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### Benedetta Campanile

*Vannevar Bush da ingegnere a tecnologo. La nascita della società dell'informazione.*

Prefazione di Mauro Di Giandomenico, Parmenide Collana del Seminario di Storia della Scienza 4. Rome: Aracne Editrice, 2016, 276 pp., ISBN: 978-88-548-9528-7

It is certainly no easy task to historically analyze the versatile figure of Vannevar Bush – a scientist whose name is generally associated with the Manhattan Project and two fundamental contributions to computer science (the invention of the first analogue computer and *Memex*) – but who was also a teacher, an administrator, a science politician and a man of institutions. Campanile, however, fully succeeds in the challenge, publishing a volume that alternates the detailed study of numerous inventions by Bush with vivid reconstructions of the historical, social and political contexts in which he moved and of his interactions with the academic, business, political and military world, both in US and in Europe.

The story opens with an overview of American culture during the years of Bush's training, firstly at Chelsea High School, then at the University of Tufts, and finally at the Master's degree course in Electrical Engineering at MIT (1916). According to a pattern of dynamic continuity, which moves from the reform of the institutions fostered by A.D. Bache and, even earlier, by F.R. Hassler, the roots of Bush's vision of the role of science, technology, and the links between academy and business date back to those years. This was also the period of Bush's first invention (the *Profile Tracer*) and of his interest, derived from the *lectio* of G.C. Anthony, in the definition and applications of the graphic language, thanks to which he was then able to engineer electrical circuits (1929), achieving a new model for the description of hydraulic, mechanical, electrical and acoustic phenomena.

In the second chapter, attention is focused on the creative path that led Bush to the realization of the *Differential Analyzer* (1925–1930), the “great electro-mechanical brain”, whose genesis and history are here related to the economic and political circumstances, both at national and international levels, which contrasted the affirmation of analogue machines in favour of digital ones. The functioning of the *Differential Analyzer*, the various technologies that Bush and his students (among whom H.R. Stewart, F.D. Gage, H.E. Edgerton and G.S. Brown) developed and the different devices (*Intergraph*, *Photo-electric Intergraph*, *Cinema Intergraph*) that they created, are examined by the author, who demonstrates her in-depth expertise in the numerous mathematical and engineering aspects related to the planning, construction and use of these machines. The analysis of the apparatus and technologies goes hand-in-hand with that of the turning points and stances of Bush's thinking, which matured

in this time: his intention to promote the use of automatic instruments of computation in a wide range of disciplines (astrophysics, atomic theory, geology, electronics and ballistics ...); the desire to consider computers as supports for scientific research *and* as teaching aids “capable of reducing the fatigue of mental work needed for learning complex concepts”; and his role in spreading a new way of doing science, which would subsequently influence the practices of the *Big Science* laboratories. Tracing Bush’s contacts with the Rockefeller Foundation, his projects in the *Center of Analysis* at MIT and in the *Office of Scientific Research and Development*, one can understand the transition from the automatic treatment of numbers to the automatic treatment of information, in the decade 1935–1945. Moreover, some cornerstones of the thinking and action of this scientist are clarified: the enhanced relationship between pure and applied mathematics, sometimes emulating, sometimes in competition with the European milieu; the opening towards new collaborative working methods; the organizational and communicative skills in dialoguing with governmental, military institutions and industry; the awareness of the power of information, conceived as a “tool for shaping institutional policy”. Campanile therefore comes to an original re-reading of some aspects of Bush’s scientific and biographical trajectory: the reasons for his “aversion” to the digital paradigm, and the choice – often agonizing – to abandon some research lines (for example, those concerning the *Rapid Selector*), to ensure his commitment to the Federal government, at the service of national administration and security.

The fourth chapter expands the subject matter to Bush’s studies in the field of automatic information processing, with particular reference to his famous article *As we may think* (1945), where he designed an analogue device for assisting the mind, which “should not replace the mind, but strengthen the intellectual activity of information retrieval through associations or *trials*”. This is the *Memex*, considered by the computer science community as an archetype of the hypertext. The book concludes by investigating Bush’s intention to trigger, through information technologies, a transformation of human ways of working and interacting, in line with the assumptions of Cybernetics and Human-Computer Interaction Theory. Two Appendices are devoted, respectively, to the List of Bush Patents and to sixteen lively biographical profiles of his scientific interlocutors.

The volume stands out for its pleasantly narrative prose, as free from technicalities as possible, and for the ample and solid documentary apparatus, derived from unpublished sources kept in the archives of *American Association for the Advancement of Science*, *Argonne Laboratory*, *National Security Agency*, *National Aeronautics and Space Administration* and *National Archives and Records Administration*. The restrictions of military secrecy, still currently

in effect, have however prevented a complete investigation of certain aspects and implications of Bush's work (e.g. concerning devices like the *Rapid Arithmetical Machine* and the *Comparator*).

Just one element may jar on the reader: the decision to rely solely on footnotes for references to secondary literature, circumscribing the bibliography to archive sources and Bush's works.

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