

Walter Pitts


Walter Harry Pitts, Jr. (23 April 1923 – 14 May 1969) was a logician who worked in the field of computational neuroscience.^[1] He proposed landmark theoretical formulations of neural activity and generative processes that influenced diverse fields such as cognitive sciences and psychology, philosophy, neurosciences, computer science, artificial neural networks, cybernetics and artificial intelligence, together with what has come to be known as the generative sciences. He is best remembered for having written along with Warren McCulloch, a seminal paper in scientific history, titled "A Logical Calculus of Ideas Immanent in Nervous Activity" (1943). This paper proposed the first mathematical model of a neural network. The unit of this model, a simple formalized neuron, is still the standard of reference in the field of neural networks. It is often called a McCulloch–Pitts neuron. Prior to that paper, he formalized his ideas regarding the fundamental steps to building a Turing machine in "The Bulletin of Mathematical Biophysics" in an essay titled "Some observations on the simple neuron circuit".

Contents
<u>Early life</u>
<u>Academic career</u>
<u>Personal life, emotional trauma and decline</u>
<u>Publications</u>
<u>References</u>
<u>Further reading</u>
<u>External links</u>

Early life

Walter Pitts was born in Detroit, Michigan on April 23, 1923, the son of Walter and Marie (née Welsia). He was an autodidact who taught himself logic and mathematics and was able to read several languages including Greek and Latin. His father and brothers were rough, uneducated, and regarded Walter as a freak. He is widely remembered for having spent three days in a library, at the age of 12, reading *Principia Mathematica* and sent a letter to Bertrand Russell pointing out what he considered serious problems with the first half of the first volume. Russell was appreciative and invited him to study in the United Kingdom. Although Bertrand Russell invited him to Cambridge University at age 12, the offer was not taken up; however, Pitts did decide to become a logician. At age 15 he ran away from home, and from that time he refused to speak of his family.

Walter Pitts



Pitts around 1954 when he was at M.I.T.

Born	Walter Harry Pitts, Jr. 23 April 1923 <u>Detroit</u> , <u>Michigan</u> , United States
Died	14 May 1969 (aged 46) United States
Scientific career	
Fields	<u>Logician</u>

Academic career

Pitts probably continued to correspond with Bertrand Russell; and at the age of 15 he attended Russell's lectures at the University of Chicago.^{[1][2]} He stayed there, without registering as a student. While there, in 1938 he met Jerome Lettvin, a pre-medical student, and the two became close friends.^[3] Russell was a visiting professor at the University of Chicago in the fall of 1938, and he directed Pitts to study with the logician Rudolf Carnap.^[3] Pitts met Carnap at Chicago by walking into his office during office hours, and presenting him with an annotated version of Carnap's recent book on logic, *The Logical Syntax of Language*.^[4] Since Pitts did not introduce himself, Carnap spent months searching for him, and, when he found him, he obtained for him a menial job at the university and had Pitts study with him. Pitts at the time was homeless and without income.^[5] He mastered Carnap's abstract logic, then met with and was intrigued by the work of the Russian mathematical physicist Nicolas Rashevsky, who was also at Chicago and was the founder of mathematical biophysics, remodeling biology on the structure of the physical sciences and mathematical logic.^[6] Pitts also worked closely with the mathematician Alston Scott Householder, who was a member of Rashevsky's group.^{[7][8][9]} During his studies under Carnap, Pitts was also a regular attendant at Nicolas Rashevsky's seminars in theoretical biology, which included Frank Offner, Herbert Landahl, Alston Householder, and the neuroanatomist Gerhardt von Bonin from the University of Illinois at Chicago. In 1940, Von Bonin introduced Lettvin to Warren McCulloch, who would become a professor of psychiatry at Illinois.



Walter Pitts (right) with Jerome Lettvin, co-author of the cognitive science paper "What the Frog's Eye Tells the Frog's Brain" (1959)

In 1941 Warren McCulloch took a position as professor of psychiatry at the University of Illinois at Chicago, and in early 1942 he invited Pitts, who was still homeless, together with Lettvin to live with his family.^[10] In the evenings, McCulloch and Pitts collaborated. Pitts was familiar with the work of Gottfried Leibniz on computing and they considered the question of whether the nervous system could be considered a kind of universal computing device as described by Leibniz. This led to their seminal neural networks paper "A Logical Calculus of Ideas Immanent in Nervous Activity". After five years of unofficial studies, the University of Chicago awarded Pitts an Associate of Arts (his only earned degree) for his work on the paper.^[11]

