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Technology, Teaching, and the Many Distances of Distance Learning

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Abstract

The "distance" in "distance learning", however it is defined, normally refers to a gap between a learner and their teacher(s), typically in a formal context. In this paper I take a slightly different view. The paper begins with an argument that teaching is fundamentally a technological process. It is, though, a vastly complex, massively distributed technology in which the most important parts are enacted idiosyncratically by vast numbers of people, both present and distant in time and space, who not only use technologies but also participate creatively in their enactment. Through the techniques we use we are co-participants in not just technologies but the learning of ourselves and others, and hence in the collective intelligence of those around us and, ultimately, that of our species. We are all teachers. There is therefore not one distance between learner and teacher in any act of deliberate learning—but many. I go on to speculate on alternative ways of understanding distance in terms of the physical, temporal, structural, agency, social, emotional, cognitive, cultural, pedagogical, and technological gaps that may exist between learners and their many teachers. And I conclude with some broad suggestions about ways to reduce these many distances.

Keywords: distance learning; technology; technique; teaching; technological distance; distributed cognition

Introduction

In these pages I will argue that all intentional learning, and most that is unintentional, is the result of a complex, creative, human web of technology in which all of us participate; that we, the technologies we use, and the technologies we create are co-participants in a rich, ever-unfolding tapestry that shapes who we are, how we think, and how we act in the world; and that almost all that we learn consequently occurs as a result of a myriad of technologically entangled teachers. This means that *all* learning is at a wide range of distances from a vast, interconnected web of teachers, any of whom may play a pivotal role in its success. Therefore, the concept of "distance learning" as a description of a single gap between a learner and a teacher is insufficient to characterise how it occurs. I will describe some of the consequences of this perspective, discussing alternative dimensions of distance and what that means for those whose job is to teach. But first, to understand the technological nature of teaching we must understand the nature of technology.

The technological nature of education

Tech (especially digital tech) tends to get the limelight when we speak of technologies in education, but Kelly (Kelly, 2010, loc. 209) observes that poetry, dance, paintings, and literature are as much technologies as are computers and software, and there are as many technologies of prayer as there are technologies of steam (Franklin, 1999). Technologies do not have to be

physically instantiated. Some technologies, such as mental arithmetic or meditation, can occur entirely within the private confines of a single human mind: they are cognitive gadgets (Heyes, 2018) that are not just the grist (the stuff we remember) but also the mill (how we organise and make use of that stuff). Language is a technology too (Changizi, 2013; Kelly, 2010; Rheingold, 2012; Ridley, 2010; Wilson, 2012). Kelly (2010 loc. 659–660) describes technology as "not a thing but a verb", although it is both. Some technologies are things that we do (writing, say), others are things that have been done (again, writing). While many dictionaries call it the application of science, most technologies ever created have used nothing even approximating scientific theory, methods, or findings; for example, archetypes such as steam engines (Mumford, 1934, p. 215) and bows and arrows (Derex et al., 2019). It is more accurate to describe science—at least in its methods, tools, and theories—as kinds of technology (Arthur, 2009, locs. 943–946; Ridley, 2015, loc. 2207). W. Brian Arthur's "the orchestration of phenomena to our use" (Arthur, 2009, loc. 51), provides a definition that makes sense of this complexity, and that is both discriminating and exhaustive. It captures both the "noun" and "verb" aspects of technology, encompasses both its physical and its non-physical manifestations, and it accommodates both the application of science (phenomena discovered by scientific methods) and technologies of faith or art, with equal ease. Phenomena may be things that happen, things that exist, causal chains, things we believe, things we imagine, ideas, capabilities and so on. In simpler terms, *technology is the organisation of stuff to do stuff*. Any stuff.

