Technical Individualization

An excerpt from **Gilbert Simondon**[1]

Gilbert Simondon (1924–1989) was a French philosopher of technology. He was a student of the philosophers of science Georges Canguilhem, Martial Gueroult, and phenomenologist Maurice Merleau-Ponty. His major works are *Du mode d'existence des objets techniques* (1958/1989) and *L'individuation psychique et collective* (1989), which was also his thesis. For a further introduction, see Alberto Toscano's "Technical Culture and the Limits of Interaction" on p. 198 of this book.

The individualization of technical beings is the condition of technical progress. This individualization is made possible by recurrent causality in an environment that the technical being creates around itself. The environment conditions the technical being, which in turn conditions it. One may call this environment, which is both technical and natural, an associated milieu. The associated milieu is that through which the technical being is self-conditioning in its functionings. It is not manufactured, or at least not altogether manufactured. It consists, rather, of a particular regime of natural elements surrounding the technical being which is connected to another regime of elements that constitute the technical being. The associated milieu mediates the relation between the manufactured technical elements and the natural elements at the heart of which the technical being functions.

An example is the ensemble constituted by oil and water circulating in and around a Guimbal turbine.[2] This ensemble is concretized and individualized by the ongoing thermal exchanges taking place. The greater the speed of the turbine, the more heat is produced by the generator by means of the Joule effect and demagnetization; yet as the speed of the turbine increases, so does the turbulence of the oil surrounding the rotor and of the water surrounding the crankcase, in turn speeding up the thermal exchanges between the rotor and the water. The invented technical object depends for its existence upon this associated milieu. Only those technical objects that require an associated milieu in order to function may properly be called inventions. Invented objects cannot take form piecemeal through the successive stages of an evolution. They can exist either as a whole or not at all. Technical objects, which relate to the natural world by putting into play an essential recurrent causality, can only be invented, rather than progressively constituted. This is because such objects are the cause of their own conditions of functioning. They are only viable if the problem of creating these conditions is solved; that is to say, if they come to exist with their associated milieus.

This is the reason we see a discontinuity in the history of technical objects with respect to absolute origins. Only forethought and creative imagination can effect this kind of time-reversed conditioning. The elements which materially constitute the technical object, and which before the constitution of the technical object were separate from one another and lacked an associated milieu, must be organized in relation to each other, as a function of the circular causality that will exist once the object is constituted. This is a case of the present being conditioned by the future. A future-function of this kind can only very rarely be the work of chance. It requires the activation of a capacity for organizing elements toward the fulfillment of certain requirements that pull things together as a whole, or provide direc-

tion, and play the role of symbolizing the future ensemble that has yet to come into being.

Like a role played in the absence of the actual actor, the schema of the creative imagination enacts the unity of the future associated milieu in which causal relations will unfold that will enable the functioning of the new technical object. The dynamism of thought is the same as that of technical objects. Mental schemas act upon one another during the process of invention, just as the various dynamisms of the technical object act on one another during material reactions. The unity of a technical object's associated milieu is analogous to the unity of a living being. During the process of invention, the unity of a living being is the coherence of the mental schemas owing to the fact that they exist and operate in the same being. Those that are in contradiction come into confrontation and are reduced. It is because living beings are individual and carry their associated milieus with them that they are able to invent. It is upon this capacity for self-conditioning that the capacity to produce objects which are themselves self-conditioning is based. What has escaped the attention of psychologists analyzing the inventive imagination is neither the schemas nor the forms nor the operations, all of which are elements that spontaneously stand in relief. What they have missed is the dynamic ground on which these schemas confront one another and combine, and in which they participate. The psychology of form takes into account the function of wholes, but it attributes force to forms. A closer analysis of the imaginative process would undoubtedly show that what is determining and plays an energetic role are not forms, but rather what supports or carries forms, namely ground. Perpetually overlooked, the ground is what holds the dynamisms. It is what allows the system of forms to exist. Forms do not participate with other forms, but rather participate in the ground. The ground is the system of all forms, or rather the common reservoir of the tendencies of forms before they even exist as separate entities and are constituted as an explicit system. The relationship of participation connecting the forms to the ground is a relation that straddles the present and imbues it with the potential influence of the future, with an influence of the virtual on the actual. For the ground is the system of virtualities, potentials, and forces on the way, whereas the forms constitute the system of the actual. Invention is a taking-charge of the system of actuality by the system of virtualities. It is the creation of one system from these two systems.