In 1943, Lettvin introduced Pitts to Norbert Wiener at the Massachusetts Institute of Technology. Their first meeting, where they discussed Wiener's proof of the ergodic theorem, went so well that Pitts moved to Greater Boston to work with Wiener. While Pitts was an unofficial student under the aegis of Wiener at MIT until their acrimonious parting in 1952, he formally enrolled as a graduate student in the physics department during the 1943-1944 academic year and in the electrical engineering-computer science department from 1956-1958.^{[11][12]}

In 1944, Pitts was hired by Kellex Corporation (later acquired in 1950 by Vitro Corporation) in New York City, part of the Atomic Energy Project.^[13]

From 1946, Pitts was a core member and involved with the Macy conferences, whose principal purpose was to set the foundations for a general science of the workings of the human mind.

Personal life, emotional trauma and decline

In 1951, Wiener convinced Jerome Wiesner to hire some physiologists of the nervous system. A group was established with Pitts, Lettvin, McCulloch, and Pat Wall. Pitts wrote a large dissertation on the properties of neural nets connected in three dimensions. Lettvin described him as "in no uncertain sense the genius of the group ... when you asked him a question, you would get back a whole textbook." Pitts never married.^[1] Pitts was also described as an eccentric, refusing to allow his name to be made publicly available. He continued to refuse all offers of advanced degrees or positions of authority at MIT, in part as he would have to sign his name.

In 1952, Wiener suddenly turned against McCulloch—his wife, Margaret Wiener, hated McCulloch^[14]—and broke off relations with anyone connected to him, including Pitts.^[14]

Although he remained employed as a research associate in the Research Laboratory of Electronics at MIT "as little more than a technicality"^[15] for the rest of his life, Pitts became increasingly socially isolated. In 1959, the paradigmatic "What the Frog's Eye Tells the Frog's Brain" (credited to Humberto Maturana, Lettvin, McCulloch and Pitts) conclusively demonstrated that "analog processes in the eye were doing at least part of the interpretive work" in image processing as opposed to "the brain computing information digital neuron by digital neuron using the exacting implement of mathematical logic", leading Pitts to burn his unpublished doctoral dissertation on probabilistic three-dimensional neural networks and years of unpublished research. He took little further interest in work, excepting only a collaboration with Lettvin and Robert Gesteland which produced a paper on olfaction in 1965.

Pitts died in 1969 of bleeding esophageal varices, a condition usually associated with cirrhosis and alcoholism.^{[1][2][14]}

Publications

- Walter Pitts, "Some observations on the simple neuron circuit" (<https://doi.org/10.1007%2FBF02477942>), *Bulletin of Mathematical Biology*, Volume 4, Number 3, 121–129, 1942.
- Warren McCulloch and Walter Pitts, "A Logical Calculus of Ideas Immanent in Nervous Activity", 1943, *Bulletin of Mathematical Biophysics* 5:115–133. Reprinted in *Neurocomputing: Foundations of Research*. Edited by James A. Anderson and Edward Rosenfeld. MIT Press, 1988. pages 15–27 (<http://dl.acm.org/citation.cfm?id=104377>)
- Warren McCulloch and Walter Pitts, "On how we know universals: The perception of auditory and visual forms", 1947, *Bulletin of Mathematical Biophysics* 9:127–147.
- R. Howland, Jerome Lettvin, Warren McCulloch, Walter Pitts, and P. D. Wall, "Reflex inhibition by dorsal root interaction", 1955, *Journal of Neurophysiology* 18:1–17.
- P. D. Wall, Warren McCulloch, Jerome Lettvin and Walter Pitts, "Effects of strychnine with special reference to spinal afferent fibres", 1955, *Epilepsia Series* 3, 4:29–40.
- Jerome Lettvin, Humberto Maturana, Warren McCulloch, and Walter Pitts, "What the Frog's Eye Tells the Frog's Brain", 1959, *Proceedings of the Institute of Radio Engineers* 47: 1940–1951.
- Humberto Maturana, Jerome Lettvin, Warren McCulloch, and Walter Pitts, "Anatomy and physiology of vision in the frog", 1960, *Journal of General Physiology*, 43:129–175.
- Robert Gesteland, Jerome Lettvin and Walter Pitts, "Chemical Transmission in the Nose of the Frog", 1965, *J.Physiol.* 181, 525–529.

