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FCJ-127 Concrete Software: Simondon's mechanology and the techno-social

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In this article I will discuss the philosophy of technology developed by Gilbert Simondon, predominantly in his 1958 book The Mode of Existence of Technical Objects, with a particular concentration on his concepts of associated milieu and concretization.

The article provides an introduction to Simondon's theory of technological genesis and indicates the problematic nature of the cultural for Simondon's account. This is made apparent by contemporary developments in techno-social networks. However, I will also argue that this insufficiency is not insurmountable given Simondon's overall ontology. Instead, it is a result of his own bias regarding technological development at the time when he was writing.

In the latter part of the paper I will attempt to demonstrate how this insufficiency can be overcome and Simondon's theory can be fruitfully applied to the theorization of contemporary social media and software. Additionally, I hope this paper will go some way to indicating Simondon's relevance to current ethical concerns regarding the relation of the technological to nature.

Although there is not room here to expand on Simondon's wider project it must be remembered that Simondon's work on technology complements and builds upon his work in other areas and that it is a further application of his relational ontology and theory of individuation. In fact, technology holds a special place in his thought as it is the domain which traverses all three of the regimes of individuation which demarcate the progress of the process of individuation, which constitutes nature for Simondon.[1] In fact it is his failure to fully articulate the connection of the technical with the regime of the psycho-social in The Mode of Existence of Technical Objects that will concern us here.

For Simondon, the development of technical lineages are not to be thought of as functional or instrumental progressions (e.g. interpreting the history of recording devices as a lineage) but by the development of their internal operation. Thus a steam train is not of the same lineage as an electric train, even though they fulfill the same purpose, because their actual technical mechanisms have developed from different origins.

Instead technical development should be understood as a development that is led by the technical structure itself, which in the course of its operation unveils and concretizes previously undiscovered synergies and relationships.

This mode of existence is framed as the process of a technical object's development via the notion of concretization, which can be understood as a directed and unifying transduction within the regime of physical matter. Simondon describes a concrete technical object as:

> *... one which is no longer divided against itself, one in which no secondary effect either compromises the functioning of the whole or is omitted from that functioning . . . The essence of the concretization of a technical object is the organizing of functional sub-systems into the total functioning . . . Each structure fulfills a number of functions; but in the abstract technical object each structure fulfills only one essential and positive function that is integrated into the functioning of the whole, whereas in the concrete technical object all functions fulfilled by a particular structure are positive, essential, and integrated into the functioning whole. (Simondon, 1980: 31)*

The shift from abstract to concrete is key here. The abstract form of a technical object describes a technical object that has 'an intrinsic perfection of its own that needs to be constituted as a closed system in order to function' (Simondon, 1980: 14). Simondon uses the example of the move from water-cooling to air-cooling systems for combustion engines to demonstrate this shift.

Although a water-cooled engine consists of two systems which are perfectly suited to carrying out their specific functions, when linked together a degree of disparity emerges between them. Simondon refers to the joining of these conflicting technical individuals as creating a 'series of problems to be resolved' (Simondon, 1980: 14).

The concretization process is one where such problems are resolved. Thus, the development of air-cooled engines, by the addition of gills to the cylinder, is seen as a measure of concretization because the engines cooling function is no longer provided by a separate closed water-cooling system, which requires its own conditions for operation that conflict with the operation of the engine, but as part of the normal operation of the single technical system.

Additionally, a further degree of concretization can be discerned because the same gills that are used for air-cooling also act as structural supports for the cylinder head. We therefore witness in this progression a move from conjoined abstract structures which are problematic, to a single concrete system which supports multiple functions.

Another aspect of the definition of an invented technical individual (ITI) is that, as part of the organization of functional sub-systems into a total functioning, an associated milieu is invented and maintained.

It is important that the specific meaning Simondon gives to the term invention is grasped here. Invention does not refer to the traditional hylemorphic notion in which a person has an idea and then builds something that corresponds to that idea; rather it is the 'birth' of a new environment or 'regime of functioning' (Massumi, 2010: 39) brought about by the operation of recurrent causality involving the actual operation of the technical individual itself.

The invention happens because a jump is made and is justified by the relationship which is instituted within the environment it creates. (Simondon, 1980: 59)

This new environment is what is named the ITI's associated milieu. When discussing the associated milieu Simondon writes:

> *Such individualization is possible because of the recurrence of causality in the environment which the technical being creates around itself, an environment which it influences and by which it is influenced. This environment, which is at the same time natural and technical, can be called the associated milieu. By means of this the technical being is conditioned in its operation. This is no fabricated milieu, or at least it is not wholly fabricated; it is a definite system of natural elements surrounding the technical object. The associated milieu is the mediator of the relationship between manufactured technical elements and natural elements within which the technical being functions. (Simondon, 1980: 60)*

Of particular importance in reading this passage is how the word 'natural' is understood. In Simondon's ontology nature consists of three regimes of individuation: the physical, the vital and the psycho-social. Therefore it is possible to interpret this passage as stipulating that a technology's associated milieu can be constituted in relation to any of these regimes. However, in The Mode of Existence of Technical Objects the description of concretization presented gives an overwhelming impression that by 'nature' in this passage Simondon is limiting his scope to the regime of physical individuation. This impression is emphasized by the disdain with which Simondon greets the intrusion of cultural factors into technical concretizations – witness his scorn for decorative fins, power-steering and starter motors for automobiles which he explains away as advertising driven gimmicks – which either add abstraction and disparity to a technical individual or disrupt its concreteness.