Almost all technologies are assemblies that are built from and contain other technologies (Arthur, 2009): the stuff that is organised to do stuff usually includes other stuff that is organised to do stuff. For example, this paper (a technology) contains words, rules of grammar, letters, APA citations and so on, that are themselves part of a massive web of interconnected technologies. Most technologies solve problems, and technologies that form part of an assembly are often counter-technologies (Dubos, 1969) to others in that assembly that cause the problems they must solve. For example, terms/semesters, timetables, lecture theatres, campuses, grades, mandatory attendance, plagiarism detection systems, and many other widespread features of educational systems are counter-technologies designed to deal with problems initially created by the invention of lectures (Dron, 2016). And many of our most cherished methods of formal teaching are counter-technologies to the problems *those* counter-technologies have caused, such as students whose intrinsic motivation is undermined by them.

Anderson (2009) characterises the relationship between pedagogies and technologies as a dance, while Fawns (2022) thinks of them as parts of an entangled, complex whole. However, methods of teaching (pedagogies), as well as the theories and principles that inform them, are technologies, too. We orchestrate tools, words, actions, structures, principles, and methods, combined with beliefs about how people learn, to bring about learning. Pedagogies are only ever components of an assembly, not standalone technologies, and they never come first. There must be other technologies available to be used as part of a teaching method before that method makes any sense at all and, at least in a formal context, many other technological phenomena, from curricula to timetables to programme regulations, need to be accommodated in advance.

It is easy but mistaken to focus on the most visible parts of the assembly that are technologies in their own right and to treat them as a synecdoche for the whole. It makes little more sense to make claims about, say, the educational value of computers in the classroom than it does to make claims about the educational value of their power supplies. It is not computers that make a difference but how they are used, and that use is *itself* a technology: a set of methods, practices, and ways of assembling them with other stuff, including pedagogies. The computer provides only some of the many situated phenomena that are orchestrated for any particular learning context. The same is true of *all* the technologies that can be used for learning, including pedagogies. Although the parts may be critical to the success of the whole, what matters is the whole, not the parts. There are virtually no technologies that, assembled with others, cannot

make a positive contribution to learning, and virtually none that cannot make a weak or even a negative contribution, including widely praised constructivist pedagogies (e.g., Andrews et al., 2011; Clark, 1982; Lassnigg, 2017). In fact, because they require greater skill and because simple logic dictates that most teachers probably have average or below average skills, constructivist approaches tend, on average, to be *less* successful—by most measures—than those based on well-designed, well-tested, and more prescriptive methods such as direct instruction (De Bruyckere et al., 2015; Hattie, 2013). This is because the roles teachers play in their enactment (not so much as users but as *participants*) may be performed more or less well. The more technique that is required of a teacher, the more their individual skill matters.

"Technique", like "technology" has multiple contested meanings, but I use the term here to simply mean the stuff people do with the stuff that has been done. Techniques are technologies that are enacted by people. Techniques may be *hard*, repeatable methods of doing something: a technique for building houses, a technique for multiplication, and so on. It is possible to perform a hard technique of this nature correctly or incorrectly. Potential variance from the ideal is, though, implicit in the term. We rarely use the word "technique" when describing how to select items from an application's menu bar because there is one and only one way of doing it. To call something a technique typically implies that it can be achieved *well* or less well. *Soft* techniques are the idiosyncratic, personal, and almost never-repeating ways that an individual may participate in a technology. Soft technique is what makes my style of writing different from yours, and one teacher's use of a pedagogy unlike that of any other. There are typically no standards of correctness against which soft technique can be measured. Although we may recognise better and worse teaching, we cannot ever say it is the best or worst it can be. Soft techniques fill gaps left by those that are harder. The more gaps there are to fill, the more our skill and creativity matter, and the more idiosyncratic the results will be, for better or worse. Poor hard technique with great soft technique may therefore result in excellence: a three-chord blues song with fluffed notes, say, may move us as much as a perfectly performed symphony. Conversely, great hard technique but poor soft technique may not guarantee it. A teacher who applies a well-proven pedagogical method precisely, but without feeling or adaptation to learner needs, may fail to support learning as effectively as one who uses poor hard technique objectively, but who fills the gaps with creativity and passion. This is at least part of the reason why there is very little difference between the efficacy of fully certified teachers who have undertaken a lengthy course of study and those who have received provisional certification after a day or two of training (Goldhaber, 2002; Goldhaber & Brewer, 1999). However, while there are few innate benefits to be gained from using *more* or *better* hard techniques (or, indeed, more or better technologies in general) each new hard technique we learn opens up new adjacent possible empty niches or, more succinctly, adjacent possibles (Kauffman, 2019) that afford new opportunities to do more, new gaps to fill. For any technology there is no predictable limit to what we can add, or assemble it with, to create something new. Even for something as simple as a screwdriver, the possible uses—from murder weapon to back scratcher—and consequently the number of possible forms of our own participation, are unprestatable and indefinitely large (Kauffman, 2019). The same is true of pedagogical methods and the vast array of technologies that they may be organised with.

