Early History of Computing in Switzerland: Discovery of Rare Devices, Unknown Documents, and Scarcely Known Facts

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Some aspects of computing history in Switzerland are well known to computing historians, such as Heinz Rutishauser's early work with automatic programming[1] and Algol, Niklaus Wirth's creation of Pascal,[2] both at ETH Zurich, and developments at IBM's Zurich research laboratory.[3] However, other Swiss contributions to early history of computing are less well known. A good place to research the history of other early achievements is in the archives of the main library of ETH Zurich and its "Sammlung Sternwarte" (collection of astronomical instruments). Another good source is the archive of the Neue Zürcher Zeitung, the leading Swiss daily newspaper, founded in 1780.

In this note, I relate some of what I have learned about the early history of computing in Switzerland, about rare devices, forgotten documents, and scarcely known facts; and I suggest some of my journey as a computer scientist turned historian.

The ETH Archive, Institute for Applied Mathematics, and a Zuse Z4

In 2010 on the occasion of the 100th anniversary of the birth of Konrad Zuse, I began systematically examining the archives of the main library of ETH (Eidgenössische Technische Hochschule) Zurich. It was my intention to write a book related to the centenary.[4] Because of the right to privacy, the access to archival material was delayed for 50 years. Thus, in 2010, I was allowed to look at the computing records in the archive for the 1940s and 1950s. I believe it was the first time that the archive was thoroughly studied with respect to applied mathematics, and I was astonished by what I learned about the facts and fascinating historic calculating devices in Switzerland, and to some extent in Germany and France.

Computer science in Switzerland had started in 1948 with the foundation of the Institute for Applied Mathematics; there was a computational need for the solution of mathematical, physical, chemical, and engineering problems (e.g., differential equations for the construction of machines, bridges, barrages [dams], and even a jet fighter). Of course, the terms "computer science" and "informatics" did not yet exist. The first director of the institute was the mathematician Eduard Stiefel. He wanted to promote applied mathematics and "avoid backwardness." In the early 1950s the first programming courses were introduced at ETH.

Also in 1948, ETH Zurich wanted to build a digital computer. At this time such devices were not yet commercially available either in America or in Europe (an exception was the unknown Zuse Z4 noted below). However, nobody in Switzerland had the knowhow required to build a computer. Therefore Stiefel and his two assistants, Heinz Rutishauser and Ambros Speiser, spent several months in the United States; Rutishauser was a mathematician, and Speiser was an electrical engineer. They visited Howard Aiken at Harvard University in Cambridge, Massachusetts, and John von Neumann[5] at the Institute for Advanced Study in Princeton, New Jersey.

In 1949, by chance, Eduard Stiefel became aware of a Zuse machine (a Z4) at Hopferau near Füssen.[6] In 1945, Konrad Zuse had fled from Berlin to Bavaria. His Z1, Z2, and Z3 devices and his S1 and S2 special machines had disappeared or been destroyed in the war, and the Z4 was his only surviving calculator. Stiefel visited Zuse in 1949 in Allgäu and tested the Z4 relay computer. As it was rather inexpensive and the institute desired to have more powerful calculating devices as soon as possible, ETH decided to rent the Z4. (We do not know how Stiefel learned about the existence of the machine.)

The Z4 became commercially available in 1945; but in the difficult postwar period, nobody was willing to buy it. The German institutions did not understand the importance of the Zuse machine or they had no money. IBM was only interested in the patents as the Z4 was not a fast electronic but a relay calculator. Nevertheless, Zuse began developing his programming language, Plankalkül, which even included non-numerical applications such as playing chess. He was thinking of a machine capable of logic not just crunching numbers. The rental agreement between Zuse and the Institute for Applied Mathematics was made in 1949. The machine was made operational between 1949 and 1950. Switzerland paid 50 thousand Swiss francs for the completion and extension of the Z4 electromechanical calculator. At first there was no conditional branching. This feature was added upon request of ETH.