Such is his dismay at how cultural influences have infected automobile design he despairs: 'The automobile, this technical object that is so charged with psychic and social implications, is not suitable for technical progress' (Simondon, 1980: 21).

The concretization process, which Simondon describes as the true evolutionary principle of technical objects (which he also calls mechanology), operates separately to economic and cultural concerns and can't be reduced to 'anterior scientific principles' (Simondon, 1980: 48). It is the study of technical individuals that aids the discovery of synergies, boundaries and indeterminations in their operations which lead to the possibilities for further invention.

Mechanology is also framed as a type of scientific development in that it reveals previously hidden virtualities and makes them available for further concretization. There is thus, to some extent, a resemblance between mechanology and technoscience. As Bernard Stiegler writes:

> *If a mechanology is necessary, this is because the laws of physics, no more than those of sociology or psychology, or all of these as a whole cannot suffice to explain the phenomenon of the technical object qua the genesis of an individual and production of an order. (Stiegler, 1998: 76)*

This account of mechanology as a scientific investigation again emphasizes the distance Simondon keeps the process from cultural influence. Given the non-separation of culture (psycho-social) from nature in Simondon's ontology why is there this apparent denial of cultures involvement in mechanology and the concretization of technical individuals in The Mode of Existence of Technical Objects?

Because of this distancing it is tempting to see mechanology as a process of purification as described by Latour (1993) in We Have Never Been Modern; that is, as a process that constructs an account of nature purified of any social involvement and vice versa. As such, Simondon's account must fail to give an adequate account of the processes of translation and mediation, in Latour's sense, of the melting-pot of nature-culture hybrids we increasingly find in contemporary reality.

This sense of mechanology as a purified process can also be discerned in Paul Dumouchel's summation of Simondon's position:

> *It is not because of the uses we put it to that modern technology radically transforms the world, but because technology gives existence to phenomena which were not there before and because technical individuals provide the conditions of the processes which constitute them. Thus there is no alternative technology which contains different values with respect to nature. What technology teaches us is that there is no 'nature' in the sense of a set of events and processes which are essentially different from those which are produced artificially. According to Simondon there is no technology which can respect what is, for technology is essentially the coming into existence of the virtual. (Dumouchel, 1995: 268)*

Dumouchel makes clear that any leap of invention requires the existence of the technical object. There is a sense in which the technical object comes first and transitions occur around it. But these developments progress through an internal logic divorced from the normative domain. Even as a purified account of technical development Simondon's account is important for its description of the operational development of technical individuals. It is the aim of this article to demonstrate that not only is the involvement of the psycho-social regime not contradictory to this account but actually necessary given the recent proliferation of technologies whose operation relies on their relation with the psycho-social.

Andrew Feenberg's humanist account of concretization

Though by no means asserting concretization as a democratic socialist theory, Andrew Feenberg uses it to support the political idea that 'socialist demands for environmentally sound technology and humane, democratic, and safe work are not extrinsic to the logic of technology but respond to the inner tendency of technical development to construct synergistic totalities of natural, human and technical elements.' (Feenberg, 2002: 188)

His proposal is for a concretization the scope of which is expanded beyond Simondon's to include within its operation the aims of critical politics. It is then a social form of concretization. This is one where social rules and constraints are embedded into technology, from which they are often forgotten or even assumed to be part of the object's 'inevitable technical destiny'. For Feenberg social values are another area of virtuality which can be concretized into technical objects as what he describes as a 'technological unconscious'.

The inclusion of these concerns into the operation of technology does not require that these technologies need become less productive. Indeed the social codes incorporated into any technology could just as well be capitalist in nature as critical. Importantly, Feenberg maintains that the choice of social codes concretized into technology is essentially a political choice and is evidence of technology's ambivalence.

For Feenberg, technological systems help structure our everyday life but are open to concretization according to a different trajectory than that supplied by contemporary capitalist operations; through the condensation of more social aspects such as an appreciation of 'workers' skills, human communication, and environmental limits' (Feenberg, 1996) into their actual operational structure.

If there are invariably social aspects involved in concretization this would contradict the purified account of technical concretization that Simondon describes. It is true that if we wished to maintain this purified position, we could just maintain that any such introduction of social concerns into technological development is de facto strictly not mechanolgical. Yet this articles wishes to show that the operation of contemporary techno-social networks makes this position untenable. However, this does not mean that we must therefore agree with Feenberg's position that an ethics of technological development be founded on a humanist 'politics of technological transformation.' Instead we will argue that this widening of the scope of mechanology is still in accordance with Simondon's overall ethics of process and development.

