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Original
The Contribution of Ellul and Illich's Thought to the Design of Appropriate Machines for Communities in Socio-ecological Transition / Franco, W., Arrobbio, O.. - STAMPA. - 108:(2022), pp. 118-126. [10.1007/978-3-030-87383-7_13]

Availability:
This version is available at: 11583/2977448 since: 2023-03-24T18:07:03Z

Publisher:
Springer Science and Business Media B.V.

Published
DOI:10.1007/978-3-030-87383-7_13

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This is a post-peer-review, pre-copyedit version of a book chapter published in Mechanisms and Machine Science. The final authenticated version is available online at: http://dx.doi.org/10.1007/978-3-030-87383-7_13

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26 November 2026

The contribution of Ellul and Illich's Thought to the Design of Appropriate Machines for Communities in Socio-Ecological Transition

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Abstract. Ellul and Illich are two of the most prominent radical critics of technology of 20th century. Nevertheless, their fame in the academia is limited to small circles of technology sociologists and philosophers. Their thought could help technologists, on the one hand to become aware of the dynamics between technology and society and, on the other hand to develop new appropriate solutions that can improve the efficiency of production by limiting individual, collective and environmental negative effects in small communities in socio-ecological transition. In this contribution, a brief summary of Ellul and Illich's studies is presented, aimed in particular at technologists. Some features of the appropriate technologies that can be traced back to Illich and Ellul are discussed: low-tech, low-power, intermediate productivity, manual operated. Finally, by way of example, an intermediate machine designed at the Politecnico di Torino for threshing and cleaning wheat grown by farmers in mountain areas is presented.

Keywords: SDG12, Technologies for social inclusion, Ecological transition, Grassroots innovation, Appropriate Technology, Intermediate Machines

1 Introduction

Ellul and Illich are considered two of the most important radical critics of technology of the last half of the 20th century [1]. They gave foundation and systematization to some principles of Appropriate Technologies, that may serve communities in socio-ecological transition.

An Appropriate Technology (AT), in a narrow sense, is a small scale, simple, energy efficient, environmentally sound, labor-intensive and community-driven technology [2]. AT movement, inspired by E.F. Schumacher [3], had remarkable success in the 1970s after the publication of the famous Schumacher's "Small is Beautiful" [4]. The AT movement is considered, together with others such as the 1980s' People's Science Movement in India, one of the historic grassroots innovation movements [5]. Grassroots innovation movements are informal phenomena which arise almost always in reaction to the perception of social injustices and environmental issues in contexts

of conventional industrial production [6, 7], and that promote inclusive innovation processes to generate bottom-up solutions for sustainable development. In this sense, grassroots innovation movements can be considered as one of the possible catalysts for transition, in particular in marginal or underserved communities.

The first part of this contribution delivers a synthesis of the main suggestions coming from Ellul and Illich's thought that may support AT for small communities in socio-ecological transition. Finally, as examples of machine "compatible" with the suggestions of the two authors, a concept and a prototype of a machine for processing wheat will be described. This machine, suitable for mountain family farmers, was developed at the Appropriate Machines Laboratory of the Politecnico di Torino.

2 Critical theory foundations for AT: Jacques Ellul and Ivan Illich

2.1 Jacques Ellul

Jacques Ellul (1912-1994) was a French sociologist and theologist. In 1944, Ellul was appointed professor at the University of Bordeaux, position that he never left till he retired in 1980. He took part to several religious, environmentalist and civic groups, took position against communism, and self-defined - and/or accepted to be defined - as believer (protestant) and anarchist. These, and other reasons, all contributed to make Ellul a somehow marginal figure in the intellectual milieu of post-war France. He was indeed much more renown in the USA than in his home country. In this contribution we will pay exclusively attention to his works on technology. Or, better, on technique. This clarification is needed if we consider the meaning the term 'technology' (which, etymologically speaking, is a discourse on technique) is usually given nowadays, by both scholars and lay people who equally use it to refer to technical objects (e.g. smartphones, computers) and processes (e.g., nanotechnology, biotechnology) [8, 9].

