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Gilbert Simondon's Genetic "Mecanology" and the understanding of laws of technical evolution

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Abstract
Since the 1930's, several attempts have been made to develop a general theory of technical systems or objects and their evolution: in France, Jacques Lafitte, André Leroi-Gourhan, Bertrand Gille, Yves Deforge, and Gilbert Simondon are the main representatives of this trend. In this paper, we focus on the work of Simondon: his analysis of technical progress is based on the hypothesis that technology has its own laws and that customer demand has no paramount influence upon the evolution of technical systems. We first describe the process Simondon called "concretization" and compare it with the process of "idealization" as defined by Genrich Altshuller. We then explain how the progress of technical lineages can be characterized as following a specific rhythm of relaxation and how it thus obeys a "law" of evolution in the industrial context. Simondon's theoretical approach, although similar to some aspects of methodologies of conception, emphasized a more accurate understanding of technical progress over possible operational applications. Simondon never intended to optimize the engineer's tasks from an economic point of view and, in fact, his conception of technical progress can be considered as independent from the capitalistic trend of innovation. However, the philosophy of Simondon provides a better understanding of what is at stake theoretically in the modeling of laws of technical evolution.

Keywords: Invention, Laws of Technical Evolution, Log-periodic models, Mecanology, Relaxation, Simondon**.**

1. Introduction

Fifty years after its initial publication (1958), *Du mode d'existence des objets techniques* (1) is still a profound work of philosophy of technique and a source of inspiration for many engineers and researchers. Gilbert Simondon (1924-1989) elaborated his analysis alone, but it was rooted in an older French tradition of research. In 1932, Jacques Lafitte had proposed, in his book *Réflexions sur la science des machines* (2), to establish the theoretical foundation of 'la mécanologie' as an autonomous science. Among many others, the anthropologist André Leroi-Gourhan, the historian Bertrand Gille, and the technologist Yves Deforge have since tried to develop a general theory of technical systems and their evolution. Simondon's main references were the work of Leroi-Gourhan on the evolution of prehistoric tools, the theorization of technical lineages by Lafitte, the analogies between technological, biological and political systems elaborated in Norbert Wiener's cybernetic, and, on the philosophical side, the ontogenetic philosophy of Henri Bergson, Maurice Merleau-Ponty's phenomenology, and Gaston Bachelard's historical epistemology.

One may also compare his work with Genrich Altshuller's contemporaneous theory (TRIZ). Altshuller's theory of innovation and Simondon's genetic approach are certainly the two theoretical contributions that are closest to engineers' methodologies of conception**.** But, while TRIZ was developed with the explicit purpose of improving soviet engineering practices and

industrial organization, Simondon's work eschewed such pragmatic intentions and intended rather to elaborate an ethical perspective on technological issues in order to reveal the cultural value of technical objects.

However, both Altshuller and Simondon presented the hypothesis that technical evolution obeys first and foremost the necessity of solving internal problems and that the user or the consumer's demand have no paramount influence upon this evolution. These similarities highlight the fact that, despite its foundation in philosophy, mecanology can converge with an applied methodology like TRIZ. Based on the hypothesis of an autonomous evolution of technical systems, genetic mecanology is still almost unknown to non-French scholars (3). Therefore it is useful to explain this original contribution to the understanding of technical systems.

With this goal in mind, we will first examine the process that Simondon called "concretization". The progress of technical lineages or the process of concretization is very similar to certain aspects of Davis Baird's analysis (4), especially in regard to the dynamism of "adaptation" and "emulation". According to Simondon, a "concrete" object is not simply a material one (as opposed to an abstract object such as a diagram). It is the final stage of a process of technical evolution, the state of a perfectly consistent functioning object. The concrete object is thus a real individual. Simondon knew that one can use another word for "concretiveness" (5)**,** so we can assume, for example, that Simondon's concretiveness in many respects stands for what is "ideality" in TRIZ (6).

Simondon thought that technical evolution shows phases of continuous progress (adaptation) alternating with other phases of saturation during which major improvement must emerge as a global reconfiguration of the structure (invention). These thresholds and ruptures of gradual evolution confer a typical rhythm to the historical evolution of technical lineages.

It is well known that the adaptation of a technical object can usually be described as a sigmoid process, although such a description is not so often justified by quantitative data (7). Nevertheless, we may ask whether there is a quantifiable law that can describe a sequence of successive sigmoid processes. It would mean that the rhythm of inventions inside a technical lineage can be predicted by a "law", just as some researchers currently propose to do with a log-periodic equation. But the mathematical modeling of this "law" remains somewhat ambiguous because many different concretization processes occur at different levels: according to Altshuller, the unequal development of the components determines the saturation of the adaptation of the technical system; Simondon also observes this operation with different objects in a much wider technological system; technological systems themselves change because of new scientific paradigms.

This type of law is also ambiguous because the rhythm of invention is not the same thing, according to Simondon's view, as the actual economic trends of technological innovation: criteria of technical progress don't necessarily match the optimization constraints that affect engineers. Simondon's mecanology is above all a philosophical analysis and as such it is normative and irreducible to operational methods of conception, like TRIZ. Still, although they have different purposes, engineers' methods and genetic mecanology show deep similarities in their description of technical evolution and its hypothetical laws. We thus claim that a clear presentation of Simondon's work may provide a better understanding of the modeling of the evolution of technical systems in general, as well as provide interesting insights for engineers, even if they don't share the same purpose.

2. The progress of technical lineages: the analogy between processes of concretization and idealization.

Like Laffite before him (2), Simondon proposed the concept of *technical lineages* to understand the historical evolution of technical objects. A genuine mecanology contrasts with other studies of technique: the unity of a technical lineage must not be determined by the function and utilization of technical objects because such a criterion would regroup objects with very different structures and functioning. The unity of a lineage defined by utilization is not to be found in the nature of the technical objects themselves but in the functioning and perceptions of the consumers and users. For example, a steam engine, an electric engine, a gas engine, and a spring engine are not a single family and hence don't belong to the same lineage: the spring engine is more like a cousin of the crossbow, unlike the other engines. Paul Dumouchel has well expressed the core of this genealogical method: "Technical objects have a reality which is independent of the user's stance and which can be observed by studying their history and evolution" (3: 8). To establish a relationship between objects according to their internal functioning as opposed to their utilization is one of the main principles of genetic mecanology.

To talk about concretization outside of a technical lineage has no meaning. Of course, technical lineages are usually complex. Technical rationality can arise at the same time in many areas without connection and with local specificities. Simondon observed that the evolution of technical systems proceeds alternatively with ramifications and selections of the range of a lineage: technical evolution is sometimes proliferating and sometimes restrained. Hence it is subject to path dependence and may appear retrospectively linear.

Furthermore, the genetic method implies that one can identify the "origin" of each lineage. Simondon calls this first stage of evolution an "abstract object", because, initially, the technical object is composed of independently functioning components: "In the old engine, each element gets involved at a precise stage of the cycle, then it is supposed to remain still and not interfere with the other elements; the pieces of the engine are like people who would work each at their turn but who would not know each other" (1: 21). Genetic mecanology also assumes that the evolution of technical systems is not meaningless, nor random; the transformations of the structures and functioning of the objects inside a lineage are determined by specific dynamics of self adaptation, self regulation and convergence of functions. Moreover, these transformations are recurrent: the technical object becomes a system of more and more synergic functions.

Just as Leroi-Gourhan showed in his study of prehistoric tools (8), Simondon's genetic analysis of vacuum tubes and engines are validated by the fact that the immanent order of concretization is the same as that of the historically observed order. From the abstract object to the concrete object, the process is very similar to the growing of ideality. It is gratifying that these descriptions converge, though Altshuller and Simondon chose almost contradictory words: concrete and ideal.

Figure 1: Printing plate 4 in MEOT (1). The concretization process: evolution of the electronic tube from 1924 to 1952. The ebonite base became smaller and smaller until it eventually vanished; the functional parts grew larger and larger and, at the end, fill the total volume of the glass light bulb. Functional convergences also imply the differentiation of functions. Specialization is accomplished synergy by synergy.

Another similarity is suggested by the fact that the abstract stage is, according to Simondon, an object where any energy exchange between the elements (which is not intended by the functioning) is considered as a defect: this is analogous to the TRIZ law of energy conductivity. From the abstract origin to the final concrete phase, the concretization process shows two types of progress: there is some minor progression, by gradual enhancement and adaptation of each technical element, function by function; and then come major improvements, inventions or reconfigurations of the structure, that do not represent compromise, but rather resolutions of incompatibilities between subsystems, so that they are integrated into the functioning of the entire system. Altshuller and Simondon also agree on the evaluation of the process of invention: real improvements in technical evolution do not result from a compromise between the contradictory effects or constraints caused by the functioning of subsystems but come from the outgoing of incompatibilities (or "contradictions" in the dialectical vocabulary of TRIZ). Major improvements must occur through a recombination of the subsystems in a way that they collaborate instead of opposing each other. Simondon uses the word "convergence" for this typical effect of major reinvention of an object in a lineage: "The technical problem is more that of a convergence of functions in a structural unity than of the search for a compromise between conflicting demands" (1:22). The evolution of a technical lineage leads to a totally unified technical individual.

Finally, TRIZ and genetic mecanology formulate the same hypothesis to account for the evolution of technical lineages: this is no blind or random process, nor is it subject to the caprice of external factors. Technical systems have, from the beginning, intrinsic potentialities of

evolution and they can evolve only towards a limited number of final types: "If technical objects evolve towards a limited number of specific types, that is in virtue of an internal necessity and not on the strength of economical influences nor practical demands" (1: 24). Again we can quote Dumouchel who subtly notes: "Like spontaneous orders in economy, concretization is the result of human actions but not necessarily of human design or fantasy" (3: 12).

3. The criteria for the evaluation of technical progress (concretization).

The first manifestation of the concretiveness of an object is its individuality: a tool is a good tool if it is solid, a wheel or a simple machine must have a structural unity, and a more complex system is well constructed if its functioning is coherent. A machine can exist only if it is reliable, if its functioning is sustainable, that means first of all if it does not self-destruct: good functioning, coherence and stability are required in order to create a machine that will last. For example, the first diesel engine could not last because its conception could not prevent it from bursting: oil and air were mixing before the compression. The second diesel engine, on the other hand, was sustainable because the mixing occurs after the compression. A thin spraying of gas-oil sparks the ignition, because the air is simultaneously very hot. The different operations are thus well coordinated in order to ensure coherent functioning, in a synergistic way, while its "ancestor" was self-destructing.

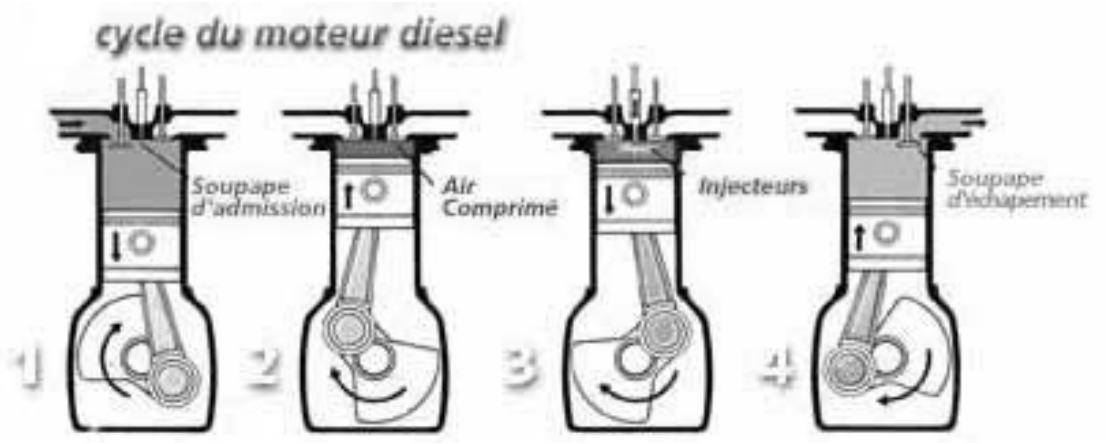

Figure 2: Cyclic functioning of diesel engine.

'Concretiveness' means therefore a perfect harmony in the technical object: the more constructive interferences there are between multifunctional elements, the more concrete the object is. Simondon's favorite example is the fins of the cylinder in an air-cooled engine. The fins are obviously supposed to expand the surface of thermal exchange in order to evacuate more heat into the air, but they can also improve the solidity of the cylinder. This is clearly an example of synergic convergence of functions. The development of these convergences in a technical system is the most apparent outcome of concretization. When one structure of a technical object is replaced by another, there is progress only if the subsystems are more synergic. Moreover, concretization implies that the environment external to the functioning is more and more integrated into the global functioning: what is first outside the object, as background or"associated milieu", becomes an internal environment inside the object. A concrete object often autonomously regulates its functioning. Simondon was very impressed by the turbine invented by the French engineer Jean Guimbal.

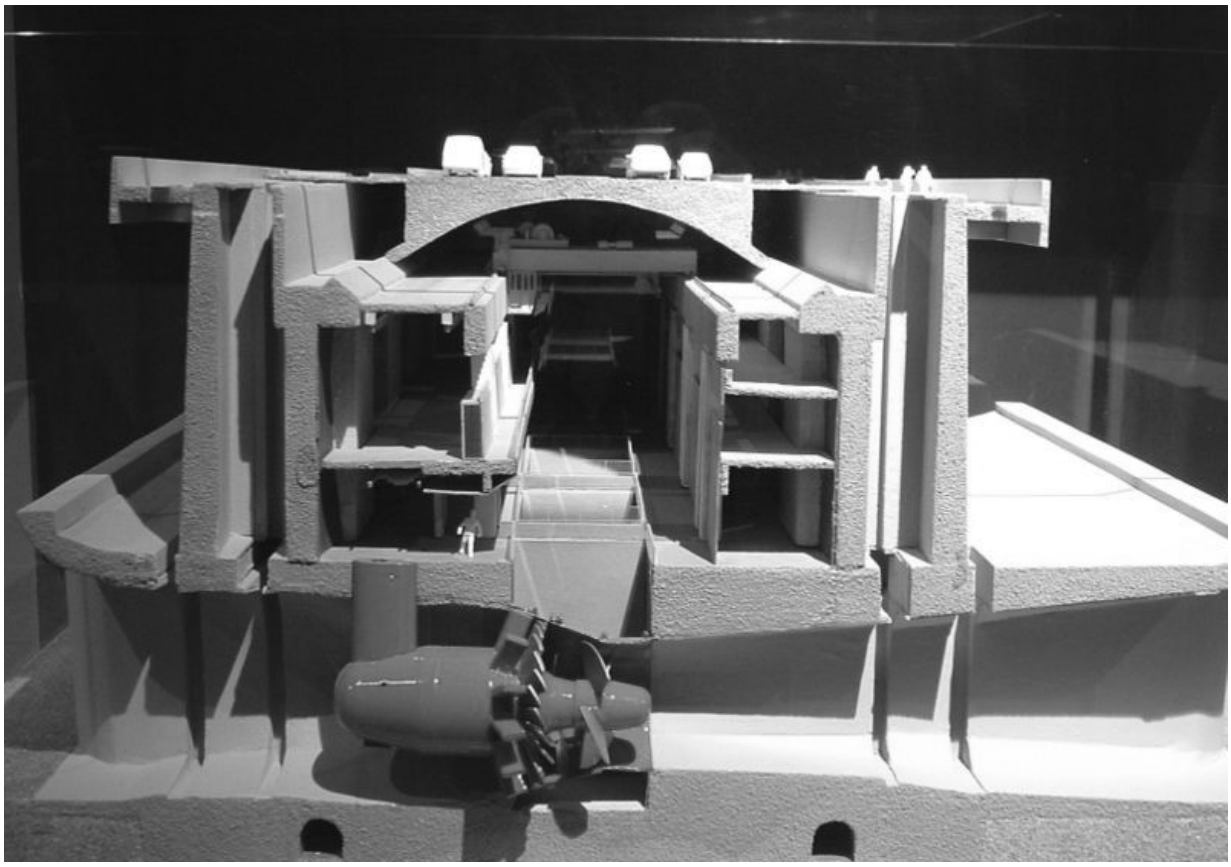

Figure 3 : Scale model of the Rance tidal power plant with its bulb turbine.

This “bulb turbine” was indeed a very clever invention: it is sustainable only because its environment was incorporated into its conception from the beginning. The idea was to fabricate an alternator which would be small enough to fit inside a watertight oil pan located just behind the turbine. To conceive such a small alternator, one has to consider cooling as resolved, otherwise the electric cables would be so tight that the high ohmic resistance would imply a huge thermal dissipation and therefore would lead to the self-destruction of the device through melting. By assuming that the alternator was able to be totally immersed in oil, which is commoved by its own rotation, Guimbal has solved this problem: the oil will bring the heat to the inner wall of the slum, which was itself immersed into the water pipe. The stronger the flow is, the more heat is produced, but more flow is also generated to clear up the heat. Guimbal solved the problem at the same time he formulated it. This example of auto-regulation reveals the strong influence that Wiener’s work (9) and cybernetics in general exerted on Simondon’s research. He extended the cybernetic notions of feed-back and of homeostasis to all machines, not only the information machine.

According to Simondon, the inventiveness of Guimbal is also revealed in the very elegant design of his invention: the space above the device is supposed to be empty, but an oil tank produces the overpressure inside the carter (so that no water can get inside). The very technical beauty is therefore invisible from outside: it can only be perceived by a technical analysis. It is not as if design were an independent activity employed to disguise the technical device after it is

conceived. Simondon strongly criticizes this sort of superficial and cosmetic design that hides the real technical essence of an object. Evolution of the external appearance of an object, uncorrelated with an internal reconfiguration, is not part of the concretization process. The "historicity" of a technical object is defined by its stage of concretization. The external appearance and design are a sort of social and cultural "super-historicity" without any real technical meaning. Inventions are often first presented in the guise of older products in order not to disturb consumers. Some objects seem obsolete when they are only out of fashion, and others claim to be innovations when they are hiding archaic functioning with a flattering appearance. Simondon's genetic mecanology uses only strictly internal criteria to evaluate the progress of technical lineages: "This notion of technical progress renders the evolution of technical objects independent from social demand and from the pressure it exerts upon the distribution and modification of such objects" (3: 14).

Thus Simondon describes concretization as an independent process marked by specific behavior: evolution proceeds level by level, from one systematic configuration to another, and gradual evolutions may appear during the stable periods at each level. Recurrent transformations between the levels give information about the "logic" of the progress and suggest that a law exists. This law of evolution of technical systems is not, like in Laffite's work, the introduction of a natural law from physics into the new field of "mecanology". As independent as they are, technical evolutions are not natural evolutions but artificial ones. So the law of technical evolution is the objectification of a regular rhythm from a human process: it is a tool for forecasting (prospective) not a rule for prediction.

4. Technical evolution during the industrial era: standardization and networks.

After the second industrial revolution, technical objects fabricated at our scale (*i.e.* at the individual level) are no longer the same organic totality they were when produced by handcrafted means and as a set of original parts. They are now just an assembling set: each element is produced in a series and can therefore be replaced by its equivalent. To function, an industrial assembly process must be composed of standardized pieces which are under the same constraints as those to which the whole formerly handcrafted object was subjected. Hence *standardization* expresses the process of concretization at the level of technical subsystems during the industrial phase. This subsystem is even more concrete than the object because it "exceeds by its power of adaptation and circulation the range of objects for domestic use: it fits into distribution and exchange channels that extend to the whole planet, it supplies networks at the scale of the world, and it can be employed in the building or the repairing of many different types of objects for domestic use" (10: 236).

Thus mecanology must change its level of analysis to apply its method to industrial concretization: the technical characteristics of the object are no longer at their own scale but, from then on, at the levels of their components and network. At the individual level, the object is subject to a design that is adapted to the consumer's taste: "This is the most important positive characteristic of industrial production. The alienation of super-historicity takes place only at the human scale and focuses at this level, while the micro-level of the components, the real technical elements, and the macro-level of distribution and exchange networks, are exempt from it" (10: 236). Somehow, industrial production, by standardizing and developing huge networks, frees technique from the bounds of the object's dimension at the same time that it reveals the non-coincidence of the technical essence of an object and it's utility.

Simondon calls this process a "phase différentiation" of "technicity" towards inferior and superior technological levels, whereas concretization works at other scales. The non-equivalent evolution of the elements must have an influence on the evolution of technical individuals. The concretization of the components leads, for example, to the miniaturization of objects: "Therefore, the magneto-electric engines are now a lot smaller than they were in Gramme's time, because the magnets are considerably reduced" (1: 65). However, miniaturization is not the same process as concretization, but rather one of its results: miniaturization represents progress from the user's point of view but not necessarily from a technical point of view if a reconfiguration is not accomplished at the same time. Nevertheless, the link between miniaturization and concretization may be precisely the point that must be studied in detail if we want to understand what a law of technical evolution would be according to Simondon.