Simondon's account of Human Progress

In his text The Limits of Human Progress: A Critical Study Simondon (2010) sketches an account of human cultural progress as developing in the same manner as technological development: as the progressive operation of concretizing relations between differing domains to resolve disparities.

To give this universal account Simondon states that he must take into consideration 'the entire system of activity and existence constituted by what man produces and what man is' (Simondon, 2010, 230). He divides these activities and their products into ontological domains (e.g. language, ethics, religion as well as the technical) to achieve this broad scope. These domains come into problematic relation with one another and produce emergent concretizations.

For Simondon, during different historical periods the concentration of human activity occurs in different domains. For example, in ancient classical civilizations there was a concentration of activity on language development whereas in the medieval period development mainly concentrated in the religious domain. During the current period, Simondon contends, the concentration of activity focuses on developments within the technological domain.

As with mechanology, development within each domain is described in terms of concretization and saturation. Importantly, progress within any domain occurs between humanity and the concretizations of that domain that have already occurred and with which humanity is said to form a system. The further development of this system requires that it isn't saturated but remains in a state of internal resonance thus engendering further progression.

The saturation of any domain leads to its stagnation. This is because saturation consists in the complete determination of all available potentialities or 'virtualities' for development in any given system. Thus regarding the domain of language at the close of the ancient world Simondon asserts:

> *... it became purely a matter for grammarians and formalist logicians seeking etymological rectitude in naming. Surely, a grammar or a formal logic do not reflect man, or at the least reflect only the smallest part of man, one that should not be inflated. (Simondon, 2010: 231)*

Though much of the world is currently in a period that is heavily invested in the development of the technical domain there is no reason to believe that this process will not also reach saturation and the focus for investigation shift to another domain. However, Simondon also notes that the chances of humanity becoming alienated from technological concretizations are less likely than from those of the domains of language and religion because:

> *Technology is even more primitive than religion: it connects with the elaboration and satisfaction of biological desires themselves . . . Thus there is at least the chance that the seeds of the decentring of man, and thence of the alienation of the objective concretizations which he produces, may be feebler in technology than in language and religion. (Simondon, 2010: 232)*

Simondon claims that technology's importance for human progress derives from its close relation to biological desire. This is why he argues so strongly for the development of a technological culture.[2]

Although the development of technology occurs via the progressive uncovering and utilization of virtualities in nature this operation must also be contextualized within this broader account of human progress which requires an ongoing internal resonance between all domains, as well as 'durable overlappings' between them.

Simondon maintains that this is achieved via reflexive, philosophical thought which, as the 'conscious form of the internal resonance formed by man and the objective concretization', can prevent alienation between man and technology by ensuring that technological progress becomes an 'integral part of human progress, by forming a system with man.'

We are now in position to contrast Simondon's and Feenberg's positions. Whereas Feenberg argues for a 'politics of technological transformation' ensuring that humanist values are concretized in our technology thus engendering a better society, Simondon espouses a more Spinozan ethical outlook.

Rather than limiting technological development by the application of humanist values this outlook asks what nature-technology and man-technology relations are capable of. It argues that progress depends on the liberation of the potentials these relations uncover rather than those that might be considered 'given in advance'. So although it is true that any given technology may be close to and satisfy certain desires this does not rule out that it may also

create further desires or leave other desires unfulfilled. In which case alienation should not just be seen as a negative condition but one that leads to production. There is then, with the development of technology, also an immanent human development, the development of a relationship to a new milieu which Simondon urges us to explore, as opposed to a politics which tries to steer technological development by assuming and fixing a humanist perspective.

This is not to say that Simondon does not see dangers relating to technology or indeed the potential for harmful forms of alienation. He fully understands why some substantive theorists of technology (e.g. Heidegger) feel threatened by machines and acknowledges, for example, that to an extent thermodynamic machines have replaced man 'as tool-bearer'. He also admits that:

> *To this phase [industrial thermodynamic] corresponds the dramatic and impassioned idea of progress as the rape of nature, the conquest of the world, the exploitation of energies. The will for power is expressed in the technicist and technocratic excessiveness of the thermodynamic era, which has taken a direction both prophetic and cataclysmal. (Simondon, 1980: 8)*

However, Simondon goes on to add that the development of technical ensembles governed by informational theory lead to a more stabilizing form of technology and must be recognized as having the potential for supporting a different form of culture and society.

The machine, as an element in the technical ensemble, becomes the effective unit which augments the quantity of information, increases negentropy, and opposes the degradation of energy. The machine is a result of organization and information; it resembles life and cooperates with life in its opposition to disorder and to the leveling out of all things that tend to deprive the world of its powers of change. The machine is something which fights against the death of the universe; it slows down, as life does, the degradation of energy, and becomes a stabilizer of the world. Such a modification of the philosophic view of technical objects heralds the possibility of making the technical being part of culture. . . . Today, technicality tends to reside in ensembles. For this reason, it can become a foundation for culture, to which it will bring a unifying and stabilizing power, making culture respond to the reality which it expresses and which it governs. (Simondon, 1980: 9)

In this statement we can discern a rebuttal of Heidegger's antipathy to technological culture. Simondon not only points to the stabilizing effect technology can have for a culture but,

more than this, that technology is actually a tool to combat entropy. Technology offers a revealing of being (or relationship with the physical regime) that is ethical in that it opens up new potentials and concretizations hitherto unknown.