On technique Ellul wrote many essays, among which: La Technique, ou l'enjeu du siècle (1954) (first English translation in 1964 with the title The technological society [10]); Le Système technicien (1977) (first English translation in 1980 with the title The technological system [11]); Le bluff technologique (1988) (first English translation in 1990 with the title The technological bluff [12]). Usually considered as a sort of trilogy, the two latter books could roughly be seen as a way for Ellul to refine and integrate the theory he first established in his 1954's book. However, how could an analysis written almost 70 years ago, when France (and Europe) had just recently left behind the destruction brought by the Second World War and had not entered yet the post-war economic boom - not to mention the informatisation of society as well as the appearance of other and more recent surprising technical advancements - be somehow useful today?

As said above, Ellul used the term "technique": "The term technique, as I use it, does not mean machines, technology, or this or that procedure for attaining an end. In our technological society, technique is the totality of methods rationally arrived at and

having absolute efficiency (for a given stage of development) in every field of human activity. […] Technique is not an isolated fact in society (as the term technology would lead us to believe) but is related to every factor in the life of modern man; it affects social facts as well as all others". [10, pp. xxv-xxvi].

He distinguishes between technical action and technical phenomenon. The latter being "[…] the quest of the one best means in every field. […] It is the aggregate of these means that produces technical civilization". [10, p. 21].

Are specific techniques bad? Or are they good? For Ellul, it is impossible to draw up a balance. Experts may not even agree among them and, moreover, some aspects (be they positive or negative) may lay out of sight [10, 11]. The only sure thing is that the technicisation process continues relentlessly and extending to all domains of life as well as to ever more corners of the globe. In the words that Merton used to introduce Ellul's La Technique to the American reader [13, p. vi], progress "[…] consists in progressive de-humanization— a busy, pointless, and, in the end, suicidal submission to technique".

Technique creates problems that only technique can solve or, better, for which mostly technical solutions are looked for. What or who could stop this reinforcing loop? Technique is completely out of control, or at the point of becoming so. It is the determinant factor as it determines people lives as well as all social sub-systems, included the political one. Men and women surrendered to the logics of technique: "[…] man thinks in conformity with this environment. […] If a person awakes to consciousness, he would no more dream of challenging or contesting the technological milieu in its perceptible aspects than a twelfth-century man would dream of objecting to trees, rain, a waterfall." [11, pp. 311-312].

Ellul deliberately refrained from proposing solutions: his work is a diagnosis and, moreover, he could see "[…] not even a beginning of a solution, no breach in the system of technical necessity" [10, pp. xxxi]. He described the way of functioning of a system, and this has not changed since he wrote his book in 1954 [10]. The appearance of new rule-breaking technological gadgets or technical procedures can almost perfectly fit into his theoretical arguments.

The only way out of all that is to become aware. Should men completely abandon or reject technique? Of course not. Without technique mankind would have never appeared. First of all, man should be made aware of what determines him. Then, he may eventually put a break to the technicisation process, by deliberatively controlling it and steering it.

Usually not listed among the masters of sociology in university textbooks (or not named at all) his name mainly circulates among limited intellectual circles (e.g., technology sociologists and philosophers) and among thinkers and practitioners ascribable to what may be referred to as neoluddism. This could be defined as the scattered and unorganised movement that sees the negative effects of technique (and eventually also the ones deriving from specific – mostly modern - techniques) and that questions the inescapable character of technological progress.

2.2 Ivan Illich

The main character of the 2019 French movie Alice and the Mayor (orig. Alice et le maire) is Alice, a young philosophy and literature graduate who just got a post at the City Council of Lyon. As she was told during the first day, her task consists in stimulating the Mayor to think again. After having observed a City Council meeting, she goes to her office and takes notes. She writes down the names of three authors, likely to be the ones to take inspiration from on the theme of modesty: Rousseau, Orwell and Illich. To our knowledge this could be the first time the name of Illich, that we deem is the least known among the three, is cited in a movie targeted to the wider audience.

