9.1 Case study: the Olivetti Programma 101 and the invention of the desktop computer

Objective

This case study tells the story of the Programma 101, the first desktop computer in history, launched by Olivetti in 1965. The case offers a great example of how a breakthrough product was created by remixing existing parts. The P101 design resulted from a revolutionary polarizing narrative of a computer on every desktop at a time in which computers were typically as big as a large room, costed as much as a nice house, and were operated by a mystical elite of scientists in white coats.

Background

The following quote from Pier Giorgio Perotto, the Olivetti engineer who led the Programma 101 development, summarizes the powerful narrative that guided the team of developers to navigate the unchartered water surrounding the idea of 'personal computing':

'I dreamed of a friendly machine to delegate those operations that are the cause of mental fatigue and errors, a machine that knew how to learn and then execute obediently, which stored simple and intuitive data and instructions, the use of which was within the reach of everyone, that would cost little and it was the size of the other office products that people were used to. I had to create a new language that didn't need a white-coat interpreter.' (P.G. Perotto, 1995)

The personal computer was only a dream. The computer world was very different from the one we know today. Computers in the 1960s were huge, expensive, and could be operated only by highly specialized personnel. Their use was limited to military applications, academic research, and rich governments and large companies' data storage. Mainframe computers rented anything from a few to a hundred thousand dollars per month and were sold at a purchase price ranging from $100,000 to a few million (Mori, 2019).

The Programma 101 sold at $3200, basically one month of rent of a mainframe, but much more significant was the productivity gains that would come with it. Unlike an expensive mainframe that had to be shared so that every user had to wait their turn in a queue, the new desktop computer provided computational capability. The same money needed for a large mainframe could instead buy dozens of P101 that were going to be used in parallel by as many operators 'in the office or at home', as mentioned in one of the ads Olivetti broadcasted at the time (link available in the reference).

The magnitude of the gap can explain why almost nobody in the 1960s thought of a computer as a tool that everybody would use one day. It was simply impossible to shrink the costs with the existing technology and mindset.

This is probably why Olivetti was an excellent candidate to invent such machines. Olivetti was a leader in the production of mechanical calculators that professional users bought for more mundane applications such as accounting, instead of sending human beings to the moon or controlling the ballistic of a missile.

The production of these calculators was possible thanks to sophisticated, high-precision mechanical technologies. Desktop mechanic calculators were largely used, and some beautiful portable versions, such as the Curta pocket machine, were also widespread (fig. 9.1).

Fig. 9.1 - examples of mechanic calculator: on the left side (a) Olivetti Divisumma, 1947; on the right side (b) Curta portable calculator).

Despite their ingenuity, there were many things that mechanic calculators were not able to do, including any mathematical function that was more sophisticated than the four basic operations or the ability to memorize and execute sequences of instructions for routine computation.

The Programma 101 developers thus had a deep knowledge of their users' needs. Besides, they could count on state-of-the-art knowledge on the nascent science of electronic computing and its integration with mechanical office tools such as typewriters and mechanic calculators; the two essential products in Olivetti's portfolio. Olivetti was, in fact, not new to the computer business. The company had invested in R&D on electronic calculus and, just a few years before, in 1953, had successfully launched a mainframe called Elea 9003. Additionally, Olivetti possessed qualified technicians and an extensive portfolio of technologies and devices developed thanks to the sophisticated mechanic technology skills in which Olivetti excelled. Finally, the company was considered a leader in industrial design and received the honor of a dedicated exhibition at the Museum of Modern Art in New York in 1952 (MOMA, 1952).

This rich set of skills and assets was critical to overcoming the lack of design, equipment, and parts for the development of small computers. All the available technologies and components were, in fact, built for large mainframes and were not adaptable to small computers for their cost and size.

For instance, the team had to resort to a different design for the memory. Memory cells available at that time (based on ferrite magnetic core) were as large and heavy as large bricks and cost thousands of dollars each. The Programma 101 memory was built by re-using an existing and old technology (magnetostrictive memory) built around a cheap and light piece of wire and sensors transforming mechanical deformation of the metal in electric signals. The Programma 101 would offer a stunning 240 bytes of memory (not a typo!). Although it is hard to believe today, 240 bytes were all NASA scientists needed to perform the complex calculations to send a human being on the moon.