In Simondon's account part of what it is to be human naturally emerges from technology use. As such our culture must reflect that technology is currently an important factor in its ongoing individuation lest it risk alienation from the contemporary technical reality. It is precisely the application of cultural values to regulate technology (as Feenberg suggests) which, from this perspective, helps maintain this form of cultural alienation.

The revealing processes associated with technology do not just occur in relation to the physical regime but also to the psycho-social regime of individuation. Once this is accepted, a new recursive level can be added to Simondon's account so that it acquires greater resonances with today's technological situation.

Concretization and Social Software

I now turn to looking at Software. This ontic domain has implications for Simondon's approach.

Matthew Fuller suggests the establishment of the discipline of Software Studies would show 'the conditions of possibility that software establishes.' (Fuller, 2008: 2). As well as echoing the method of Deleuzian transcendental empiricism, this resonates with Simondon's mechanology, especially its emphasis on the previously undiscovered synergies and relationships that technological development reveals. To maintain a Simondonian perspective software will be considered in terms of its operation. Although much has been written about how software can be defined (Mackenzie, 2006; Fuller, 2008; Manovich, forthcoming; Galloway, 2004), for example regarding its materiality as code (Hayles, 2002), we will focus on its operation, thus not separate from its instantiation within a working technological situation.

The questions I want to ask are, firstly: 'As a technology, what is software's relationship to the regime of the psycho-social?'; secondly: 'Does this relationship warrant the broadening

of mechanology's focus outside the regime of the physical?' and finally, if it does, 'Can this give us a way of understanding what differentiates new media networked technology from the kind of mechanisms on which Simondon focused?'. My claim is that one of the ways we can understand the operation of certain types of networked, software-based technology is that the associated milieu that is invented and maintained is constructed in association with the regime of the psycho-social and not just that of the physical.

We will now look at two examples in order to explore this.

The first is developed from Urs Bruegger's and Karin Knorr Cetina's discussion of the networked operation of the Foreign Exchange Market, a system which is an example of techno-social concretization underpinned by software (2002a, 2002b).

The market is comprised and maintained by the global interactions (via a multitude of devices) of traders with a software-based system which records, structures and displays these interactions back to the traders:

> *Like an array of crystals acting as lenses that collect light, focusing it on one point, the systems collect and focus activities, interests, and events on the surface of computer screens. The screens themselves are identically replicated in all connected institutions and trading floors, forming, as it were, one huge compound mirroring device and site (2002a).*

It is the relationship that the traders have with the market as it appears on the screen which interests the authors. The screen is not just a medium to receive information but 'is a building site on which a whole economic and epistemological world is erected' (2002a: 395). The traders interact with this world as if with a living organism (the authors describe this as a postsocial relationship). However it is clear that this market-world is not an object, in that it is not spatial. Its existence is rather one of process and flow.

The development and operation of this market system can be theorized in a Simondonian way as not only a process of concretization but also the development of an associated milieu.

Bruegger and Knorr Cetina describe the market prior to computerization:

> *Before the introduction of the screen, interbank currency markets were network-markets: transactions were conducted in the bilateral mould via the phone or telex, and most of the traders' time was spent finding out 'where the market was'. Any coordination that did come about was limited to those moments and parties involved in particular connections. The market nested in territorial space; it lay hidden in a transnational banking network of institutions that did not share the same information. (2002b)*

From just this short passage we can discern that one disparity that resided in the previous system was the tension between the information held about markets at the local level and the global reach of the market. It was then a problem of the speed of global information sharing which required resolution via concretization.

However:

> *After the introduction of screens, the market became fully available and identified as a separate entity in its own right for the first time – with prices, interests and the relevant information all visually indicated on screen. The market on screen is a 'whole' market and a global presence; it subdivides into different information feeds and dealing systems, but these are configured to form a global picture framed by the boundaries of the screen, which also serves as a medium for transactions. (2002b)*

With the development of the computerized market-system there is an overcoming of the local-global disparity by the construction of a single, global market.[3]

Additional to this concretization, and what marks the market-system out as a true Invented Technical Individual is the creation and maintenance of an associated milieu. What makes the associated milieu of this particular individual significant is that it is constituted by activity from the psycho-social regime and not, as with Simondon's examples, the physical regime.