Ivan Illich (1926-2002) is a quite unclassifiable thinker, at times defined as free-thinker, others as philosopher, sociologist, pedagogist and theologian, among others. Author of provocative and influential books, whose production mainly concentrated in the 1970s, he was mainly renown (and still is, albeit to a minor extent) within alternative social movements.

We can see in Illich's suggestions a sort of operational translation of Ellul's insights. Indeed, Illich did offer solutions or, at least, directions to look to for solutions. It did so by concentrating its treatises on specific societal subsystems, mostly education [14], mobility [15], and health [16], of which he also depicted their perverse functioning. Perverse effects that start when the process he termed 'institutionalisation of values' occurs and that may bring – not just for the three above-mentioned subsystems - to the establishment of a 'radical monopoly' [17]. This describes those situations in which an industrial production process – not be intended as just related to the proper industry sector – exerts an exclusive control over the satisfaction of a need and excludes non-industrial activities from competition. When this happens, a new form of poverty makes its appearance (in both industrialised and non-industrialised countries) that makes people unable to satisfy, in a creative and autonomous way, their needs outside of market relations.

Illich asked for the recognition of the existence of thresholds, in the use of energy or in relying to industrially produced goods and services, whose crossing brings to environmental pollution, social polarisation, and psychological impotence. While the former of the three may even be avoided, the latter two will be not. Some tools are more suitable than others to prevent the critical thresholds to be crossed and, consequently, to prevent the three environmental, social and psychological bads to manifest in their most pernicious forms. Illich calls these "convivial tools". A more detailed description is delivered in section 3.3.

3 Some common characteristics of appropriate machines

We define appropriate those machines that can be fully included in the category of AT. There are numerous examples of appropriate machines developed to serve small communities, including devices for self-building [18, 19, 20], housework [21], artisanal self-construction [22], peasant agriculture [23]. The great majority of them have

some characteristics in common which are discussed and related to the thought of Ellul and Illich in the following of this section.

3.1 Low-tech

Simplicity is one of the characteristics of appropriate machines [2], which arises from the need, on the part of small communities, to have the technology under full control, to be able to replicate it autonomously and to be able to maintain it over the years. Simplicity must be understood as resolved complexity. It consists in identifying a simple solution to a complex problem, for example through the hybridization of new knowledge on old practices, with the idea that technological innovation does not necessarily mean the new replacing the old, but also renewed use or redesign of traditional solutions [24, 25].

In our opinion, the propensity towards low-tech solutions in the context of small communities in socio-ecological transition also originates from the desire, more or less conscious, to want to bring technology back to the dimension of an instrument. In fact, as Ellul points out in [11], “even when technology is abstract, a procedure, an organization, it is far more of a mediation than an instrument”. Technique takes the form of exclusive mediation between man and the natural environment, and in the relationships between individuals. “Thus, mediation by technology excludes any other, and this allows technology to entirely escape the desired or supposed values.”. Furthermore, mediation is: (i) “autonomous” since what is possible through Technique is necessary; (ii) “sterile and sterilizing”, since Technique is univocal, stable and ordered, “is a truly efficient medium, and it has imposed itself in lieu of poetic mediations.”; (iii) “non-mediated towards man”, since "the relation to technology is immediate, which does not mean that consciousness has now become the simple reflection of the technological environment" [11].

Technique becomes the environment and removes the natural environment. In order to recover a conscious relationship with the natural environment, it is therefore necessary to reduce the complexity of technology, to identify and develop low-tech solutions.

3.2 Intermediate productivity

According to Ellul, the fact that technique is an end and not a means is demonstrated by the low appreciation we have for the numerous objects we produce just because of the effectiveness of the technical means of production. These are often objects that are neither pleasant, nor truly useful, neither symbolic, nor affective. The focus is on the productivity of technology, not on the quality of the objects produced. “These objects have no value or importance, whatsoever, they exist only as products of the technological mechanism. What characterizes this society is not the object but the means."[11].

Numerous grassroots movements focus on product quality rather than quantity. For example, there is an orientation towards widespread and artisanal production [26], or towards peasant agriculture [27]. When the quality of the production is considered primary, other design parameters gain relevance, such as the quality of work, the posi-

tive interaction between worker and object of production, the possibility of realizing and expressing oneself through a working act.