Another example of this internal bricolage was the small printer included in the computer as the primary output device (screen technology was still not an option). Giovanni De Sandre, one of the team members, found out that such a printer had already been developed in another project. So Piergiorgio Perotto, the team leader, visited a colleague, Franco Bretti, who had created a device with the right specs but had never really found a use for it. Thanks to the lack of internal bureaucracy and control, Perotto had easy access to the invention, did not have to ask for permission to involve Bretti's team in adapting the mini printer for the Programma 101, and never had to resort to power deriving from hierarchical authority to obtain collaboration. This model realized what Perotto defined as the critical balance between 'determinism and chaos', i.e., the necessity for an innovative organization to avoid highly prescriptive, rigid organizational structures while allowing for some local autonomy and redundancy (Perotto, 2015).

Other key inventions were developing an easy programming language and the magnetic card, the ancestor of the later floppy disk.

The Programma 101 language was so simple that it could be learned by reading 50 pages manual. However, Olivetti engineers went even further. Why bother to learn a coding language if there was a way to feed the machine with a pre-made program that users could buy in a ready-to-use format? The magnetic card was the answer. It was a strip of paper with a magnetic side that could be slipped in the P101 pretty much how we do today with a subway ticket. The card would slip through the machine, and the machine would read the code and process the instructions inside its internal memory. It was, by any means, the ancestor of what we call today an external memory archive or mass memory such as the floppy disk or the more contemporary USB drive.

Finally, there was an aesthetic problem. If the P101 was supposed to be used by average users and sit on a desktop in an office, what should it look like? Aesthetics was not an issue for the computers of that time: not only were they not small enough to be boxed into something, but their specialized users could not care less about their appearance. According to the mainstream point of view about this issue, aesthetics was nonsense for computer builders. Once again, Olivetti never endorsed this view. For the design of the ELEA 9003, a more traditional mainframe computer, Olivetti asked Ettore Sottsass, a famous Italian architect, and industrial designer, to design the machine to improve user interaction through ergonomic, modular and aesthetically pleasant design.

Fig. 9.1c - Programma 101 final design.

The author of the curvy and sensual design of the new machine was another designer, Mario Bellini. The machine featured rounded edges and surfaces to rest hands, along with an ergonomic keyboard to reduce typing fatigue. Touches of colour interrupted the otherwise bland, grey, minimalistic design. Keys were arranged by functional groups into white, grey, and black clusters, and a light display popped out from the right upper corner to indicate either correct functioning (green light) or error (red). The P101 came with no display, replaced with the traditional paper roll of an ordinary calculator (actually an inline printer). The magnetic card slit was easily accessible on the front panel, and all cables and complex components were hidden in the box. It is interesting to learn from Mario Bellini's own words what inspired his design (2011, emphasis added):

'I remember that one day I received a call from Roberto Olivetti: "I want to see you for a complex project I'm building." It involved the design, not of a box containing mechanisms and stamped circuits, but of a personal object, something that had to live with a person, a person with his chair sitting at a table or desktop, and that had to start a relationship of comprehension, of interaction with the machine, something quite new because before then computers was as big as a wardrobe. We do not have any relationship with a wardrobe: in fact, the most beautiful wardrobes disappear from the wall. However, this was not a wardrobe or a box; this was a machine designed to be part of your staff, **just like another person**.'

Just when the Programma 101 was in its full development, in 1964, the Olivetti Electronic lab, which just a few years ago had been relocated to a new facility in Pregnana near Milan, was sold to General Electric. The passage to GE created much uncertainty in the team, who did not know what was going to happen to their project, and that was highly skeptical GE had any serious interest in it either. However, a minority of Olivetti leaders were still supportive of investing and growing the computer production, including Roberto Olivetti, Adriano's son. Roberto mentioned to Perotto in rather vague terms the initial idea to develop a small electronic calculator that could do something more than regular mechanic ones and cost little.