All of us organise stuff to learn, not just those designated as teachers. Learners are always the most significant organisers of stuff, including stuff organised by a designated teacher to help them to learn, but this is just the very tip of a huge iceberg. Other teachers may include other learners; textbook authors, editors, and illustrators; designers of classrooms; creators of curricula; software designers; learning designers; makers of college regulations; librarians and so on. But this, too, only scrapes the surface. Architecture, for example, teaches. The opportunities campuses afford to see others learning, to talk in corridors and common rooms, to facilitate interaction, and so on, may be integral to the effectiveness of in-person institutions. As a result,

poor formal teaching or even a total absence of it can (if other teaching technologies like curricula, timetables, textbooks, classrooms, and dialogue with other students are available) sometimes lead to exceptional learning outcomes (Dron, 2023). The internet, too, is awash with teachers, intentional and otherwise, from creators of tutorial sites and videos to Q&A forums like StackExchange or Quora. Almost all the environments and technologies in which we participate teach. Technologies are not just means to the direct ends to which they are put; they are embodiments of the thinking that went into them and, through our participation, they become part of our own cognition. Johnson (2012, loc. 149), for instance, describes how the near-miraculous avoidance of a major plane disaster was not just the result of the skill of the pilot but "a kind of duet between a single human being at the helm of the aircraft and the embedded knowledge of the thousands of human beings that had collaborated over the years to build the Airbus A320's fly-by-wire technology". This is equally true of what we internalise in our individual minds. Almost all of what we know, we know from others, and much of it is technological in character: words, methods, theories, techniques and so on. We are part-technology as much as, through our participation, technologies are part-us. And technologies are as much part of our hearts and souls as they are of our minds. Most of the soft roles we play when participating in any technology, from cooking to writing a love letter, are part of what makes our lives richer and more connected with others. Technologies participate in our distributed cognition (Gibson, 1977), and they are co-participants in the collective intelligence of which we are a part. They are the things that make us smart (Norman, 1993): their smartness is, in a meaningful sense, part of our own. For Clark (2008), technologies are not just enablers but physical extensions of our minds. In sharing our technologies, we literally share our minds with others. It is in this sharing that we learn not just skills and facts, but how to be human. No one is an autodidact. Our teachers include innumerable named and nameless souls stretching back into the indefinite past. In any act of intentional learning, and most that are unintended—we are co-participants, part of a massively distributed, technology-mediated gestalt teacher with countless others, stretching back in an unbroken line to the dawn of recorded history and beyond. This means that virtually all learning is, in part, at a wide range of distances from those who taught us.

Distance learning

The concept of distance learning has until now usually been used to characterise a gap (however it is measured) between teachers and students. By acknowledging the many co-participants in any intentional learning experience, including the technologies they produce, we can stop thinking about *whether* learning is at a distance from teachers or not, and think instead about *how* distance is distributed, *which* teachers matter most, and dimensions of distance that might matter. We might, for example, consider some or all of the following overlapping, mutually affective, but distinct kinds of distance. (Bear in mind that there are almost always multiple distances between the multiple teachers involved in most learning journeys.)

