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Title: Authority, Autonomy and Automation: The irreducibility of pedagogy to information transactions

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Abstract:

This paper draws attention to the tendency of a range of technologies to reduce pedagogical interactions to a series of datafied transactions of information. As the ability to gather and analyse data becomes increasingly fine-grained, the threat that these datafied approaches over-determine the pedagogical space increases also. Drawing on the work of Hegel, as interpreted by 20th century French radical Alexandre Kojève, this paper develops a model of relational pedagogy which has three points of incompatibility with attempts to reduce the learning environment to datafied measures.

Firstly, Kojève's account of authority in Hegel posits two aspects to the memetic relation between teacher and student: recognition and realisation, which belong to the ipseity or about-self-ness of the subject, and are incompatible with a general definition of data. Secondly, the Hegelian approach to human historical time, in particular the assertion that the Concept, time and Desire are begun in the future, not the past, renders it incompatible with mathematical time as used in data processing. Finally, from these it is possible to derive a distinctive notion of the work *of pedagogy, grounded in Kojève's realist reading of Hegel, which is irreducible to information processing.*

In consequence of this threefold irreducibility, the paper draws attention to a need for relations of human pedagogical work to be inherent in the design of educational technologies, and highlights the dangers of presuming a machine intelligence model in the design of learning environments.

Keywords: Hegel, Educational Technology, Philosophy of Information, Alexandre Kojève, Luciano Floridi, Ipseity

Problematisation: The Datafied Subject

Controversy surrounded the 2012 award of $621,000 from the Bill & Melinda Gates Foundation to the National Centre on Time and Learning to use fMRI and Galvanic Skin Response to gauge degrees of engagement in the classroom (Kroll, 2012). The implicit identification of engagement with physiological-neurological states and its association with efficiency or efficacy of learning raise foundational questions about the nature of learning. Of concern here is not only the question of whether such empirical measures can differentiate between the 'deep' attention required for problem solving and meaningful learning and distracted forms of 'hyperattention' (Lewin, 2016), even assuming that were possible, such measures pose ethical and epistemic questions for education. Ethically, such a physiologically reductive conception of engagement challenges the long-standing characterisation of education as *witting and willing*, requiring some intentional commitment on the part of the student (Peters, 1966). Intersecting this concern is an epistemic question regarding the neurological reduction of learning to a transfer of information, optimised when conditions are most conducive to its reception as transmitted. Such reductive assumptions are common in the design of learning analytics systems, in which inter-operability is achieved by narrowing possible formats through which learners may express forms of knowledge (Sclater & MacDonald, 2004) or by carefully determining contexts to remove extraneous variables (Siemens, et al., 2011), and require an analysis capable of bridging the epistemic and ethical dimensions of the model. The range of behaviours, from attention to violent radicalisation (Dickens, 2015) which data mining software seeks to identify and modify on this basis grows every day.

Anxieties surrounding the values and purposes of education in contemporary Western society are both masked and exacerbated by the increasing emphasis on the gathering and ranking of data on performance, paradoxically differentiating purpose while homogenising measures of efficacy (O'Connell, 2015). These anxieties are paralleled in the world of work, in which the concept of general purpose machine learning raises existential questions for the relationship between humanity and the control of means of production (Spencer, 1996) (Humans Need Not Apply, 2014). This paper draws upon an understanding of human agency, recognition and responsibility, drawn from the Hegelian tradition, as interpreted by the French philosopher and civil servant Alexandre Kojève, and from personalist phenomenology, to develop a critique of the notions of recognition, time and work, both physical and intellectual, as it is conceptualised in the philosophy of computing and information. Through such critical insights, new directions for pedagogical work are proposed, focused upon the distinctively intentional nature of the human person. Hegel's conception of authority and recognition illustrates an aspect of human learning which is fundamentally relational and cannot be reduced to an informational description. This recognition has profound implications for both pedagogical work and pedagogic relations.