The uneven development of the component's functions causes the saturation of the progress of a technical system. But Simondon also analysed this phenomenon at another level: the global technological network is subject to saturation when the improvements of objects' concretization are exhausted. Therefore, studying at this level allows us to find a specific rhythm and its law of relaxation. The standardization of components creates an historical solidarity between all the technical realities: historicity. How can we understand and, perhaps, forecast this historicity? There is not only synchronic solidarity between technical devices but also diachronic rhythm, a very specific duration of a technique all along the succession inside a lineage "that determines by its law of serrated evolution the significant periods of the life of a technique" (1: 67).

5. The law of relaxation as law of technological evolution: a log-periodic equation?

Evolution's law of the technical system is a "law of relaxation", which, according to Simondon, is without any equivalent in the natural (physical or biological) world. Technique has a specific and original rhythm of relaxation: "Such a rhythm of relaxation has no equivalent anywhere else; neither the human world, nor the geographic world can produce such an oscillation with successive crises and emergence of new structures" (1:67). These new structures are not only the reconfigurations inside of technical lineages but also the results of bifurcations and substitution between lineages. When a real technological revolution occurs, a technical lineage may be transformed, but it may also be abandoned and replaced by new ones with different functioning processes.

Following his research on the concretization of electronic tubes, Simondon also studied transistors and the amplification process (11). His other philosophical works employ "modulation" as a main concept. So we can be sure that he observed very closely the technical evolution that led to microchips. Nevertheless it is not a single lineage. From the electronic tube to semi-conductors, and then from the transistor to microchips, technical evolution has only a functional unity. Hence it is not a simple concretization process but a "substitution after saturation" as Smaïl Aït-el-Hadj describes it (12).

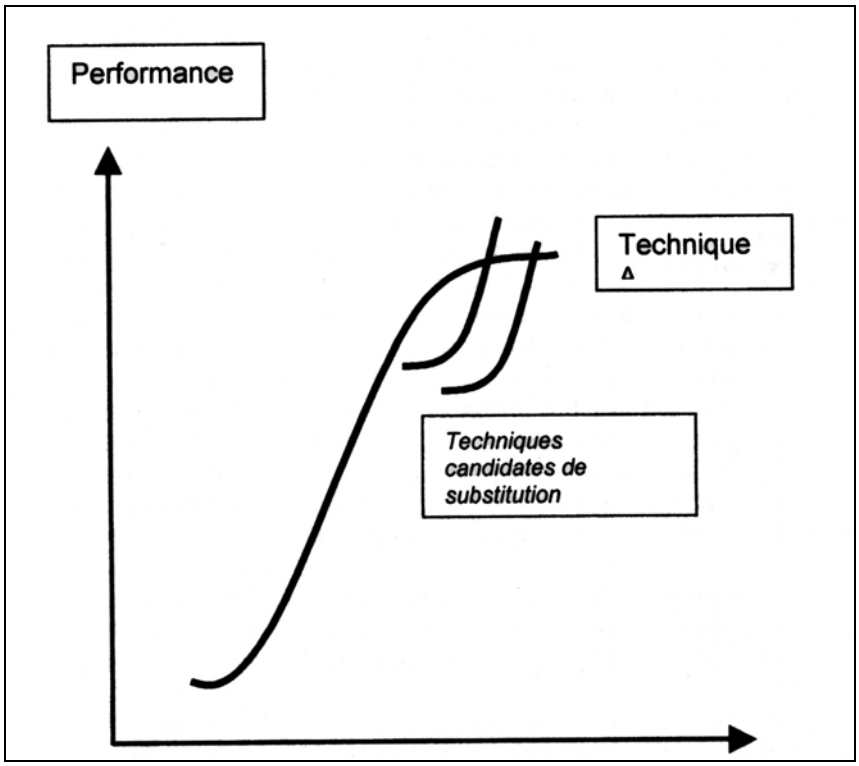

Figure 4: Technological substitution after the saturation of a technical lineage (12: 148).

As it creates new structures in a proliferating ramification, the relaxation of technological evolution can be set apart from all other laws of evolution by Simondon. It is to be noticed that, according to Simondon, the difference between the natural and the technological world is not exactly the same as that between a natural and an artificial object: technicity can be found in some organic tools (like crab claws) but it is found foremost in organized matter; artificiality is quite different, because it means that an artificial object needs a specific and artificial environment to live or function: hothouse flowers are artificial, and so are machines that cannot function anywhere. Concretization can lead to hypertely but in general the more concrete a machine the better it adapts to every environment (because it has integrated its own "milieu associé") and so, in fact, it's more natural than artificial! However, concretization itself is an artificial process because it occurs only in a technological system. Some relaxation processes do exist in the natural world, like certain geysers for example, but such processes are functioning as a periodic cycle: in the end they come back to their initial state, they do not create any new structures. But recent research (13, 14) shows that these differences are not particularly relevant: many physical as well as biological morphogenetic processes have been identified which show exactly the same recurrent crises and creation of new structures. Does this mean that there are no longer any differences between the law of evolution of a technical system and natural laws? Probably not. On the one hand, there is still a difference of nature between artificial and natural systems ; on the other hand, it appears that we now have a new way to model this sort of evolution: *log-periodic equations*.

These models have been invented precisely to describe processes that show alternative phases of gradual progress and crisis culminating in a global change. Therefore, they correspond

qualitatively to the natural processes of relaxation which are analogous to the succession of the sigmoid curves in the evolution of technological systems.

These log-periodic laws are already used for modeling many different processes, such as the aftershocks of earthquakes or stock market crashes (13). This sort of equation has also been proposed for modeling the morphogenesis of astronomical structures, the evolution of biological species or the long cycle of economic development (14), the evolution of particle accelerators (from the first cyclotron to the proton collider LHC) and even the chronologic evolution of jazz! (15).

After he studied earthquakes, Didier Sornette was the first to determine the range of this sort of equation, afterwards becoming a respected economist. He defined log-periodical laws as a modification of classical power laws with a complex dimension. The basic equation describes a self-similar fractal ramification. For a temporal evolution (like a genealogical lineage), it predicts the time interval between two evolutional crises:

$$(1)\ (T_n - T_c) = (T^0 - T_c)\ \square g^{-n}$$

T_c is a critical time (for example, the concrete stage for a technical lineage) and the end of the evolution predicted by the theory. This limit can be reached only after a series of events T_n (successive crisis: saturation and then invention or substitution). There is a constant ratio g between two successive events (T_{n+1} / T_n) and T^0 is also a constant that can be calculated for each type of lineage. So the equation (1) means that there is a self-similarity with a factor g when one compares the series of time intervals in a logarithmic scale: log (T_n-T_c). One may thus model an accelerating evolution as well as a decelerating one. This sort of "law" is a probabilistic one and it predicts only the rhythm of major transformations, not their nature. The only prediction about what will happen is then provided by the supposed recurrence of these events. We are therefore invited to interpret TRIZ and Simondon's analysis as qualitative laws that complete this quantitative law of relaxation.

This sort of anticipation works only during the crisis within a technical lineage. During a technological revolution, the substitution of one technical lineage by another is the result of a selection between many new structures and functioning possibilities. So, even if the concepts of "laws" and "lineage" suggest a linear evolution and a predetermined process, it is a retrospective illusion: there is path dependence in the technical evolution that hides the other possibilities. One may invent in the future a new structure that is in fact the resurgence of a previously abandoned process of concretization.

However, we claim that log-periodic laws should be included among the theoretical tools of genetic mecanology as well as those of TRIZ. They can be used for many types of empirical studies and even for forecasting. The physicist Laurent Nottale is one of the researchers that use these equations. He has recently (17) proposed to apply them to the alternative phases of gradual progress and saturation of technological evolution by identifying major events as technological ruptures caused by scientific revolutions (16). For him "technological innovation is not a random process. Moreover, it is certainly not disconnected from the great changes of paradigms occurring in fundamental physics. Fundamental theories and knowledge are indeed the ground and basis for the development of innovations" (17: 2). This approach holds much promise although many theoretical problems remain. First, Altshuller, Simondon and Nottale seem to share the same ambition of modeling technical evolution and propose analogous tools to do it. We may

nevertheless ask whether they are really studying the same object as those engineers and designers who want to anticipate technological innovation.

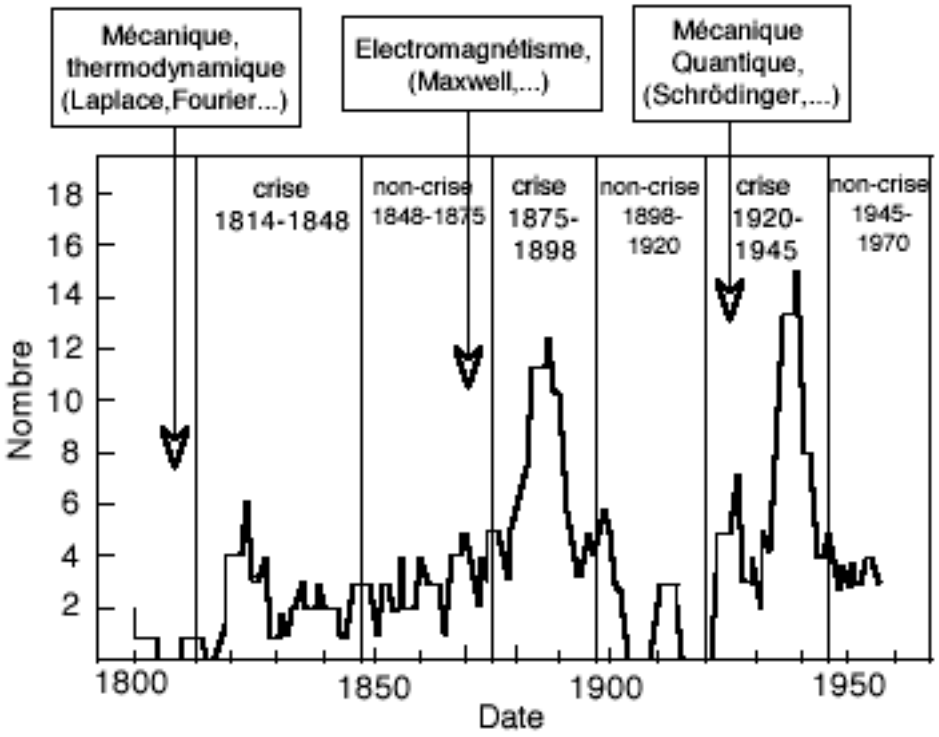

Figure 5: Chronological correspondence between scientific revolutions, long economic cycles and the alternative rhythm of technological progress and stagnation phases between 1800 and 1960 (17: 2).

6. Conclusion

The work of Nottale seems to confirm some of the hypotheses of genetic mecanology, especially the possibility of modeling a law of the evolution of technical systems and the importance of saturation phases. But the inventions (technical reconfigurations) that can be predicted are not the same events as innovations (modifications in order to increase the value). Altshuller developed his theory in a non-capitalistic environment; Simondon explicitly described concretization as a process disconnected from economic factors (which can only disturb the process); Nottale has connected the scientific, technological and economic processes, but he still gives priority to technology over economy.

Is this what engineers and designers are looking for? Or is the methodology of conception concerned more with understanding the capitalistic dynamic? Against any naive hope of predicting the creation of new technologies, it must be reminded that concretization is not the same process as what we observe today in technological innovation and the search for the greatest economic productivity.

For instance, Simondon sometimes gave very surprising definitions of progress: during an interview with the technologist Jean Le Moyne, in 1968, he defends the idea that, in some respects, a thermal machine is superior to an electric machine because it can work without being

connected to a network. What a strange point of view! Simondon then recalls that, at the end of World War II, steam engines were very useful to the French resistance. So, we must conclude with a dilemma: Simondon's work offers a law of evolution of *pure* technique; but what most of people are eager to understand, from an operational point of view, is precisely not so pure.

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Communicative In-Betweens of E-mail Communication

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Abstract
In this paper I seek to deconstruct internet-based communication. I highlight Derrida's focus on the margins and in-betweens of communication, and relate it to the genre of e-mail. I argue (i) that the silence between the dialogic turns becomes more marked, while (ii) the separation of present and previous statements becomes less marked. The visibility of the silence between the turns (i) can be a resource for increased awareness of how communicative exchanges are shaped by self-arrangements and -presentations. The dissolution of the separation between present and previous statements (ii) can be a source for unfruitful quarrels.

Keywords: deconstruction, in-betweens, digital communication, self-reflection, conflict escalation

Derrida demonstrated in his writings that communicative media are essentially shaped by the silence, the in-betweens, the margins, the spectres that surround the media. He did, however, never relate thoroughly to the digital media. However, in the past thirty years, the communicative landscape has changed with, among other technological innovations, an overwhelming use of digital media. These media have in turn engendered numerous new communicative relationships, which again has engendered changes in language and social constellations.[1] To what extent these changes will alter the way people communicate, and on what particular social levels (among intellectuals, political activists, businessmen, etc.) these changes will be transformative, is yet to be seen. Since the technologies are still evolving, and users are still exploring their new affordances and limitations, there is no reason to believe that the changes in communicative relations have yet come to a halt.

The intimate relationship between communicative media and communicative content is also well known in the present philosophical landscape.[2] A key philosopher whose work helped shape the issues and vernacular of the discourse around this relationship was Jacques Derrida. Derrida continuously reflected upon (or to use his own language: deconstructed) the impact various kinds of communicative media had on communicative, social, cultural, theoretical, etc. practices.

Derrida, who died in 2004, was quite aware of the impact of digital media, and acknowledged its significance. He thus makes the strong claim that:

> ... *in the past* psychoanalysis would not have been what it was (no more so than many other things) if *E-mail*, for example, had existed. And *in the future* it will no longer be what Freud and so many psychoanalysts have anticipated now that *E-mail*, for example, has become possible. (Derrida 1995, s. 34, italics in the original)

However, though Derrida's claim supposes a view of basic communicative changes wrought by e-mail, ultimately, his reflections on digital media remained sporadic and somewhat distant. They do not reveal the same level of acquaintance as his reflections on other media.[3] The aim of this

paper is therefore to transfer some of the Derridean reflective approaches to the digital medium known as e-mail.

In my approach I will highlight Derrida's focus on the margins of communication, which has included the exploration of such tropes as the silences, the in-betweens, the non-said, the ghosts, and relate it to the evolving genre of e-mail. Derrida has in various ways argued that in order to designate the significant differences between media one should focus upon their differing ways of shaping the silence. I will thus point out the way in which e-mails shape silence (or more generally: the communicative in-betweens); and what the significance of this shaping might be.

I will argue that e-mails, when compared to speech and paper-based writings, accentuates the silence in one respect, since the silence in the dialogic turns is marked in new ways. In other respects silence becomes less apparent, since previous exchanges keep on being immediately ready to hand and thus keep on "talking" while the exchanges continue. The accentuation of silence is, on the one hand, a resource for reflection upon the communicative context in various ways. The diminishment of silence may imply, on the other hand, a form of agenda management, a conversational convention pressing the writers to stick to the agenda laid down by previous communications. This may lead either to a narrow fixation of topics or to conflicts.

I will justify these claims in the following way: In my first section (I), I start out by situating the e-mail medium in relation to other digital media, written letters, and face to face exchanges. My analysis will focus on the communicative construction of the e-mail in terms of a combination of four significant material factors: limited anonymity, a well-defined field of addressees, an absolute separation between the turns, and the ready-to-hand availability of an archive. The combination of these factors is decisive for the arguments in this paper. In section two (II), I will extract some key points in Derrida's thought. I will demonstrate that while he continuously emphasizes the media-dependence of communicative relations, it misconstrues this theme to present it as though Derrida were demonstrating that different media make us *communicate* something different. Rather, Derrida's point is that different media, on the one hand, shape the in-betweens of the communicative exchanges in various ways, while, on the other hand, the variations produced in the shapes of those in-betweens can itself be a resource for bringing the importance of those in-betweens to light. In section three (III), I will analyse the formal aspects of the in-betweens of e-mails. As stated above, I will argue that the silence between the dialogic turns becomes more marked, while the separation of present and previous statements becomes less marked. Finally, in section four (IV), I will sketch some possible scenarios related to these points. I will argue that the visibility of the silence between the turns can be a resource for increased awareness of how one is exposed to the reaction of the addressees. And it can be a resource to become more aware of how communicative exchanges are shaped by self-arrangements and -presentations. I will furthermore argue that the dissolution of the separation between present and previous statements can be a source for unfruitful quarrels, where the disputants tend to stick to their own agenda, and where it can be difficult to end quarrels. This insight can be a resource for a more subtle understanding of the content of communicative exchanges. The content is not something that is given in advance, but is something that is gradually found or created during the exchange and shaped by the medium.

Before moving to the actual analyses, a word of clarification about the starting point of this approach. When reading Derrida it is often tempting to interpret him as being committed to a determinist theory of technology – due to his rhetoric style. I do, however, not think this is the best interpretation of his view. If one were to pick-up Feenbergs distinction (e.g. in Feenberg 2002, pp. 3-13) between *instrumental* theories *(*technology as merely a neutral tool for reaching

pre-defined ends), *substantialist* theories (technology as altering and determining practices in various ways) and *critical* theories (technology as possessing certain *potentials* in various directions), he should most certainly be put into the latter category. Technology does not determine human interaction; but as its affordances become stereotypical, they tend to shape the relations of us in certain ways, because some kinds of practices become more natural than others. Human beings are, however, reflective and creative beings, and as soon as they become aware of certain tendencies they are usually able to transgress the limitations that might stem from these inclinations – if they find such transgressions desirable. This is, however, not to say that the new practices will not carry limitations and negative consequences. Or to put it Derridean: Every practice carries its own blind spots, margins, in-betweens and silences – but no blind spot, margin, in-between and silence is necessary.

This is also my view in this paper. Technologies are neither neutral nor determining for human relations, but they do carry certain potentials that naturally shape social relations in various ways. If they did not alter our social relations there would, as it were, be no reason to use them. Changes in the overall media-landscape thus naturally entail changes in social relations. The aim of the following analyses is to reveal some new tendencies that stem from new communicative media. We are not determined by these tendencies, but in order to relate rationally to them, a good step forward is to become conscious of them.[4]

I.

As a communicative medium for exchange of files and messages, the e-mail actually precedes the internet. MIT demonstrated a prototype e-mail in its "Compatible Time-Sharing System" in 1962.[5] In 1969 it was implemented on ARPANET – the predecessor of the internet. The establishment of ARPANET (and later the internet) transformed the communicative landscape. Communicative media such as e-mail, instant messaging, newsgroups, bulletin boards, internet forums, blogs, virtual worlds and WWW came into being – just to name a few of the most prominent interfaces.[6]

These media vary in many respects. There are varying degrees of (i) anonymity (do we actually know the physical person(s) with whom we correspond?), (ii) synchronicity ((a) how instantly can one expect the messages to be available to the addressee? (b) For how long are the messages available?), (iii) global reach (what is the (a) geographic and (b) public reach of the exchanges?).

(i) In e-mails there is a rather low degree of anonymity (which one has to go to extraordinary lengths to preserve – hence, the complications of sending spam). Most often, we know something about our e-mail interlocutors. We exchange e-mails with friends, relatives, colleagues, bureaucratic or administrative staff, etc. In other internet based media there is a more extended degree of anonymity; identity is affiliated with usernames that in varying degrees hide the physical person (this is the case in many chat rooms, virtual worlds and internet forums); or there is no identification of the author at all (this is the case on some websites). It is certainly *possible* to have anonymous exchanges through e-mail, but most often not desirable (I will return to this below).

(ii) E-mails are furthermore (a) asynchronous; there is an absolute separation between any singular turn – an author cannot expect the addressee to be immediately available when dispatching the message. E-mails are, on the other hand, potentially readable within seconds after they have been sent. That does, however, depend on the e-mail software- and server capabilities,

and it can be exploited only if the addressee is online and checking her e-mail. As soon as the e-mail has been received it is (b) available and ready to hand until the receiving agent actively deletes it.

(iii) As to the global reach of e-mails, (a) they can easily be distributed over long distances (on a technical level there is no difference in sending an e-mail to your neighbour or someone on the other side of the globe), while their (b) public reach varies between private (one to one) and local (a definite group of specified addressees).