Forms are passive inasmuch as they represent actuality. They become active when they organize themselves in relation to the ground, thus actualizing prior virtualities. It is undoubtedly difficult to elucidate the way in which the system of forms may participate in a ground of virtualities. We can only say that this takes place in the same mode of causality and conditioning that exists in the relationship between each of the structures of the constituted technical object and the dynamisms of the associated milieu. These structures are in the associated milieu and are determined by it, as well as being determined through it by other structures of technical being. The structures also partially determine the technical object, each in its own right. The technical milieu is determined separately by each structure, and in turn determines those same structures globally, by providing the energetic, thermal and chemical conditions for their functioning. There is a recurrent causality between the associated milieu and the structures, but the recurrence is not symmetrical. The milieu plays an informational role: it is the seat of self-regulation, the vehicle for information or for the energy already regulated by information (for example, the water that moves more or less quickly has a greater or lesser cooling effect on the crankcase). Whereas the associated milieu is homeostatic, the structures are animated by a non-recurrent causality; each goes its own way.

Freud analyzed the influence of the ground on forms in the life of the psyche. He interpreted this influence as that of hidden forms on explicit forms, which is what led to the notion of repression. Experiments have in fact proven the existence of symbolization. One such experiment involves placing a subject in a hypnotic state and describing to him a violently disturbing scene. When the subject 'wakes up' he is cognizant of the scene, but it is symbolically transposed. What has not been proven is that the unconscious is populated by forms comparable to explicit forms. The dynamic of tendencies is sufficient to explain symbolization if you accept the effective existence of a psychic ground from which explicit forms unfold, forms which the waking mind and the conscious state cause to appear, and in which they participate. It is the milieu associated with the system of forms that institutes between these forms relations of recurrent causality, and it is this which causes the system of forms as a whole to be recomposed.

Alienation represents a break between the ground and forms in psychic life, with the result that the associated milieu no longer regulates the dynamism of the forms. The imagination has been poorly analyzed to date because forms have been privileged in terms of activity and have been thought to take the initiative in psychic and physical life. In reality, there is a very strong kinship between life and thought. All the living matter cooperates in the life of a living organism. It is not only the most obvious or best-defined structures of the body that take active roles in life. Blood, lymph and connective tissues play a part in life. An individual is not only composed of a collection of organs interconnected to form a system. It is also composed of that which is neither organ nor structure of living matter inasmuch as it constitutes an associated milieu for the organs. Living matter is the ground for the organs. It is what links them together to make them an organism. It

is what maintains the basic thermal and chemical equilibrium within which the organs produce sudden but limited variations. The organs participate in the body. Living matter is far from being purely indeterminate or purely passive; nor is it blind aspiration. It is the vehicle of informed energy. Likewise, thought is composed of distinct structures such as representations, images, certain memories, and various perceptions. But all of these elements participate in a ground which gives them a direction, a homeostatic unity, and which conveys informed energy from one to the other and from each to all. One could say that the ground is the implicit axiomatic in which new systems of forms are elaborated. Without the ground of thought, there would be no thinking being, but only a series of discontinuous representations without linkage. The ground is the associated mental milieu of forms. It is the middle term between life and conscious thought, just as the associated milieu of a technical object is the middle term between the natural world and the fabricated structures of the technical object. We can create technical beings because we have in ourselves an interplay of relations and a matter-form relation that is highly analogous to the one we institute in the technical object. The relation between thought and life is analogous to the relation between the structured technical object and the natural world. The individualized technical object is an object that has been invented, which is to say produced by a play of recurrent causality between the life and thought of a human being. Any object that is associated solely with life or with thought is not a technical object but a rather a tool or an apparatus. It has no internal consistency because it has no associated milieu instituting a recurrent causality.