References

1. Smalheiser, Neil R. "Walter Pitts" (http://muse.jhu.edu/login?uri=/journals/perspectives_in_biology_and_medicine/v043/43.2smalheiser.html) Archived (https://web.archive.org/web/20160304001349/http://muse.jhu.edu/login?uri=%2Fjournals%2Fperspectives_in_biology_and_medicine/v043/43.2smalheiser.html)

[medicine%2Fv043%2F43.2smalheiser.html](#)) 2016-03-04 at the [Wayback Machine](#), *Perspectives in Biology and Medicine*, Volume 43, Number 2, Winter 2000, pp. 217–226, The Johns Hopkins University Press

2. Cf. Anderson (1998) p.218 (https://books.google.com/books?id=-l-yim2INRUC&printsec=frontcover&dq=Talking+Nets:+An+Oral+History+of+Neural+Networks&hl=en&src=bmrr&ei=cQi3TZT2PIrj0QH61_zFCg&sa=X&oi=book_result&ct=book-thumbnail&resnum=1&ved=0CDEQ6wEwAA#v=onepage&q=walter%20pitts&f=false) conversation with Michael A. Arbib
3. Cf. Conway, Flo; Siegelman, Jim (2005), p.138 (<https://books.google.com/books?id=gwaDvnqU6yYC&printsec=frontcover&vq=walterpitts#v=onepage&q=pitts&f=false>)
4. Singer, Milton, "A Tale of Two Amateurs Who Crossed Cultural Frontiers with Boole's Symbolical Algebra", *Semiotica*. Volume 105, Issue 1-2, 1995. Cf. pp. 134–138 (<http://www.reference-global.com/doi/abs/10.1515/semi.1995.105.1-2.134>)
5. "Pitts, Walter" (<http://cognet.mit.edu/MITECS/Entry/lettvin1>), MIT Encyclopedia of Cognitive Science (Archived (<https://web.archive.org/web/20030830083757/http://cognet.mit.edu/MITECS/Entry/lettvin1.html>) August 30, 2003, at the [Wayback Machine](#))
6. Cf. Conway, Flo; Siegelman, Jim (2005), p.139 (<https://books.google.com/books?id=gwaDvnqU6yYC&printsec=frontcover&vq=walterpitts#v=onepage&q=pitts&f=false>)
7. Cf. Aizawa & Schlatter
8. Cf. Anderson (1998) p.105 (<https://books.google.com/books?id=-l-yim2INRUC&dq=walter+pitts+and+alston+householder&q=alston+householder#v=snippet&q=alston%20householder&f=false>) conversation with Jack D. Cowan
9. Cf. Aizawa 1992
10. Smalheiser, Neil (2000). "Walter Pitts". *Perspectives in Biology and Medicine*. **43** (43, 2): 217–226. doi:10.1353/pbm.2000.0009 (<https://doi.org/10.1353%2Fpbm.2000.0009>). PMID 10804586 (<https://pubmed.ncbi.nlm.nih.gov/10804586>). S2CID 8757655 (<https://api.semanticscholar.org/CorpusID:8757655>).
11. Gödel, Kurt (9 January 2014). *Kurt Gödel: Collected Works* (<https://books.google.com/books?id=4pjlAgAAQBAJ&q=%22Research+Laboratory+of+Electronics%22+%22walter+pitts%22&pg=PA157>). Clarendon Press. ISBN 9780191003776 – via Google Books.
12. Cf. Conway, Flo; Siegelman, Jim (2005), pp. 141–2 (<https://books.google.com/books?id=gwaDvnqU6yYC&printsec=frontcover&vq=walterpitts#v=onepage&q=pitts&f=false>)
13. Cf. Anderson (1998) p.4 (https://books.google.com/books?id=-l-yim2INRUC&printsec=frontcover&dq=Talking+Nets:+An+Oral+History+of+Neural+Networks&hl=en&src=bmrr&ei=cQi3TZT2PIrj0QH61_zFCg&sa=X&oi=book_result&ct=book-thumbnail&resnum=1&ved=0CDEQ6wEwAA#v=onepage&q=walter%20pitts&f=false) conversation with Jerome Y. Lettvin

