Tools and Their Users

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Introduction

The statement that every tool shapes its users' habits and mentality would apply to any technology in any era of the human history. But today's advanced ICT devices, which accompany almost all human activities from very early ages onwards, seem to have a qualitatively different impact. Here, I will try to show how these devices –by virtue of a special feature of theirs- have become dangerously entangled with the self-ordained dynamics of market economy and outcome-measurement-based educational policies, eventually jeopardising the raising of next generations of technology developers.

In an earlier article I have searched for the reasons behind a behavioural change that almost suddenly emerged among my students around 2007-08, and tried to show the possible correlation with the penetration of performance-based evaluation into various domains of social life. The problematic change mentioned there was related to the students' seeking for "*a safe haven in imitating machine intelligence, which brought with it submission to externally set targets, strong dependence on external appreciation, insufficient self-confidence, and rapid loss of motivation under failure*" [1]. During the many years that followed these symptoms persisted and within the last academic year some unprecedented types of error started to appear in the exam papers and home works, which indicate that some mechanisms that used to compensate the adverse effects of these evaluation policies must have been deactivated or some new mechanisms must have stepped in that aggravate their adverse effects. I suspect that ICT devices are partially responsible for these mechanisms.

Education and Raising the Edifice of Comprehension

In order to analyse the impact of the entanglement of advanced ICT devices, outcome-measurement-based educational policies and the dynamics of market economy on students, let us

envisage comprehension as a complex dynamic edifice that rises on the fundament of cognitive abilities, which are extensions of the embodied tacit knowledge. In the course of development (which is strictly speaking a life-long process) each level is supposed to emerge as an abstraction out of the former. Alexandre Borovik [2] describes this process very vividly in the context of mathematics:

"The crystallisation of a mathematical concept (say, of a fraction), in a child's mind could be like a phase transition in a crystal growing in a rich, saturated—and undisturbed—solution of salt. An "aha!" moment is a sudden jump to another level of abstraction. Such changes in one's mode of thinking are like a metamorphosis of a caterpillar into a butterfly."

However, this creative and spontaneous process is highly sensitive to external impacts (particularly systematic ones). Sustainable development of the edifice of comprehension asks for meticulously tuned "boundary conditions", i.e. external supports and stimuli that have to step in and out with correct timing, catalysing the actualisation of potentials in a way coherent with the lower levels of the edifice as well as with the necessities of the environment. The person-dependent and highly unpredictable developmental process must evolve according to its own pace and cannot be evaluated on basis of standardised criteria. Particularly, outcome-measurement-based evaluation creates a harmful interference with the developmental dynamics, providing a positive bias in favour of the selected measurable criteria, while leaving immeasurable (or at least not immediately assessable, yet for the progress crucial) assets like true comprehension, intuition and motivation unnoticed, unappreciated and eventually letting them fade away.

Nevertheless, this pessimistic picture need not materialise as long as the child and later the student has other opportunities -other than the official education system- to get into touch with life, to receive stimuli and appreciation for the unnoticed assets, as well as pressure to improve his/her unnoticed weaknesses. It is exactly at this point, where the advanced (especially IC) technologies that penetrate children's lives intensively and at very early ages make a qualitative difference as compared to more traditional ones by blocking the channel of interaction with real life. I suggest that the characteristic feature of contemporary IC technologies responsible for this blockage is the highly-developed and excessively user-friendly interfaces.

Facing the Interface

If we try to apply the concept of "user interface" to a traditional tool, e.g. hammer, the user interface would probably be its handle: the interface between the user and the part of the tool that actually performs the job. Such an interface protects the user from the physical inconveniences of the job, but does not prevent him/her from witnessing the operation. The same could be said about the keyboard of an old-fashioned typewriter where you have a free glance at the operation of the internal mechanism. But contemporary ICT devices are characterised by the "opacity" of their user interfaces. These user-friendly interfaces translate even sophisticated operations into basic sensorimotor tasks like clicking, shifting, dragging and dropping, and into basic cognitive tasks like pattern matching. Never before have technology users been so perfectly "protected" from the complexity of the underlying phenomena and absolved from the exigency of having some comprehension about them. Plotted against the background of market economy, this low intellectual demand on behalf of the users and the low prices of mass-produced consumer devices create a self-amplifying positive feedback loop, creating masses of cheap devices and huge masses of –increasingly younger- customers.

From here onwards, I will refer to user interfaces, which isolate the user from the actual operational level while presenting him/her a virtual face, as ***isolating interfaces***. The notion of interface can even be extended metaphorically, and all devices and supporting technological systems themselves can be considered as interfaces between the user and the real problem.

The complicity of isolating interfaces (both real and metaphorical), outcome-measurement-based education system and market economy is multi-directional:

Market dynamics unleashes masses of cheap ICT gadgets with isolating interfaces upon the plastic brains of young children. While these toys become parents' favourite means of keeping the children occupied, whole generations are isolated from very early ages onwards from the challenging stimuli of the real world that would have compelled the emergence of new cognitive abilities. On the other hand, these gadgets give children ***false sense of self-confidence***, eventually attract many of them to professions of prospective technology developers and assist their progress even during the first years of their higher education by translating relatively sophisticated tasks into the language of a lower cognitive level, creating in the students the illusion of mastery and autonomy in the respective domains. Meanwhile, the outcome-measurement-based system conceals from the educators students' lack of true comprehension for a long while. Nevertheless, the illusion of mastery and autonomy can be sustained only until students reach a stage that demands creativity, where most of them start to discern the huge gap of incompetence underneath the seemingly safe ground. This –combined with the high performance pressure and competition- leads not only to the ***loss of the false self-confidence*** but also loss of ***motivation*** among those who were prematurely attracted to these professions (this typically happens during the third year among my electrical and electronics engineering students). On the other hand, students with high capacity and passion for comprehension are also adversely affected by the outcome-measurement-based evaluation system, which is tailored for isolating interfaces, i.e. does not encourage or appreciate the derivation and deduction of new levels of abstraction from previous ones, but compels learners to take ready-made and level-specific rules for granted. This deprives the students of their ***developmental autonomy*** and their natural motivation for learning: the sheer ***pleasure*** of "jumping to a higher level of abstraction" and the associated ***cognitive pride***.

Conclusion

Ergonomics demands that devices match the needs of their users and support -rather than impede-their development. But the present combination of pragmatic educational policies, which treats human as automaton, and the market economy, which repudiates the value of human potential, trusts children to cognitively non-ergonomic devices, which turn them into automata and waste their potential long before they have a chance to become developers of future technologies. Nevertheless, this can be considered as nature's negative feedback that can in the long-run terminate wrong policies.

References

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