The assumptions on which such learning analytic systems operate are derived from the philosophy of computing and information. This is the case whether the data analysed are written verbal responses, or in the increasingly invasive and granular series of network physiological sensor data available in the Internet of Things (McEwen & Cassimally, 2014) (Wolpe, et al., 2005). All forms of information transactions are subject to an information-theoretic conception of knowledge. Until recently, this was the dominant model in the philosophy of computer science, because it is highly satisfactory in explaining the causal chains of information transferred between one information processor and another. According to the information-theoretic conception:

> K knows that s is F = K's belief that s is F is caused (or causally sustained) by the information that s is F (Dretske, 1981).

Information, according to this conception, is meaningful, well-formed data (Floridi, 2004): for a machine to know, it must possess a well formed sequence of data in an agreed format in which that data is meaningful, and that sequence must have been caused by informational transactions that sustain its meaning and attribution of a truth value. Attempts to more accurately represent the structures of human consciousness by introducing a symbol-grounding element – enabling machines to process internal images as if they were perceived externally (Steels, 2008) – still treat minds/brains as information processors, treating the phenomena of internal 'images' as identical to information processed through other causal channels.

While this model is highly satisfactory for the transfer and authentication of data between computer systems, it is fundamentally penurious if applied to human learning. This is so, both because the subjective experience of the givenness of the phenomenon is not reducible to a faulty folk-psychology of internal 'images', as I have argued elsewhere (Lundie, 2015) and because the recognition of the other in human pedagogical interactions is not reducible to a call-response-authenticate model of information transmission. It is this latter critique which is the focal point of this argument. In contrast to the information-theoretic conception of knowledge, human educational experiences are necessarily perspectival, not intrinsic to packets of knowledge content, but irreducibly related to some subject. Human learners value their own information incommensurably with information simpliciter (Lundie, 2015). Educational, as opposed to mere information-transfer experiences are also necessarily situated in interpersonal particularity (Guilherme, 2014).

Moving beyond my previous work in this field, it is necessary to differentiate indexicality, the 'aboutness' of subjective experience, which resides in the relation subject-purpose-object (Lundie, 2015) from ipseity, the intrinsic 'myness' of the phenomenon as given. Derrida's treatment of 'enseignement', literally 'the making of signs' as a process of semiotic 'showing' is here illustrative (Trifonas, 2002, p. 106). While a trace of intentionality may remain in the act of pedagogy as 'showing', this intention resides in the object, an 'aboutness', in the act of showing, the intent is permitted to evaporate. In contrast, the ipseity of the pedagogical experience resides in the subject. Intentionality might be assigned to a pedagogical act after the fact, as it is assimilated into broader values, ipseity on the other hand is immediate and intrinsic. It is impossible for education to take place which is not at the same time the education *of some subject*, part of the narrative concept of the self (Zahavi, 2005). Both intentionality and ipseity belong to the inward-facing content of human informational transactions, such that 'to undergo an experience necessarily means there is something it is like for the subject to have that experience' (Zahavi, 1999). The differentiation of these aspects of self-consciousness, and their incommensurability (a) with eachother and (b) with information under the general definition, is at the core of the Hegelian concept of recognition.

Recognition, in Hegel, is the essential ground of self-consciousness. In contrast to Husserl, who posits the equivalence of Being-for-itself and being given (Marion, 2002), Hegelian self-consciousness rests upon a fundamental incommensurability between the one who recognises and the one who is recognised[1]. The authority of the teacher, Kojève-Hegel asserts, is bound to the future, and thus bears an affinity with the structure of human-historical time, a structure very different to that of processing time in the philosophy of computing and information. Finally, human work, which is also caught up with the Hegelian concept of time, is represented by Kojève's reading of Hegel as intentional, negative and as struggle – points which mark out the distinctiveness of human work in contrast to the execution of the computer program. Considering recognition, time and work in Kojève-Hegel, it is possible to differentiate a domain of human education for the process of self-becoming, the development of authentic self-consciousness, and to differentiate this against a simulation of the same provided by certain technologically reductive pedagogies. In infinitely deferring the object of teaching, the subject is also left incomplete by these reductive pedagogies, resulting in a simulacrum of education, devoid of meaningful intent.