- **Physical distance**: There is usually greater salience to interactions with those to whom we are physically close. Closeness allows us to use different and (generally speaking) more flexible technologies than those available to learners who are not co-present, and for a broader range of phenomena to be orchestrated. It provides relatedness, one of the three central pillars of intrinsic motivation (Ryan & Deci, 2017), for free, albeit that support for the other two needs, autonomy and competence, may (without great effort) be significantly curtailed (Dron, 2016) and so demand counter-technologies such as active learning approaches or ways of personalising learning to bring about successful learning. Simply sharing a physical environment with others requires accommodation—using technologies such as turn-taking, hand-raising, and organised seating. It allows social phenomena that are part of our genetic heritage to be part of the assembly, from pheromones to hugs. It allows us to use the act of travelling to and from a location, and

the commitment that entails. To a large extent, physical proximity to teachers matters only in this one special case of in-person learning. Otherwise, it usually makes little difference whether the learner and their many teachers are separated by one kilometre or thousands.

- **Temporal distance**: Arguably more important than physical distance, a large amount of what we intentionally learn is through stuff that was created by someone in the past. Greater temporal distance makes direct communication with the creator more punctuated, and sometimes (for instance when they are dead, or when they are us at a previous time) impossible. Temporal distance also relates to pacing. Individuals may benefit from asynchronous time to reflect between posts or wait in frustration for support from others. Synchronous discussion may be less reflective but may support some kinds of bonding more effectively (Haythornthwaite et al., 2000), and may support pedagogically useful phenomena like interpersonal entrainment (Liam et al., 2019) that would be impossible asynchronously.
- **Structural distance**: The technologies for learning may be organised in ways that materially impact learning, including role/organisational hierarchies, classroom layouts, the organisation of online systems, relationships between elements of a system, and so on. Brand (2018) notes that all stable systems are pace-layered, with larger and slower changing elements having the greatest structural influence, while smaller and faster changing elements fit into their contours, only rarely having more than small, incremental effects overall. Each layer may be thought of as structurally distant from the next. This is as true of the technologies of learning (and, indeed, all technologies) as it is of ecosystems and civilisations, from the effects of classrooms or learning management systems on how learning happens within them, to the effects of legislation on institutions. Often, the effects of larger, slower, structurally more distant elements on the smaller, faster changing elements (students, say) in an institutional system play a very large role in determining how learning happens, from the imposition of forms of assessment to specifications for course length or even pedagogical method. Structural distance to a teacher may be traversable, while structural distance to a governing body rarely will be.
- **Agency (or empowerment) distance**: Agency is the ability for a learner to control their own learning trajectory. Agency distance acts as a rough corollary to Anderson's (2016) concept of agency presence. Conventionally, it might be seen as relating to the learner's independence to learn, or their autonomy but, as we have seen, no one is a truly autonomous or independent learner. However, a learner may be more or less *dependent,* thanks to the imposition of hard rules and norms reducing their agency, thus increasing agency distance. There are, though, many other aspects of the process that that can reduce learners' agency, from inadequate prior knowledge to weaknesses in pedagogical practices. Having agency is not just a question of having choice: in fact, too many choices can be overwhelming, to the point of being at least as bad as having no choice at all (Schwartz, 2004). To be in control, simply having choices is not enough. We need the capacity to make *informed* choices and the *power* to act on them (Garrison & Baynton, 1987). If not, we need the power to *delegate* control to someone with more knowledge or skill, and to take that control back again when it is no longer needed (Dron, 2007). Agency distance shares much in common with Moore's (1997) concept of transactional distance. While transactional distance speaks in part to the psychological gulf between a learner and a teacher, its communication gulf is primarily concerned with the extent to which a teacher controls the learning trajectory (Moore calls this "structure") or the learner is in control (Moore calls this "autonomy"), with what Moore calls "dialogue" allowing negotiation of control (Dron, 2007).