It is necessary to try to understand what is really useful to us, to rediscover frugality, i.e. the individual and collective capacity to recognize what we need [28]. As Illich explains, productivity is opposed to conviviality, having to be, exasperation to self-limitation, oppression to equity [17].

3.3 Manual operation

By conviviality, Illich means the opposite of industrial productivity [17]. *"*A convivial society would be the result of social arrangements that guarantee for each member the most ample and free access to the tools of the community and limit this freedom only in favour of another member's equal freedom".

Illich distinguishes two basic types of energy: a metabolic type, and an external one, and classifies the tools according to the type of energy used, distinguishing hand tools from power tools. As for the former, "mere transducers of the energy generated by man's extremities and fed by the intake of air and of nourishment", Illich believes that "they lend themselves to convivial use" being defined as convivial those tools that "can be easily used, by anybody, as often or as seldom as desired, for the accomplishment of a purpose chosen by the user. The use of such tools by one person does not restrain another from using them equally. They do not require previous certification of the user. Their existence does not impose any obligation to use them. They allow the user to express his meaning in action" [17, 29].

Conversely, tools that use external energy, called power tools, favour the centralization of control. Furthermore, they are often too expensive to be equally available worldwide and are therefore the prerogative of wealthy groups, or require a high degree of specialization, and therefore are unable to provide the freedom and versatility of simple hand tools.

3.4 Low-power

The particular attention to hand tools also depends on the fact that, according to Illich, they are the tools that guarantee, par excellence, equity. Anyone who breathe and eat can use them. On the contrary, power tools become the prerogative of some and contributes, especially as power increases, to the creation or exacerbation of social inequalities.

Illich states that "What is generally overlooked is that equity and energy can grow concurrently only to a point. Below a threshold of per capita wattage, motors improve the conditions for social progress. Above this threshold, energy grows at the expense of equity. Further energy affluence then means decreased distribution of control over that energy [15]*"*.

Illich, demonstrates his intuition by analyzing the theme of transportation, and highlighting how exceeding a certain threshold of individual power available for moving- corresponding to the muscular power for driving a bicycle - there is a systemic decrease in the efficiency of the transportation system. In societies whose transportation system is based on the automobile, most people spend an increasing chunk of

their existence on unwanted travels, while only a small global elite can afford to travel enormous distances during their lifetime.

This thought of Illich has been confirmed in [30], in which the productivity and energy efficiency of different machines for threshing and cleaning grain are compared. Increasing the available power obviously increases productivity. However, the most evident increases manifest at low powers. In terms of energy efficiency, it is observed instead that this is maximum below a certain level of power, comparable to the metabolic one.

4 Re-Thresher, an example of appropriate machine

As an example, the prototype of an appropriate machine, designed within the Laboratory of Appropriate Machines of the Politecnico di Torino to meet the specific requests of peasants who produce small quantities of high-quality wheat grown in impervious mountains, is presented. A specific participatory design methodology was developed, which started from an accurate identification of users' needs and their involvement in the design phases [31]. Users need to have a machine that performs the threshing and cleaning operations of the grain where it is not possible to use a traditional combine harvester, either due to the impossibility of access, or due to the small size of the fields (as in the case of catalogue fields of historical varieties of cereals).

The solution designed (Fig. 1) has the characteristics discussed in section 3, i.e. low-tech, intermediate productivity, manual operation and low-power. In effect, given the production of small quantities of wheat, for family use or for small local supply chains, the productivity of the machine is not central. This allows to move towards the design of a low-tech and low-power machine, possibly operated manually and electric-assisted. One or two people manually operate the machine through corresponding cranks. The mechanical transmission is of cycling derivation. Through several chain drives, the power is transmitted to the beater roller, to the ventilation system, and to the mechanism of the vibrating sieves. The grain, detached from the straw by the beater roller, is conveyed, by gravity, to the vibrating sieves, where it is hit by a flow of air which has the purpose of expelling impurities from the machine. The clean grain is collected in a special drawer.