The principle of the individualization of the technical object by recurrent causality in the associated milieu allows us to think more clearly about given technical groupings and to determine whether they should be treated as technical individuals or as organized collections of individuals. We would argue that a technical individual exists where there is an associated milieu that is a sine qua non condition of its functioning. Where this is not the case, we have a technical ensemble.

Take a laboratory – for example, for the study of the physiology of sensations. Is an audiometer a technical object?[3] Is an audiometer a technical individual? Not if you consider it in isolation, without a power supply or headsets or speakers used for electroacoustic transference. It is thus part of the definition of the audiometer that it must be placed in certain conditions with regard to temperature, voltage and noise level in order to obtain the stable frequencies and intensities necessary for the measurement of sound thresholds. The room's sound absorption coefficient and the resonance factor at various frequencies must also be taken into account. The site is part of complete apparatus: audiometry requires either that testing be done out in wide-open spaces or else in a soundproof room with a suspended anti-microphonic floor and large quantities of fiberglass insulation on the walls. What then is an audiometer per se, such as one might purchase from a supplier or might build from scratch? It is an ensemble of technical forms that possess a relative individuality. In general, it is composed of two high-frequency oscillators, one fixed and one variable. The low beats of the two frequencies produce the audible tone;[4] the attenuator makes it possible to control the intensity of the stimuli. Neither of the oscillators is a technical object on its own, because it requires a stable cathode and anode voltage. This stabilization is generally produced by means of an electronic system of recurrent causality, and it is this that constitutes the milieu associated with the technical forms of the oscillators. Yet this associated milieu is not entirely an associated milieu. Rather, it is a system of transference, or a means of adaptation enabling the oscillators to avoid being conditioned by the natural and technical external milieu. This external milieu would only become a true associated milieu if a random drift in the frequency of one of the oscillators were to provoke a variation in the supply voltage that counteracted that same frequency drift. This would set off a reciprocally causal exchange between the regulated power supply and the oscillators. The result would be a self-stabilization of the ensemble of technical structures. In the present example, however, only the power supply is self-stabilized, and it does not react to random variations in the frequency of one of the oscillators.

The theoretical and practical difference between these two cases is vast. In fact, if the energy supply is simply stabilized without an existing relationship of recurrent causality with the oscillators, limiting or extending simultaneous usage of this power supply changes nothing. One could, for example, plug a third oscillator into the same power source without disturbing its functioning as long as normal throughput limits were observed. On the contrary, in order to obtain an effective retroactive regulation, only one structure should be plugged into a single associated milieu. Random opposing variations of two structures that are nonsynergistically linked to the same associated milieu might otherwise compensate for one another and fail to produce a regulated interaction. Structures linked to the same associated milieu must function synergistically. This explains why the audiometer is composed of at least two distinct parts which cannot be self-stabilized by the same associated milieu; i.e., the frequency generator on the one hand and the amplifier-attenuator on the other. Interaction between these two must be avoided, by ensuring that there are two separate