Recognition, Authority and Authentication

Fundamentally, Hegel's celebrated notion of a master-slave dialectic posits a differentiation between recognition and the recognised. The ipseity of the phenomenon of recognising is not identical to the ipseity of being recognised – there is a fundamental inequality of relation. This situation renders human recognition, for Hegel, incompatible with a transfer-authenticate channel of communication required by the information-theoretic conception of knowledge. The causal relation of recognition is one of submission, a point which Kojève bisects into the twin anthropogenic behaviours of recognising (the phenomenon as experienced by the slave) and realising (the phenomenon as experienced by the master) (Kojève, 1969, p. 8). In place of the single causal

[1] Indeed, in a radical attempt to assert the completion of the Hegelian conception of history, Kojève in his later work begins to lose sight of this, himself positing something akin to the penurious notion of interchangeable call-authenticate recognition (Kojève, 2000) with the same penurious consequences for the project of self-becoming.

channel of symbol-grounding epistemologies, which posit an interiorisation of external phenomena, each phenomenon, in this Hegelian anthropology, is marked by the ipsative experience of these two irreducibly unequal channels: A→B ≠B→A. These channels or behaviours are the only forms of mediation which pertain to human autonomy (Kojève, 1969, p. 15), rendering it incompatible with a single-channel information-causal epistemology.

The place of autonomy in the Hegelian account of recognition helps to elucidate a particular thorny problem in the definition of machine intelligence. The place of experience, of recognising the nature of one's learning (as opposed to merely being subject to heteronomous notions of 'attention' (Lewin, 2016)) and of realising the work of pedagogy (to which we shall return) is, on this model, intrinsic to a human definition of intelligence. This brings it into direct contrast with the Turing Test model of intelligence, which reduces the ipseity of experience to a mere epiphenomenon (Churchland, 1984). While we may accept the 'weak' thesis that 'learning' is a useful metaphor and model for the transfer and manipulation of information by computer processors, the Hegelian model here proposed precludes a 'strong' ontological identification of information transfer-authentication with learning (Searle, 1980). While Churchland's strong identification of the Turing Test with intelligence remains internally cogent, it follows from the fundamental incompatibility of the two ipsative dimensions of recognition and realisation that this can only serve as proof of the possibility of machine intelligence if it also serves as proof of the impossibility of human intelligence.

While subsequent scholarship in the philosophy of computing and information has given serious attention to the ethical dimensions of the construction of the self in relation to the digital, acknowledging "the question of who am I for you" (Floridi, 2013, p. 224) as a meaningful aspect of human recognition, I would content that such accounts still fall short of answering the challenge posed by Hegelian inequality because they fail to take account of the temporality of the other in a dialectic. Learning encounters mediated through online and digital agents do not have the status of a temporal other. The temporality of the information agent is distinct from the temporality of the teacher, and this temporality is pertinent to the nature of authority as exercised between student and teacher. Whereas the Turing Test does rest upon recognition – the recognition by one natural language user of another (Urquhart, 2004) – this form of recognition is not reciprocated by a realisation. One half of the anthropogenic relation is absent. The result of a self-construction based on relations with such misrecognised atemporal others may be that the learner begins to re-ontologise herself hereronomously. This is evident when learners learn how to respond as the system would like, in language the machine can understand, instead of in forms of expression mediated from the object of study.

Returning to the general definition of information as employed in the philosophy of information, an authentication channel is required such that data, under a well-formed language, can be meaningful to more than one agent. For Kojève's reading of Hegel, however, drawing on early Heideggerian scholarship,

> Self-Consciousness is simple-or-undivided Being-for-itself; it is identical-to-itself by excluding from *itself* everything *other* [than itself]. Its essential-reality and its absolute object are, for it, *I* [I isolated from everything and opposed to everything that is not I]. And, in this *immediacy*, in this *given-being* [i.e. being that is not produced by an active, creative process] of its Being-for-itself, Self-Consciousness is *particular and isolated*. What is other for it exists as an object without essential-reality, as an object marked with the character of a negative-entity (Kojève, 1969, pp. 10 - translator's parentheses).