A comparison of e-mails with traditional paper based textual exchanges would find a number of shared features – especially with the paper based form of the *letter*. In relation to (i) anonymity there is only a sporadic tradition for anonymous *exchanges* in letters. It is true that there is some tradition for *sending* anonymous letters, but since it is quite difficult to *respond* to such letters (due to the limits of the exchange systems) they seldom evolve into actual exchanges. In e-mails it is easy to respond to an anonymous e-mail, but it is most often not desirable (anonymous e-mails are most often spam, and responding to spam generates more spam). In relation to digital media, paper based media are (ii) more asynchronous. The (a) delay between sending and receiving a contribution in an exchange is more marked, and inscribed in the act of correspondence by both the sender and the receiver. At the same time there is (b) an asynchronous availability of previous contributions to the dialogue: As soon as the letter has been dispatched, it will normally not be available to the writer. It will be available to the addressee as long as she keeps it, but in responding to a letter, one cannot assume that the addressee has access to the exact content of the original message. Finally, in relation to (iii), the global reach of e-mails, paper based letters in comparison are (a) geographically more local; with the time span between sending and receiving more spread out with letters exchanged between more distant areas, the pragmatic usefulness of this feature is reduced. Exchanges have to concentrate on matters that are not of urgency. As to their (b) public reach, they are just like e-mails always submitted to a well defined field of addressees. The ready-to-hand possibility of adding several addressees to an e-mail do, however, on average increase the number of addressees in comparison with paper based letters.[7]

In this paper I will demonstrate that the combination of (i), (ii,a) and (iii,b) (limited anonymity; the well-defined field of addressees; the absolute separation between the turns in the exchanges) all accentuate an awareness of the in-betweens of the communicative exchanges. This tendency is on the one hand emphasized by the ready-to-hand availability of archives (ii,b), but at the same time these archives carry a structural inclination to lose this awareness at another level in the exchanges.

Many of these features can in varying degrees be found in other media (both digital and analogue). It is not decisive for my argument to claim that e-mails stand out with a specific core set of features against any and all media. Some features will be overlap variously with this or that digital or paper media. However, the introduction and success of e-mail entails that this combination of the features I've labelled (i), (ii,a), (ii,b) and (iii,b) has come to be widespread, as yet relatively unresearched, in communicative relations. And the claim of this paper will be that this combination is reciprocally conditioned by and conditions the communicative in-betweens. Subsequently, similar properties have appeared inside other media (most significantly in newsgroups, internet forums and blogs), some of which – for instance, instant internet comments on on-line newspaper articles – have begun to impact the public sphere.

To repeat, my point is not to claim that each of the following mechanisms could only happen in the e-mail medium. In fact, the (partly) paper based *fax* might have prefigured many of the same mechanisms (for instance, the ease of sending the same fax to many addresses at the same time in a relatively brief interval).[8] Technology does not determine human interaction; but as its affordances become stereotypical, they tend to shape the relations of use in certain ways.

II.

The significance of media in communicative exchanges has been a prime focus in Derrida's writings since 1967, when he published *De la Grammatologie*, *L'écriture et la difference* and *Le voix et le phénomène*. Originally these investigations were centred on a discussion of the relationship between spoken and written language. Derrida attacked the contention that written language should be considered to be a mere derivative of spoken language.[9]

His strategies for this attack are difficult to summarize in few sentences. However, for the sake of our argument, two points should suffice to substantiate the attack: On the one hand, (1) Derrida showed that writing is used to express various kinds of statements that lack a phonetic counterpart. Examples of this are the symbols that can be found in mathematics (Derrida 1967a, pp. 20). Furthermore, certain distinctions that can be made in writing are not understandable when transferred to spoken language. An example of this is the difference between the French *différence* and *différance* (Derrida 1972b, p. 4).[10]

On the other hand, (2) Derrida showed that the reason why we are *inclined* to think of spoken language as more primary than written language is that the media in spoken language (the voice) tends to escape us.[11] This is so, because the voice is narrowly tied to the immediate context. The voice is only perceptible at the time where it is uttered, and the focus of the speaker is thus to be understood immediately in the time of speaking, whereas in written exchanges the writer has to be aware of the future context in which the reader will access the message. In the spoken exchange there is thus no time span that separates the creation of the medium and the perception of it – content and medium thus tends to conflate. Since the temporal distance between the author and the received message is increased in written exchanges, the question of the relationship between the author and the message becomes more pressing: what is the relationship between the time of writing, and the time of reading? In spoken exchanges the speaker and the message tend to be conflated.

This latter point actually made Derrida emphasize the *primordiality* of writing – at least in a non-chronological sense (Derrida 1967a, pp. 16-7 + 81). He claimed that the written in a certain sense could be considered to carry the *trace* of language – i.e. that a focus on writing in the archaic sense will enable us to see important aspects of the constitutive elements of language.

This is a very substantial claim, which ought to be spelled out more clearly in order to be justified. I will, however, not commit myself to this point. The reason why I mention it here is that it led Derrida to a refinement of the concept of the written. It was clear to him that writing, as it is normally understood, did not contain that key to the constitution of language. He realised that it is important to notice other facets of writing than what is found in books and letters. Writing is able to play with the relationship of time in such a way that the relationship between the past, present and future is made available for contemplation on the part of the agents within the communicative community.

This kind of playing with time led Derrida to an interest in the relationship between philosophy and literature. He analysed various kinds of artistic forms of expression (e.g. literature, poetry, theatre, music, drama, ballet, dance, fable, mimicry, film, TV), and how these forms, due to their different media, can serve as templates for different kinds of deconstructive contemplations.

It is, however, important to notice that Derrida's primary aim is not to show how these different media can carry different kinds of expressions. Rather he wants to demonstrate how these media make us aware of different kinds of silence:

> All the "genres" of this generalized writing [...] are distinguished by trace effects whose structure is in each case original. The different "silences," for example, never merge. (Derrida 1972a, p. 297)[12]

Even though Derrida is writing, here, of the different forms of expression as "genres of *generalized writing*" one should not be misled to think that he is assuming a unified form of expression. This is clear in the ending of the quote: The *silence* of different media differ. This is an important point. The point is that different media differ in how they establish a relationship between something that is emphasized as significant and important on the one hand (the focus of the media); and, on the other hand, something that constitutes the margins, the "silence" particular to a given media (with its own in-betweens and blind spots).[13]

According to Derrida there are no spots that are blind *in principle*. But every media carries blind spots because it is necessary to introduce structures of focus and patterns of repetition in order for significance to stand out from the insignificant. Languages are constituted by (among other things) (i) a focus on something that is said, to the detriment of something that is not said; (ii) a stipulated relationship between signifier and signified; and (iii) empty spots that separate the signifying signs. The blind spots of the media are thus to be found in the (i) "in betweens" of those aspects of the world that are articulated (what is *not* being said)); in the (ii) "in betweens" of the signifier and the signified (the *relationship* – as such – between language and world); and in the (iii) "in betweens" of the structures and patterns (what is the significance of the space between the signifiers).[14]

To focus upon the in-betweens of the languages that are carried by various media may reveal important insights about the constitution and limitations of these languages. It goes, however, without saying that it is difficult to contemplate the in-betweens of languages, since they shed their silent aspect by becoming objects of linguistic focus. At the same time, the dissolution of one kind of in-between can only happen by establishing another. The aim of deconstructive analysis can thus not be to make everything explicit. The aim is rather to achieve an *awareness* of the contingency of *any* implemented linguistic constellation.

Derrida demonstrates in his analyses that there are contingencies of the constellations which stem from the media that carries them.[15] Changes in the media-landscape will thus inevitably entail changes in the cultures in which they are used. Analyses of this landscape may thus reveal new aspects of the cultures.

As mentioned in the introduction of this paper, Derrida unfortunately never analysed the new digital communicative media in detail. In 1997 he gave an interview about the disengagement of the paper-based media. He acknowledged that digital media might lead to a disengagement from paper in the media. In 1997 the actual shape of this disengagement was, however, not yet visible – and Derrida refrained from a detailed analysis of the digital media, because he was not well

acquainted with them. The aim of the remainder of this paper will thus not be to dive into Derrida's actual reflections on digital media, but rather to *use* Derrida's points about the in-betweens in a reflection on these media. Since the digital media take very different forms, I will, however, mainly focus upon one of these forms – the e-mail. I will furthermore focus the paper in only discussing the third kind of in-between mentioned above: What is the significance of the space between the signifiers.

entre... un silence ("enter/between ... a silence"; Derrida 1972a, s. 278)

III.

It makes sense to compare the e-mail media both with written letters and with spoken language. D. Crystal has demonstrated that the language in e-mails carries resemblance with the language used in both spoken language and written letters (op. cit.). In this paper, I will focus upon what happens in the betweens of the dialogic turns. What happens in the separation of the utterance of speaker A and the utterance of speaker B? I will argue for two claims.

(1) E-mails emphasize a property of written language in that the separation between the turns is absolute. In the process of writing and after having send a letter or an e-mail you are confronted with absolute silence. The separation between writer and addressee means that the writer has no sensible impression of how the message is received by the addressee.

(2) In another respect e-mails differ from both spoken language and written letters in that earlier statements in the exchanges are more ready to hand in an e-mail archive. This means that agents are able to more quickly and more closely relate the content of a newly received e-mail to earlier contents – something that may entail a heavier emphasis on relevance in relation to previous contents.

1. The Silence of the Addressee.

During the writing and dispatching of a letter, the author is normally separated from the addressee, distinguishing this communication situation from face to face oral exchanges. In the face-to-face situation there is a continuous reaction on the part of the addressee. The addressee will, often unconsciously, raise or knit her eyebrows, nod approvingly, shake her head, comment continuously during the statements, place herself in bodily positions that express her feelings, etc. The speaker can in this way continuously edit the ways in which the statements are presented, in order to secure that they are understood in the right spirit.

In this sense writing generally introduces a new kind of in-between that is often not immediately apparent in spoken exchanges, because the reactions of the addressee are delayed severely in written exchanges. It is true that sometimes the difference is not as radical as described above. The telephone call is an example where the continuous response is less apparent, since the visible aspects are not available. But even on the telephone it is possible to sense the reaction of the addressee through various cues, such as vocal reactions, or the sound of respiration; and even in cases where this is not possible, the reaction will (most often) follow immediately after the statement and leave no gap.[16]

In the following I will focus on the gap between sending the letter and receiving a response. This gap (or in-between) can play an important role in the flow of the communicative exchange. This is especially clear in cases where the writer is excited about how the addressee will respond to the

content of the letter. Every letter writer has experienced what it means to wait for a response in such cases. The letter writer will also take the length of the time lag between sending the letter and the response as a cue. If the response arrives later than expected this may be understood negatively as the expression of a neglectful or a supercilious attitude. Or it may be understood positively as the expression of a painstaking attitude. Likewise, if the response arrives sooner than expected, this may be interpreted as over-zealous, submissive, spontaneous and/or emotional. And this shapes the next turns in the exchange, because the addressee of the response will interpret the contents of the response in the light of her interpretation of the premature or delayed reception.[17] A focus on the time lags between letters will thus illuminate ways in which the writer is exposed to the reactions of the addressee.[18]

The gap between communicative turns is especially marked in paper based letters and in e-mails, because they are *addressed;* you usually know the exact recipients of your writings; and the recipient knows that you know. Communication through e-mail is generally non-anonymous and the field of interlocutors is well-defined. In other digital media – such as newsgroups, bulletin boards, internet forums, blogs and WWW – the field of recipient is often less well-defined. Communication through less well-defined fields of interlocutors impedes to some degree clear cut expectations about reasonable responses, because it is not clear who should be responsible for creating responses, and it is furthermore even less clear whether they have become aware of the urge for response.

The gap accentuates something that is also at play in spoken exchanges: The insecurity and significance of how the communicated statements will be received by the addressee. It is, however, much more accentuated in written exchanges. Due to the extended distance in writing between the sender and the addressee, it becomes evident that the significance of statements cannot be solely extracted from the intentions of the writer. The significance of statements comes into being in the *between* of the writer and the addressee.[19] So, when A for example wants to write a letter with nice compliments to B, she will often not be able to use the same formulations as if she wanted to write the same compliments to C – because B and C have different temperaments, and will thus receive the compliments in different ways.

This kind of attitudinal adaptation to perceived character traits among communicants is something that we do spontaneously all the time. Since different people respond differently, a repertory of corresponding accommodations is continuously evolving. The need for these skills is important both in spoken and written exchanges. The difference is that the time lag between the turns creates down time on the communicative axis, in which one of the communicating agents neither articulates, expresses nor listens to the other. The agents stop being active. At the same time, the sender knows that the recipient is receiving, reading and reacting to her message. It is an empty space that creates room for contemplation upon the communicative relationship – the waiting sender feels that she has exposed herself to the addressee. Written exchanges in this way illuminate an in-between of communicative exchanges. The gap between the turns illuminates ways in which the senders are exposed to the reactions of the recipients.

I take it that the above analysis exemplifies the Derridean point that was presented in the previous section: Different communicative media carry structures that can illuminate how the in-betweens of other media shape our communicative relationships. E-mails share many of the characteristics of traditional letters, as, for instance, the absolute separation of the communicating parties, the well-defined group of interlocutors, and a similar gap between the sender's dispatch of the e-mail and the reply to that e-mail, during which there is time for contemplation upon the relationship

between the dispatched messages and the addressee. But there are two coordinates that differ, and in so differing, effect the shape of e-mail silence:

(i) The time between dispatch and possible reception of a response is potentially shorter, as the technology speeds up the whole cycle of dispatch, reception, and response. It is technically possible to receive a response within less than a minute. And even in cases where a thorough response is called for, it is realistic to finish it within half an hour. This certainly presupposes that the addressee reads the e-mail immediately, but in today's digital landscape this is not an unrealistic presupposition, and it forms the background of expectation in which e-mails are sent and responded to. A lot of people are extensively online, with an e-mail client running that signal every incoming e-mail at short intervals.

This difference entails that the gap between the turns becomes significant much sooner than the exchange of traditional letters. The gap between sending a letter and receiving a response depends on the speed of the postal delivery, but, at best, the circuit will take at least two days to complete. E-mail technology thus dramatically shrinks the time gap between the turns, making it possible that the communicating agents will still have the exchange fresh in their minds. It is thus more likely that the significance of the gap will be perceived at a time where the initial statement is closer to hand, giving the writer a better opportunity to reflect upon the relationship between the written content (in greater detail) and the succeeding silence.

(ii) This point is further supported by another difference between paper-based exchanges and e-mails: The writer can always have an exact copy of dispatched e-mails archived. This is seldom the case when the exchanges are mediated by paper. In some cases the writer can have access to a draft, and in rare cases perhaps even a photocopy. Drafts are, however, rarely identical to the final version, and often they are discarded after dispatch. Photocopies are admittedly close to identical to the original, but the existence of such copies is quite rare, while they are created automatically by most e-mail clients. Sometimes the content of the initial message is also copied into the response – something I will return to later.

The availability of the exact content of the dispatched e-mail in the period of the gap or silence makes the significance of the turns of e-mailing more prominent, so that if, for example, the writer starts to wonder why no response has arrived, she can take a look into the dispatched e-mail and ask herself whether there is something in the e-mail that could be perceived in another way than intended. Or if the response arrives sooner than expected, she can take a look into the initial message to see if, for example, there is something in the articulation that indicates urgency. The e-mail media thus carries some (visible) tools that not only permit a contemplation of the invisible and silent margins of the exchanges, but make it natural and explicit in the construction of the e-mails. These tools may also, to some extent, be available in traditional letter exchange, but the relative slowness of that circuit make it less likely that the letter writers will be as conscious of the time lags between letters. They are, however, emphasized in the higher pace of e-mail exchanges and the recurrent availability of the initial articulations.

2. The Noise of Previous Positions.

The existence of archived previous statements in an exchange can thus potentially serve as a tool to become aware of the significance of the silence between the turns. In another respect it can, however, also prevent an awareness of how something significant can happen in the between of the turns. In communicative exchanges, it is natural that the parties have different agendas. It is furthermore natural that they interpret the situation and the issue(s) of the exchange differently. If

not, there would, as it were, be no reason for the exchange to take place. This often entails that the topical focus of the exchanges gradually drift. So when A utters something, this will make B think of something slightly different, and this will shape the response of B and the response will thus not be straight to the point of the exact questions and points made by A. B's response will, once again, be interpreted in a slightly different way than intended, which will make the response of A slightly lopsided as to the response of B – etc.

This gradual drift is a natural dimension of most exchanges – something that makes exchanges appear vivid and intense. The communicating parties affect each other in a dynamic way. Exchanges where the drift is absent or minimal are felt to be static, claustrophobic and awkward (frustrating). However, exchanges where the drift is exaggerated are not fruitful either. They are felt to be chaotic, incoherent, disjointed and fluctuating (frustrating as well).

E-mails contain structures that may exaggerate both the topical drift and the rigidification of topics. The drift away from the topics at hand is supported by the less flexible mechanisms for turn-taking. This means that it can be tempting for writers to extend each contribution in a way that makes it difficult for the responder to survey the content, which can mean that the slip between the focus of the initial and responding contribution will increase.[20]

I will, however, mainly focus on the tendency in e-mails to fixate and rigidify communicative exchanges. I will argue that this tendency shows something significant about how silence is differently at play in e-mails as opposed to spoken and paper-based written exchanges. This tendency arises, once again, in the archival availability of previous contributions in the dialogue. As mentioned above, the instant availability of previous contributions can highlight the silence between the turns – namely, in the actual gap between the turns. However, as soon as the response has been received and read, the availability can be used differently. It can be used as a yardstick against which the response can be assessed. Did the responder take the initial contribution seriously? Did she answer the questions, or sufficiently reflect upon the points made? Is she adhering to the agenda of the initiating message? Or is she evading the agenda by shifting the focus or the subject?

The novelty here is not in the policing of topical relevance, which is an assessment concomitant of most communicative exchanges, but in the strength of the tools for doing it. Given that every single character is potentially available to all participants, it is tempting, especially if the dialogue turns into a heated discussion, for communicating agents to undertake pedantic investigations of previous statements in order to show that their partners are not sticking to the point, or are misinterpreting previous e-mail contents. Not only are previous contributions instantly available, but most e-mail clients make it easy to copy and paste previous statements into a response, allowing for a sentence by sentence commentary.

In extreme cases such rigidity can lead to discussions that continue endlessly, with mutual recriminations about disingenuousness, agendas, misquoting, etc., each party accusing the other of not responding to the contributions made by oneself.

Notice, my claim is not that such quarrels (or "flames") could not happen through the sending of traditional paper based letters. Nor is it my claim that paper based exchanges never have am archive of previous contributions. But it is, for one, rare that such complete archives exist; and, secondly, even in cases where such archives exist, they will not be as ready-to-hand as in e-mails – the availability of editing tools will be reduced in comparison to the tools available in e-mails.

To return to the discussion of how communicative media are shaped by the in-betweens, this tendency in e-mail exchanges can be seen as a reduced awareness of the role of the gap. In returning to the previous statements, the communicating parties annuls the significance of the lags between e-mails. By sampling the archive of previous e-mails in an attempt to establish a communicative authority that has the final say in the way the exchange is supposed to go (by urging the responder to stick to the point), the gap between messages is dissolved as a significant factor influencing the exchange. This is an unhappy result, since the gap is a point where the disputants could have become aware of how the communicative exchange basically must happen as a *collision* and *negotiation* of (at least) two agendas and horizons. And if the agents tend to hold on to their own agenda and horizon it will, on the one hand, generate a rejection from both sides of the communicative circuit, and, on the other as the communicative object becomes communication itself, the information gain diminishes dramatically.

* * *

Thus, there is a distinct tension in the technical structure of e-mail communication between the potential to become aware of ways in which the in-betweens shape our communicative exchanges and other structures that prevent an awareness of the in-betweens. On the one hand, e-mails facilitate a heightened awareness of the silence of the other as the speed of the exchange, in comparison to other written exchanges, has so dramatically increased. The silence of the other becomes significant while the latest contribution is still present in mind. This awareness is facilitated by the time lags between the turns. On the other hand, by making the archive of messages instantly available, the awareness of the significance of the in-betweens is diminished, thus resulting in a competition between agendas.

Neither of these mentioned structures should be taken as the inevitable destinies of the communicative exchanges. It is one thing to point out facilitating or preventing tendencies, but quite another to make strong claims about determining factors on the mechanisms in communicative exchanges.

This is also the reason why it is not possible to generalize over the effect of e-mails in facilitating or preventing an awareness of the significance of the in-betweens. In some cases the facilitating mechanism is the strongest. At other times the preventing mechanism will win. This depends to a large extent on the atmosphere of the exchange, the individual characters of the participants, and the content of the exchange. But under *certain* circumstances communication through e-mails may have the above mentioned effects.

IV.

I will now outline some, although not all, of the implications and perspectives of my argument. Generalization is difficult here because the new ways of relating to the communicative in betweens are still evolving together with the technology, and the contingencies marking exchange, (as mentioned above) create different behaviours in different situations. The following should thus only be understood as an outline of which directions further research into this field could take.

1. Becoming aware of the Significance of the In-betweens.

The visibility of the significance of the in-betweens facilitates an awareness of how one is exposed to the reactions of the other and how the communicative exchanges can never be

unilaterally determined. In spoken face-to-face exchanges, this aspect of communication tends to slip out of our minds as communicative adaptation to the reactions of the other happens continuously *during* the articulation . This facilitating feature is something that e-mail exchanges have in common with paper-based writings. It is, however, accentuated even further, because the exchanges happen at a higher pace (cf. the arguments put forward in the previous section).