Z4 was a slow computer without a stored program; yet the Zuse machine was more modern than many similar US devices: it was a binary, programmable, tape-controlled calculating machine with floating-point arithmetic. It had a rather strange mechanical memory which needed less space than relay storage. In the ETH archive,

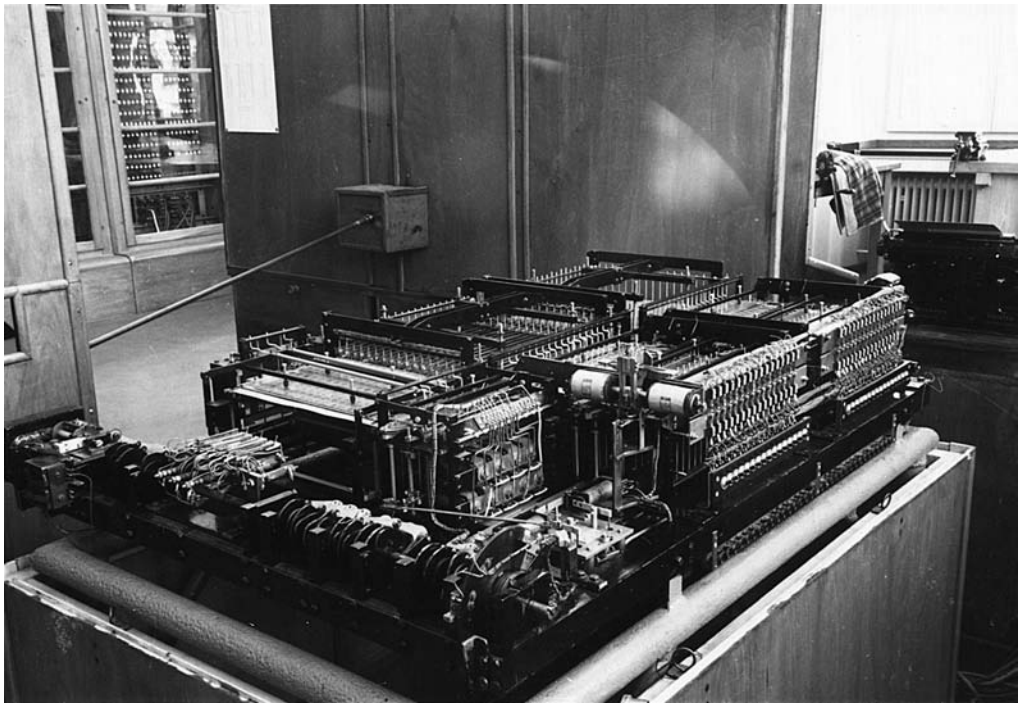

Figure 1. Mechanical memory of the program-controlled binary relay calculator, Zuse Z4, with floating-point arithmetic (courtesy of ETH Library, Zurich).

there is a list of 55 tasks[7] carried out using the Zuse Z4. (The contract and the use of the Z4 in Zurich [1950–1955] provided important academic recognition of Zuse's work.[8])

The rental of Z4 resulted in ETH postponing building its own machine. Then in 1963, ETH bought a commercial computer produced by Control Data Corporation.

In my judgment, the rental of the Zuse Z4 relay calculator from Konrad Zuse and the construction of the first Swiss electronic computer ERMETH (Elektronische Rechenmaschine der ETH [described below]) and their scientific uses were the most significant 1950s events in the early history of computing in Switzerland.