14. Gefter, Amanda (February 5, 2016). "The Man Who Tried to Redeem the World with Logic" (<https://web.archive.org/web/20160614095134/http://nautil.us/issue/21/information/the-man-who-tried-to-redeem-the-world-with-logic>). *Nautilus*. No. 21. MIT Press and NautilusThink (published February 5, 2017). ISSN 2372-1758 (<https://www.worldcat.org/issn/2372-1758>). Archived from the original (<https://nautil.us/issue/21/information/the-man-who-tried-to-redeem-the-world-with-logic>) on June 14, 2016. Retrieved 13 Jul 2016. "There was just one person who wasn't happy about the reunion: Wiener's wife. Margaret Wiener was, by all accounts, a controlling, conservative prude—and she despised McCulloch's influence on her husband. McCulloch hosted wild get-togethers at his family farm in Old Lyme, Connecticut, where ideas roamed free and everyone went skinny-dipping. It had been one thing when McCulloch was in Chicago, but now he was coming to Cambridge and Margaret wouldn't have it. And so she invented a story. She sat Wiener down and informed him that when their daughter, Barbara, had stayed at McCulloch's house in Chicago, several of "his boys" had seduced her. Wiener immediately sent an angry telegram to Wiesner: "Please inform [Pitts and Lettvin] that all connection between me and your projects is permanently abolished. They are your problem. Wiener." He never spoke to Pitts again."
15. Gefter, Amanda (5 February 2015). "The Man Who Tried to Redeem the World with Logic" (<http://nautil.us/issue/21/information/the-man-who-tried-to-redeem-the-world-with-logic>). *Nautilus*.

Further reading

- Aizawa, Kenneth, "Connectionism and artificial intelligence: history and philosophical interpretation", *Journal of Experimental and Theoretical Artificial Intelligence*, Volume 4, Issue 4, 1992, pages 295–313
- Aizawa, Kenneth; Schlatter, Mark, "Walter Pitts and 'A Logical Calculus'" (<https://doi.org/10.1007%2Fs11229-007-9182-9>), *Synthese* (2008) 162:235–250.
- Aizawa, Kenneth; Schlatter, Mark, "Another Look at McCulloch and Pitts's 'Logical Calculus'" (<http://philpapers.org/rec/AIZALA>), Centenary College of Louisiana, Shreveport, Louisiana
- Anderson, James A.; Rosenfeld, Edward (editors), *Talking Nets: An Oral History of Neural Networks* (<https://books.google.com/books?id=-I-yim2INRUC&printsec=frontcover>), 1998. The interview with Jerome Lettvin discusses Walter Pitts.
- Conway, Flo; Siegelman, Jim, *Dark hero of the information age: in search of Norbert Wiener, the father of Cybernetics* (<https://books.google.com/books?id=gwaDvnqU6yYC&printsec=frontcover>), Basic Books, 2005. Cf. p.138 (<https://books.google.com/books?id=gwaDvnqU6yYC&dq=walter+pitts+lecturer+mit&q=walterpitts#v=onepage&q=walter%20pitts&f=false>) & various.
- Easterling, Keller, "Walter Pitts" (<http://www.cabinetmagazine.org/issues/5/walterpitts.php>), *Cabinet*, Issue 5 Winter 2001/02
- Piccinini, Gualtiero, "The First Computational Theory of Mind and Brain: A Close Look at McCulloch and Pitts's 'Logical Calculus of Ideas Immanent in Nervous Activity'" (http://www.umsl.edu/~piccinini/First_Computational_Theory_of_Mind_and_Brain.pdf), *Synthese* 141: 175–215, 2004. Kluwer Academic Publishers A. Gefter 2016, "The Man Who Tried to Redeem the World with Logic." The Best American Science and Nature Writing

External links

- "Walter Pitts" (http://www.csulb.edu/~cwallis/artificialn/walter_pitts.html), website of Professor Charles Wallis, Department of Cognitive Science, California State University at Long Beach, accessed 30 Jan. 2009 (archived 2009)

- "The Man who Tried to Redeem the World with Logic" (<http://nautil.us/issue/21/information/the-man-who-tried-to-redeem-the-world-with-logic>), *Nautilus Magazine* issue 21, 5 February 2015
-

Retrieved from "https://en.wikipedia.org/w/index.php?title=Walter_Pitts&oldid=1097423035"

This page was last edited on 10 July 2022, at 17:20 (UTC).

Text is available under the Creative Commons Attribution-ShareAlike License 3.0; additional terms may apply. By using this site, you agree to the Terms of Use and Privacy Policy. Wikipedia® is a registered trademark of the Wikimedia Foundation, Inc., a non-profit organization.