The attempt to make the addressee understand the received message in the right spirit is certainly at play in any communicative relationship. However, in written communication this has to happen without an immediate contact with the addressee. The sender is thus urged to adapt more reflectively: How will the addressee react? What can be done to prevent misunderstanding? Etc. The sender is urged to a larger extent to anticipate how the other will react, since the sender will not be able to be present with the receiver to continuously rephrase or elaborate during the exchange. A consequence of this is that the communicating parties will have to be more aware of their rhetorical and argumentative means. Another consequence is (as mentioned above) that the communicants become more aware of how the media shape the content of our communication. These are some of the reasons why it is important to accentuate the in-betweens of the exchanges in e-mail communication, especially as they directly inflect content.

It can furthermore be argued that the accentuation of the in-betweens has another consequence. The internet is a medium for extended experiments with self-engineering. Users of the internet experiments with the creation of virtual characters in various boards, chatrooms, blogs, virtual worlds, etc.[21] This phenomenon is not as accentuated in e-mails as in other internet based media, and this is probably due to the lack of anonymity in most e-mail exchanges. However, the awareness of how self-engineering affects the reception of communicative contributions is most likely also an important source of these experiments. And this awareness is, as demonstrated above, increased due to the accentuation of the communicative in-betweens in e-mails. This is thus another way in which the in-betweens of the media have had a significant impact of our communicative relations.

2. The Reduction of the Impact of the In-betweens.

As demonstrated in the previous section, the unhappy consequence of having at hand archives of e-mails is the annulment of the structuring in-between-ness of the exchanges. This is certainly in a narrow perspective a negative consequence. It would, however, be more Derridean to take the failure itself as an occasion for deconstructive research. On an immediate level, the lesson to be learned from the stigmatized exchanges should be that we use the conserving mechanisms less litigiously. It can certainly be valuable to return to previous statements in an exchange, but only if the effects of the in-betweens are respected so that the communicating agents acknowledge that the agenda of the exchange must encompass a degree of freedom allowing for changes in the topical structure derived from the nature of the exchange itself.

On a broader scale the failure can be a source for a revitalization of an important hermeneutic insight: In communicative exchanges the subject or the content is not given in advance, but is something that is gradually found or created during the exchange. In Gadamerian terms, one could say that the subject of the exchange is something that unfolds during the fusion of communicative horizons. Or, to put it less strong (and more Derridean): during the *collision* or *clash* of horizons. This collision of horizons is however not mainly or only shaped by what is actually said by the participants. What is being said should rather be analysed against questions of what is *not* being said, and questions of what kinds of media are used in the exchange.

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Endnotes

1 Some of these changes are articulated in Crystal 2006; Slevin 2000.

2 This relationship is for example reflected in the works of Crystal and Slevin (op. cit.). Other examples are Thompson 1990 and Thompson 1995. Earlier examples of this kind of reflection can be found in McLuhan 1964 and various works from the Frankfurt school – for example in Horkheimer/Adorno 1944 and Habermas 1962.

3 Derrida was a reluctant user of internet and e-mail (Derrida 1997, p. 56)

4 To rephrase this point inside another tradition (Friedman et al 2006, pp. 352-3): Even though media support certain forms of *usability,* it is not certain that these forms of usability are desirable, since they may be inconsistent with other human values. Human beings are not *determined* by usability, but in less reflected situations, they are certainly shaped by what is seen as the most natural approaches.

5 http://www.cis.usouthal.edu/faculty/daigle/project1/ctss htm

6 These media are to a large extent text based. One could also mention *webcasts* which is a growing phenomenon that contain audio content (e.g. through the *Voice over Internet Protocol*) and/or video content (IPTV). For simplicity I will, however, mainly focus on text based media. My aim is not to exhaust the communicative aspects of the internet, but rather to reveal some mechanisms that are significant.

7 This mechanism is also furthered by the forwarding function. It could be argued that this function reduces my point about the well-defined field of addressees – one can forward an e-mail, just as it is, instantly, to destinations that the original e-mailer never intended. However, if the e-mail is forwarded to destinations not intended, I think it fair to say that the original e-mailer is not the actual author of the forwarded e-mail.
It is, however, true that in special cases an e-mail is sent with an invitation to forward the message indefinitely. In such cases the field of addressees is indeed not well-defined. This special case does, however, not refute my point that *generally* e-mails are exchanged between well-defined fields of addressees.

8 Even though it *could* have happened with the fax, I do not think it is a coincidence that it did not. The argument for this would, however, take this paper of the track.
9 Despite their other differences, Derrida and W.J. Ong equal on this point (Ong 1982).
10 One could argue that since the distinction between *différence* and *différance* is created by Derrida himself (since he is the one who created the *différance*-term) this example is artificial. This does, however, not change the fact that Derrida, when writing his text ("La différance" – published in Derrida 1972b), was able to create meaning that could not be immediately (i.e. without some amount of explanation) presented in oral form.
11 This point is carried out in Derrida 1967c, esp. in ch. VI, pp. 91-7.
12 The English translation is taken from B. Johnson in Jacques Derrida *Dissemination*. Chicago. University of Chicago Press, p. 243.
13 In his later writings, Derrida speaks of this as the relationship between spirits and spectres (Derrida 1993).
14 Derrida 1972a, pp. 295-7.
15 Derrida 1967c, p. 42+83; 1993, ch. 2; Derrida & Stiegler 1996, pp. 67-8.
16 The difference between written and vocal exchanges is, however, not fundamental. It is for example possible to tape vocal statements and exchange them through the postal system or electronically. In that case the vocal exchanges would also be characterized by an absolute silence of the addressee during the writing and dispatching.
17 It is probably possible to point out examples where the contents of letters is not that vulnerable to the shape of the vacuum. This is, however, not decisive for the following points. What is important is the actual vacuum between the turns in a written dialogue *can* teach us something about the interrelatedness of the communicated statements – it is not that important whether this is *always* apparent.
18 There are cases in which silence can become immediately significant in face-to-face spoken exchanges too. The most obvious example is if someone does not answer your appeals. In written exchanges this feature is, however, more widespread because the vacuum is a technical necessity. And it is furthermore radicalised due to the lack of gestic and facial reactions.
19 A similar point is carried out in Briggle 2008, p. 77.
20 For an illuminating discussion of the unfruitful consequences of large e-mails, see Friedman & Currall 2003.
21 For an elaboration on this phenomenon, see Crystal 2006; Slevin 2000; Madsen 2007.

Hermeneutic practices in software development: the case of Ada and Python

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Abstract
This paper shows the relevance of hermeneutic philosophy to understand how info-communication technologies frame our contemporary lifeworld. It demonstrates that *the programming languages are the result of collective interpretations of the general lifeworld of programmers, management and political decision-makers.* By having been inscribed into the processes of language use, this general interpretation permeates the particular practices of understanding that are possible within the language framework.

I support my argument by contrasting the hermeneutic concerns about the understanding between programmers which stand behind the design of the Ada and the Python programming languages. Ada, with its emphasis on achieving seamless communication through rationalistic standardization and the technical embodiment of the background of understanding, bears the imprint of the culture of Cold War-era DoD-funded military projects. On the other side, Python is inscribed with a culture of open-ended discussion and self-reflective practices of conventionalization that is characteristic of the FLOSS world.

Keywords: hermeneutics, programming, practices

Hermeneutics, software technology and understanding

During the process of software development, participants – users, developers, customers – must engage in various *hermeneutic practices* to achieve a shared understanding with respect to many issues: software artifacts, program codes, relative valuations of problems, norms, and the general social context of development. These practices can take a number of forms, including producing inscriptions in formal or informal languages, or engaging in multi-modal discussions in various media. I'd like to show that also the seemingly solitary interaction with human-computer interfaces – like computer language compilers – can be viewed as a kind of hermeneutic practice, aimed at sharing the background of the interface designer at the very level of skillful actions.

I use the term "hermeneutic practice" instead of "communication", because I want to emphasize that the role of these practices is not exhausted by conveying explicit meaning within a previously given horizon of understanding. These practices are necessary to build out *the horizon itself*, within which communication can take place, and within which the explicit symbolic inscriptions – like source codes – can be interpreted. What "gets transmitted" through them is often not an explicit message, but unarticulated background assumptions, skills, and orientations, with which particular questions and problems can be approached.

In the case of software, to a great extent, the programming language constitutes the horizon in which programmers articulate and convey their ideas. In my attempt to show how relevant hermeneutic philosophy is to understand how info-communication technologies frame our

contemporary lifeworld, I'll demonstrate that *the programming language framework is itself the result of the collective interpretation of the general lifeworld situation by programmers, management and political decision-makers. By having been inscribed into the processes of programming language use, this general interpretation permeates the everyday practices of understanding that are possible within the language framework.*

I'm going to assess the validity of this statement with two case studies, focused on the hermeneutic concerns of the language designers about the understanding between programmers. These cases have been selected as two influential milestones in the half century-old discourse about what can be considered as "good" programming practice, exemplifying two distinctly opposed ideals as an answer to that question.

I've chosen the Ada programming language as my first example because of the striking similarities between the concerns of its designers and some influential philosophers of the hermeneutic tradition. Besides providing an interesting insight into the practices of Cold War-era DoD-funded military projects, this choice brings an opportunity to assess the claims of Heidegger and others about the status of *technical language* in the light of a contemporary historical example. Furthermore, the insights thus gained are still relevant, since the concepts built into Ada have influenced many contemporary languages, including JAVA.

As my second example, I've chosen to analyze a widely used open-source language, Python, because it seems to follow a different strategy to address similar concerns. While the designers of Ada wanted to achieve shared understanding through normalizing programming practice by controlling every detail of the programmer's technical environment, Python designers factor these concerns out of the language and shift them into the normative disciplinary space of the surrounding discourse. To use Barry Boehm's distinction (1979), Ada focuses on a "restricted view" of practices, whereas Python builds on a more encompassing view of what "discipline" is.

If Ada is the characteristic language of the "Closed World" (Edwards, 1996), Python in contrast represents the "Open World". It is inscribed with the culture of open-ended discussion and self-reflective practices of conventionalization that is characteristic of the FLOSS world. It will be shown that the classical analyses of hermeneutic philosophers are not adequate in this cultural horizon. To understand the enthusiasm of Python developers, we have to turn toward philosophers who raise similar concerns, but argue for a positive appropriation of technology. Python programmers are influenced by Robert Pirsig and his book *Zen and the Art of Motorcycle Maintenance* (1984) in conceiving their own activity as one that is directed at artistic perfection, and provides shared enjoyment of cooperative work.

In contrast with the classical hermeneutic reflections on the standardizing role of technical language, the practices of understanding of these Python programmers are better viewed as processes of *self-coordination*, standing close to the classical ideal of democratic scientific discourse and criticism, as Polányi depicts it in his utopian "Republic of Science" (1962). It is not a standardized horizon of understanding, maintained by a technologically embodied field of disciplinary power (as in the case of Ada), but rather the conscious *self-discipline* of free subjects that leads to the conventions and standards, which are indispensable for dealing with the ever-growing complexity of socio-technical systems.

Before we go into the details of our case studies, let us review the classical standpoints in the hermeneutic tradition about the status of technical language.

The problem of the "technical language" in the hermeneutic tradition

In 1957, at just about the same time as the Dartmouth Conference on the future prospects of Artificial Intelligence, and as the design of the first high-level programming language (LISP) took shape in the American military-industrial complex (Edwards, 1996: 257), Heidegger contemplates the "language machine" as something that will deeply influence the structure of human experience:

> The language machine regulates and adjusts in advance the mode of our possible usage of language through mechanical energies and functions. The language machine is - and above all, is still becoming - one way in which modern technology controls the mode and the world of language as such. Meanwhile, the impress is still maintained that man is the master of the language machine. But the truth of the matter might well be that the language machine takes language into its management and thus masters the essence of the human being. (Heidegger, 1957; quoted also in Heim, 1993: 8)

This perplexing vision – being as essentialist and romantic as it might be – seems also very disturbing in its plausibility (Dreyfus, 1998). If we reconstruct the argument based on the wider context of Heidegger's work, it can be summarized as the following: Since language permeates our practices and our understanding of the world and ourselves, and also given that modern technology employs a range of controlled languages, modern technology greatly influences our practices and our understanding of the world and ourselves. Technology intervenes "through mechanical energies and functions" in the lifeworld situations of language use, or more generally – to borrow a term from Lucy Suchman – in the contexts of *situated action*. How does this intervention take place? Since the field of our possibilities of perception and action are largely determined by the technological environment (Ihde, 1999; 2003), whenever we carry out actions via a command interface or solve problems through programming, the field of our possible interactions is preformed and restricted by controlled *technical codes* (Feenberg, 2000). Technical codes imprint specific techniques and patterns of practice on the situations of the technology's subsequent use, thus they acquire a character of *power* (as we are going to discuss it later).

To point at a similar example, according to the critique of Habermas (1987), the pathology of modern age is that the "system" – here he thinks of economy, power and (presumably[1]) technology as the *controlling media* of certain non-discursive forms of rationality – intrudes into the realm of "lifeworld", characterized by a discursive, hermeneutic form of understanding. This process of "colonization" withdraws moral, political and aesthetic questions from the realm of discursive understanding and subjugates them under the non-discursive rationality of economic and technological processes. In contrast with the discursive-hermeneutic communicative action embedded in culture, *controlling media* force communication into their reduced technical code, shaped by their narrow form of rationality. They reduce communication to the role of coordination of human action.

György Márkus states in a classical paper (Márkus, 1987) that natural scientists – and his argument applies to technologists as well – don't "do" hermeneutics, and they don't seem to be lacking it. How can this be reconciled with his hermeneutist stance? His explanation is that the paradigmatic and specialized nature of research and the standardized scientific education grants

them a shared background, which makes hermeneutics unnecessary in understanding scientific publication.

To sum up, Heidegger, Habermas and Márkus are concerned with the possibility that modern technology makes hermeneutic understanding dispensable, and replaces it with reduced – and thereby more efficient – forms of communication. They depict the domain of hermeneutic understanding as *distinct from* and *threatened by* the realm of modern technology. Thereby, they posit a schism between the two domains. If they are right, then the hermeneutic practices we have taken into the focus of our analysis are simply unwanted frictions in the technological machinery of software development, temporary problems that are going to be eliminated with the progress of technical systems.

On the other hand, while the impact of info-communication technologies on our lifeworld is undeniable, these philosophers are overshadowed by their generalized pessimistic and deterministic overtones, which are not widely shared by philosophers of technology anymore. Up to the present day, technical codes did not coalesce into a unified mega-framework of thinking, not even in the realm of natural science or artificial intelligence research. Beside their standardizing tendencies, 21st-century communication technologies seem to stimulate various forms of democratic, open-ended discourse, creative self-expression and free flow of information. Yet still, in their outmoded, essentialist fashion, these classics all address a very profound question, one that is still relevant today: *how do people understand each other and themselves in the era of technologically structured and mediated interaction*?

Instead of viewing technology as a realm that stands separate from or intrudes into the domain of hermeneutics, I argue for *continuity* between the traditional problems of hermeneutics – understanding different cultures, ancient texts, works of art, and ourselves – and contemporary practices of software development. I'm also siding with Andrew Feenberg (1996; 2000), Don Ihde (1990; 1999), Hubert Dreyfus (1997; 1998), Claudio Ciborra (1998), Lucas Introna (2006) and many other theorists in arguing that there is a need for an *empirical*, hermeneutic-phenomenological analysis of technology, and particularly IT. I understand this analysis to be "hermeneutic" on two levels (Heelan, 1989; 1997). On the first level, we should recognize the importance of the activities in which technologically situated actors engage themselves to understand each other: the importance of hermeneutic practices *within* the realm of technology. On the second level, *our method itself* is a hermeneutic one: we reconstruct the meaning of the technical artifacts and rationales while re-contextualizing them in the cultural horizon, in which they were originally meaningful.

In contemporary philosophical literature, there are many other examples of positive appropriation of technical objects, and particularly, information technology. Robert Pirsig's enthusiasm for the art of technology is paralleled by Douglas Hofstadter's influential book about the interwoven threads of art, mathematics, computing, and philosophy, which illustrates the inherently paradoxical and open-ended nature of rationality even within these seemingly rigid frameworks of thinking (Hofstadter, 1979). Andrew Feenberg (1996; 2000) emphasizes the importance of the fundamentally cultural aspects of the appropriation of technology, which he calls "secondary instrumentalizations". Claudio Ciborra (1998) uses the late Heidegger's concept of the *Enframing* [Gestell] to interpret the users' lifeworld in various information infrastructure projects. Dreyfus and Spinoza (1997) reinterpret Heidegger's rich phenomenological rendering of *the thing* [das Ding] (Heidegger 1950) as having *both* optimistic and pessimistic consequences with respect to modern technology, and Bruno Latour (2004) – while condemning Heidegger's

romanticism and sweeping critique – puts the techno-scientific *thing* right into the focus of his critical inquiry.

Now let's turn to a more in-depth study of the two contrasting programming cultures!

Concerns behind the design of the Ada programming language

The design process of Ada was situated in a discourse in quest for the "best" language, in terms of programmer productivity, reliability and efficiency. The series of Ada requirement specifications (Woodenman, Tinman and Steelman), the *Ada 83 Rationale (RATL)* and the *Ada Quality and Style: Guidelines for Professional Programmers* (AQS) are rich sources of reflections on the practices of the day, and they make clear the rationales behind the design decisions that left their mark on the language.

The general motivation was that in the early seventies, the US. Department of Defense (DoD) software projects saw an impending crisis of software reliability, and a Babelian confusion of languages among the various development fields. The crisis was often attributed to the lack of expressivity of the languages used, and the difficulty of reusing proven solutions. These factors contributed to the disproportionate growth of software development costs. In 1973, Col. Whitaker started the DoD "Software Initiative", aimed to reduce the "High Cost of Software" (Whitaker, 1993; Ichbiah, 1984; daCosta, 1984). This was intended to reduce development and maintenance costs by consolidating all DoD development under a unified language. However, the committee went much further: they were quite consciously designing a *community of praxis*, a *culture of understanding* instead of a computer language. The language features were selected to promote *coding practices* that were deemed beneficial: clarity, high abstraction, explicitness, code reuse and transferability of skills. The following excerpts show some of the main concerns of this standardization effort:

> Clarity and readability of programs should be the primary criteria for selecting a syntax. [T]he programmer [should] use notations which have their familiar meanings, to put down his ideas and intentions in order and form that humans think about them, and to transfer skill she already has to the solution of the problem at hand. (WOODENMAN - Needed Characteristics, reproduced by Whitaker, 1993)
>
> Safety from errors is enhanced by redundant specifications, by including not only what the program is to do, but what are the author's intentions, and under what assumptions. If everything is made explicit in programs with the language providing few defaults and implicit data conversions, then translator can automatically detect not only syntax errors but a wide variety of semantic and logic errors. (WOODENMAN - Conflicts in Criteria, reproduced by Whitaker, 1993)
>
> The user should not be able to modify the source language syntax. [...] Changing the grammar [...] undermines the basic understanding of the language itself, changes the mode of expression, and removes the commonalities which obtain between various specializations of the language. (WOODENMAN - Needed Characteristics, reproduced by Whitaker, 1993)

With these criteria, the language designers tried to address certain situations, where understanding among programmers often breaks down. The programming language serves not only as an interface with the computer, but also as the linguistic medium of the programmer

community, in which they articulate their problems, intentions, assumptions and ideas. The occasional misunderstandings often result in reliability failures. For example, maintaining and fixing a program code that was written by someone else requires a lot of interpretative effort, because it involves the reconstruction of the original understanding of the problem situation from partially articulated traces. The criterion of *explicitness* addresses this. There is also the painful chore of deciphering existing solutions in order to adapt them to new situations. This is necessary because of the lack of "commonalities", or common conceptual abstractions covering a wider set of situations. In order to make code "reusable" in future problem situations, the common structures and conventions need to be standardized and the code has to be divided into independent functional modules. Specific language structures were proposed to alleviate these issues, to allow for a "higher abstraction level" (Smith, 1987).

What is common in all these breakdowns of understanding is that they lead to open-ended hermeneutic efforts. These hermeneutic episodes are pictured by the language designers as unwanted, because they introduce unpredictable outcomes and delays, thereby constitute risk.

The belief that there exists a totally transparent and explicit formulation of any problem reveals a certain epistemological naiveté from the part of the language committee. Such beliefs have been contested by many theorists, because when we start to explicate our background knowledge, we implicitly start to build on an even broader set of background knowledge, again in need of explication (Winograd and Flores, 1987).

But the elimination of hermeneutic practices for frictionless communication is not in the interest of the wage laborer at the lowest level of corporate hierarchy. DoD specialists often "stress the low skills and motivation of most military programmers" (Kling and Scacchi, 1979: 34). Short-term deadline pressure overrides subtle concerns. Source code beauty also ranks very low among the programmer's priorities if she doesn't have any feedback on the long-term costs of her code (Kling and Scacchi, 1979: 37). Hard-to-decipher code can easily make her the irreplaceable "key figure" of the project (Boehm, 1979), by the fact that only she can understand it. She might even be proud of her ability to solve hard hermeneutic problems with her unique skills, and might also get rewarded with wage bonuses for doing that (Boehm, 1979). How could she be motivated to think abstractly and modularly, to write code not for herself, but for her successors, who have to interpret it (Smith, 1987)? Or framing the question within the socio-cultural space: how can her thinking be aligned with the abstract principles and long-term interests of the management (Gerhardt, 1989; Kling and Scacchi, 1979)?