More About the Early ETH Team: ERMETH

In 1951, Rutishauser, Speiser, and Stiefel published an influential but forgotten manual on electronic digital computers, including a worldwide survey of computer projects.[9] They mention Alan Turing's automatic computing engine but there is no reference to his now famous 1936 paper on computable numbers. In the same year, the most important early European computer conference "Colloques internationaux du Centre national de la recherche scientifique" took place in Paris.[10] In his paper, found at ETH archive, Stiefel presented the results of the work done so far at ETH with the Z4. Apart from Howard Aiken and Norbert Wiener, there were many British participants, but Turing was absent.[11] There are not many connections between Turing and ETH Zurich: Turing did spend several weeks travelling in Switzerland at one point in his life; and in 1937, the Swiss mathematician Paul Bernays discovered some mistakes in Turing's 1936 essay[12] (Turing published a revised version of his paper).[13]

In the early 1950s, the United Nations Educational, Scientific and Cultural Organization (UNESCO) tried to establish an international computation center in Europe. The University of Zurich and ETH Zurich were one of three applicants (the others were Italy and The Netherlands).[14] Herman Goldstine, von Neuman's collaborator in Princeton, was in charge of the selection. Later on, Switzerland withdrew its candidacy. At the end, UNESCO decided to found the center in Rome. Due to financial problems it was never really put in operation.

Stiefel, Rutishauser, and Speiser were responsible for the construction of the first

Figure 2. Zuse's electromechanical calculating punch M9 mass-produced in cooperation with Remington Rand, Zurich (courtesy of Max Forrer).

Swiss electronic digital computer ERMETH. Rutishauser is one of the main fathers of what was then known as automatic programming (1951) and one of the leading creators of the programming language Algol. Speiser was the founding director of the IBM Research Center near Zurich.[15] In Zurich the Italian Corrado Böhm,[16] one of Stiefel's assistants, wrote a doctoral dissertation on compilers. In 1949 Bohm had tested the Z4 in Germany and written a report in cooperation with the Swiss engineer Harry Laett.

My research of the early history of computing in the ETH archive and other places is still going on. Only recently I found documents which indicate that, in the 1950s, Hasler AG (now Ascom) had planned to market ERMETH and its magnetic drum storage. The Bernese company had manufactured this vacuum tube computer and had supported it financially. IBM was a competitor of Hasler. This intention to commercialize the machine was abruptly given up because ERMETH's chief engineer, Speiser, left ETH to become the first director of IBM Research at Adliswil (now Rüschlikon). Until a short time ago, it was generally believed that originally Swiss industry had no interest in constructing computers.

Other Early Computing Devices

In this section, I will say something about each of the early devices shown in Table 1.

Zuse M9. Also in connection with Zuse's 100th birthday on 22 June 2010, I spoke with Josef Steinmann, an engineer formerly with Remington Rand Switzerland, about the existence of another early Zuse machine, the relay calculating punch M9 (=Z9). This device is mentioned in Konrad Zuse's memoirs but without a name. M9 was the first Zuse machine manufactured in quantity. Remington Rand, Zurich, ordered the calculators. This equipment was used for many years by a textile company in the Swiss mountain valley of Toggenburg. The program-controlled machine was preserved at the repository of Technorama, a large museum of technology in Winterthur where it was largely forgotten. In 2010, M9

Table 1. Other early analog and digital calculating devices in Switzerland.

Year	Device	Operation
2010	Zuse M9 (1953)	Program-controlled calculating punch
2011	Cora (1963)	First Swiss transistor computer
2013	24-m Loga calculator (1910)	World's largest mass-produced cylindrical slide rule
2014	Schwilgué (1844)	World's earliest extant key-driven adding machine
2014	Thomas arithmometer (1863)	Early copy of the world's first successful calculating machine
2015	Multiple Curta (1954)	Engineering drawings and patent documents
2016	24-m Loga calculator (1910)	Seventh surviving copy of 24-m Loga calculator

was transferred to the Museum für Kommunikation in Berne. However, the machine was in poor condition and had to be repaired. In the 1950s, Zuse had manufactured more than 20 copies of M9; apparently only one has survived. Together with the Bernese museum, in 2011, I organized an oral history interview with several M9 engineers, and so we were informed about other eyewitnesses and M9 users. In 2011, previously unknown high-quality technical drawings and some photographs of M9 emerged in Toggenburg. From these we learned how the M9 looked and that the extant machine in Berne is incomplete.[17]

Cora. In 2011, a local press agency declared that in 1963, Contraves, Zurich, an arms factory, had constructed the first Swiss transistorized computer called Cora. Its builder was the Hungarian engineer Peter Toth. The only remaining Cora is on exhibition at the Ecole Polytechnique Fédérale (EPFL), Lausanne. Contraves built a second mark, Cora 2, which was used for computer-aided design (Coragraph).

