“Automation v Augmentation: the two forms of technology at work”

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In the past ten years, the rapid progress of AI has reignited the debate on the potential of technology to automate full spans of business activities and its dire consequences on employment. This possibility has been demonstrated in many physical places, such as data centers, warehouses, and factories. However, experts are more nuanced. Full automation has its own, daunting, challenges, and some rather claim that the future of ``smart industry'' lies in increased agility enabled by a new alliance between human and machine, sealed by AI. This debate raises the question of what is automation in the first place, a term which is notoriously difficult to define.

In this talk, we will consider a few examples of automation over time, starting with Jacquard's loom in the early 19th century to fully automated warehouses at the end of the 20th century, in order to show that automation should not be defined relatively to the human tasks which they replace, but relatively to the problems they solve. Automation is a specific way to solve a problem through the operation of a machine. It requires the problem to be solved /systematically/, a term which we will explicate in detail.

Automation has however strong conditions, as it requires the problematic situation itself to behave systematically. This is why it works best in closed, carefully designed environments such as a factory. Open situations, such as a lawsuit, are until now the domain of traditional human problem solving. In that case, the human agent keeps the central stage in solving the problem at stake, and technology is only here to facilitate her performance of some tasks, -- for example a legal database search -- i.e. to /augment/ her. /Automation/ and /augmentation/ are the two basic modes by which machinery can be put to work, because they are based on two fundamentally different approaches to problem solving.

However what we believed were open situations have been regularly redefined to become systematic ones. How can this happen? Our thesis is that, whereas typical machines operate through rigid mechanisms that can only solve a narrow set of problems, computers have mechanisms which are easily reconfigurable (``programmable''). The progress of computability theory and software design has made machines increasingly /flexible/ to solve ever larger classes of problems --

from the rigid mechanisms of the industrial revolution to algorithmic behaviour, then to concurrent interaction, and now to adaptive, inductive ``learning''.

Is there a limit to this trend? AI is about the automation of problem-solving itself ,and therefore it could in theory expand vastly the scope of automation. However, AI is today mostly presented as an augmentation technology (a ``co-pilot''), and not an automation one. We suggest three reasons for this limitation : First, the need of AI to be complemented by traditional computational tools (such as compilers), which will still face the same traditional difficulties. Second, the data collection cost for achieving systematicity, which will make it in many cases unprofitable. Third, the fact the human meanings evolve over time. Language is a chaotic system which evolution cannot be predicted, because it reflects the evolving and intersecting conversations, actions and practices of communities of people.