In order to answer this question, we have to see that the Ada initiative is an attempt to thoroughly *transform the way in which programming problems are perceived and articulated by the programmer*. The concerns of the management are carefully designed right into the structure of the language. From now on, the programmer can't even conceptualize her problem without taking these into account, since they are already inscribed in the use-patterns of her conceptual tools. Even if the Ada programmer were not consciously aware of these concerns, she would have to conform to them. This transformation took place at the level of language skills and in the patterns of interaction.

What makes the programmer follow the rules of the language? How is this kind of *discipline* to be established? The „regulation" of the „possible usage of language" is achieved by means of a strictly specified, technically embodied *compiler* program. It does not only constitute the interface between the programmer and the machine, it also has a *disciplinary function*: it simply doesn't let such code through, which doesn't conform to the intentions of the language designer.

It works as an abstract "electric fence", forcing the programmer to think the right way. *The compiler is thus a political artifact, working as an obligatory passage point* (Lessig, 1999; Winner, 1986; Latour, 1992). In order to protect the technical code of the compiler with the social code of legislation (Lessig, 1999), the designers were even so cautious as to register "Ada" as a trademark, in order to be able to revoke the right of using the name from compiler implementations that do not fulfill the Ada specifications.

Even within an established language framework, there is room for misunderstanding as the various participants come with different backgrounds of understanding. To address this, the structure of Ada reflects the organizational hierarchy of development at an even more specific level. The organization of functional modules (packages) is supposed to mirror the hierarchical organization of work by delineating self-enclosed units that can be intellectually managed by a responsible individual or a team (Ichbiah, 1984: 994). The pathways of communication and control between the modules – and thus between associated developers – have to be declared explicitly in the code. The goal is to achieve a certain economy of interaction between developers. The individuality of backgrounds doesn't matter so much if the space of possible/necessary interactions between developers is reduced and formalized to a certain extent. This induces a certain social stratification, a power-hierarchy between designer and developer groups. It is ironic that the proverb "divide and conquer", used often by design theorists to refer to modularization (e.g. DeRemer and Kron, 1975), is at the same time a management strategy in the original sense!

If we look at the definition of power given by the late Foucault, we can see that it is highly relevant in this case:

> [T]he exercise of power [is] a way in which certain actions may structure the field of other possible actions. (Foucault, 1982)

The programming language – as a product of the actions of its designers and its implementers – is, in this sense, a field of power, because it structures the possibilities of action, and thus the field of hermeneutic practices in which its users can take part.

The programmer perceives her problems and carries out her actions within this field of possible actions. However, for the programmer, this built-in perspective rarely ever gets into the focus of thematic understanding. She keeps her immediate problems and tasks in her mind, and engages in a code-compile-test cycle, while trying to avoid compiler errors. The agent exercising power over her is not personally present; sometimes it is not even identifiable as a particular individual or a group. However, it is there, and it guides the hand of the programmer while writing code because it has been inscribed into the biased design of her tools. In fact, just like in the case of Bentham's Panopticon, the power field gets internalized by the programmer in the form of routines, skills and conceptual frameworks, by which she orients herself and copes within her technological lifeworld.

The designers of the programming language thus implement a modernistic tendency: they draw a line between what they consider "normal" and "deviant" programming practice and then they intervene into the structure of technologically mediated practices to bring the behavior of the programmer under control.

The experiential aspect of this situation can be characterized with Heidegger's notion of *the They* [*das Man*]. The They is the mode of our existence in which our perception and action follows modes that are determined by others:

> We enjoy ourselves and have fun the way *they* enjoy themselves. We read, see and judge literature and art the way *they* see and judge. […] [T]he they maintains itself factically in the averageness of what is proper, what is allowed, and what is not. Of what is granted success and what is not. This averageness, which prescribes what can and may be ventured, watches over every exception which thrusts itself to the fore. (SZ 127 / BT 119)

When we act in the mode of the They – and this is the typical mode of everyday action –, we are following intentions that are not ours, but are so deeply engraved in our practices that we cannot even articulate them, or imagine doing otherwise. The mode of existence of the They – according to Heidegger – is characterized by *averageness* [Durchschnittlichkeit] and *dependency* [Unselbständigkeit]. We often follow normalized practices, and we depend from those – including ourselves – who shape these practices. The They also *disburdens* [entlastet] us from the burden and responsibility of many important decisions, because these decisions are already built into the normalized practices themselves, which we follow unquestioningly.

> However, because the they presents every judgment and decision as its own, it takes the responsibility of Dasein away from it. [...] It can most easily be responsible for anything, since no one has to vouch for anything. (SZ 127 / BT 119)

In the utopian world of the Ada designers, programmers won't need to make individual decisions between alternative interpretations or practices of language use, because others will have already taken care of these. The user is not allowed to make changes to the linguistic framework – she has no choice but to obey the syntactical and stylistic rules of the language. This *disburdening* is in essence a military hierarchy embodied in the language. In this ideal world, no special ability is needed for the frictionless development, and the place of the individual programmer can be filled by *anyone*. The once-admired hacker gives place to the normalized, replaceable cogwheel of the development machinery.

Of course, back in the seventies, this reflected well the needs of the DoD projects, which involved many subcontractors, employed hundreds of programmers and encountered high fluctuation over their very long time spans. The *averageness* and *dependency* were necessary to build such highly complex technological systems as the F-16 jet fighter (Whitaker, 1993) – and they are still relevant in most contemporary software development organizations.

Conclusions drawn from the Ada case

At this point, we might be expected to conclude that Habermas and Heidegger are right in their pessimistic visions: hermeneutic practices are indeed being replaced by technical code, which reduces language to the purpose of the coordination of human action. But this is not the conclusion I'd like to draw. First, it is not a reified „language machine" or "Technology" with a capital "T" what "masters the essence of the human being", but it is rather a collective act of managers, programmers and political decision-makers, who are acting under specific historical conditions. People in the management of the DoD had good reasons to mirror a military hierarchy in the language: they wanted to win the Cold War with their limited resources. In their cost-saving effort, they (as *the They*) represented the American taxpayer. Their goals and means do

not come from a trans-historical reality, but emerge from a wider-scale, historically situated political discourse. When this discourse takes a different turn, when the specific historical conditions change, the process can take a wholly different trajectory, as the subsequent history of Ada illustrates. When in 1987 political decision-makers mandated the exclusive use of Ada in all DoD projects through DoD directive 3405.1, it created a protected space within which a large development culture started to flourish. The software of the F-16 jet fighter and the Boeing-777 airliner are the greatest results of this era. This means that Ada was technically successful , as quantified studies have also shown (Reifer, 1987, 1996; Whitaker, 1993). But soon after when Emmett Paige, the Assistant Secretary of Defense lifted the requirement for DoD projects to use Ada (Paige, 1997), the market share of the language went into steep decline. This decision reflected a change in strategy from the part of the DoD: they took a different approach to avoid the problems that were originally addressed with Ada. *Instead of focusing on the language, they started to focus on regulating the general patterns of the software engineering process,* with all its communication and inscription-producing practices (CPPCUADoD, 1997). Ada barely survived in the commercial world, even after its success in the protected market of the DoD. In 2006, it made a headline in the AdaCore newsletter that Boeing chose Ada for the control of the *air-conditioning system* of the Boeing 787.[2]

This shows that the technical code is still subject to societal discourses at the meta-level. As we're going to see in the case of Python, explicit normalization at the level of the language is only one approach among many. There are alternative ways to stabilize development processes, and these are subject to different measures of success within various social contexts.

Nowadays Ada contributes much less than 1% to the software developed worldwide. There is also a wide proliferation of other programming languages, like Python, which are founded on principles that are contrary to those of Ada. The „mega-machine" of the DoD also gave place to many new forms of organization in software development, like eXtreme Programming (Beck, 1999) or the Agile movement (Hunt, 1999), due to various changes in the social world, copyright laws, etc. (CPPCUADoD, 1997; Feinberg, 1987).

Furthermore, Ada cannot be unanimously taken to be a success even according to its own aims. It was widely acclaimed to be hard to learn, hard to use, and its strict syntax prohibited the use of certain abstractions generally considered handy (e.g. conditional compiling). Beside all its strict rules, it still had to be supplemented with a 193-page long style manual (AQS), just like most other programming languages. The productivity increase generally attributed to Ada, measured in function points and number of lines of source code written per day (Reifer, 1987, 1996), might as well be attributed to the verbosity of the language, instead of its ease of use. The "sofware crisis" persisted despite the advent of Ada, not only in the DoD but also in the private sector. More detailed criticism can be found in (Baker, 1997; Bennett et al., 1982; Dijkstra EDW658-663; Feinberg, 1987), which argue that Ada is too bureaucratic and inefficient.

Disburdening language users by taking away from them the power of making local decisions about their own practices can have negative effects as well. "Many social interactions [...] have a »local rationality« which may not [be] visible in (assumed) global perceptions of common computing environments.", argue Kling and Scacchi (1979: 39), or, in other words, the use-contexts envisioned by the designers might be at odds with reality (Kling and Scacchi, 1979: 30). The criterion that the core language cannot be extended effectively killed all individual initiative from the part of the compiler or tool developers.

Finally, as some analysts point out: "When higher quality, lower cost expectations were not immediately realized, Ada was blamed." (Kerner, 1992; CPPCUADoD, 1996). Frustrated with the language and the practice they did not choose, users and decision-makers often shifted the responsibility for their mistakes to the language designers.

So far, the theories of Heidegger, Habermas and Márkus seem to be very consistent with the design rationales built into Ada. Their fear is exactly what Ada aimed to achieve. The problem is that the validity of these rationales has proven at least questionable by the concrete history of Ada. Now let's turn to our next case study, which stands at the other extreme of the programming language spectrum with respect to hermeneutic concerns.

Open-source languages: the case of Python

Having seen the sophisticated design rationales behind the language of the military, the following question might spring into the reader's mind. If it took such a sophisticated design to avoid communication breakdowns and ensure shared understanding in the case of Ada, how come that individualistic hobbyists in the FLOSS world can develop complex, high-quality software systems without similar, highly centralized, hierarchical bureaucracies, supported by the language? Particularly, how can it be that FLOSS source code does not always degenerate into incomprehensible, "spaghetti" code even in the case of C and Python, both of which contain language features that make them much more prone to this than Ada is?

I'd like to demonstrate that concerns about understanding each other's code are just as important in the FLOSS community as was in the DoD, but here, as opposed to the DoD, they take a more hermeneutic approach to achieve that.

Constructing "pythonicity": the Zen of Python

> Beautiful is better than ugly.
> Explicit is better than implicit.
> Simple is better than complex.
> Complex is better than complicated.
> Flat is better than nested.
> Sparse is better than dense.
> Readability counts.
> Special cases aren't special enough to break the rules.
> Although practicality beats purity.
> Errors should never pass silently.
> Unless explicitly silenced.
> In the face of ambiguity, refuse the temptation to guess.
> There should be one-- and preferably only one --obvious way to do it.
> Although that way may not be obvious at first unless you're Dutch.
> Now is better than never.
> Although never is often better than *right* now.
> If the implementation is hard to explain, it's a bad idea.
> If the implementation is easy to explain, it may be a good idea.
> Namespaces are one honking great idea -- let's do more of those!
>
> (Tim Peters, "The Python Way" on python-list, 04.06.1996, also PEP 20)

This is the "Zen of Python", a summary of the values esteemed by the Python developer community. It is so standard that there is even a built-in statement in the interpreter, which prints out this list. Some take the list to be a joke, but these rules are often referred to in various arguments about design decisions (e.g. between 1999 and 2007, "Explicit is better than implicit" is mentioned individually on the python-dev list 79 times, and on the python-list 303 times), and they were introduced in order to be cited (Tim Peters, "The Python Way" on python-list, 04.06.1996). This is obviously not an exhaustive list of logically independent "founding principles": it is better to conceive them as heuristics that are somehow characteristic of the *general framing* of arguments used in debates. A solution is called "pythonic" if it is in accord with these rules. Of course, what to call "pythonic" is not easy to settle upon: the rules are inconsistent not only with some other standard practices (as Ian Bicking points out in the "UnZen of Unpython", there is at least one good reason to argue against each rule), but they also conflict with each other. (For example, "flat is better than nested" seem to stand opposed to the hierarchical namespaces – comparable to Ada packages – praised in the last line.) In order to use them as arguments, they have to be interpreted and argued in each concrete situation, and the last word is always that of Guido van Rossum, the original designer of the language.

The endeavor to relive technology within a "Zen" way of life, to rejoice in the artistic moments of engaging technology has its ideological roots in Robert Pirsig's influential book *Zen and the Art of Motorcycle Maintenance* (1984). Pirsig argues there that the nature of "Quality" defies definition and explicitness, because it must be conceived as a general orientation toward artifacts, people and ourselves. Every fragmented articulation of "Quality" can only serve the purpose of transforming the orientation of people, instead of exhausting its meaning. The effort to explicate quality turns it into an external set of rules, a form of disciplinary power which instills a rule-following "slave mentality" (Pirsig, 1984: 199), whereas real Quality stems from the creative and responsible interpretation of the lifeworld situation by free and self-motivated people. We are going to assess, to what extent is this ideological background reflected in the actual practice of developers, and at what price comes this "freedom".

Talking of hermeneutics, the most relevant feature of the "Zen of Python" is that *at least 10 of the 19 rules argue for the easy understanding of source code* – just as the Ada specifications do! It is a plea for a modernist aesthetic of simplicity, practicality and order, but praises it only to the extent to which it helps to make the code easier to understand (Rossum, 1996). And understanding is indeed very important in the case of Python. Since the data typing system is not static – as in Ada – but dynamic, it is not easy to tell, for example, what kind of parameters can be used to call a function. Since there are no type-checks neither at compile-time, nor when the parameter is passed to the function, bugs only appear when an assumption about the parameter breaks deep within the function (Alex Martelli, "Inheriting the @ sign from Ruby" on python-list, 12.12.2000). It is thus essential to make the assumptions explicit about the function's parameters – for example, by using meaningful parameter names, by providing relevant comments, or by communicating through other channels. This means that in principle, it is quite easy to write incomprehensible Python programs. It can be made very hard to guess from the source code what goes on at runtime.

In general, the designs of the two languages endorse *different patterns of use*. Ada assumes that interfaces will be defined beforehand by an elite designer group, and then the lower-level programmers will proceed with the implementation. Python is designed towards interactivity and rapid application development within small developer groups. Reliability concerns are addressed through promoting peer review and extensive testing, rather than language constructs.

Ada and Python are both designed for readability and understandability, but they have different conceptions on what they take to be "readable". *In the case of Ada, "readability" is explicitness and verbosity, while in the case of Python, "readability" is simplicity and terseness*. In the DoD community, you write understandable programs because you are disciplined by the compiler (and the legal code behind it). In the Python community, "readability" is influenced by syntax, but even more emphasis is being laid on building the shared culture, in which one feels responsible and motivated to be helpful to her fellow programmer. The general impression is that you should get feedback from your fellows and your customers, but only rarely from the compiler/interpreter. In many cases, it is up to the various user communities' choice to settle upon standards and conventions:

> "A universal convention supplies all of maintainability, clarity, consistency, and a foundation for good programming habits too. What it doesn't do is insist that you follow it against your will. That's Python!"
>
> —Tim Peters on comp.lang.python, 2001-06-16
>
> A style guide is about consistency. Consistency with this style guide is important. Consistency within a project is more important. Consistency within one module or function is most important.
>
> But most importantly: know when to be inconsistent -- sometimes the style guide just doesn't apply. When in doubt, use your best judgment. Look at other examples and decide what looks best. And don't hesitate to ask! (PEP 8: "Style Guide for Python Code")

This approach leaves ample space for decisions at the *local level* of development. The progress of language evolution, first through mailing-list discussions and reviews, and in recent times through the semi-formal process of Python Enhancement Proposals (PDP, PEP 1, PEP 42) also reflects this democratic spirit, and this sometimes results in swift changes of the core language (Rossum, 2001).

On one hand, the "Zen of Python" and the PEPs form part of a *conservative* strategy: they are being employed by senior developers to fend off those, who want to "bend [the language] into uncomfortable positions" (Patrick Phalen, "The Python Way" on python-list, 03.06.1999). In other words, "Like a FAQ, which tries to reduce newsgroup traffic by answering questions before they're asked, PEPs try to reduce repeated suggestions." (PDP). They do so by explicating the rationales and the shared values that went into each design decision.

On the other hand, the "Zen of Python" is always open to reinterpretation, and PEPs are often revised, if there is enough community support to do so. That the democratic principles laid out in (PDP) are indeed in effect can be demonstrated by the fact that on average, 1.72% of the postings on python-dev are votes cast using the Apache Project voting scheme (See figure 1).

In contrast, such local overriding of global conventions was perceived to be the root cause of reliability and cost problems by chief Ada designer Jean Ichbiah (Ichbiah, 1984). Thus, even if the Ada standardization process was open to peer commentary (some 7000 comments were considered) (Ichbiah, 1984; Boehm, 1979; daCosta, 1984), it never resembled the openness of the

PEPs. The basic requirements and assumptions remained fixed, and any further extensions were banned. Ichbiah insisted upon that

> [...] a design like this has to be done with a single strong leader, since it is very important that the major architectural lines of a language be kept consistent: Consistency can only be achieved with one person defining the major lines. (Ichbiah, 1984: 997)

Python also has a charismatic designer (mockingly called the "Benevolent Dictator for Life"), Guido van Rossum, who was solely responsible for final decisions on language design questions up until 2000 (Rossum, 1996, 2001). Although he is the one generally attributed for the conceptual integrity of the language, we have seen that the Python evolution is much more decentralized and flexible than Ada standardization.

As we can see on (Fig. 1.), words like "readab(-le, -ility)" and "convention(-s, -alization)" appear in Python-related mailing list/newsgroup postings with at least as, or even greater frequency than in those dedicated to other languages. The frequency of postings mentioning specifically Python-related understandability issues, such as "implicit(-ness)", "explicit(-ness)", and "indent(-ation, -s, -ing, ...)", is significantly higher than in other forums. On (Fig. 2.) it can also be seen that these ratios are resulting from a sustained interest, instead of a single debate. It is also worth pointing out that the frequencies of the postings using these words are correlated.

These findings are *signs of an ongoing process of reinterpretation and renegotiation* of what is understandable and how to arrive at shared understanding. *This discourse is a characteristic example of what I call "hermeneutic practice"*.

Here – at least in an idealistic sense – shared understanding is achieved within democratic spheres of discussion opened up by the structured patterns of use of communication media, so that anyone can – to borrow a concept from Polányi (1962) – align and *coordinate himself to others* if she wants to contribute, or try to persuade others to do so in the case she thinks otherwise. It is generally assumed that everyone would do her best to achieve shared understanding: explicit rules represent the current state of this *self-coordination process*, and they themselves emerge from such processes.