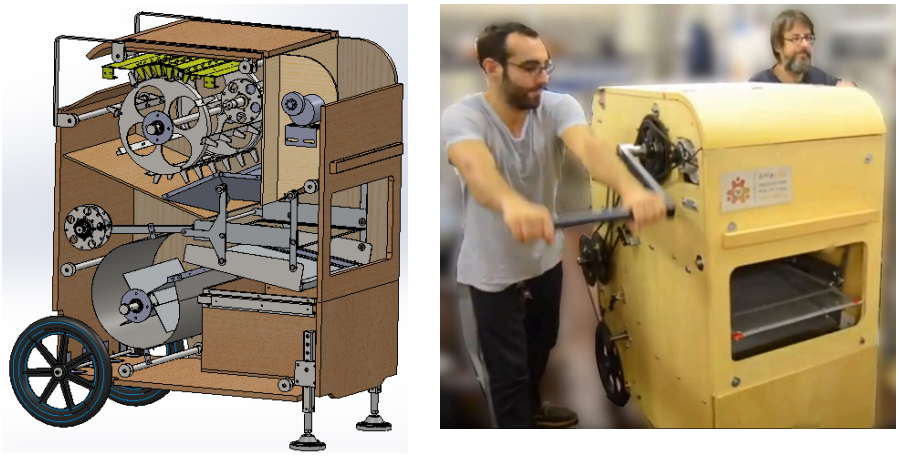


Fig. 1. Re-Thresher, a manually operated power-assisted thresher-cleaner machine. a) The detailed design. b) The prototype

5 Conclusions

Ellul and Illich are two of the most important radical critics of technology of the last half of the 20th century. United by the idea that a systematic examination is necessary to identify the relation between technology and society, their analyses have contributed to exercise a unique intellectual influence on numerous scholars. They can be considered, in a sense, among the founding fathers of AT movement. In addition, the fact that Illich has complemented one of Ellul's last public presentations held at the end of the three days of the conference "Technique and Society in the Work of Jacques Ellul" at the University of Bordeaux in 1993 is read by some as confirmation of complementarity and affinity of the two intellectuals [1].

Ellul mainly studied the relations between technology and society, refraining from making judgments or proposing solutions. He highlighted how technique is the determining factor of society, more than economics and politics, and how, through a sort of automatism, it tends to develop into a universal and totalizing environment and system. Technique has become the only mediation between man and the environment and between men and men, who find themselves deprived of the mediation tools developed over millennia, such as narration, poetry, myth, tradition, symbolic and cultural codes.

Illich explained how the planetary crisis has its roots in the process of replacing the machine to man, the rational and unified processes to the occasional and punctual responses of the different communities. The relationship between man and tools of production is reversed into an opposite relationship. Tools make man a slave. Illich, unlike Ellul, proposes some solutions to the crisis, including the development of tools that improve efficiency while preserving the autonomy of individuals, extending their range of action without producing slaves or masters.

The analysis of Ellul and Illich, half a century later, still proves to be topical and possible source of inspiration for the design of technologies appropriate to small communities implementing socio-environmental transition processes. To limit the negative individual, social and environmental effects of a hypertrophic technology, it seems interesting to develop intermediate, simple, low-power, possibly manual solutions, capable of satisfying the limited productivity needs of frugal communities with improved energy efficiency.

In support of this reasoning, an assisted manually operated thresher-cleaner designed at the Politecnico di Torino for small scale mountain peasants is also presented. The machine is capable to produce, with high efficiency, small quantities of cereals for self-consumption or for local supply chains.

In conclusion, we believe that the thought of Ellul and Illich must come out of the narrow circle of sociologists and philosophers of technology, and also be the patrimony of technologists. There appears to be an untapped potential for cross-fertilization between humanists, social scientists and technologists that will be useful to fully exploit in the imminent phase of energy transition and resource scarcity.