Loga Calculator. In 2013, I happened to find two large early logarithmic calculating aids, one at the Department of Computer Science of ETH Zurich[18] and one at the rather unknown museum of Union Bank of Switzerland (UBS) headquarters in Basle. To our knowledge these 24-m-long Loga calculators are the world's largest mass-produced and probably the most precise cylindrical slide rules. In the early 20th century, these analog devices were produced by Loga Calculator in Zurich and Uster (near Zurich). The length of the logarithmic scale is 24 m (80 lines $\times$ 60 cm $=$ 48 m; due to overlapping scale sections, only 24 m can be used). In September 2016, the seventh surviving copy of the 24-m Loga calculator turned up in the Swiss Canton of Thurgau (Komturei, Tobel). Apart from Loga Calculator there were two other important manufacturers of cylindrical slide rules, Billeter and National, both in Zurich. Numerous Loga documents are to be found at the Schweizerisches Wirtschaftsarchiv in Basle. Incidentally, there were two independent discoveries of logarithms, one by John Napier (Scotland) and the other by Jost Bürgi (Switzerland). Bürgi invented them first; Napier published them first.[19]

Schwilgué and Thomas. In 2014, Heinz Joss (a slide rule collector) and I were looking for a historic slide rule and visited the Sammlung Sternwarte (collection of astronomical instruments) of ETH Zurich's main library. To our delight, we found an early copy (1863) of a Thomas arithmometer[20] and one of the very rare surviving copies of Schwilgué's key-driven adding machines (patented in 1844). It is in much better condition than the device in Strasbourg; it is preserved at ETH main library. Jean-Baptiste Schwilgué redesigned the famous astronomical clock of the Cathedral in Strasbourg. The cover of my book "Meilensteine der Rechentechnik. Zur Geschichte der Mathematik und der Informatik" shows this almost unknown, forgotten historic calculating machine.[21,22]

Multiple Curta. The pretty four-function stepped-drum machine Curta, which looks like a pepper mill, is probably the finest mechanical pocket calculator. In 2015, I found high-quality engineering drawings of multiple Curtas and patent documents from Vienna. They are located in Beck's museum at Pfäffikon near Zurich, which preserves the writings of Curta's inventor Curt Herzstark, a highly gifted Austrian engineer who was deported to Buchenwald concentration camp. Two, four, or five machines can be combined to a parallel mechanical calculator. Unfortunately, the multiple Curta was never built.[23]

Swiss Ancestors of ENIAC Builders Eckert and Mauchly

According to an email of 16 September 2016 from Bill Mauchly, son of the ENIAC (Electronic Numerical Integrator and Computer)

co-inventor, John William Mauchly's great grandfather Pankratius Fidelis Mauchle (1813–1854) of Straubenzell emigrated to Ohio. Straubenzell now belongs to the Swiss city of St. Gallen. The grandfather's name was John William Mauchly or Mauchle (1850–1918). Stefan Sonderegger (archivist of the city of St. Gallen) told me that, since the late middle ages, members of the Mauchle family had owned one of the largest farms in the Heiliggeistspital St. Gallen, called Schoretshueb. Adrian Zwahlen published an essay "Das Textil- und Transportgewerbe des mittelalterlichen Hofs 'Schoretshueb' St. Gallen. Mikrogeschichte als wichtiger Zugang zur Erforschung des ländlichen Nebengewerbes" in the journal Traverse (vol. 21, 2014, no. 2, pp. 29-39) and a master thesis titled "Die wirtschaftliche Entwicklung der Schoretshueb, eine Mikrogeschichte zur spätmittelalterlichen Getreideproduktion in der spezialisierten Landwirtschaft der Nordostschweiz" (University of Zurich, 2012, 130 pp.).