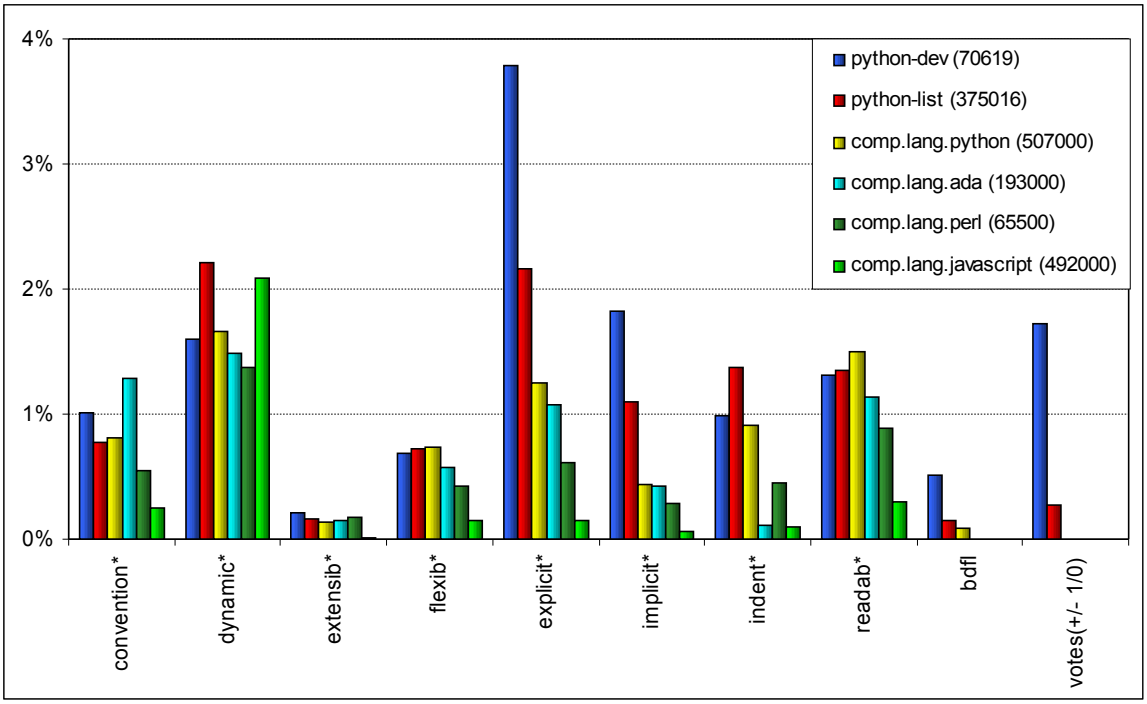

Fig. 1. Percentage of mailing list/newsgroup postings containing the respective keywords. (Figures for python-dev and python-list refer to occurrences in non-cited body text, whereas comp.lang. newsgroup figures contain all occurrences. The total number of postings is shown in parentheses.)*

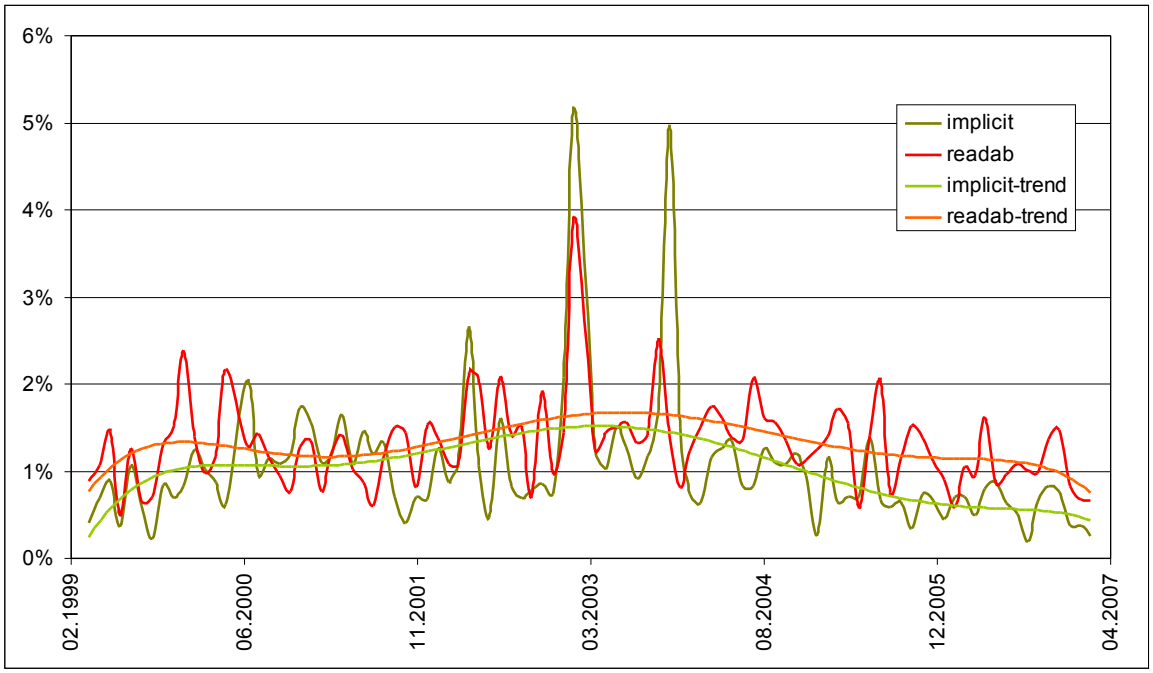

Fig. 2. Correlation between the relative frequency of pattern "implicit" and "readab" in python-list postings. The correlation coefficient is 0.502.*

Conclusions drawn from the Python case

We can now turn toward answering our original questions. Ada and Python are two paradigmatic cases of technical codes, but Python is not a technical code in the sense it is feared by Heidegger and Habermas. We must admit that it does try to reduce the number of decision alternatives open to the programmer, as well-designed technical artifacts do (Norman, 1998). "There should be one – and preferably only one – obvious way to do it." – that means, there should be only one preferred language idiom for standard problems, so that people will tend to use in the same way (Rossum, 1996). But this is not strictly enforced (James J. Besemer, "Dijkstra on Python" on python-list, 13.08.2002), and contrary to Ada, it is not the invisible, biased field of power, unconsciously transforming the phenomenal world of its users. Python does not try to restrict the user's field of interaction in order to force her to adhere to a specific standard of readability and a specific ideal of order: to a great extent, it is up to the user's community to take a stand on these matters.

Answering our other question, FLOSS software development doesn't disintegrate, because "free" software development is not necessarily "anarchic". Instead of having strict methodologies and controlled technical codes, their conventions emerge in rather highly structured, decentralized and self-disciplined hermeneutic practices. Conventionalization is often based on *self-coordination,* instead of the decisions of an appointed elite expert committee.

Why does this approach seem to work so efficiently? Ada wants to standardize and automatize one of the highest levels of intellectual work. But as DeMarco and Lister conclude their arguments in their classic book "Peopleware":

> When you automate a previously all-human system, it becomes entirely deterministic. The new system is capable of making only those responses planned explicitly by its builders. So the self-healing quality [characteristic of human systems] is lost. […] If ever the system needs to be healed, that can only be done outside the context of its operation. […] If the […] system has a sufficient degree of natural ad-hocracy, it's a mistake to automate it. Determinism will be no asset then; the system will be in constant need of maintenance. (DeMarco and Lister, 1999: 113-114)

If DeMarco and Lister are right, the "rigidity" inherent in the concept of the "technical code" is self-defeating: socio-technical systems conditioned by overly rigid technical codes might not have the necessary "self-healing" quality to survive in a fast-changing world. In contrast, the Python language and the community itself, by having a "sufficient degree of natural ad-hocracy", can accommodate itself fast to new challenges. Certain conventions are "factored out" of the core language, so they can be renegotiated in each user community, according to their particular needs and valuations. In certain user communities, conventions might gather a strongly conservative momentum, whereas in others, they might remain only loosely coordinated.

General conclusions

I've chosen my two case studies to represent two opposed ideals of understandability, and two markedly different approaches of achieving shared understanding. These cases also offered a rich source of self-reflection by the actors themselves on the social context of programming language use. The analysis could have been extended to other languages, like, for example, LISP, which

embodies other historically situated ideals of understandability, such as mathematical elegance, but this would have exceeded the limits of this article.

In claiming that the technically embodied instrumental environment shapes hermeneutic practices, and the conceived ideals of these practices shape technologies, I'm not arguing for a strictly deterministic connection between cultural context, instruments, and the particular practices of understanding mediated by them. Such a thesis would be easily refuted by pointing out that many open-source projects are written in JAVA, which inherits some of its core features from Ada. Nevertheless, the biases built into the instruments can be traced back to the reflections of users and designers, and can be situated in the cultural horizon.

This is consistent with my claim that *the language framework is the result of the collective interpretation of the general lifeworld situation by programmers, management and political decision-makers. By having been inscribed into the processes of programming language use, this general interpretation permeates the particular practices of understanding that are possible within the language framework.* Hermeneutic practice – whether done by developers or reflected upon by language designers – is thus a central element in software development.

I have also assessed the positions of Heidegger, Habermas and Márkus, according to which our age is characterized by a tendency in which hermeneutic practices are being replaced by technical code. Márkus's explanation seems to be relevant both in the case of Ada and Python, but instead of a given fixed set of shared assumptions (as he thinks), it is the paradigmatic and specialized nature of *ongoing hermeneutic practice* that grants the shared background.

Heidegger's and Habermas's position seem to be in accord with the design rationales built into Ada. The problem is that hermeneutic practices in FLOSS projects like Python transcend this horizon. Their visions don't seem to have trans-historical validity: they are only relevant in the case of "Ada-thinking", but "Ada-thinking" has many alternatives. What I still find relevant is *the general framing of their questions*: the emphasis on the praxis-constituting role of language and on the importance of hermeneutic practices in our technological culture.

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Function Yes in Ada
(taken from Ada Quality and Style, Ch. 10.)

```
package Terminal_IO is
   […]
   function Yes (Prompt : in     String) return Boolean;
   […]
-------------------------------------------------------------------
with Text_IO;

package body Terminal_IO is
   […]
   -----------------------------------------------------------------
   function Yes (Prompt : in     String) return Boolean is

      Response_String : Response := (others => Blank);
      Response_String_Length : Natural;

   begin  -- Yes
      Get_Response:

      loop

         Put_Prompt(Prompt, Question => True);
         Text_IO.Get_Line(Response_String, Response_String_Length);
         Find_First_Non_Blank_Character:
         for Position in 1 .. Response_String_Length loop
            if Response_String(Position) /= Blank then
               return Response_String(Position) = 'Y' or
               Response_String(Position) = 'y';
            end if;
         end loop Find_First_Non_Blank_Character;
         -- issue prompt until non-blank responses

         Text_IO.New_Line;
      end loop Get_Response;
   end Yes;
   -----------------------------------------------------------------
   […]
end Terminal_IO;
```

Function Yes in Python

```
from sys import stdin

def Yes( prompt ):
    “”” Returns True if user answers ‘y’ or ‘Y’ “””

    print prompt + '?'

    # issue prompt until non-blank responses
    while True:
        response = stdin.readline()
        for c in response:
            if c not in ' \n':
                return (c == 'y') or (c =='Y')
```

Sources relevant for the Ada case

Comprehensive archive of Ada-related documents
http://www.iste.uni-stuttgart.de/ps/AdaBasis/pal_1195/ada/ajpo/

Websites dedicated to Ada-related activity
http://www.acm.org/sigada/
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http://sw-eng.falls-church.va.us/ajpofaq.html

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Endnotes

1 For a detailed critical reconstruction, see Feenberg 1996.
2 http://www.adacore.com/2006/05/01/hamilton-sundstrand-selects-gnat-pro-for-boeing-787-air-conditioning-pack-control-unit/

The Internet – Proposing an Infrastructure for the Philosophy of Virtualness

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Abstract
This paper proposes a preliminary infrastructure for future philosophical discourse on the virtual, interactive, visual, top layer of the Internet. The paper begins by introducing thoughts on such words as real, virtual, reality, knowledge, and truth. Next, news summaries are provided illustrating some effects from the "real world" on the virtual part of the Internet, and vice versa. Subsequently, nine major categories of Internet variables are identified. Finally, over one hundred questions about the philosophical nature of the virtual part of the Internet are listed and are organized into fourteen categories.

Keywords: Internet, Philosophy, Technology, Virtual, Infrastructure

On Purpose and Method

As I see it, philosophy is a tool whose purpose is to assist thinkers in thinking through the techniques of analysis, synthesis, and evaluation of questions, problems, and unknowns, in search of logical explanations for those things that occupy our minds.

I confess: I am attempting to contribute to the knowledge base of the philosophy of technology by posing more questions, more problems, and more unknowns. This, in itself, is a contribution, according to Nozick (1974), who claims the need for and the goodness in what he terms "less complete work, containing open questions and problems ..." In addition, Russell (1997, p. 161) sees the value of philosophy "not for the sake of any definite answers to its questions" but in the questions themselves, for "these questions enlarge our conception of what is possible, [and] enrich our intellectual imagination …"

In my quest for logical explanations about the philosophical nature of the visual interactive top layer of the Internet, herein referred to as the Philosophy of Virtualness, I have been able to brainstorm, identify, and categorize some philosophical areas of interest for future discourse. Russell (1997, p. 7) confirms "it is natural to begin with our present experiences" as we search for certainty. I have constructed these areas of interest primarily as an empiricist using observations, experiences, and introspection (Grayling, 1998) by first exploring definitions on such subjects as reality, knowledge, and truth. Next, I provided some news articles that examined the effects of the interactive part of the Internet on our real societies as well as the effects of our real societies on the interactive part of the Internet. Finally, I synthesized, evaluated, and used introspection of this data to identify some variables of the Internet and to create a list of over one hundred questions related to the interactive layer of the Internet. Refer to page 63 for the list of questions. Brey (2005) confirms the need for a more systematic evaluation of the Internet.

On Definitions

From my experience, when people speak of the Internet, they typically mean the interactive, visual top layer in which they interface with others, as opposed to the physical, infrastructure bottom layer. Due to its fascinating characteristics, this interactive top layer deserves a closer philosophical inspection. Is this interactive top layer just another communications technology or is it something more? Note that in this paper, the physical infrastructure bottom layer of the Internet will be ignored. Thus, for the remainder of the paper, the word "Internet" will refer primarily to the visual interactive top layer where users interface with other users.

We might define technology as something that extends to our human capabilities. We can ask if the Internet meets this definition. I imagine we could easily agree the answer is "yes," and so conclude that the Internet is a technology under the given definition. But, should we ask if it is something more than a technology? Could we consider it to be like a mall, a library, a school, a park, a museum, a theater, a community center, a telephone, a billboard, a workplace, a bank, a post office, a television, a radio, a public journal, a newspaper, a spy device, or something more? Does it meet any of the criteria for a community, a village, a society, a country, a world, a galaxy, or is it something different? Is it networked, digital, artificial, and / or virtual? Should it be called *The Internet Galaxy* (Castells, 2001), *The Network Society* (Dijk, 1999), *The Virtual Community* (Rheingold, 2000), or the *Internet Society* (Bakardjieva, 2005)? When people are on the Internet, do they interact, have relationships, share common purposes and interests, organize into groups, and provide assistance to each other, among many other tasks? Do these characteristics provide help to further define the nature of the Internet?

According to the DK Illustrated Oxford Dictionary (1998), a computing definition for "virtual" is "not physically existing as such but made by software to appear to do so." The Internet's interactive visual top layer is primarily made by software to appear to exist; it would not exist without software. Thus, I propose that the word virtual would apply to the top layer of the Internet. Therefore, I will refer to the interactive top layer of the Internet as something virtual which is not physically existing but made primarily by software to appear to do so. Since I have associated the word virtual with the interactive top layer of the Internet, I must distinguish it from things that are not made by software to exist which I will refer to as our "real world." From our real world we enter the virtual part of the Internet. Note that the physical bottom layer of the Internet is not virtual and we wil exclude it from our discussions in this paper.

Others also believe that the Internet is something more than a technology. Benson (2007, p. 13) refers to blogs as "… a community with occasional celebrations." Brey (2005) refers to the Internet as having "virtual communities" and distinguishes them from "physical communities." He also describes "online social relationships" in contrast to "offline social relationships" stating that the Internet makes possible the creation of individuals in communities with "shared interests and concerns." Brey further states that Dyson argues that the Internet allows for the creation of communities of individuals with similar minds.

On Real and Virtual

We should compare the words "real" and "virtual." In my "real world" I am able to hear, see, smell, feel, or taste things. In comparison, when I am on the Internet, I can hear and see things easily. According to Dorsey (2007), researchers at Worcester Polytechnic Institute are developing technologies for touch, taste, and smell for use in "artificial worlds." But, even if the Internet is able to match the real world in these five senses, would there still be something different about Internet? We might begin by exploring the qualities of the word real. Real has continuous time as a characteristic. For the Internet, what meaning does time have and is it continuous? Maybe

"change" is another characteristic of real? If no one from any real world accessed the Internet for a month, then will have anything changed in the Internet? We could also ask questions like, "Are Websites real?" When no one is accessing them, do they still exist? They are stored as bits. Are bits real? Another distinguishing characteristic of real may be things that are living and growing. Would we consider anything as living or growing in the Internet? Additionally, my real world appears to three-dimensional in space. What dimension is the Internet? Also, in the real world, we can measure the distance between objects. How do we define the distance between objects in the Internet? What does proximity mean in the Internet? In addition, in the real world, there is real property. What kind of property exists in the Internet? Are Websites or domain names property of some sort? And if so, whose property are they? Is virtual property real? Furthermore, in my real world, because no two people can occupy the same physical space, they must not have exactly the same view of a thing. In the Internet, can two people have the identical view of a Website, thus seeing exactly the same thing? Thus, what are the differences between the real world and the virtual part of the Internet? Could the Internet ever have the same qualities as the real world or could the Internet have even better qualities?

On Reality

Russell (1997, p. 9) indicates that "one of the distinctions that cause most trouble in philosophy … [is] the distinction between 'appearance' and 'reality,' between what things seem to be and what they are." We can only wonder what Russell would have thought about the Internet. Would his definition for appearance and virtual be similar? Russell (1997, p. 11) also questions reality: He asks, "Is there a real table at all?" Perhaps if he had viewed Websites, he might ask, "Is there a real Website at all?" Russell follows his first question with a second question: "If so, what sort of object can it be?" This same question can be asked about Websites today: "what sort of object is a Website?" Russell (1997, p. 13) continues his investigation of reality by defining matter. He considers matter as having several properties, one of which is "occupying space." This allows us to ask, "Does a Website occupy space?" in order to determine if it meets one of the criteria for matter. Cass (2007) estimates that the Internet weighs 0.2 millionths of an ounce which includes all Webpages. Therefore, a single Webpage does appear to have some weight, albeit minuscule, and so does it occupy some space? Russell (1997, p. 17) continues investigating matter: "Is there a table which has a certain intrinsic nature, and continues to exist when I am not looking …?" Naturally, we can pose a similar question: "Is there a Website which has a certain intrinsic nature and continues to exist when I am not looking?" Brey (2005) lists bewilderment about the difference between reality and representation as a perceived harm of the Internet.

On Knowledge and Truth

People searching the Internet for information will encounter an abundance of data and are subject to the burden of distinguishing the truthful data from the false data. Brey (2005) concludes that it is often "impossible" to determine the "correctness" of Internet information because of the complexity in assessing sources. Russell (1997, p. 121) states that the "truth consists in some form of correspondence between belief and fact." He contends the more important question is, "How we can know what is true and what is false?" Similarly, in the age of access to endless information on the Internet, how can we know what is true and what is false? To discuss this issue, Russell (1997, p. 140) introduces the concept of "probable opinion" and states "… the greater part of what would commonly pass as knowledge is more or less probable opinion." Thus, I wonder what Russell would think about Wikipedia. Popkin and Stroll (1993, p. 187) assert that "many skeptics have claimed that people's 'knowledge' only expresses opinions that may or may not be true." What kind of "knowledge" is on the Internet? Let us use blogs as an example. Are

blogs knowledge? According to Popkin and Stroll (1993), Mill believes that opinions should not be suppressed (even if the majority does not approve) for several reasons: (1) because they might be true, (2) that in the process of reviewing the arguments against a certain opinion one might understand his/her opinion better, and (3) that there may be elements of the opinion that are true. Would Mills be pleased with blogs and Wikipedia? Even Leibniz had a "vision of a great synthesis of knowledge, [a] universal encyclopedia that would be accessible through catalogues, abstracts and indices to the international community of scholars …" (Collinson and Plant, 2006, p. 109). Would Leibniz think of Wikipedia or the Internet as an implementation of his vision?

On Assumptions

The Internet has many intriguing qualities. Its function, or rather the function to which the Internet has evolved, appears to possibly be to connect the inhabitants of the Earth together. Borgmann (1999, p. 4) argues that "the Internet particularly has given many people the liberty to escape the constraints of their age, gender, and race, of their shyness, plumpness, or homeliness, and to set their glamorous inner selves free and adrift on a World Wide Web." Brey (2005) describes one perceived Internet benefit as being a "tool for freedom." Brey (2005) contends that a harmful effect of the Internet is the obscurity in sustaining distinct "boundaries between public and private spaces." In addition, probably one of the most unique aspects of the Internet is to allow instant n-way communication. By n-way, I mean x-number of senders connected to y-number of receivers where {x} and {y} are each the set of whole numbers. Similarly, Brey (2005) lists a benefit of the Internet as allowing "many-to-many communication." Also, Benson (2007, p. 13) concurs that the Internet, and specifically blogs, "… can be a way of creating a geographically distributed, even global, conversation and interaction." Additionally, the Internet, along with advances in the transportation systems provides for the development and existence of globalization – a topic of grave importance which is beyond the scope of this paper. Globalization is potentially a catalyst to the latest economic consequences we are experiencing. Due to the tight integration of the Internet, the real world, and globalization, any changes occurring in the real world are experienced rapidly on a global scale. This factor contributes to the assumption that the Internet is most likely more than just a communications technology.

On Systems

The real world as well as the Internet can be divided into systems. A system is a set of things that are related. From experience and observation, I note that the Internet influences the real world and the real world influences the Internet. These influences can be categorized by system type and might include broad systems such as cultural, economic, educational, employment, entertainment, legal, military, political, religious, societal, and spiritual.

On Empirical Knowledge of A Posteriori Beliefs

I have been analyzing news articles that illustrate the effects transferred between the real world and the Internet. This activity I consider to be a form of observation from which I introspect, synthesize and evaluate. To aid in the formation of the infrastructure for the Philosophy of Virtualness, I will attempt to recreate the observations that have led to my views and ultimately to the set of questions at the end of this paper. Thus, I am providing summaries from selected news articles, in the sections that follow, showing the effects transferred between the real world and the Internet. Additionally, I have been personally involved with the Internet and its interactions, as an end-user as well as a computer scientist, systems scientist, technology educator, and business employee (in both the profit and nonprofit sectors).