The immediacy of self-consciousness suggests an ontology for self-conscious data which cannot be *meaningful* in the sense employed by the general definition, because, as the ground of meaning, the self is incapable of communicating the same datum to another self without changing the meaning from ipseity, *I-ness*, to otherness. In place of communication, the transfer and authentication of meaningful well-formed data from one agent to another, self-conscious selves must proceed by recognition. Self-consciousness, in Kojève-Hegel, requires the twin anthropogenic behaviours of recognition and realisation, an irreducible inequality between sender and receiver.

In contrast to a co-equality of information transfer, the Hegelian account of self-consciousness requires serious consideration to be given to the unequal nature of teacher-student relations as necessitating a form of authority. This is the case whether the direction of this relation persists across the course of many years, or alternates between recognition and realisation from moment to moment. Published in occupied France in 1942, Alexandre Kojève's *On the Nature of Authority* represents the end-point of a line of thinking within Western political philosophy concerned with the definition of authority and the differentiation of just and unjust authority[2]. Drawing on Platonic, Aristotelian, Hegelian and Scholastic tradition, Kojève proposes not a single definition, but a constellation of mutually irreducible authorities which bear a family resemblance in that they are clearly distinguishable from, and indeed antithetical to, force. The authority of the father, predicated on generative priority, Kojève associates with the scholastic theologians, locating its potency in the past; the authority of the master over the slave, based on Hegelian relations of recognition finds its locus in the present; while the authority of the judge, predicated on equanimity, Kojève associates with Platonic eternal universalism. The authority of the teacher Kojève subsumes within an Aristotelian analysis of the authority of the leader over the band.

This form of authority is based neither on the struggle of life and death (as in Hegel's more general thesis) nor on mere age or priority, as would befit an education which was purely cultural transmission, whether of the traditions of the distant past or of information pre-existent in the technosphere for mere micro-seconds. For Kojève, the authority of the leader over the band is based upon the leader's potential to anticipate beyond immediate need, and therefore finds its locus in the future (Kojève, 2014).

This association of teaching and time, in particular the locus of the teacher's authority in anticipating the future, although initially associated with an Aristotelian conception of authority, is also of significance to Kojève's analysis of Hegelian epistemology. Kojève emphasises the incorporation of history, and historical time, into philosophy in Hegel. The 'concept' in Hegel *is* time, but not time in the way conceived by the philosophy of information and computing. Historical time, for Kojève-Hegel, cannot be measured in bits-per-second. Linear, polynomial, non-polynomial and even exponential measures of processing time (Urquhart, 2004) fall short of the Hegelian relation between time-as-concept and the eternal. Because time, for Kojève-Hegel is human historical time, engendered by desire, the concept, like the authority of the teacher, has its origin in the future (Kojève, 1969, p. 134). This 4-way relation of time, concept, human desire and the authority of the leader/teacher is one to which we shall now turn in detail.

Time, Concept and the Teacher

Kojève defines Concept in Hegel as "a coherent whole of words having a meaning" (Kojève, 1969, p. 101), that meaning being predicated on the one recognised. As such, Concept rests on the human, that is, the historical-temporal claim upon meaning in relation to truth. In contrast to attempts to represent Hegel as either idealist or dualist, Kojève emphasises that both the subjective and the objective belong in the realm of the real and relational. Drawing upon Hegel's analysis of Fichte, Kojève is at pains to point out that Hegel "is even more 'realist' than Descartes" (Kojève, 1969, p. 151). Reading Descartes in the context of his Augustinian intellectual heritage, it is legitimate to point to the role of the *ego cogito* as central to the relation between self and world, subject, object and intention (Lundie, 2015), not as separating a material world from a mental or subjective one, but as essential to the mental ordering of the material. Hegel's dialectical differentiation between recognition and realisation as incommensurable components of the ipsative experience of self-consciousness adds a further dimension of analysis to such a realist account of the relation between human-historical subject and its agency in the ordering of the world. For Descartes, self-consciousness does not follow either from the *ego cogito*