In the archives of the "Neue Zürcher Zeitung," the leading Swiss daily newspaper, I found a letter to the editor of 24 May 2002. The author, Samuel Matthias Haffter (Basle), reports that both of the ENIAC inventors were of Swiss origin. All his life, Hans Mauchly spoke Swiss German (more precisely: Bernese German). Gini Mauchly Calcerano, who studied German in Germany (email of 21 September 2016), confirmed that, as a child, her father lived in Ohio in an area that was largely German, and the public school classes were held in German until World War I. There were a lot of Swiss Germans in the area.

Haffter drove by car to the "Appenzellerland" accompanied by Pres Eckert and his wife.[24] There they were looking for traces for his ancestors. Appenzell is split into two half-cantons, Appenzell Ausserrhoden und Appenzell Innerrhoden. The Swiss phonebook contains 2 entries for Eckert in Appenzell Ausserrhoden and more than 60 entries for a similar, more common name, Egger (0 Eckert and 2 Egger in Appenzell Innerrhoden). This indicates that Eckert's ancestors might have lived in Appenzell Ausserrhoden.

In the late 1950s, Haffter met Eckert and Mauchly at Univac in Philadelphia. According to emails of 22 September and 1 October 2016, he did not remember the precise date and the exact place in the Appenzellerland. Eckert's visit to Switzerland took place in the 1960s. Haffter was a member of staff of Remington Rand, Zurich.[25]

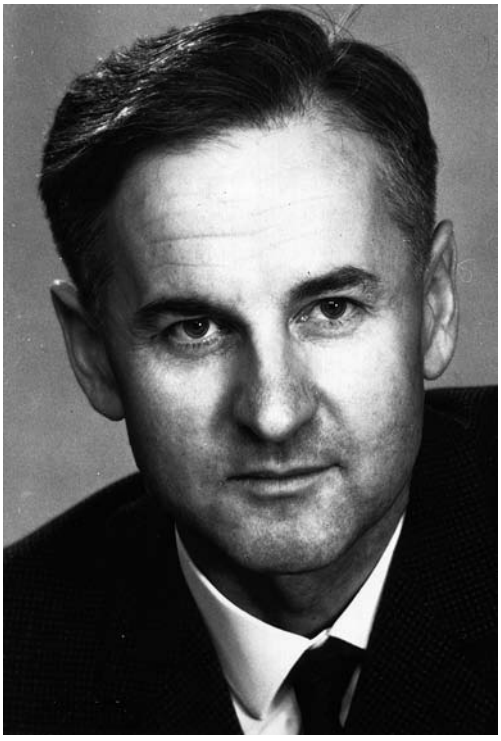

Figure 3. Heinz Rutishauser, the most famous early Swiss computer pioneer (courtesy of ETH Library, Zurich).

Figure 4. The world's largest and most precise mass-produced logarithmic cylindrical slide rule Loga calculator. Scale length: 24 m (courtesy of Konzernarchiv UBS).

Final Note

When I started my research in 2009, my main interest concerned the relationship between Konrad Zuse and ETH Zurich. Due to the surprising discovery of unknown documents and precious analog and digital calculating devices, I am now preparing a second revised and enlarged edition of my book "Meilensteine

Figure 5. The world's oldest extant key-driven adding machine was invented by Jean-Baptiste Schwilgué, creator of the astronomical clock of Strasbourg Cathedral, on the book cover of "Meilensteine" (courtesy of De Gruyter Oldenbourg, Berlin/Boston).