power sources and ensuring that the surface separating the two structures is reinforced, to shield either side from any electrical or magnetic interference. On the other hand, the material limit of an audiometer is not its functional limit. The amplifier-attenuator is normally extended by the acoustic generator and room, or by the outer ear of the listener, depending on whether the subject is connected to the system by loudspeakers or a headset. This suggests that there are relative levels of the individualization of technical objects. This criterion has an axiological value: the coherence of a technical ensemble is greatest when the ensemble is composed of sub-ensembles that have the same level of relative individualization. Thus, in a sensation-physiology laboratory, there is no advantage to grouping together the audiometer's two oscillators and the amplifier-attenuator. Rather, it makes sense to group the two oscillators together so that both are simultaneously and proportionately affected by variations in voltage and in temperature. In this way, the variation in the low beats resulting from these two correlated variations in the frequencies of the oscillators is kept to a strict minimum, given that the two fundamental frequencies will increase or decrease in tandem. On the other hand, it would go entirely against the logic of the functional unity of the generator of beat frequencies to set up different power supplies and to set one oscillator's supply to one phase and the second oscillator to another phase. This would interrupt the self-stabilizing effect brought about by the compensation of the two variations, which gives the *ensemble* composed by the two oscillators a high level of stability as regards the frequency of the low beats. It makes sense, however, to connect the oscillators into a different phase of the network from the one to which the amplifier attenuator is plugged, to avoid variations in the amplifier's anode consumption affecting the supply voltage of the oscillators.

The principle of individualization of technical objects in an ensemble thus resides in the sub-ensembles composed by recurrent causality in the associated milieu. All of the technical objects whose associated milieus feature recurrent causality must be separated from one another and connected in such a way as to maintain the independence of their respective associated milieus. The subgroup of oscillators therefore should not only have a power supply distinct from that of the amplifier-attenuator, but their connection to one another must also be autonomous. The amplifier must have a very high input impedance compared to the output of the oscillators so that the effect of the amplifier on the oscillators is very weak. If one were to plug the attenuator directly into the output of the oscillators, the adjustment of the attenuator would react on the frequency of the oscillators.

The higher-level ensemble comprising all of the sub-ensembles is defined by its capacity to freely realize any relational placement whatsoever without compromising the autonomy of the individualized sub-ensembles. This is the role, for example, of the laboratory operator control panel. Both the use of screening to shield from electric or magnetic fields and the use of nonreactive coupling, such as the cathode follower, are aimed at ensuring the independence of the sub-ensembles while at the same time permitting necessary combinations between their functionings. This is the functional role of the second-level ensemble we call the laboratory: using the results of functionings without permitting interaction between the conditions of functioning.

We may then ask at which point individuality arises: at the level of the sub-ensembles or at the level of the ensemble itself? The answer is always to be found using the criterion of recurrent causality. In fact, there is never a true associated milieu at the level of the ensemble, which in this case is the level of the laboratory. If an associated milieu exists, it is only in some respects, not in general. For example, the presence of oscillators in a room where audiometric testing is taking place is often irritating. If the oscillators use transformers with iron magnetic circuitry, the magnetostriction of the magnetized strip creates an annoying vibrating sound. An oscillator with resistances and capacitances also produces a weak sound due to the alternating phases of electrical attraction. To perform a well-controlled experiment, one must place the equipment in an adjacent room and control it remotely, or the subject must be isolated in a soundproof room. Likewise, in electroencephalography and electrocardiography experiments, magnetic radiation from the power transformers can interfere with the amplifiers. The higher-level ensemble we call a laboratory is therefore composed especially of noncoupled devices, avoiding the chance creation of associated milieus. The ensemble remains distinct from the technical individuals in that the creation of a single associated milieu is undesirable. The ensemble includes a number of devices aimed at preventing the formation of a single associated milieu. It prevents the internal concretization of the technical objects it contains. It only uses the results of their functionings, without permitting interaction between their functionings' respective conditionings.