On Effects

Ozmon and Craver (2003, p. 135) claim that Peirce believed that "Our idea of anything is our idea of its sensible effects." Ozmon and Craver summarize Peirce's beliefs that "… ideas or concepts cannot be separated from human conduct, for to have an idea is to be aware of its effects … in the arena of human affairs." We can apply Peirce's belief to our own discussion. We should look at the effects the real world is having on the Internet because these effects will shape the interactive virtual part of the Internet. These effects are entering from the global population, thereby rendering the virtual part of the Internet as an entity comprised of global influences. Equally as captivating are the effects from the virtual part of the Internet on the real world. These effects are flowing to the global, real world, shaping it with new ideas. Brey (2005) lists a variety of benefits and harms of the Internet to the culture and society and concludes a need for understanding both better.

On Effects from the Virtual Part of the Internet on the Real World

In this section, I provide summaries of selected news articles from which I have observed the effects from the virtual part of the Internet on the real world. I also list the systems impacted as well as my thoughts. The articles are listed in chronological order.

	Terrorists of Internet Generation Act On Their Own (2007)
System	Cultural, Political, Social
Effect	Article states that third generation terrorists (those who are planning, funding, and attacking on their own) are learning their tactics from the Internet. "Its only connections to al-Qaeda are Web sites and a shared anti-West philosophy. Its practitioners go on-line to find inspiration as well as practical advice …"
Thoughts	Is the Internet good or bad for a society?

	Mideast Bloggers Chip Away at Governments' Media Control (2007)
System	Political, Cultural, Social
Effect	"Bloggers are chipping away, writing about everything from human rights to the region's rulers to the most taboo topic – Islam." "Blogs started taking off in the Mideast a few years ago as access to the Internet grew…" Blogs "strive to tackle political and social issues." "Governments defend their Web regulations, saying they are protecting citizens from 'immoral' and 'defamatory' content. But rights groups and bloggers say officials are really trying to retain their media control."
Thoughts	Can the Internet be used to change the real world society?

	Students Use IM-Lingo in Essays (2007)
System	Culture, Educational
Effect	Article states that students are using instant messaging lingo in their essays and other written assignments in high school and middle school. Some teachers think that it is good that students invented a new language that is used in communicating in our high-tech world.
Thoughts	Is the Internet changing the real world languages?

	Amateur Hour for Political Ads (2007)
System	Political, Cultural
Effect	"Do-it-yourself political advertisements made by amateurs are now flooding the Internet thanks to cheap digital video production equipment and free video sharing

	sites like YouTube." "But while the homemade ads are good for laughs, campaign professionals are wondering whether they could actually influence election results." "In such a wired world, the distinction between professional and amateur ads and incriminating video snippets is increasingly becoming irrelevant." "People don't distinguish between campaign-made ads on YouTube or homemade ads or a blogger following a candidate with a camera." The Federal Election Commission regulates formal political advertisements but does not regulate amateur ads.
Thoughts	Does the Internet encourage more people to become involved in the real world society? Can professional be distinguished from amateurs on the Internet?

Army's Newest Recruiting Tool: YouTube (2007)	
System	Military
Effect	The U.S. Army is using YouTube and the Internet to recruit young people by showing videos. The Army has a special channel on YouTube so that soldiers can upload real video clips once approved.
Thoughts	Is there a distinction between the real world wargames and the Internet virtual wargames?

Virtual Vines Grow On World Wine Web (2007)	
System	Economic, Social
Effect	Article states that there is "a winery where the grapes are real but the experience is as virtual as members want it to be with e-mail updates, live chat, and Web cams." This costs $5000-$10,000 per year. Web cams show the crush, complete with live chat so viewers can question the workers. There is even an on-line tasting where
Thoughts	people are sent samples ahead of time. What are the differences between the real world and the Internet?

Site Warns US to End Search For Soldiers (2007)	
System	Military, Political
Effect	An Islamic extremist Website warned that searching for American troops will put them in greater danger.
Thoughts	The n-way communication of the Internet provides for immediate and widespread communication.

MySpace Agrees to Provide the Names of Sex Offenders (2007)	
System	Social, Legal
Effect	MySpace has agreed to provide information to several states it has on sex offenders who have a profile on MySpace. They removed 7,000 profiles as part of the investigation. Many of these sex offenders have violated parole or probation by contacting children on MySpace. A MySpace attorney stated, "This is no different than an offline community." Before MySpace could legally release the information, it had to receive subpoenas and other legal actions under the Federal Electronic
Thoughts	Communications Privacy Act. Does the Internet mirror real world societies? Should the Internet have the same legal regulations as the real world and whose legal regulations should it have?

Internet Moms: Getting the Best of Both Worlds (2007)	
System	Cultural, Economic, Employment
Effect	"While many of the people [she] met online don't live close to her geographically, she says the Internet can offer an enormous sense of community and support." A

Thoughts	supervisor states, "… home workers can bring companies great benefits… [employees] get the flexibility to run their home lives and their work lives at the same time and the company gets employees who are more committed to a company…" Article also states that because of the Internet's international and "24/7" nature, it is beneficial for workers to work from home at various hours. It also states that having the ability to select from a worldwide population is advantageous. Does proximity affect Internet relationships? Does the Internet make the real world better?

Drink Mai Tai, Check Email (2007)	
System	Cultural
Effect	Article concludes that more people are working while on vacation and specifically those that are younger. Twenty-five percent of people under forty took their laptop on vacation, while only fifteen percent of people aged fifty to sixty-four took their laptop on vacation, and less than fifteen percent of people over the age of sixty-four took their laptop on vacation.
Thoughts	Are work and pleasure time becoming indistinguishable?

Internet Porn's Storyline May be a Riches-to-Rags Tale (2007)	
System	Economic, Cultural, Entertainment
Effect	Sales of X-rated DVDs are low due to Internet's free/low-cost photos and videos created by amateurs that are uploaded and available for free on the Web. In 2006, rental and sales of X-rated DVDs decreased more than fifteen percent from 4.28 billion in 2005 to 3.2 billion in 2006. The $13 billion sex-related entertainment market is at risk.
Thoughts	Is the Internet redefining some industries?

Nation Warming to Porn (2007)	
System	Cultural
Effect	In April 2007, more than one third of US Internet users visited online adult sites. Article concludes that porn is part of our everyday life now as opposed to the past because it has become more pervasive. Article states that employers and teachers are noticing females wearing more revealing clothes and assumes this is due to the prevalence of porn online.
Thoughts	Is the Internet changing the real world societies for the better?

It's 'A Real University' Online, Bowles Says (2007)	
System	Educational
Effect	The University of North Carolina System of 16 Universities is offering 130 on-line degree certificate and licensure programs to compete with University of Phoenix. UNC President Erskine Bowles asks the question, "…would you rather get [a master's degree] from a real university like the University of North Carolina, or would you rather get it from some virtual university?" UNC expects 80,000 additional students to enroll by the end of the next decade. Bowles implies there's a distinction between a "real university" online and a virtual university.
Thoughts	What is the difference between a real university online and a virtual university? What is the best method for education?

Conservative Bloggers In Full Revolt Over Immigration (2007)	
System	Political
Effect	One blogger stated he received 800-900 emails a day from readers. "Blogs and anti-immigration organizations used the Web to tap into the growing discontentment over

	the immigration bill, using the Internet to organize phone and fax campaigns to urge senators to vote against the bill. It was a plugged-in show of force that would have been beyond comprehension a decade ago."
Thoughts	How powerful is the Internet's effect on the real world societies?

On Effects from the Real World on the Virtual Part of the Internet

In this section, I provide summaries of selected news articles from which I have observed the effects from the real world on the virtual part of the Internet. I also list the systems impacted and some thoughts. The articles are listed in chronological order.

	Egyptian Blogger Sentenced (2007)
System	Political, Religion, Cultural, Social, Legal
Effect	An antigovernment Internet blogger was sentenced to four years in prison by an Egyptian court. This was the first person prosecuted. He was charged with contempt of religion and for defamation of the President Mubarak. Another blogger states, "… this means that the state cannot tolerate anyone voicing his opinion ..." This sparked debate among bloggers over the limits of religious and political expression in Egypt. "Within minutes of the judge handing down the sentence, word of the verdict spread to Cairo and other cities via text messages, email and blogs."
Thoughts	Has the Internet created a new set of consequences for actions?

	It's Not A Game (2007)
System	Social, Economic
Effect	IBM is spending $10 million to "help build out the '3-D' Internet, according to its CEO. The article states "it offers endless social possibilities with people around the globe …" "This virtual world – don't call it a game – has become a phenomenon." It has "huge opportunities to sell products and services." "Metaverse … is gaining currency as the generic name for virtual worlds." Linden Lab made $11 million in 2006 revenues from Second Life, primarily from the sales of virtual land. Customers are buying land which is really renting space on the 1750 servers that store the digital representation of Second Life. There are nightclubs, jewelry makers, landscapers, pet manufacturers, golf courses, beaches, bars, ski areas, and more. The CEO hopes other virtual worlds will interoperate with Second Life, so that Linden Labs can control the standards of virtual worlds. IBM's VP for technical strategy states "today virtual worlds are where video and VCRs were in the early 1980s, or where the Web was in 1993."
Thoughts	Will the Internet become a mirror of the real world and whose real world? Will the Internet change the economies of the world for the better?

	Defining Truth in a Wiki-World (2007)
System	Social, Cultural
Effect	Articles states Middlebury College does not allow the use of Wikipedia as references. It questions, "What qualifies as intellectual authority in an age of information overload, when society relies increasingly on the Internet?" Author states that some are "troubled by what they regard as a tendency on the Web to value anonymous, collective thought over individual intellect." "Globalization and technology are creating other socio-cultural changes that challenge old notions of expertise." "The Internet's ability to empower individuals with an illusion of infinite knowledge challenges even notions of reality." "Is information on the site absolute fact or simply a matter of group consensus?" Article recommends the "need to carefully sift any information over the Internet."
Thoughts	

	What are knowledge and truth on the Internet?

	Students Accused of Cyberstalking (2007)
System	Social, Legal
Effect	Two high school students were charged with cyberstalking by creating false profiles of their assistant principals on MySpace. "The Internet and social sites such as MySpace have vaulted youthful pranks onto a worldwide stage that can carry serious consequences." Students in several states have been criminally charged after posting fake profiles. In Texas in 2006, a principal sued students after students posted a fake profile indicating that she was a lesbian. Forty-five states have laws against cyberstalking. A parent of the student states "If we are going to start arresting children over this kind of stuff, we've gone terribly wrong as a country." The law in North Carolina includes any electronic communication making a false statement concerning death, injury, illness, disfigurement, indecent conduct, or criminal conduct with the intent to abuse, annoy, threaten, terrify, harass, or embarrass.
Thoughts	What kinds of laws are needed for the Internet? What are the rights of free speech on the Internet?

	Virtual Feds Visit Second Life Casinos (2007)
System	Legal, Entertainment, Economics
Effect	Article states that Second Life is under investigation by FBI for its Internet casinos, but that the US Government cannot decide on the legality of virtual gambling. Although the Second Life agreement prohibits illegal activity, Linden Lab, creator of Second Life has no way to monitor or prevent gambling. Linden Lab could face criminal charges under the 1970 Illegal Gambling Business Act or the Unlawful Internet Gambling Enforcement Act.
Thoughts	What does illegal activity mean in a virtual society?

	Turkey to Block 'Insulting' Web Sites (2007)
System	Political, Cultural
Effect	Turkey is blocking Websites that are insulting to the founder of modern Turkey. Turkey temporarily blocked access to YouTube. In Turkey it is illegal to "talk of breaking up the state or to insult Ataturk."
Thoughts	How much should a real society attempt to control the Internet?

	As Blogs Spit Bile, A Bid to Make Nice (2007)
System	Legal, Cultural, Social
Effect	"The conversational free-for-all on the Internet known as the blogosphere can be a prickly and unpleasant place." Article states that people are trying to create a code of conduct by banning anonymous comments and having ability to delete threatening or libelous comments. "But since the Web offers the option of anonymity with no accountability, online conversations are often more prone to decay into ugliness than those in other media." These guidelines will be policed by the community and will be voluntary.
Thoughts	Does the nature of the Internet change the behavior of people in the real world?

China Aims to Further Tame Web (2007)	
System	Political, Cultural
Effect	Chinese President intends to rid the country of "unhealthy" Internet content by placing it under propaganda control. "Development and administration of Internet culture must stick to the direction of socialist advanced culture." China's Internet users grew by 26 million and is now 137 million people. China already uses filters and censorship systems that block the majority of users from sites offering uncensored opinions and news.
Thoughts	Is the real society attempting to replicate itself on the Internet?

'Entropia Universe' Opens Virtual Pawnshops (2007)	
System	Economic
Effect	An Internet game titled "Entropia Universe" has sold five licenses for virtual pawnshops for $404,000 that make loans to people who turn in virtual items such as laser rifles.
Thoughts	Is the Internet the new global economy?

Banned TV Channel Turns to YouTube (2007)	
System	Political
Effect	President Hugo Chavez restricted a TV channel from broadcasting. Now it is broadcasting on YouTube. It was the most subscribed feed for the week.
Thoughts	Does the Internet provide alternative methods for the real world?

WCVB, YouTube Reach Content Deal (2007)	
System	Entertainment, Cultural
Effect	WCVB-TV and four other TV stations owned by Hearst-Argyle Television Inc. will post news, weather, entertainment videos, and local programming on YouTube as part of their digital strategy of distributing content on the TV, the PC, and the mobile phone.
Thoughts	Is the Internet important to the real world?

'Amateur' Charge Infuriates Blogosphere (2007)	
System	Cultural
Effect	Andrew Keen, founder of Audiocafe, argues the following in his book: "Internet culture is actually a jungle peopled by intellectual yahoos and digital thieves." "The basic notions of expertise are under assault amid a cultural shift in favor of amateurism of blogs [etc.]." "Millions and millions of exuberant monkeys…[are] creating an endless digital forest of mediocrity." The bloggers are a "pajama army of mostly anonymous writers who spread gossip and scandal, intellectual kleptomaniacs who search Google to copy others' work and digital thieves of media content." The title of his polemic is "The Cult of the Amateur: How Today's Internet is Killing Our Culture." The article states that Keen's work is "shocking for its unforgiving view of Silicon Valley's utopian aspirations."
Thoughts	The Internet is referenced as killing our culture and referenced as utopia.

Luring Clients with Second Life (2007)	
System	Social, Cultural, Economic
Effect	"IBM is looking to extract real-world benefits from the virtual world that's called Second Life." Article states that IBM is experimenting now before it becomes

Thoughts	essential to be present in Second Life. IBM Michael Rowe believes "this is the next evolution of the Internet." Second Life allows people to create a virtual life for themselves. In this virtual life, people can buy or lease real estate, open businesses, buy things, meet friends, go to concerts, perform concerts, buy islands, and hold business meetings. It also has its own currency. Users communicate through instant text messaging. Islands cost $1,675 plus $275 per month maintenance fee. IBM owns more than 30 islands. The American Cancer Society had a walkathon and raised $41,000 in real money with 1200 walkers. Cisco Systems created a place to get remote medical diagnosis. There are 7.2 million residents up from 1 million in the fall 2006. 1.6 million people have logged on in the past sixty days. Land costs $9.95 a month to be a premium member otherwise it is free. Do all real companies want to be in the virtual world? Is Second Life a virtual society? What is a virtual society?

	AT&T Anti-Piracy Effort Raises Privacy Concerns (2007)
System	Legal, Entertainment, Economic
Effect	AT&T intends to create technology that identifies customers who use its network to upload illegal copies of movies and music.
Thoughts	Will AT&T be the Internet police?

	Paranoia Grows Over Google's Power (2007)
System	Economic, Culture, Political, Legal
Effect	Article states that people are concerned over the power of Google. Google's attorney states, "We are seeing breakthrough technologies emerging in the space of months. Social norms have a hard time keeping pace." Google has asked for a "comprehensive legislation to harmonize laws of various governments, all of which want their say over the World Wide Web. Self-regulation by the Internet industry has not worked." "New rules are needed to fend off governments which might try to force companies to divulge customer data." "Every major privacy panic since then has occurred against a similar backdrop of rapid technology change, and the psychological dislocations that inevitably follow until a new period of social adaptation and understanding evolves."
Thoughts	What are the rights of people when on the Internet? Who determines who is going to control the people when on the Internet?

	Web Cam Exam Proctors are Latest Cheating Deterrent (2007)
System	Educational
Effect	Article states that on-line educational institutions typically do not give exams because of the problems associated with securing the testing environment. Software Secure has created software that locks down a computer during testing, has fingerprint authentication, and has a Web camera and microphone. There are 3.2 million students taking on-line classes. "Will it be seen as too invasive?" A Dean at Worcester Polytechnic Institute stated it "would be probably pushing the boundary of our comfort level." "The military is asking questions about testing to make sure students are earning credible degrees."
Thoughts	Is online education good or bad, credible or not? Should it be controlled and who should control?

On Change

After examining the empirical evidence to date of the effects between the real world and the Internet (as provided in the news article summary section above), I speculate that the real world

societies and cultures are changing as a direct result of the effects from the Internet. I wonder if the change will be a permanent change to our real world. Kotter (1996) states change is only permanent if the culture is changed. Culture, according to Kotter (1996, p. 148) "refers to norms of behavior and shared values among a group of people. *Norms of behavior* are common or pervasive ways of acting that are found in a group and that persist because group members tend to behave in ways that teach these practices to new members … *Shared values* are important concerns and goals shared by most people in a group that tend to shape group behavior and that often persist over time, even when group membership changes." In this situation, the Internet appears to have been shaped and is being shaped by the people and for the people with the values, beliefs, and behaviors the people desire. However, not all people who are on the Internet have the same beliefs or value the same behavior, thus resulting in conflicts between those who want strict controls and those who want little or no controls. The Internet, because of its complexity, vastness, and its ability to allow for adaptations, is able to rapidly create new alternatives for many of the people desiring to circumvent strict controls.

Additionally, it appears that the systems on the Internet are all intermingling and their distinctness seems to be diminishing into overlapping systems. For example, Sim (2007, p. 42) believes that "… religious systems are becoming politically far more active across the globe. The close links between religious belief and politics call for analysis …"

On Controls and Laws

I have observed the real world attempting to influence the virtual part of the Internet through real world controls and laws. Popkin and Stroll (1993, p. 89) discuss Marx's ethical views as he "maintains that industry and technological discoveries develop much more rapidly than do the techniques for controlling them." This, I believe is apparent with the Internet. Popkin and Stroll (1993, p. 60) stress that "one of the most difficult and perplexing questions in political philosophy" in regards to society is "who should rule?" Some of the effects being noted in the news (as I summarized them previously) are concerned with the question of who should rule what aspects of the virtual part of the Internet. I ponder that if the real world is successful in controlling the virtual part of the Internet, then will the Internet be reduced to nothing more than a replica of a real world and whose real world will it be like? In contrast, it appears that the Internet is also affecting the real world's societies. We might ask, "Does it really matter if one affects the other? Why would it matter?" There are reasons why we should be concerned. One reason leads me to discuss Nozick's (1974) work on Utopia.

On Utopia

Nozick (1974) defines a "Utopia Model" (projected onto our world) as having the following characteristics:

1. possibility for a wide and diverse range of communities
2. ability for people to enter these communities if they are admitted
3. ability for people to leave these communities if they wish
4. ability for people to shape these communities to their wishes
5. possibility for utopian experimentation to be tried
6. possibility for different styles of life to be lived
7. possibility for alternative visions of good to be individually or jointly pursued.

Introspection leads me to wonder what Nozick would think of the virtual part of the Internet. Would he consider it some form of utopia projected onto our world? If the Internet could be a

utopia of some sort, and if the real world eliminates any of these seven characteristics identified by Nozick, then will we have lost hope of utopia forever on the Internet? If the virtual part of the Internet is something of a utopia or a subset of a utopia, should we attempt to preserve it before it is "de-utopianized?" This is just one reason we should be concerned about the consequences of the effects from the real world on the Internet.

On Measuring Effect

Can we measure the rate of effect from the virtual part of the Internet to the real world and vice versa by measuring something in the virtual part of the Internet? If the rate of effect is greater from the real world to the virtual part of the Internet than from the virtual part of the Internet to the real world, then should we prepare for obsolescence of today's virtual part of the Internet? Conversely, if the rate of effect is greater from the virtual part of the Internet to the real world than from the real world to the virtual part of the Internet, then should we prepare for global changes to our real world? To determine the rate of effectual change on such systems as the Internet, we could begin by determining its variables.