From Simondon's text we can discern three general requirements for the stipulation of an Invented Technical Individual having an associated milieu. These are that:

> *i. the operation of the ITI partially determines the necessary conditions for its ongoing operation*
> *ii. a satisfactory environment for the technical object is created by some transformation of a part of the natural world*
> *iii. ITI's operate with a level of indeterminacy which enables them to adapt to their environment.*

What is the Invented Technical Individual in this example? It is the market-system, which is the whole network of devices and instantiated software as well as the traders interacting with it. Without these traders the individual would not exist because its associated milieu (the market-world) would not be operational. Although we can imagine the network operating without any trader interactions it is only with these interactions that the system operates fully as a system and original virtualities are uncovered.

In relation to the first requirement listed above the operation of the market-system creates and maintains the market-world ('market on screen') with which the traders interact and which is a necessary condition for the system's continued operation.

The part of the natural world that is transformed to create the satisfactory environment (second requirement) is the trading activity that is mediated by the instantiated operation of the software. As mentioned previously, in Simondon's own examples the portion of the natural world transformed was always part of the physical regime of individuation. In this example I suggest the associated milieu is, at least partially, constituted by activity from the regime of the psycho-social.

The third requirement refers to how an ITI and the associated milieu it creates and requires for its continued operation integrates with the environment in which it operates. As Simondon writes:

> *... the existence of the technical object is sustained by a double relationship — a relationship with its geographic environment on the one hand, and with its technical environment on the other. The technical object stands at the point where two environments come together, and it ought to be integrated into both these environments at the same time. Still, these two environments are two worlds that do not belong to the same system and are not necessarily completely compatible with each other. (Simondon, 1980: 54)*

This passage reminds us of the Uexkull inspired later writing of Merleau-Ponty on organism-environment relationship (Merleau-Ponty, 2003). For Simondon different technical individuals require differing levels of openness and adaptability to their working environments depending on their function. For example a traction engine must be able to operate on various inclines and in different climatic extremes and so requires a different level of openness and adaptability compared to a similar engine operating in relatively stable factory conditions.

It's clear that an extraordinary amount of technical infrastructure needs to be in place for the market-system to exist (e.g. global networks, server farms, computing hardware and software). However, this form of technology also requires engagement from the psycho-social in order to generate an associated milieu and become truly technological. This does not just mean economic, political and institutional structures but also the affective engagement of the traders themselves. This kind of engagement is demonstrated by one trader who, when asked what the market was for them, responded:

> *Everything. Everything. How loudly he's screaming, how excited he gets, who's selling, who's buying, where, which centre, what central banks are doing, what the large funds are doing, what the press is saying, what's happening to the CDU, what the Malaysian prime minister is saying, it's everything – everything all the time. (2002b)*

A novel aspect of this technology then, is that the cognitive and affective reactions of those who use it become part of its operational structure.

The Foreign Exchange Market is an example of quite a closed system where the instantiation of the market's rules in the hardware and software, as well as the relations of the activity of the traders within those systems, creates the emergent individual of the 'lifeform' of the market as an ongoing temporal 'object' with which traders forge a relationship. If we shift our attention to more open systems based on software we can see that a similar Simondonian analysis can apply.

The label 'Web 2.0' is a contested one (Everitt & Mills, 2009). However, Tim O'Reilly's seminal article of 2005, What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software attests, at least, to a new structuring of online sociality.

Of core importance to the operation of the software involved is the notion of network effects. What is a network effect in this context if not the establishment and exploitation of a techno-

logically mediated, constantly updated milieu of social data? The virtualities that are excavated in the software's operation are the captured operations and interactions of the users of the software. The capture of these operations is usually via databases but the process is more precisely described by the phrase 'architectures of participation' (O'Reilly, 2005) (a phrase which resonates with Deleuze and Guattari's 'apparatus of capture'). 'Architectures of participation' also invokes the cultural, aesthetic and social aspects of the software which both attract and enable capture/participation.

The importance of network effects for the actual operation of these systems can be found in the slew of Californian style aphorisms that are used to describe them, such as the call to build systems 'that get better the more people use them', or that 'data is the next Intel inside' or the more forthright: 'Network effects from user contributions are the key to market dominance in the Web 2.0 era' (O'Reilly, 2005).

What these systems usually involve is some form of retention of user engagement coupled with ongoing real-time interactions. In Simondonian terms, there is therefore an on-going transduction of the technical with the psycho-social.

This kind of operation forms the basis for retail websites such as Amazon and eBay. Of the latter, O'Reilly states 'eBay's product is the collective activity of all its users; like the web itself, eBay grows organically in response to user activity, and the company's role is as an enabler of a context in which that user activity can happen' (O'Reilly, 2005).

The social network Twitter provides another example of a more open ITI. Although we can conceive of the total ongoing traffic flowing through the Twitter data centre as the associated milieu maintained by Twitter qua ITI, the magnitude of this flow is such that an individual person is unlikely to experience it as such. Unlike the unified and integrated experience of the Foreign Exchange Market, which is 'identically replicated' on all trader screens, Twitter's users only seemingly experience such global identity through occasional widespread participation in the discussion of trending topics. However, even these trending topics are usually localized and experience of them is nuanced by the constitution of the individual's network. Where traders feel they all simultaneously experience one 'life form' via their screens for Twitter users it is perhaps more accurate to say their streams are so individualized as to be more akin to separate 'life forms'. Indeed users often edit their stream's membership in order to modulate the level of information flow and character of their personal Twitter milieu. Additionally the ability to access one's Twitter stream via different client software further increases the possibility of different user experiences.