- **Cultural distance**: Culture is, to a large extent, defined and enabled by the technologies that it employs. Franklin (1999) sees the two as virtually synonymous. However, culture is also concerned with shared values, albeit that all technologies embed or express values, as they are enacted and as they intertwine with our lives and our societies (Bijker, 2005). We are all parts of very many overlapping cultures, from families to Mac users to religions to nations, all of which have unique knowledge, norms, and, more often than not, vocabularies that are only meaningful to those within them. Becoming part of a culture is, to a large extent, concerned with adopting the methods, practices, tools, and hard techniques associated with it, from specialised language to rituals or citation practices (Dron, 2019). The more that these technologies and values diverge from our own, the greater the cultural distance, and thus the more difficult it will be to learn.
- **Social distance**: Among the most important phenomena orchestrated in a teaching context are those of relatedness. Social distance is concerned with how close we may feel to those from and with whom we learn, as well as with identity and belonging. Social distance may significantly affect our motivation to learn (Ryan & Deci, 2017) and there are strong arguments to be made that all learning is essentially social in nature (Bandura, 1977). Although interaction with others is most significant in determining social distance, this is not *just* to do with whether we engage directly with them. For example, we may identify with celebrities, religious icons, or thought leaders even though we may not know them personally and even though we may not expect a reaction from them. Indeed, we may feel empathy with authors and creators of artefacts who are long dead. Similarly, even in entirely static texts or videos, skilled soft technique can draw us into what Holmberg (2020) describes as "guided didactic conversation", even if a teacher is not present. Social distance has a rough corollary in the concept of social presence (Rourke et al., 1999) in the Community of Inquiry framework. It also relates closely to the psychological gulf that accompanies the dynamics of transactional distance (Moore, 1997). The technologies we employ, and the soft techniques we add to the assembly, can make a significant difference to social distance.
- **Emotional distance**: This is concerned with the extent to which we are moved by what and how we are learning, our desire to learn it, the frame of mind with which we go into it, and how we share our emotions with or perceive the emotions of others contributing to the process. This has a rough corollary in the concept of emotional presence (Cleveland-Innes & Campbell, 2012). Emotional distance is often highly influenced by the passion that is expressed through the soft technique(s) of the teachers involved in the process: poor soft technique can lead to indifference, while passion in a teacher (including writers of books, other learners, and so on) can arouse our own.
- **Cognitive distance**: This is concerned with whether we have the foundational knowledge and cognitive tools (mainly technological in character) to make what we intend to learn part of our adjacent possible. It is, on the one hand, concerned with whether we have developed the hard techniques that are internal to our own minds and bodies that are needed as part of the assembly and, on the other, the knowledge on which they rely. If the level of challenge is too high or too low, the effects could be worse than simple failure to learn: intrinsic motivation may suffer (Ryan & Deci, 2017), reducing the chances we will ever do so. Cognitive distance is also concerned with the extent to which the cognitive processes of the many teachers who might be involved in a learning event (including the learners) are revealed to the individual learner, whether directly, through interaction, or through reflection. Cognitive distance, in this sense, has a rough corollary in the concept of cognitive presence (Garrison et al., 2001).
- **Pedagogical distance**: This relates to the methods of teaching (pedagogies) employed by all contributors to the process. In a classroom, in which a designated teacher orchestrates many of the phenomena, pedagogical distance to the teacher may be very low while, for independent learners without direct guidance or those told by the teacher to solve

> problems for themselves, it may be quite high. The greater the pedagogical distance, the more that depends on learners' own pedagogies or those of others (such as writers of Wikipedia articles) to whom they turn. Pedagogical distance has a rough corollary in the concept of teaching presence (Anderson et al., 2001).

Different measures of distance may matter in different ways to different learners in different contexts, and there are many overlaps and dependencies between them. For example, a higher social or cognitive distance may lead to a greater emotional distance, while greater cognitive distance may increase agency distance. Sometimes, greater distance in one dimension can be compensated for by less distance in another, as predicted by Anderson's interaction equivalence theorem (Miyazoe & Anderson, 2010).