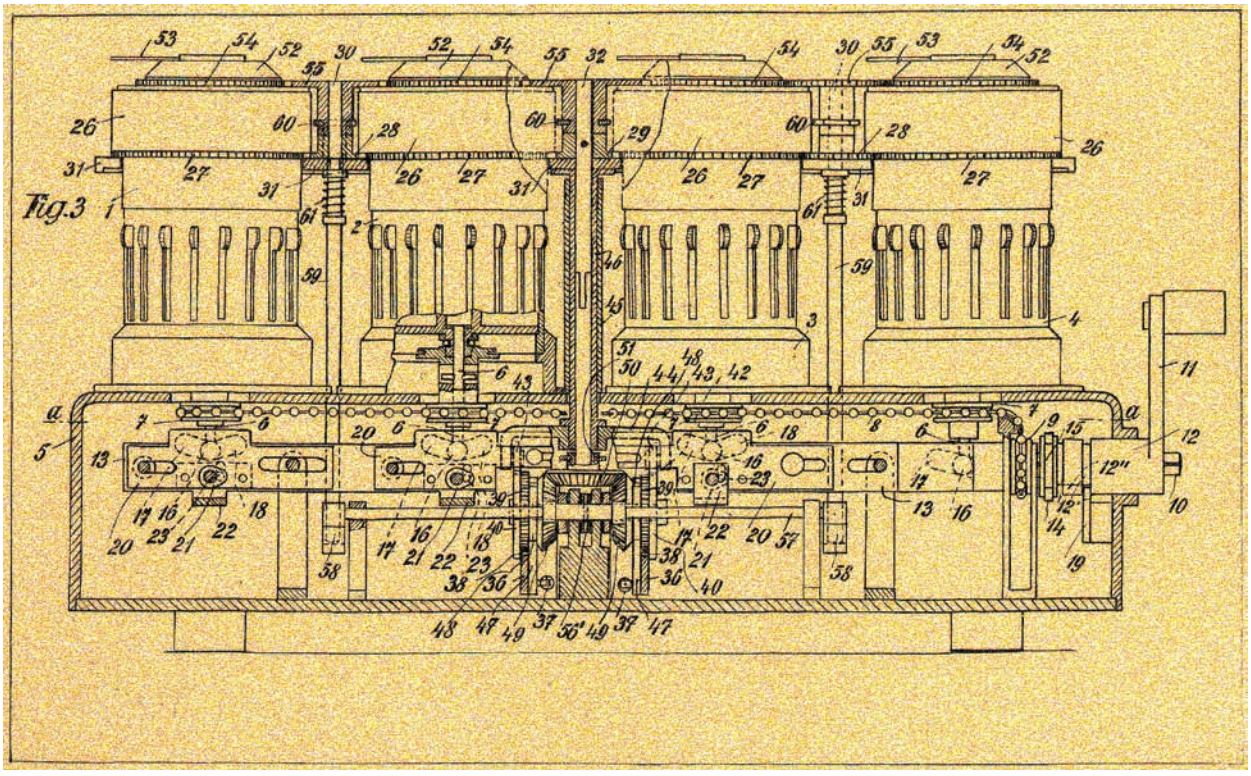

Figure 6. Multiple (four-fold) Curta by the Austrian engineer Curt Herzstark, the world's smallest mechanical parallel calculator (courtesy of Museum Beck, Pfäffikon).

der Rechentechnik. Zur Geschichte der Mathematik und der Informatik."[26]