Perotto's team was still in Olivetti, but their lab was located in the Pregnana Factory, now owned by GE, isolated from the company headquarters. Thus, Perotto and his collaborators ended up being in a paradoxical situation. The team worked in isolation, surrounded by a hostile competitor but forgotten by the mother company that was putting renewed energy in its traditional businesses. While, to some extent, frustrating, this isolation provided the necessary discretion to the team, who were left free to work on the prototype while being sheltered by both competitors' imitation and internal enemies who considered the project foolish and wasteful.

It was the end of 1964, and the team was finally ready to show a fully functioning prototype to the Olivetti top management. The P101 was wrapped into an anonymous metal box made of ugly blue tin, nothing like the beautiful case that Mario Bellini eventually designed. The internal demo was impressive. Natale Capellaro, the Director of Production and the inventor of one of the Divisumma, the most successful Olivetti's mechanic calculator, congratulated Perotto and told him, perhaps with a mix of sadness and wonder, that that day he had finally realized that the age of mechanic calculus was over.

The Programma 101 was presented at the 1965 BEMA conference in New York (Business Equipment Manufacturers Association). Ironically, the fact that the P101 was not exposed side to side with other computers turned out to be a fundamental reason for its success. While the other computers were exposed in a space where regular people were not allowed, the Olivetti stand was visited by common folks and business people and the less specialized press. This untraditional audience was not only surprised to find a little tech wonder amidst the most traditional office products but needed such a small computing solution. Furthermore, everybody loved it! A spectacular demo was organized in which the P101 was able to compute the orbit of a satellite in a few seconds, a time that to De Sandre, who was assisting with the demo, felt like three days. It is not clear if this was a deliberate choice, but it was brilliant from the communication point of view in a time in which the race to the moon was in its full development. Visitors would not believe their eyes and would ask if the machine was just a terminal connected to a mainframe somewhere. The American press loved it too, and Business Week published an article titled *Desk-top Computer is Typewriter Size*.

Olivetti received thousands of orders, and NASA bought 44 units and used them within the Apollo project. A competitor, Hewlett Packard, bought another small batch, perhaps with the intent of carrying out some reverse engineering to understand which type of technical solutions Olivetti had figured to produce such a small machine (Olivetti sued HP later on and a US court ruled out that HP had infringed Olivetti Intellectual Property rights).

Instructions

Apply the framework described at the beginning of chapter 9 to describe how the remix strategy works to the case of the Programma 101.
Can you make another example of innovative products resulting from remixing?

References

Readings

Bianchini, R. (2019), Olivetti Programma 101; at the origins of Personal Computer, avaiable at https://www.inexhibit.com/case-studies/olivetti-programma-101-at-the-origins-of-the-personal-computer/

Mori, E. (2019), The Calculator That Helped Land Men on the Moon**,** IEEE Spectrum, available at https://spectrum.ieee.org/tech-history/silicon-revolution/the-calculator-that-helped-land-men-on-the-moon

Perotto, P. G. (1995). Programma 101. L'invenzione del personal computer: una storia, available at http://www.oldcomputers.it/parts/olivetti/programma101/docs/perotto_programma101.pdf

Perotto, P.G. (2015), Quando l'Italia invento' il Personal Computer, Ivrea (Italy): Edizioni Comunita'.

Websites

http://www.silab.it/frox/p101/_index.html: vintage website with details about the design of the machine and a sample of programs

http://www.claudiovianini.com/index.html: from this site it is possible to download the P101 user manual and an excel based simulator

http://www.piergiorgioperotto.it/piergiorgioperotto.aspx: website dedicated to the memory and work of Pier Giorgio Perotto

http://www.museotecnologicamente.it/the-tecnologicmente-museum-workshop-in-ivrea/, official site of the Olivetti Foundation museum.

Video

https://www.youtube.com/watch?v=lpkqdbz1R_s: Memory of the future, Olivetti commercial for the P101

https://www.youtube.com/watch?v=POWPaDNZ9gQ: Gastone Garziera TedX presentation (available in Italian with English closed captions via youtube settings)

https://www.youtube.com/watch?v=2RjIRKIetP8: History Channel documentary (available in Italian with English closed captions via youtube settings)