[2] Following the Second World War, the question of a just or proper authority is rendered absurd by the atrocities of its exercise. Empirical findings in cognitive and individual psychology begin to pathologise the 'authoritarian personality' (Adorno, et al., 1950) while Anglophone political philosophy reorients toward questions of economic and distributive justice (Rawls, 2009) (Nozick, 1973) or community and identity (Sandel, 1998) (Nussbaum, 2004). Kojeve, both in 1942 and in his mature work in subsequent decades, is somewhat exceptional in still clearly addressing the same central question of authority in politics which animated Aristotle, Hobbes and Rousseau's analyses in previous centuries.

syllogism, nor from self-affection, "but from my being acted on… by an other than me" (Marion, 2003, p. 42). While a Turing machine may be recognised, engaged with and assigned being both as subject and object of such a relation, Kojève-Hegel here sketches something beyond a transcendental subjectivity – a two-directional relationality of being.

While in the master-slave authority relation, the particularity of context for human deeds is "always overshadowed by the further possibility of a complete indifference to life by one of the actors" (Pippin, 1993, p. 147), the leader-band (teacher-student) authority relation is characterised by profundity, the recognition of the leader as more fully realising the future-oriented good of the band. Such relation is not reducible to the master-slave dialectic, the more exclusive focus of Kojève's middle work, nor to the authority of the judge, wherein Kojève posits a final mutual reduction of recognition to realisation: A→B =B→A:

> [the judge] neither loves nor hates [the actors] , if he refers to their acts and not their persons and… if his intervention in their interaction will not and could not be altered by the sole fact of interchanging A and B, A playing the role of B, and B that of A. (Kojève, 2000, p. 79)[3]

In contrast, the authority of the leader/teacher is associated with Aristotle on the basis that Aristotle's *Politics* posits the leader as the one best skilled in anticipating beyond the basic or immediate needs of the band (Kojève, 2014).

> Only with Aristotle does Time make its way into absolute Knolwedge. The Eternity to which the (eternal) Concept is related is now situated *in* Time. But Time enters into *absolute* Knowledge only to the extent that Time itself is *eternal* (Kojève, 1969, p. 131).

Reducing this notion of concept as a relation to eternity, situated *in* time, to a relation of concept as time itself, Kojève-Hegel points to, but never elucidates, a symmetry between the concept and the authority of the teacher. While the concept is engendered by Desire, and therefore is begun in the future, the authority of the teacher is engendered by anticipation (which is itself a desired future). In such a symmetry, the teacher and the concept become synonymous. The role of Desire in Hegel's understanding of human work, as I shall go on to demonstrate, precludes the possibility of the concept standing as an 'eternal', 'ideal', disembodied or purely informational entity.

Turning now to the relation time-concept-future-teacher, it is the open-ended irreduciblility of the human response, always open to the chaotic nihilism of the further possibility of indifference, but even in its ordinary operation carrying within itself the intentionality of non-indifference, that renders it impossible to conceptualise in a merely mathematical model of time. In his dialogue with Strauss, Kojève is keen to differentiate again the forms of authority: "Tyrants… fear the brave, the just, and the wise; they must suffer the fact that they cannot enjoy the company of such virtuous souls because of this fear" (Pippin, 1993, p. 143). While for Hobbes it is the universal rationalistic order engendered by fear which is located in the future, Kojève's understanding of history and historical progress relies on a future-orientation to both concept and work, which creates the possibility for