The development of such third-party software is made possible due to the availability of Twitter's milieu of social activity via its API (Application Programming Interface). API's are openly available code-based protocols that third party software developers can use to build applications that interact with proprietary data systems. The overall Twitter API actually consists of three API's; the REST API, the Search API and the Streaming API. Each of these API sub-groups enables developers to utilise different aspects of Twitter functionality. The REST API lets developers build basic Twitter functionality into their software such as the ability to send tweets or re-tweets and unfollow or follow other users. As the name suggests the Search API enables developers to integrate Twitter search functionality into their software as well as access trending data. The Streaming API enables developers to access and publish content from the ever-changing milieu of Tweets that are currently in the system in real time.

The range of software the openness of the Twitter API enables is diverse and is important for Twitter as it allows the low-cost expansion of an Architecture of Participation to emerge which both maintains its associated milieu but also suggests lines for possible further development.

Examples of the types of software developed using the Twitter API include a range of client tools which help users access and publish to the Twitter milieu in various ways (e.g. the Tweetdeck client brands itself as for the 'power-user' and lets users simultaneously follow multiple streams, whilst a number of other apps enable Twitter functionality from mobile devices). Other tools focus on enabling the easy linking of multimedia content from within the restrictive 140-character limit of a Tweet (e.g. Instagram, YFrog and Twitvid). Additionally there are analysis tools which help users track and measure activity within the Twitter milieu, in much the same way as financial tools aid analysis of specific conditions in the financial market. A client like Hootsuite, for example, statistically tracks the uptake of tweeted content or the number of mentions a specific word or phrase has in a specific period. Another service, Klout, claims to be able to calculate a users level of influence within their online social milieu.

It is debatable that all these developments can be described as concretizations or true inventions as they don't tend to develop the operational nature of the system overall. [4]

To understand the importance of code for the establishment and further concretization of an associated social milieu it is first necessary to take a brief look at the composition of a tweet. This will enable us to understand how limitations imposed on software development helps structure its dynamism. In particular we can see how this is played out in the case of

Twitter with regards to its proposed development of 'annotations' and subsequent suppression of client software development.

A tweet consists of more than just the 140 characters (or less) that a user posts to Twitter as a status message. Every tweet consists of a number of namespaces each of which is reserved to contain a certain type of data relating to that tweet. In non-technical language a namespace is a labelled container into which data can be put. The name applied to this container (space) is a piece of meta-data that describes the kind of content it contains.

In the case of Twitter there are a number of namespaces which are stipulated and which all tweets possess. For example all tweets have the following namespaces as part of their construction:

id – this is the unique identifying number of a particular tweet
text– this is the 140 character limited text body of a tweet
source– this names which application was used to send the tweet (e.g. Tweetdeck, Tweetie, Web)

Some of the data sent in tweets is also nested within different classes. For example inside the 'user' class are namespaces for such pieces of data as:

screen_name- this is the username chosen for the Twitter account
location- this is the geographic location the user has specified for their account
followers_count- this namespace contains the value for the number of followers the user account has

It is via this relatively stable set of namespaces that Twitter's associated milieu is maintained and from which the diversity of third-party software is developed.[5]

In a move that, at the time (April 16 2010), was seen as highly significant for the developer community Twitter announced the addition of a new kind of namespace to the Twitter API called Annotations (Molina, 2010).

An annotation was not the addition of another strictly defined namespace, like those described above, to the fixed anatomy of all tweets. Rather, annotations would give developers the ability to create and name their own new namespaces which could be added to tweets via their own Twitter client software and which they could also parse and publish within that same software.

What this meant was that Twitter, in the spirit of openness, was enabling developers to define new kinds of parsable information that could be contained inside a tweet alongside the usual namespaces. This development would enable developers to create their own unique services on top of the established Twitter platform.

Not only would annotations be a significant widening of the kind of social and cultural information that would constitute the Twitter milieu but it would also facilitate the development of specialized Twitter clients that could attract sub-groups of Twitter users based around the content contained in the new namespaces.

The example Molina gives of the kind of XML code that an annotation might produce is of adding book information in additional namespaces, which would then display in a users client if it were programmed to parse that namespace, and thus save the valuable 140 characters of the main tweet for comment.[6] One could then imagine a Twitter client could be developed just for discussing books where each tweet would carry information about the book being discussed.

As Molina states in his announcement the possibilities for the utilization of annotations was very broad:

> *Annotations are a blank slate that lend themselves to myriad divergent use cases. We want to provide open-ended utility for all the developers to innovate on top of . . . Certain annotations will become standards democratically because everyone agrees. Some might have diverging opinions. It's something that we hope will grow organically and be driven by sociological and cultural forces. (Molina, 2010)*

Although online discussion regarding the potential utilisation of annotations in Twitter didn't progress beyond commercial application there is no doubt that such an opening up of the Twitter API could also have social and political uses as well as enabling an even more defined analytics. [7]

From the Simondonian perspective such a broadening of the Twitter associated milieu can be understood as an increase of indeterminacy in the system which in turn enables the possibility for further concretization.