Technological distance

All of these distances could be reframed, directly or indirectly, as different kinds of *technological* distance. By this I mean the technological gap between what the phenomena (including all the technologies in the assembly) afford, and what the complete assembly requires for learning to succeed. This includes hard or soft technique as well as any other technologies and phenomena that may need to be assembled to bring about learning. While three of the distances I describe above (pedagogical, cognitive, and cultural) are explicit examples of technological distance, the rest depend on and entail technologies, from language or ritual to carpentry or the internet, to reduce distance. For instance, social distance relies on the technologies that mediate our interactions with others (from words to social media), emotional distance relies on both such technologies and the soft technique of participants, and so on. What makes it worth distinguishing them are the *other* phenomena they orchestrate, and the purposes to which they are put.

Technological distance can be reduced by pre-orchestrating some of the phenomena needed to learn. This is largely what designated teachers attempt to do when they organise stuff in a classroom or online course. They use technologies, from chairs to pedagogical methods, that make learning easier. More often than not, they assemble other stuff that has already been organised for learning—from lecture theatres to textbooks, all of which are designed or can be used to reduce the effort needed to teach by pre-orchestrating phenomena that play a teaching role. For instance, a general discussion forum might need a great deal of additional orchestration of phenomena by all participants if it is to play an effective role in learning, so much organisational, pedagogical, and subject matter skill may be needed: the technological distance is high. Conversely, an adaptive tutoring app running on a tablet might demand relatively little additional orchestration or components unless it is difficult to use or run. Other technologies, from internet connections and web searches to diagramming and books, can be added to close the technological distance.

In any act of intentional teaching, whether formal or not, it is often desirable for the technological distance to be low for "hygiene" technologies that support but that do not directly promote learning (for instance, to access and navigate a digital system), and higher for those that do, thereby requiring the learner to fill in the gaps themselves in personally meaningful ways. However, it is important to be aware of the many less obvious activities and structures that teach. For example, the physical effort needed to travel to a classroom could play an important pedagogical role in preparing for learning (Salas et al., 2011) so something as simple as scheduling two classes in one room could reduce technological distance but adversely affect learning. Also, if the gaps are too large, learners may be confused, lacking the cognitive tools to connect the new knowledge and skills, in which case these must be provided. This relies heavily on a clear understanding of what is in the learner's adjacent possible and what is not. As Hattie

(2013) puts it, learning must be visible, and that demands additional methods to add to the assembly, from interpreting expressions to marking assignments.

Conclusion

There is and can be no generalisable science of teaching (although it may use phenomena discovered through science) because it is a fundamentally technological activity. The methods, tools, components, and techniques we use provide endless variety that is unprestatable, the effects of any of which can rarely be generalised—and then only provisionally until the technologies or the assemblies around them change. It is difficult if not impossible to accurately predict which individual technologies (whether pedagogies or nails) will work better than others, because it is only the assembly that matters, and the assembly is always unique. How it is done, by all the teachers involved, often matters more than what they do. However, much can be done to equip teachers (formal or otherwise) with technique (soft and hard) that can be used to better adapt to each unique context. For example, rich, informative stories that others can apply in their own practices can ignite passion, provoke new ideas, inspire new methods, and suggest new ways for tools to be used in different assemblies. Making learning visible can help us to understand the diverse distances learners must cross; open sharing can increase the adjacent possible for everyone; building from small, open, easily assemblable pieces, be they digital, conceptual, physical (or whatever) can provide more adjacent possibles; and so on.

Above all, as educators, we need to remember that the purpose of education is not (just) to make machines in the heads of others, but to support them in participating more fully in the world as active participants, problem solvers, and creative assemblers of phenomena; to be makers, not just instantiations of technologies. Seeing education through a technological lens thus provides a means to see teaching as a fundamentally human, creative, meaning-filled role, in which compassion, talent, invention, and caring are at least as significant as the methods and tools used to achieve it. No one and everyone is a distance learner: we are all bound by an intricate web that connects us intimately with everyone else, yet learning always happens where we are now. We all teach, and that means we are all learning technologists. We should be proud to bear the name, because it is what makes us human, and what allows us to be a part of the collective intelligence of our species.

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