

«The Silent Revolution», a traveling exhibition

The other day I had the experience of visiting a very curious exhibition. Curated by the Institute of Microelectronics of Barcelona, and with support from the Fundación Española para la Ciencia y la Tecnología, «The Silent Revolution» is a traveling exhibit that, from November 2022 to March 2024, has been displayed at a number of prominent sites in the Barcelona area including the Universitat Autònoma de Barcelona and the Institut d'Estudis Catalans. Its topic is the seventy-five-year history of the transistor. As it would appear, the transistor is a technology that, despite its foundational role and ubiquitous presence in our current era (the 'digital age', as it is called), often passes unperceived. The purpose of this exhibit, then, is to cause us to stop for a moment and perceive it.

What was the most important invention of the 20th century? Was it the airplane, first flown by the Wright brothers on the sandy shores of North Carolina in 1903, harbinger of the age of flight? Was it nuclear power, developed during the Manhattan Project, ushering in the atomic age? Was it the V-2 rocket, the launcher of the space age?

No. It was the transistor, invented seventy-five (or seventy-six) years ago, in 1947, when a research group for AT&T at Bell Labs in New Jersey demonstrated the amplifying effect of a germanium semiconductor device.

This, at least, is the thesis sustained in the exhibition. Meanwhile, the title of the exhibit, «The Silent Revolution», is a reference to a curious feature of the transistor's history— that, although our children may dream of becoming astronauts and airplanes have become quintessential icons of technological fetishism (and even nuclear power, while not immune to controversy, is at least the focus of highly mediated debates), the lowly transistor, on the other hand, has spent its seventy-five years of existence in relative obscurity.

None of this, granted, is dwelt upon in the exhibit, although, as a subtext, it gives the exhibitionary narrative a sense of '*reivindicación*'

or ‘return of what is due’— as though the transistor were an underdog of history finally due its well-deserved recognition.

Another narrative thread running through the exhibit is that of ‘digital revolution’. Each of the seven informational posters that comprise the body of the exhibit’s exposition is printed on a background of red gradient giving way to blue. This visual metaphor is punctuated by the addition of three dates and accompanying graphics representing the three stages of this revolution: 1947, the invention of the point-contact transistor; 1960, the invention of bipolar ‘MOSFET’ transistors used in high-density integrated circuits; and 2022, the current digital age, represented by an array of 1’s and 0’s.

It should be mentioned that this historiographical approach mirrors that of a recent book written by Ignacio Mártil titled *Microelectrónica: La historia de la mayor revolución silenciosa del siglo xx*. Mártil is a Professor of Electronics at the Universidad Complutense de Madrid and a member of the Real Sociedad Española de Física, as well as a science popularizer through, among other things, his blog *Un poco de ciencia, por favor*. His presentation («El 75 aniversario del Transistor Bipolar: La invención más importante del siglo xx») within the lecture-series organized in parallel to the «Silent Revolution» exhibit and hosted by the Institut d’Estudis Catalans (IEC) can be accessed online through the youtube channel of the Institute of Microelectronics of Barcelona (CSIC).

Now, here I must admit that, despite having recently earned my doctorate in the history of science from the Universitat Autònoma de Barcelona, when I first visited this exhibition and looked up the associated series of lectures online, I was largely ignorant of the history of the transistor. And so I was interested to hear Mártil’s account of that ‘miraculous trimester’ at Bell Labs in 1947. I was amused by the stories of the boyish competitiveness of Shockley, Bardeen, and Brattain— the transistor’s three primary inventors and 1956 Nobel Prize winners in physics. Apparently, when it came time to take a photo for the press, it was Shockley who shoved the other two aside and claimed the coveted position of center-frame.

Of course, none of this is particularly dwelt upon in the exhibit itself, where Shockley and the rest get little more than a few lines of text. But this is simply due to the brevity of the exhibit’s exposition, which could probably be printed in its entirety on a single page of paper and still be readable. My complete visit took less than twenty minutes, although I did stop to linger by the two display tables containing an assortment of transistor paraphernalia laid out behind glass. The panel on microchip manufacturing also caught my eye with its brief yet impenetrable depictions of the eight-stage photolithographic printing process.

It was the final panel of the exhibit, however, that proved to be the most revelatory. There, I learned that the Institute of Microelectronics of Barcelona (IMB) is not only the largest research center in Spain for the investigation of electronic micro and nanotechnologies, but —significantly— it is also the only center in Spain with the capacity for manufacturing integrated circuits. This is due to the IMB’s 1,500 m² ‘white room’ where the condi-

tions of extreme cleanliness and climate control required for microchip printing are carefully maintained.

And so it was that I suddenly found myself considering the transistor (and, specifically, the microchip) in a new light— not just as the protagonist of a 'silent revolution' but as a key product within a precarious global supply chain in which Spain finds itself facing an enormous external dependence. As I was later informed by a Caixabank Research report from 2022¹, a shortage of microchips has set alarm bells ringing throughout Europe. The Spanish government has approved over twelve billion euros of public funds designated for creating domestic microchip production plants. Currently, top-of-the-line microchips are produced almost exclusively in Taiwan (63% of the total), South Korea (18%), China (6%) and the US.

Again, none of this is mentioned in the exhibit. And that is a shame, because it certainly puts the whole thing into perspective. Right now, it would seem, is actually a *very* opportune time to stop for a moment and consider the humble transistor— and our reliance on it. But, instead, the exhibition's creators only hint at this looming contemporary context, opting, rather, to tell a classic tale of American (and Spanish) technological ingenuity. As though the passing of the somewhat arbitrary timespan of seventy-five years represented, in itself, a perfectly natural justification for celebrating and reproducing such an account.

In short, «The Silent Revolution» exhibition can be read as an example of what journalist and lecturer Michele Catanzaro has described as the difference between science *journalism* and science *popularization* (or 'divulgación', in Spanish). Whereas good journalism involves the weaving together of a narrative from the discourses of various (and sometimes conflicting) interested parties, popularization is often just another name for the press release pipeline of scientific institutions. And whereas journalism, at its best, aims to equip its audience with tools for critical engagement in issues of contemporary significance, popularization can, at times, infantilize its audience as though they were students in a grade-school science class.

This, then, brings us back to «The Silent Revolution». Can an exhibition that neither poses questions nor indicates a pathway for engagement really be expected to «un-silence» the role of the transistor in our society? At the very least, it is a start. What is needed now is a space for deeper reflection and dialogue regarding this fundamental technology and, particularly, its role in the semiconductor crisis of today.

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1. <https://www.caixabankresearch.com/en/economics-markets/public-sector/chip-perte-project-will-spain-manage-gain-foothold-microchip>