So, for example, the individuation of smaller and more nuanced psycho-social groupings around niche collections of annotations augmenting the standard Twitter milieu and accessed via a range of independently developed Twitter clients could be envisaged.

However, at the time of writing this potential line of progression in the Twitter API seems to have been dealt a fatal blow. On March 11 2011 Twitter changed its API Terms of Service (Twitter, 2011) and contacted independent developers to warn them to stop developing Twitter clients. In this message to the community Twitter's platform/API leader Ryan Sarver (2011) bluntly stated:

> *More specifically, developers ask us if they should build client apps that mimic or reproduce the mainstream Twitter consumer client experience. The answer is no. [8]*

The reasons given for this move was that Twitter claimed that they wanted their users to 'experience a unified Twitter experience', that is they felt the ability to access the Twitter milieu via different clients might confuse users. Additionally there were also some privacy concerns with allowing access to Twitters API via clients they could not control. These reasons were generally met with scepticism and surprise by the developer community. As if to compound this move of stifling further client development Twitter also acquired Tweetdeck, the one remaining widely used third-party Twitter client they didn't already own.

Although the Annotations project was already on hold this announcement and simultaneous change to the Twitter API Terms of Service seems to have killed off this line of development altogether as well as any supplementary lines of development which might have concretised around it. The barring of developers from building clients which can accept information outside the main timeline (which is essentially what annotations do) prevents the utilization of annotations at all.

This move has effectively closed the development of the Architecture of Participation and associated regime of functioning of Twitter to third-party developers and locked it down in a way similar to the Foreign Exchange Market discussed earlier. This means that outside the proprietary Twitter development team the opportunity for invention proper has been ended,

as there is no opportunity to increase the operational indeterminacy from which fresh inventive leaps can emerge. [9]

It should now be clear that unlike Simondon's purified version, a mechanology of social software must include social and cultural aspects in the concretization process. As a result, despite Simondon's dismissal of adornment in relation to mechanical technology, for social software cultural phenomena are not an obstacle to, but an additional opportunity for, technical development. As such it's possible to suggest that there is a co-constitution of the technical with the social at a new level.

Yet the point is that such utilizations of Simondon's operational theorizing of technology in no ways go against his core description of a mechanology. As we saw earlier Simondon describes the development of an associated milieu as being 'the mediator of the relationship between manufactured technical elements and natural elements' and that for him nature includes the psycho-social. What we argue, however, is that Simondon's reluctance to allow social aspects into his theory of concretization cannot be sustained when considering contemporary networked media technologies, other than at the cost of their being denied technological status.

A rejoinder could be made that the milieus created for the operation of these technologies are not strictly psycho-social as they tend to consist of recorded interactions which are therefore now physical artefacts within a system. Although this is strictly true it is still necessary that the interactions (which are cultural in nature) occur in the first instance. Moreover, the milieus under discussion require that interactions are ongoing. This permanent transformative nature of the milieu not only describes one way technology supports the creation of the transindividual but that the transindividual reciprocally feeds back into the ongoing maintenance of the milieu. What Simondon says of the Guimbal turbine applies just as well to a social technology such as Twitter or the technology on which stock markets run: 'Technical objects which in their liaison with the natural world put into play what is essentially a recurrent causality must be invented rather than developed in stages, because such objects are the cause of their own condition of functioning' (Simondon, 1980: 61).

This also introduces a different way to theorize the distinctiveness of such techno-social networks; that is as technologies whose associated milieus are, at least partially but emphatically, constituted by recurrent causality with the regime of the psycho-social.

The change in the nature of this recurrent causality has ethical consequences in that it engenders the possibility for the production of new technological lineages that have the potential to support different forms of culture and society.

The example of Twitter annotations illustrates that the corporate ownership of associated milieus of psycho-social activity necessarily leads to a closing down not only of technical invention but also of the mediated psycho-social. Following Simondon's analysis of informational technology as being regulative in the same way that culture is, then concern at the corporate control of social software is surely justified.

Recent developments regarding the expansion of the attention economy (Beller, 2006), new forms of labour (Scholz, 2008), the focus on data-mining (O'Reilly & Battelle, 2009), the competition to collect the social graph of network participants, and fears over copyright, control and surveillance are just some examples of the ethical (in the sense of the possibilities for affecting and being affected) implications of social software and its control.

The plasticity of software (encapsulated in the notion of the API) which organizes such relationships also presents new ethical challenges as the 'rhythm and relaxation' of development of such technology occurs at increasing speed.