[3] Justice (the locus of the authority of the judge) and recognition (the Hegelian locus of the authority of the master) are to be distinguished from one another precisely in regard to the interchangability of mediation. While all authorities are socially mediated (Pippin, 1993), justice requires impartiality. Kojève's emphasis on the dependence of philosophical concept on human historical possibility leads him in his later work to the conclusion that the revolution and the end of history, as theorised by Hegel, had already arrived. While this attempt to presage a final reduction and resolution to the Hegelian dialectic proves unconvincing, it is not entirely penurious for the argument advanced in this paper. The characterisation of Kojève as 'romantic buraucrat', concerned primarily with the administration of authority-as-justice in established conditions of universal mutual recognition, introduces the thesis that the sage-philosopher and the administrator have a shared *work* of making manifest this 'ideal' reality in the material social conditions of the polis (Groys, 2013). Under such an understanding, even should the first two incompatibilities – that of recognition/authentication and human-historical/processing time – be resolved, the critique that human (and specifically pedagogical) work is irreducibly distinct from machine work, remains valid.

the realisation of mutual (not to say interchangeable) recognition. In this regard, the authority of the leader/teacher, and its future-oriented relation to concept should be differentiated from the authority of the master over the slave, with its present-oriented conservative rationality.

As such he is critical of the '"Intellectual" who criticizes the real world in which he lives from the standpoint of an "ideal" constructed in the universe of discourse, an ideal to which one attributes an "eternal" value, primarily because it does not now exist and never as existed in the past' (Strauss, 1991, p. 137).The role of the philosopher, linked to the historicity of the *concept*, is in speculating on rational possibility (Pippin, 1993) – as human self-consciousness is a co-condition of truth and reality [something follows, not sure what]. The distinction here between a disembodied, Platonic eternal standard of truth, as argued for by Strauss (Schlie, 2013) and Hegel's future-oriented locus of philosophy and of teaching opens up the need for temporal, that is to say, human and intentional *work*.

> the *historical* plane of *active social* life [is the only ground] where one argues by *acts* of Work (against Nature) and of Struggle (against men) (Strauss, 1991, p. 168).

Mathematical time – the time in which Turing Test machine learning takes place – is symmetrical. The laws of physics are unaffected by the direction of time – reversing the direction from future to past leaves the equation unaltered (Penrose, 1989, p. 392). This is not to say that all equations which constitute the information processes in our technosphere are symmetrical. In particular, information theorists differentiate polynomial (P - essentially symmetrical, in which the equivalence of A=B can be computed just as easily given either A or B) and non-polynomial time (NP – in which A=B is easily determined given A, but in which it is impossible to ascertain A given B, except through a comprehensive search or exponential complexity) (Urquhart, 2004).

For Kojève's reading of Hegel, contrastively, the Concept *is* time, but not technical time, time as measured by bits-per-second Internet connections or GHz processor speeds. Neither P nor NP time are sufficient to account for the historical time in which Hegel locates human experience. The Hegelian ideal forever remains ideal, the circle is never closed, learning is ceaseless, yet truth remains an empty set, "it is the optimistic form of skepticism" (Kojève, 1969, p. 109). Seeking to express this in the terms of the philosophy of information, it is useful to draw on the concept of Kolmogorov complexity. The Kolmogorov complexity of an object is the length of the shortest program capable of producing a description of the object (Li & Vitanyi, 1997). Recalling the impossibility of communicating the self-grounded data of ipseity as information, it may be surmised that the Kolmogorov complexity of each authentic learning (as opposed to merely informational) interaction is infinite, involving as it does the recognition and realisation of two irreducible self-conscious beings. At the same time, paradoxically, the immediacy of self-consciousness in itself renders its Kolmogorov complexity 0. Given the givenness of the being-for-itself, its self-consciousness must follow. Therefore, no data is necessary for the learner as self-conscious subject to recognise herself as self. It is not the case that an accumulation of programmable transactions can amount to an act of student-teacher authority in action.