On Variables

Variables, by definition, are factors that change. By identifying the variables associated with the virtual part of the Internet, we can theoretically monitor them, track their rate of change, determine their direction of change, and thus form an opinion on trends. A trend, by definition is a direction of movement. However, it would be an enormous task, if not an impossible one, to monitor and track the variables. Alternatively, we can, at a minimum, be more cognizant of the variables, which might result in focused observations. Then, when we philosophize about the topics of interest in the Philosophy of Virtualness, we could insure that the applicable variables are considered in the discussion using these variables as a template for completeness. Relationships between variables also provide valuable information about the Internet, and it would be advantageous to record any noticed observations on these interactions.

On Internet Variables

There are a substantial number of variables for the virtual part of the Internet. Through observation, introspection, and synthesis, I can delineate the following categories of variables:

	Variables
People Variables	▪ Who is on the Internet? ▪ How many people are at a specific location on the Internet?
Property Variables	▪ Types of data on the Internet (Information, News, Encyclopedia, Videos, Pictures, Personal, Opinion, Mail, Instant Communication, Discussions, Government, Goods, Books, Commerce, Museum, Entertainment, Games, other)
Location Variables	▪ Physical location connection to the Internet (where on Earth) ▪ Type Location (car, home, airplane, hotspot, work) ▪ Virtual location (what Website(s) are connected)
Task Variables	▪ What are people doing while in the Internet? – Helping others (financial, spiritual, medical, technical, emotional) – Receiving help from others (financial, spiritual, medical, technical,

	emotional) – Education (formal, informal) – Companionship – Communication (telephone, video, email, blog, chat, listserve) – Religious / Spiritual – Political – Entertainment – Employment (work, search) – Economic (shopping, banking, selling, trading, financial) – Devious (spying, hacking, stealing) ▪ Concurrent Tasks (how many different tasks concurrently)
Infrastructure Variables	▪ Routing ▪ Addressing Servers Linking
Restriction Variables	▪ What is restricted? ▪ What is restricting? (Government, military, country, employer, parent, per Website via access rights / passwords) ▪ Why restricted?
Time Variables	▪ What time are people on specific Websites? ▪ How long of time are people on specific Websites? ▪ When is property updated?
Technology Variables	▪ What are people using to connect to the Internet? (cell phone, desktop, laptop, PDA, game console, other)
Cultural/Social/Ethical Variables	▪ Identity of Person (true identity, false identity) ▪ Location of Person (true location, false location) ▪ Biographical information of Person (true biography, false biography) ▪ Intentions of Person (good intentions, bad intentions) ▪ Culture of Person (Norms of Behavior and Values)

On Areas of Philosophical Interest

It is my belief that the virtual part of the Internet is distinct from the real world and merits its own philosophical category. Thus, I will attempt to synthesize a set of questions that might become a subset of the "infrastructure" of the Philosophy of Virtualness. Some of these questions have already been addressed, but for the sake of completeness, I will list them nevertheless. Note that the term "Internet" primarily refers to the interactive, visual, top layer.

General Virtual Issues	▪ What is the Internet? ▪ What is the purpose of the Internet? ▪ What is the nature of the Internet? ▪ What are the relationships between the real world and the Internet?
Virtual Metaphysics Issues	▪ Does the Internet have meaning? ▪ Is the Internet real? ▪ What is real in the Internet? ▪ What is virtual in a real world?

Virtual Ethical Issues

- Who should be allowed to access the Internet?
- Who should not be allowed to access the Internet?
- What should people be allowed to do in the Internet?
- What should people not be allowed to do in the Internet?
- Who should decide who has access and to what?
- Who should decide what people can/cannot do on the Internet?
- How should people behave in the Internet?
- Is the Internet good or bad?
- Is the Internet good or bad for our real world?
- Is the Internet a utopia?
- Should certain people be restricted to certain information in the Internet?
- Who should decide who can access certain information in the Internet?
- What value is the Internet?
- Is it good or bad to have global information on the Internet?
- Should a person on the Internet do something because they can?
- Who can people trust in the Internet?
- How do you know who can be trusted in the Internet?

Virtual Deontological Issues

- What should be the moral conduct in the Internet?
- Should the Internet have moral standards?
- Who should create the moral standards for the Internet?
- Who should enforce the moral standards for the Internet?
- How should moral standards be enforced for the Internet?

- What rights should a person have on the Internet?
- What rights should the states have to control people on the Internet?
- What should be right and wrong on the Internet?

Virtual Social Issues

- Blogs and other similar communication vehicles:
  - What is the purpose?
  - Should it be controlled?
  - Who should / should not be allowed?
  - Who should control?
  - Are these good or bad?
  - Should people be held responsible for their communications?
  - How can the expertise of a communicator be determined?
  - Who determines if a communicator is an expert?
  - Should communicators replace experts?
- Are experts needed in the Internet?
- Does the Internet enable bad people to be bad?
- Does the Internet foster bad behavior in good people?
- Are people being corrupted on the Internet?
- Does the Internet encourage bad behavior in bad people?
- Does anonymity on the Internet allow for people to be more truthful?
- Is having the ability to be anonymous in the Internet good or bad?
- Is the Internet good or bad for individuals?
- Is the Internet good or bad for the real world?
- Are good people still good in the Internet given the lack of rules?
- Are people different in the Internet than in their real world?
- Is the Internet changing the values and beliefs of the real world?

Virtual Political / Legal Issues	▪ What is the nature of politics on the Internet? ▪ Should the Internet be controlled? ▪ Who should control the Internet? ▪ Should real world's legal rights extend to the Internet? ▪ Should real world's laws extend to the Internet? ▪ Is the Internet good or bad for real world's politics? ▪ What is the nature of rules on the Internet? ▪ What is the nature of the government on the Internet? ▪ What is the nature of boundaries on the Internet? ▪ Are Websites properties in the Internet? ▪ What rights do Website possess? ▪ Are domain names property? ▪ What rights do domain names possess? ▪ Should a person be responsible in a real world for their actions in the Internet? ▪ What is the nature of property in the Internet?
Virtual Epistemology Issues	▪ How can we ensure truth in the Internet? ▪ What does truth mean in the Internet? ▪ How do we know if information in the Internet is truth? ▪ What does knowledge mean in the Internet? ▪ What purpose does Wikipedia serve? ▪ Is Wikipedia good or bad? ▪ Should Wikipedia information be controlled? ▪ Who should be allowed to place information in Wikipedia? ▪ Who should not be allowed to place information in Wikipedia? ▪ Should it matter if the Internet contains truth or not? ▪ What information should or should not be in the Internet? ▪ Who should decide who is most knowledgeable to populate Wikipedia? ▪ What effect does the majority have in determining truth in the Internet?
Virtual Economic Issues	▪ Is the Internet good or bad for real world economics? ▪ What is the nature of economics on the Internet? ▪ Is the Internet changing real world economics?
Virtual Technology/Science/ Matter Issues	▪ Is the Internet composed of matter? ▪ Is the Internet a physical object? ▪ Does the Internet occupy space?
Virtual Ontology Issues	▪ Do Websites exist when no one is accessing them? ▪ Are Websites real? ▪ What kind of time exists in the Internet? ▪ Does the Internet still exist when the computer is off?
Virtual Education Issues	▪ What is the nature of education in the Internet? ▪ What purpose does Internet education serve? ▪ What kind of education is necessary in the Internet? ▪ Is the education received in the Internet good? ▪ Is the education received in the Internet real? ▪ What credentials should educators in the Internet have? ▪ What is the nature of a good Internet class? ▪ Who should be allowed access to education in the Internet? ▪ What is the value of learning in the Internet?

	▪ How should education be delivered in the Internet? ▪ How should education be evaluated in the Internet? ▪ How do people learn in the Internet? ▪ What is the nature of teaching methods for Internet classes? ▪ What should students expect in Internet classes? ▪ What should teachers expect in Internet classes? ▪ What rights do students have in Internet classes? ▪ What rights do teachers have in Internet classes? ▪ How should students behave in Internet classes? ▪ Is Internet education good? ▪ What is the difference between a real university online and a virtual university?
Virtual Religious/Spiritual Issues	▪ Is the Internet good or bad for real world's religion? ▪ What is the nature of religion in the Internet? ▪ What is the purpose of religion in the Internet? ▪ Is the Internet changing real world religions?
Virtual Aesthetic Issues	▪ Is the Internet a form of art? ▪ What constitutes art in the Internet? ▪ What is the purpose of art in the Internet? ▪ What is the purpose of pictures/videos in the Internet? ▪ Is YouTube or MySpace an art form? ▪ Is the Internet beautiful?
Other	▪ Should the Internet ever have the same properties as the real world? ▪ Could the Internet be a framework for utopia? ▪ Is the Internet of philosophical interest?

On Conclusions

In summary, my quest for logical explanations about the Philosophy of Virtualness has led to more questions, problems, and unknowns rather than to answers, resolutions, and knowns. I have attempted to identify variables for future observation and organize philosophical areas of interest to create a foundation for the discourse on the Philosophy of Virtualness. I have also provided some basic thoughts on terms such as real, virtual, reality, knowledge, truth, change, control, and law, along with some assumptions. I have not attempted to provide any answers. It was also my intent to not exclude any questions from the list of philosophical areas of interest. My definition of philosophy is broad and is focused on all possible areas where philosophical questioning could assist thinkers in thinking.

My search for understanding the reality of the virtual part of the Internet remains incomplete, and grows in complexity as I attempt to describe philosophical attributes. Russell (1997, p. 16) concludes that "Philosophy, if it cannot *answe*r so many questions as we could wish, has at least the power of *asking* questions which increase the interest of the world, and show the strangeness and wonder lying just below the surface even in the commonest things of daily life."

The virtual part of the Internet is full of strangeness and wonder. Have you concluded that the virtual part of the Internet is nothing more than just another communications technology, or will you take the challenge, enter into a discourse on the Philosophy of Virtualness, and contemplate

the definitions, assumptions, variables, and questions that make the virtual part of the Internet such a fascinating philosophical entity?

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Book Review: Nanotechnology and Society

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Review of *Nanotechnology and Society: Current and Emerging Ethical Issues,* edited by Fritz Allhoff and Patrick Lin (Springer, 2008) ISBN: 978-1402062087. 300 pages. $119, Hardcover.

As is well known from philosophers of technology, ethics is a significant dimension of the National NanoInitiative launched in 2000. An impressive number of grants and programs devoted to the ethical issues raised by nanotechnology have been funded over the past few years and the two editors of this volume are among the most active scholars in this field. They already collaborated on editing two previous collective volumes and co-founded the Nanoethics Group, "a non partisan organization"whose mission is to help people understand the ethical issues arising from nanotechnology. For the present volume they gathered a number of leading scholars, most of them linked with two independent organizations renowned for their impartial expertise and experience in societal issues raised by new technologies: the Meridian Institute and the Woodrow Wilson Center for Scholars. In addition to the individual essays are two official contributions : a report from the ethics committee on Science and Technology of the government of Québec and a condensed version of the European Group on Ethics' opinion on nanomedicine.

This collection of 16 papers provides a state of the art survey of ethical issues raised by nanotechnology in 2007. Since this anthology is meant to serve as a kind of textbook that can be used in class, it surveys a wide spectrum of issues dealt with in the programs accompanying nanoinitiatives all over the world. The anthology includes health and environmental risks associated with nanoparticles, societal and legal issues about privacy and patenting, the NBIC program for enhancing human performances, and economic issues. Clearly the purpose is not to develop new perspectives or in-depth analyses on these already classic topics. Rather, it is to help students to discuss them and policy makers to deal with them.

With this pedagogic aim in mind the editors seem extremely concerned with the establishment of nanoethics as a discipline of its own. In their introduction they raise the question of the uniqueness of nanoethics. Is it a new applied ethics? Is it legitimate to encourage speculative ethics about far-fetched futures with an inclination for science-fiction or should nanoethicists be content with cost-benefit analyses of near-term risks? There is no unanimous or consistent response to these questions. While Jean Pierre Dupuy, who wrote the anthology's forward, makes the case for the unique metaphysical dimension of the NBIC program technologies, the editors' introduction adopts a more skeptical and pragmatic tone. The editors suggest that there are no specific issues--not even more intense issues--raised by nanotechnology that would require an applied ethics, like biomedical technologies do. Nevertheless, the editors argue that nanotechnology requires ethical attention. In an essay entitled "the bearable newness of nanoscience," Arthur Zucker, a philosopher from Ohio University, argues against Georg Khushf that ethics is not integral part of nanoscience. Zucker writes that nanoscience does not present specific ethical issues except when it becomes a business and as such requires a business ethics especially to avoid conflicts of interests. He calls for a re-examination of science as a profession. By contrast, in another section of the volume dealing with industry and policy, Ashley Shew argues that nanotechnology is unique and requires a specific code of conduct.

From such a heterogeneous collection of considerations and opinions, one gets the impression of a patchwork which gives a sense of the diversity of issues but does not make up a coherent picture. The anthology contains a number of stimulating contributions that raise new issues to be addressed. For instance, in the last section about global issues the question of relativism emerges from Joachim Schummer's paper. Since nanotechnology is developed all over the world in a climate of competition while ethics is traditionally rooted in local contexts, attached to cultural systems of values, how is it possible to envision international regulation of nanotechnology? Just in order to prepare the ground we have to start an inter-cultural dialogue which itself requires a kind of ethics! Even after this cascade of papers and volumes on nanoethics, there is plenty of room for scholars to think about nanoethics!

Book Review: Democratizing Technology

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Review of *Democratizing Technology: Risk, Responsibility, and the Regulation of Chemicals* by Anne Chapman (Earthscan Publications, 2007). ISBN 978-1844074211. $99, Hardcover.

In *Democratizing Technology*, philosopher Anne Chapman, adds a new, and ultimately policy-focused perspective to the discussion of risk, using the arena of synthetic chemicals as her technology of focus. Her project is to expand the concept of risk beyond the economic frame of "risk assessment" toward understanding risk within the larger arena of the public sphere and public policy. She chooses synthetic chemicals, to use as the main case study in her book because, throughout the decades of their production, new and unexpected problems arise on a regular basis. Additionally, chemical regulation and policy is exemplary of two aspects that she finds problematic: a science-based approach to risk and a largely economic argument for their production.

Initially, she examines the philosophical and theoretical underpinnings of the current approach to risk, in order to illuminate assumptions embedded therein. In her careful step-by-step analysis, Chapman defines terms as she goes, beginning with "technology" itself. Technology is "'world-building': it is both how we add material things to the world and the things that we have added to the world that we use."(2) She argues that instead of using "economic prosperity" as the government's reasoning for promoting technological innovation, the real responsibility of government is for the shared, public world. One of the key concerns presented is that risk and its embedded reliance on economic indicators is not the standard by which technologies should be assessed for regulatory purposes. Instead, Chapman argues, we should consider the *riskiness* of a technology. In other words, the standard that governments use to assess technologies should consider not only the probability of harm, but also: 1) how extensive are the unknowns with the given technology, 2) is the thing put at risk of great value, and 3) are the consequences of a harmful event irreversible?

Her thinking draws primarily from the work of two scholars in political philosophy and the philosophy of science. First, she presents the work of Hannah Arendt, as it pertains to responsibility for shaping our shared environment and extrapolates on this by proposing regulatory possibilities. She states: "It is in the work of Hannah Arendt that I have found a political philosophy adequate to the task of thinking about technology . . .[as she] emphasized the publicness of the world." (6, 26) Second, she uses the work of Nancy Cartwright and the "Stanford School" to explain science and science-making. Science is not a unitary discipline but many types of science, sharing a systematic, empirical method but not a single view of reality. (44) This pluralist view of science leads Chapman to maintain that:

> "Each science has its own relationship with technology. Some sciences lead to new technological developments, some reveal the effects of technology on natural systems and are important in the regulation and control of technology, while others simply give us a better understanding of the world." (44)

While her interdisciplinary interweaving of the work of Arendt and Cartwright is innovative, she makes, in my opinion, another, more illuminating, and potentially controversial observation in Chapter 4. The problem motivating this move is that sociologists of science and technology often do not differentiate between science and technology and instead focus on "practices" while ignoring other substantive aspects. While agreeing that, in Arentian terms, both are world-making processes that add knowledge and material objects to the planet, they are fundamentally two different types of things. Science and technology "answer to different norms and we use different criteria when judging them: how we judge whether or not the outcome of a scientific investigation should be added to our stock of knowledge about the world is quite different from how we judge a material object." (47) The former is examined for the link between evidence and conclusions, while with the latter, evidence is only important for non-obvious facts about the technology (i.e. toxicity). Other questions and norms are applied to technology such as: is it useful, is it ugly or beautiful, or how does it impact social relations? These are answered by opinions which are matters of reasoning, not evidence, in the case of matters of fact. Because of this, the activities that regulate them should be distinguished, and technological regulation should be primarily in the domain of democratic control.

Because there are significant differences between science and technology, and that science is used as the model for the regulatory structure, it is inadequate and inappropriate for the regulation of technology. While there have been changes in the UK to allow more citizen input "in the debate about risks from new technologies . . .the subject matter of the debate is considered to be science, not technology." (39) The US also uses a science-based approach to restrict technologies such as those of chemical production. Similar to the UK, this means that science-based proof-of-harm must be evident for action to be taken. Thus the criteria of science, and not technology, form the basis of regulation.

Chapman next examines three assumptions behind government technology policies: 1) science leads to technological innovation; 2) technological innovation is positive for the public and the economy; and 3) public input about risk of new technologies is via consumer choice and thus the regulatory body's role is to provide consumer information. In the case of technology innovation and regulation, the argument for economic growth often takes precedence over other concerns. While 'growth' is a positive and natural biological term, it fails to capture the essence of technology, a human-made phenomenon. In addition, the word 'consumer' also fails to capture the essence of how we use technology. It implies total consumption of the artifact, but the reality is that many artifacts (cars, carpets, chemicals, etc.) are not fully consumed but end up as waste products and/or pollution degrading the environment. She points to Arendt's distinction between activities of labor and work where the first is "to provide for our needs as living organisms" and the other is to make "products that form part of the world." (51) These two activities can and often do coincide but the moral responsibility for the shared world that Arendt so eloquently advocated, is often absent. Extrapolating from Arendt, Chapman argues that democratic regulatory systems should engender moral responsibility for the shared environment—they should hold a "better world" for citizens as their goal, not the economy, as the sole criterion.

There are many problems with the various concepts of risk, which she carefully chronicles in Chapter 6. The most prevalent form of risk used for technological regulation is based on what is known or what is probable. From a basic science perspective, there is always a degree of uncertainty which can be translated to unknowns. Often the regulatory body, treating technology as a science, concludes that it is safe until more is known for sure. She suggests that technologies, such as chemicals, should be held to a standard that takes into account the norms of technology, not science. In advocating for the criteria of *riskiness* rather than risk, in

technological assessment, the author states: "Whereas risk relates to outcomes, riskiness is a property of a thing, situation or activity and is relative to our knowledge about it." (112)

In Chapter 8 she examines the political and ethical framework of policy and regulation, countering the assumption of utilitarianism at the heart of cost-benefit analysis (typically used to limit regulation). Using Nancy Cartwright's concept of *nomological machines*, she argues:

> " regulations are part of an ordered framework in which the causes of economic activities have effects. Rather than asking what the costs and benefits of a regulation will be, we should ask how the regulation will change the effects that the causes of economic activities have. . . The questions we should ask is how changes to the world will change what the interests of individuals are [because] what is in the interests of the world cannot be derived from consideration of the interests of individuals." (117, 124)

Her concern is how regulatory regime changes affect the impact of economic activities? And how can we put the shared world and its citizens as the locus of policy action rather than the individual, conceived of in current practices as either a person or corporate entity?

The conclusion of the book, in Chapter 10, sets forth a possible solution drawing from the discipline of architecture and planning. Reminding us that her definition of technology is "world-building"--the things we add to the world and how we add them-- she concludes that the domain of making buildings and shaping environments is a more suitable model from which to draw on for policy purposes than science. Because synthetic chemicals are materials that are not found in nature, but are "things" added to the world, they are a technology, more akin to buildings and their arrangements than to scientific knowledge. Urban and regional planning can include a networks of public agencies, private and public interests as well as non-governmental organizations negotiating either explicitly or implicitly in shaping the public realm. On a micro-level, building codes are also negotiated, adopted, and developed over time, with input from experts, insurance companies, and public interests. They not only include the utilitarian perspective or private property viewpoint but also, more expansively, they consider the shared environment which is of public concern.

Advocating this approach, Chapman concludes:

> "Like public controls over built development, I suggest that public controls over technology should consist of two types of systems: technical standards, equivalent to building regulations, and a system equivalent to the planning system that can take into account matters that are not easily quantified and measured." (158)

Having taught and practiced in the field of architectural technology for 20 years before moving into the field of Science and Technology Studies, I had some reservations about her conclusion. The real word of land use planning is fraught with special interests wielding uneven power, made evident by the environmental justice movement of the past decades. Building codes, while laudable for their protection of public safety, can also be frustrating and limiting to those wanting to use innovative green technologies and designs. That said, though imperfect, this may be the best model for a regulatory system with regard to governing technologies in the public realm today.