References and Notes

1. H. Rutishauser. Automatische Rechenplanfertigung bei programmgesteuerten Rechenmaschinen. Birkhäuser Verlag, Basel, 1952, 45 pp.
2. N. Wirth. "A Brief History of Software Engineering." IEEE Annals of the History of Computing, vol. 30, no. 3, 2008, pp. 32–39.
3. A. P. Speiser. "The Relay Calculator Z4." Annals of the History of Computing, vol. 2, no. 3, 1980, pp. 242–243.
4. H. Bruderer. Konrad Zuse und die Schweiz. Wer hat den Computer erfunden? de Gruyter Oldenbourg. Berlin/Boston, 2012, xxvi, 224 pp.
5. Von Neumann had studied chemistry at ETH Zurich.
6. K. Zuse. The Computer, My Life, Springer Verlag, 1993, 259 pp.
7. H. Bruderer. Wofür wurde der Relaisrechner Z4 von Konrad Zuse an der ETH Zürich verwendet?. Available at http://dx.doi.org/10.3929/ethz-a-006620309
8. A. P. Speiser. "The Relay Calculator Z4." Annals of the History of Computing, vol. 2, no. 3, 1980, pp. 242–243.
9. H. Rutishauser, A. P. Speiser, and E. Stiefel. Programmgesteuerte digitale Rechengeräte (elektronische Rechenmaschinen). Birkhäuser Verlag, 1951, 102 pp.
10. H. Bruderer. "The Birth of Artificial Intelligence. First Conference on Artificial Intelligence in Paris in 1951?" International Communities of Invention and Innovation. IFIP Proceedings, A. Tatnall, C. Leslie, eds., Springer, pp. 181–185.
11. The voluminous proceedings were translated into French. Both reports indicate that "On computable numbers" had only a small impact on the development of the stored program computer.
12. P. Bernays, Letter to Alan Turing of 24 September 1937, Archive of King's College, University of Cambridge, 3 pp.
13. As there is a lot of research in theoretical computer science in Zurich, in 2012, an international Turing conference took place at ETH as part of the Turing centenary, of which I was a co-organizer.
14. "UNESCO: Bericht über die Bewerbung von ETH und Universität Zürich um den Sitz eines internationalen Instituts für angewandte Mathematik," 7. Juli 1951, ETH archive.
15. A. P. Speiser, "IBM Research Laboratory, Zurich: The early years," IEEE Annals of the History of Computing, vol. 20, no. 1, 1998, pp. 15–35.

16. C. Böhm. "Calculatrices digitales du déchiffrage de formules logico-mathématiques par la machine même dans la conception du programme," PhD dissertation, ETH Zürich, 1954, 51 pp.
17. H. Bruderer, "Discovery of Two Historical Computers in Switzerland: Zuse Machine M9 and Contraves Cora and Discovery of Unknown Documents on the Early History of Computing at the ETH Archives," Making the History of Computing Relevant. IFIP WG 9,7 (International Conference, HC), 2013; revised selected papers, Springer, Heidelberg, New York, 2013, pp. 96–104 (IFIP Advances in information and communication technology, vol. 416).
18. I taught didactics of computer science at ETH Zurich.
19. J. Waldvogel, "Jost Bürgi and the Discovery of the Algorithms." Elemente der Mathematik, vol. 69, no. 3, 2014, pp. 89–117.
20. This mechanical calculating machine was patented in 1820, but successful production started in the 1850s.
21. H. Bruderer, "Meilensteine der Rechentechnik." Zur Geschichte der Mathematik und der Informatik, De Gruyter Oldenbourg. Berlin/Boston 2015, 850 pp. Available at http://www.degruyter.com/view/product/432414, http://www.maa.org/press/maa-reviews/meilensteine-der-rechentechnik
22. H. Bruderer, "Computing History Beyond the UK and US: Selected Landmarks from Continental Europe," Communications of the ACM, vol. 60, no. 2, 2017, pp. 76–84.
23. H. Bruderer, "The World's Smallest Mechanical Parallel Calculator. Discovery of Original Drawings and Patent Documents from the 1950s in Switzerland," International Communities of Invention and Innovation, IFIP Proceedings, Springerpp. 186–192.
24. His second wife; his first wife had died.
25. In cooperation with Samuel Matthias Haffter, Thomas Haigh, Bill Mauchly, Gini Mauchly, Chris Eckert, Jim Scherrer, Stefan Sonderegger, I tried to find out more about the Swiss ancestors of the ENIAC pioneers John Presper Eckert and John William Mauchly. Many thanks to them.
26. I am hoping to find a sponsor for an English translation of the second edition.

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