Historical time, for Kojève is necessarily conditional upon a purposive project of self-making (Pippin, 1993). This is so because Hegelian time is engendered in Desire. The Concept (which Kojève asserts is equivalent to time) is begun in the future, not the past (Kojève, 1969, p. 134). Concept as having a meaning predicated on the recognition of the teacher as the one who speaks them, possesses an ontic quality. It is not merely the prescience of the teacher as one more possessed of information about the physical or historical world which constitutes his authority-as-profundity (Kojève, 2014), rather, this authority has the character of "speaking existence" (Kojève, 1969, p. 133). In the acts of recognition and realisation which constitute the teacher/student relation, the student as other liberates the teacher ontologically with respect to nature (Kojève, 1969, p. 18). The relation between nature and human work is a theme which highlights a further tension between Hegelian and technological-informational pedagogies.

Pedagogy, Work and Programming

Having established a sense of the ipsative phenomena of human recognition and realisation as incompatible with the information-theoretic conception of knowledge, and the circular future-oriented nature of human-historical

time as incompatible with mathematical processing time, it is possible to construct a model of the teacher and student as engaged in a relational, meaningful project of work. This conception of work, grounded in Hegel's realism and Kojève's critique of any attempt to separate an 'eternal' concept from the reality of human historical time, may be usefully contrasted with the operation of a computer program.

> A man can work hard risking his life for no other reason than to experience the joy he always derives from *carrying out* his project or, what is the same thing, from transforming his 'idea' or even 'ideal' into a *reality* shaped by his own *efforts* (Strauss, 1991, p. 140).

The conception of work inherent in the information-theoretic conception of knowledge is of the processing of symbols already assigned meaning as though through the internalisation of an exterior language game. The semiotic problem, raised by Rumelhart et al (Rumelhart, 1986) comes closest to addressing this discrepancy between human, ipsative, intelligence, and machine 'intelligence'. Semiotic computing attempts, within the bounds of the two-directional causal relation of the information-theoretic account, to posit a triadic relation between signs, users and the interpretant (Fetzer, 2004). In so doing, semiotic computing attempts to reproduce the processes of meaning-making by which human minds assimilate new information to existing systems of thought. Even in such complex forms, however, the outcome of intellectual work in any given computer program is already inherent in the program (Lundie, 2014), nothing is created by its execution that was not inherent in its design, no matter how unpredictable the outcome.

The concept of recognition as developed above is subtly but importantly distinct from the semiotic model of intelligence. While semiotics is concerned with the interpretant recognising another being as *standing for* or *meaning* a thing, grounding meaning in the symbol, Hegelian recognition is concerned with recognising the other *in and of itself*, grounding meaning in self-consciousness and the awareness of the other as other. Furthermore, as the concept, in Kojève's reading of Hegel, is identical to (human) time, a causal channel is dismissed as radically insufficient to an account of truth. Learning is ceaseless, yet truth remains an empty set, the circle is never closed, and so learning is, for Kojève-Hegel, an "eternal task" (Kojève, 1969, p. 109). This is the reason why attempts to map the complexity of the human experience of learning in informational terms results in the paradox highlighted above.

Recognition, in contrast to programming, is essential to the satisfaction of the human as intentional being. To be unrecognised is to be unsatisfied, with potentially disruptive consequences (Agiomavritis, 2012). While informational work-as-programming, which passes through the processing subject, leaving the subject unchanged, recognition is bound up with a being or subject capable of positing itself as a totality distinct from its programming. The purely information-processing agent, transferring and authenticating knowledge without remainder, cannot enter into the act of teaching as realisation, nor of learning as recognition. In order for such a pedagogical relation to exist, for the *work* of pedagogy to take place, some *subject* must exist, posited in existence by its relation to the other.