It is the ability to track the operational implications of such changes that makes Simondon's ontology so valuable. A unique aspect of Simondon's analysis is that entities, or individuals as they are conventionally thought of, are never complete. That is their process of individuation does not result in a stable individual we can call finished. It is this quality that enables them to provide the pre-individual milieus for further concretizations. This contrasts with the link-node analysis of relations we find in much network theory which focuses on how fully formed (saturated), autonomous and fully-present objects come into relation with one another. This often leads to analysis of these networks as ones that are static or rely for change on power differentials between node objects.[10] Simondon's notion of concretization, on the other hand, does not neglect the role of power in relations but rethinks what a relation actually is, so that it is re-theorized as a constructive operation and not a reification of a relationship. In network theory the relation itself becomes as object-like as the terms it brings into relation, resulting in the problem of accounting for the recursive relations between three objects. For example, although we can map the financial market or Twitter as a network of people, devices, software etc this does not capture the reality of the ongoing operation of all these things. This is something a Simondonian analysis gets us closer to.

Broadening Simondon's theory of technical genesis, so that it goes beyond the development of a double relationship with the regime of physical individuation to include the psycho-social, demonstrates the relevance of his theory to contemporary networked media.

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Notes

[1] Simondon's wider project involves providing an account of nature as the progressive development of the individuation process which constitutes three regimes (physical, biological and psycho-collective) all of which ultimately develop from a metastable, pre-individual being. Simondon develops the idea of the pre-individual from a range of sources including thermodynamics (especially potential energy) and Anaxaminder's apeiron. The pre-individual is not a substantial ground which subtends all individuation but must be regarded as the metastable condition of being, that is 'a being that is more than unity and more than identity, and that has not yet dephased itself into multiple dimensions (Simondon, 2009: 11).'

Furthermore, in his work Simondon gives an account of the immanent operation of the individuation of being (transduction) which underpins his delineation of the various regimes of nature as well as the development of technological objects as outlined in this essay. The transductive operation is both a dephasing and structuring operation which Simondon develops from both thermodynamics and cybernetics and which ontologically prioritizes the

process of individuation over any purported individual

[2] Simondon's claim for the need for the development of a technological culture needs to be understood in relation to his understanding of alienation, which differs to that developed by Marx. For Simondon contemporary culture is out of phase with the technical reality within which we live (because it is based on ancient culture which was developed in relation to tools and not machines) for it neither understands or takes into account that technical individuals are 'the end-product of an evolution' (mechanology) rather than mere utensils. To create a productive resonance between culture and technology the behaviours that govern development in both (concretization/saturation) need to be understood and taken into account so man is not alienated from the technical aspects of the reality that surround him.

[3] The system is still being improved, for example, in 2006 the Philadelphia Stock Exchange relocated most of its trading engines '80 miles — and three milliseconds — from Philadelphia, and into NJ2, where . . . the time to communicate between servers is down to a millionth of a second' (Vanderbilt, 2009). These types of improvement are not concretizations however as they do not lead to further qualitative developments of the system.

[4] The development of applications for mobile devices, especially phones, may be the exception here as they do constitute a real development of the system's relation to its operational environment in both the physical and psycho-social sense with the enabling of more widespread user interactions as well as the development of a location based dimension via GPS. The latter especially can be seen as a further concretization between software and environment.

[5] For a full list of the namespaces contained in a tweet see Raffi Krikorian's Map of a Twitter status object: http://mehack.com/map-of-a-twitter-status-object.

[6] From Molina's (2010) XML example it is easy to discern how the annotations tags contains the new developer created namespaces in a traditional nested format.

```
<annotations>
<annotation>
<namespace>iso</namespace>
<key>isbn</key>
```

<value>030759243X</value>
</annotation>
<annotation>
<namespace>amazon</namespace>
<key>url</key>
<value>
http://www.amazon.com/Although-Course-You-Becoming-Yourself/dp/030759...
</value>
</annotation>
</annotations>

[7] An analysis of blog posts by developers just after the announcement shows a concentration of thinking around annotations as providing potential for either commercial or fairly straightforward cultural use.

For example Mal Curtis (2010) suggests annotations could be used to append links to other media files, translations of the tweet in other languages or even software code to tweets. Additionally he also sees such further applications as "the weather, your location, currently listening music / watching tv / film and your Facebook / social media profile information. Or advertising."

[8] The extent of the changes to the API Terms of Service can be seen in the comparison document produced by Somerville (2011). Section 1.5 in particular applies to legally enforcing the request made by Twitter to developers to restrict development of clients.

[9] Zittrain's (2008) argument regarding generative development expresses a similar notion to Simondon's affirmation of the importance of indeterminacy for further invention. For Zittrain a platform is non-generative when it is so locked down that it prevents innovation by its users because they are required to use it in one specific way. Conversely a generative platform allows users to 'tinker' and explore freely and thus uncover potential lines of development on that platform.

[10] This portrayal of Network Theory is based on Graham Harman's metaphysical exposition of Bruno Latour's work in Prince of Networks (Harman, 2009). The author is aware that this is just one version of Network Theory but the clarity with which the Ontology is developed in this work helps sharpen the general comparison to Simondon.

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