Below the level of technical objects, do groupings exist that possess distinct individuality? The answer is yes, but this type of individuality does not have the same structure as that of a technical object with an associated milieu. This type of individualization is that of a multifunctional ensemble without a positive associated milieu, that is, without self-regulation. Take, for example, a hot cathode lamp. When this lamp is placed in an assemblage with a self-polarizing cathode resistor, it does give rise to phenomena of self-regulation. For example, if the heating tension increases, the cathode emissions increase as well, increasing negative polarization. However, the lamp will not amplify much more, and its output will hardly in-

crease, as will its anode dissipation. A similar phenomenon causes Class A amplifiers to automatically level off their output levels despite variations in their input levels. However, these regulated counter-reactions are not solely produced inside the lamp. They also depend on the entire assemblage, and in the case of certain types of assemblages, they do not exist at all. Thus, a diode whose anode becomes overheated begins to conduct in both directions, increasing the intensity of the current across it. The cathode receives electrons from the anode and heats up even more, emitting more and more electrons. This destructive process manifests a positive circular causality involving the entire assemblage and not only the diode.

Infra-individual technical objects can be called technical elements. They are distinguished from true individuals in that they do not have an associated milieu. They can, however, be integrated into an individual. A hot cathode lamp is a technical element rather than a complete technical individual. It can be compared to an organ in a living body. Following this line of thinking, it would be possible to define a general organology, which would study technical objects at the level of the element. It would be a subdomain of technology, like mechanology or the study of complete technical individuals.

Diode

Can the diode be seen as an absolute origin? Not entirely. Indeed, thermoelectronic emission was unknown at the time, whereas the flow of electrons across a field had been known for some time. Electrolysis had been understood for a century, and the ionization of gas for several decades. In order to fulfill the technical requirements of a diode qua diode, the conditions of thermionic emission and nonreversibility of the flow of electrons must exist. Under normal conditions, of the two electrodes, the heated one emits electrons, whereas the nonheated electrode does not emit, making the diode essentially a two-way valve.

A heated electrode can act as either a cathode or anode, whereas a nonheated electrode can act only as an anode, being unable to emit electrons. A nonheated electrode can only attract electrons when positive; it cannot emit electrons even when negative vis-à-vis another electrode. This means that when electrodes are externally charged, a current is created by means of the thermoelectronic effect when the cathode is negative relative to the anode, whereas no current will be produced when the heated electrode is positive relative to the nonheated electrode. It is this functional asymmetry between electrodes that reveals the nature of the diode and not the flow of emissions of electrons across the void space of an electrical field. Experiments in the ionization of monoatomic gases had already shown that free electrons were able to traverse an electrical field. That, however, is a reversible, non-polarized process, whereas if you turn en electron tube upside down, the positive column and the luminous rings change sides relative to the tube but stay on the same side relative to the direction of the current produced by the generator. A diode is composed of the association of this reversible phenomenon of the flow of electrons through a charged field and the condition of irreversibility created by the fact that the production of flows of electrons is produced by only one type of electrical charges (negative ones) and by only one of the two electrodes, the heated one. The diode is a two-electrode vacuum tube with one heated and one non-heated electrode, between which an electrical field is created. This represents an absolute beginning, inasmuch as the condition of irreversibility of electrodes is linked to the phenomenon of the flow of electrons across a vacuum, creating a technical essence. The diode is an asymmetrical conductance.

Translated by Karen Ocana with the assistance of Brian Massumi.

Notes

1. Gilbert Simondon, *Le mode d'existence des objets techniques* (Paris: Aubier, 1969), pages 56–65.
2. A type of hydraulic turbine, invented by Jean-Claude Guimbal, powered by tidal movement. Sea water is both the natural milieu of this technical object and a functional element within it (translator's note).
3. "Audiometer: instrument for measurement of acuity of hearing. Specifically to measure the minimum intensities of sounds perceivable by an ear for specified frequencies." *Chamber's Science and Technology Dictionary* (New York: Chambers, 1991), page 60.
4. "When two sound waves of different frequency approach your ear, the alternating constructive and destructive interference causes the sound to be alternatively soft and loud – a phenomenon which is called 'beating' or producing beats." http://hyperphysics.phy-astr.gsu.edu/hbase/sound/beat.html (translator's note).

From:
Brouwer, Joke and Mulder, Arjen ed. Interact or Die, V2 Publishing/ NAi Publishers. (Rotterdam, 2007) pp 206 - 213