References

1. Ellul, J., Illich, I. Statements by Jacques Ellul and Ivan Illich. Technology in Society 17(2), 231-238 (1995).
2. Hazeltine, B., Bull, C. Appropriate Technology. Tolls, Choises, and Implications. Academic Press, San Diego (1999).
3. Lissenden, J., Maley S., Mehta K. An era of Appropriate Technology: Evolutions, overights and opportunities. Journal of Humanitarian Engineering 3(1), 24-35 (2015).
4. Schumacher, E.F. Small Is Beautiful. Economics as if People Mattered. Blond & Briggs, London (1973)
5. Smith, A., Fressoli, M. and Thomas, H. Grassroots innovation movements: challenges and contributions. Journal of Cleaner Production 63, 114-124 (2014).
6. Smith, A., Elisa, A., Fressoli, M., Thomas, H., Abrol D. Grassroots innovation for sustainable development: some enduring dilemmas, In: Proceedings of the Global Research Forum on Sustainable Consumption and Production Workshop 2012, Rio de Janeiro, Brazil (2012).
7. Smith, A., Fressoli, M., Abrol D., Elisa, A and Ely, A. Grassroots innovation movements. Pathways to sustainability. Routledge, London & New York (2017).
8. Hickman, L. Philosophical Tools for Technological Culture: Putting Pragmatism to Work. Indiana University Press, Bloomington (2001).
9. Schatzberg, E. Technology: Critical History of a Concept. The University of Chicago Press, Chicago and London (2018).
10. Ellul, J. The Technological Society. Knopf, New York (1964).
11. Ellul, J. The Technological System. The Continuum Publishing Corporation, New York (1980).
12. Ellul, J. The Technological Bluff. Eerdmans, Grand Rapids (1990).
13. Merton, R. K. Foreword, in Ellul, J. The Technological Society. Knopf, New York (1964).
14. Illich, I. Deschooling Society. Harper & Row, New York (1971).
15. Illich, I. Energy and Equity. Calder and Boyard, London (1974).

16. Illich, I. Medical Nemesis. The Expropriation of Health. Calder and Boyars, London (1975).
17. Illich, I. Tools for Conviviality. Harper & Row, New York (1973).
18. Mukerji, K. Soil Block Presses. German Appropriate Technology Exchange, GATE, Eschborn (1988).
19. Ferraresi, C., Franco, W., and Quaglia, G. Concept and design of Float-Ram, a new human powered press for compressed earth blocks. In: ASME IMECE2017, International Mechanical Engineering Congress and Exposition, Tampa, Florida, USA (2017)
20. Franco W., Quaglia G., and Ferraresi C. Experimentally based design of a manually operated baler for straw bale construction. In: IFIT 2016, The 1st International Conference of IFToMM ITALY, Vicenza, Italy, Mechanism and Machine Science, 47, pp. 307-314 (2017).
21. Dean, T., The human powered home. Choosing muscles over motors. New Society Publishers, Gabriola Island (2008).
22. L'Atelier Paysan. Available from: https://www.latelierpaysan.org/ Last accessed 2021/05/26.
23. La Via Campesina. International Peasants' Movement. Available from: https://viacampesina.org/en/ Last accessed 2021/05/26.
24. De Decker, K., Low Tech Magazine 2012-2018. Lulu.com, Milton Keynes (2019).
25. Edgerton, D. The Shock of the Old. Technology and Global History since 1900. Oxford University Press, New York (2007).
26. Sennet, R. The Craftsman, Yale University Press, New Haven-London (2008).
27. Slow Food. Available from: https://www.slowfood.it/ Last accessed 2021/05/26.
28. Berardi, F. After the future. AK Press, Chico (2011).
29. Borremans, V. Guide to Convivial Tools. Library Journal, Special Report No.13. Bowker, New York (1979)
30. Franco, W., De Piccoli, M. Intermediate Agricultural Machines Energy Efficiency: The Example of Harvesting and Threshing. Mechanisms and Machine Science 91, 533-541 (2021)
31. Franco, W., Barbera F., Bartolucci, L., Felizia T., Focanti F. Developing intermediate machines for high-land agriculture. Development Engineering 5 (2020).