as introducing and framing ambitious research work that has been proliferating since 2014; e.g. Bakhshinategh, Zaiane & Elatia 2018; Liebowitz 2018.

[2] According to Cotton Mather: see Comenius, Bardeen & Hoole 1887: ii.

[3] 'Gamification' refers to the 'use of game design elements in non-game contexts' (Deterding et al. 2011: 2), for example, turning a lesson on a historical event into a kind of 'detective' activity to find clues about what happened.

[4] See e.g. Van Lehn's (2011) meta-analysis which showed the improvement produced by tutoring to be less than one sigma. See also Barnum (2018), 'Why "personalized learning" advocates like Mark Zuckerberg keep citing a 1984 study—and why it might not say much about schools today.'

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