> In contrast to the knowledge that keeps man in a passive quietude, Desire dis-quiets him and moves him to action. Born of Desire, action tends to satisfy it, and can do so only by the "negation," the destruction, or at least the transformation, of the desired object: to satisfy hunger, for example, the food must be destroyed or, in any case, transformed. Thus, all action is "negating." Far from leaving the given as it is, action destroys it; if not in its being, at least in its given form… But negating activity is not purely destructive, for if action destroys an objective reality, for the sake of satisfying the desire from which it is born, it creates in its place, in and by that very destruction, a subjective reality. (Kojève, 1969, p. 4)

According to Kojève-Hegel, all desire is bound up with the relations of recognition and realisation, desire exists in a person posited as subject by relations of authority. It is from this relation that desire, which is rooted in the future, emerges, and it is from the profundity of the teacher as capable of directing the work of realising such a future that authority and concept, the relational and the objective, can be reconciled.

Implications and Applications

Having developed an account of ipseity, the *isness* of the subjective self, derived from Kojève and Hegel, as consisting in two mutually-irreducible and irreducible-to-information phenomena: recognition and realisation, several implications follow for the relationship of pedagogy to information technology. Firstly, it is clear that even in pedagogical accounts in which the authority and skill of the teacher is radically detached from 'concept' as informational knowledge (Rancière, 1991), there remains a residual relation of recognition, derived from the prescience of the teacher. Furthermore, such a prescience does not consist primarily in the knowledge of a completed circle of knowledge in the past, such as would be implied by a semiotic account of knowledge. In the semiotic account, the teacher grounds her authority in the ability to connect new knowledge to systems of meaning, the origins of which are predetermined by informational meanings in the past. Far from merely "the carrier of rational information" (Bailey, 2005, p. 60), the teacher is model of the concept. The account presented above, however, derives the teacher/student relation from a future-oriented concept of work, as grounded in a desire that is memetic, not transmitted as information from teacher to student, but recognised as a form of social contagion; "human Desire must be directed toward another Desire" (Kojève, 1969, p. 5). Teaching becomes the act of "speaking existence" (Kojève, 1969, p. 133).

The memetic account of teaching has been seized upon by advocates of anti-technocratic pedagogies (Crawford, 2015), but need not be penurious for the design of educational technologies. According to the account developed above, an information-theoretic account of knowledge still functions highly effectively as a metaphor in the design of information systems. The danger of such an account only occurs when the metaphor is taken for an ontology of the human learner, either deliberately or naively so, and used in the design of systems for the transfer of knowledge to human subjects as though they were solely information processors.

In this model, mediating technologies are not in themselves problematic: "the I is absolute mediation" (Kojève, 1969, p. 15), but may become so when the process of becoming self-realising is turned not against an 'other' capable of recognition, but only against an echo (Floridi, 2013, p. 224), an infinitely deferred other, or informationalised representation of the self, then the potential for the subject to become detached from the capacity for the authentically human work of education arises. Platforms such as Khan Academy, which enable interpersonal pedagogical relations to arise have a great potential to extend the possibilities of authentic education, as do approaches which make use of the modularity of human experience (Benkler, 2013), enabling the subject to navigate a plethora of small and manageable pedagogical interactions each of which facilitate the unique direction of their self-realisation.

In a pedagogical philosophy wherein memesis and recognition are foregrounded, recognising that the subject attains self-realisation not only through the acquisition of some object of knowledge but relationally, through engagement with an other who is distinctively, irreducibly and incommensurably *other*, the proper role of technological mediations and enhancements can only be communication with a real (not artificial) teacher. It is a necessary feature of that teacher-student relation that it acknowledge that which is irreducible – either to a common dataset among a group of students, or between teacher and students – this irreducibility poses challenges for learning encounters which are mediated solely by technology, in that the technology necessarily gathers and enables the evaluation only of finite, datafied characteristics which can be at best a proxy for ipseity. Even where these proxies are increasingly fine-grained, as in the brain scanning and galvanic skin responses highlighted at the outset, they do not amount to the "unique particularized singularity… the particular *isness* of the self" (Conroy, 2004, p. 6) and as such are insufficient basis to fully realising pedagogical relations.

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