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Carolyn Eisele (1902-2000)

Our Friend Carolyn

I find myself unable to write a standard notice of Carolyn's passing. It is a cliché to say someone was unique; however, she was an amazing person, different from any I have met or will likely ever encounter again. So, I will try to explain how her life and work impacted me and our field of study. Because it was a relationship based on mutual scholarly interests, I hope this account will convey — especially to younger students of Peirce's work — an appropriate sense of gratitude which all of us should feel in recognition of her pioneering efforts and successes as a founder of Peirce Studies.

I first met Carolyn in May of 1973 at Texas Tech University where she had been invited to address a conference on *Men and Institutions in American Mathematics.*[1] At that time Max Fisch was in residence at Texas Tech as Visiting University Professor. He and Charles Hardwick introduced me to her. At this conference, Carolyn read a paper entitled "The New Elements of Mathematics by Charles S. Peirce," an account of her massive forthcoming edition of Peirce's mathematical writings, much of the material from his unpublished papers, most of which had not been included in the *Collected Papers.*

As a beginning assistant professor, I was astonished when, about halfway through her speech, two distinguished members of the audience (who were visitors to our campus) interrupted her, in what I took to be an impolite manner. It seemed clear that they wanted to destroy her presentation before she could read it. (That was my first exposure to persons who had only ill wishes for Peirce or his friends.) Other distinguished members of the audience defended Carolyn's right to have her paper read, but she really needed no assistance. As we say in Oklahoma, "She lit into those guys like a hungry wolf on a flock of chickens." They never knew what hit 'em. She got through her paper fine, and became a star of the meetings because of the knowledgeable and brave way she put her rude critics to rout. I repeat this anecdote because more than any other — and I was to see several similar events over the years — it illustrates Carolyn's single most memorable characteristic: an absolutely unshakable and noble spirit.

What had upset her critics? Salomon Bochner was to speak at the conference,

but he was indisposed at the last minute, so a delegate read his paper which was seriously critical of Peirce — an OK thing if one has done one's homework — but Bochner had not done his. A curtailed version of his talk was eventually published in the conference proceedings, largely because Carolyn, joined by Max Fisch, quickly took Bochner to task on his home ground in the *American Mathematical Monthly*. An extract in Carolyn's words will show the issue.[2]

> My remarks at the Conference on the History of American Mathematics, relative to the paper written by and read for Salomon Bochner at Texas Tech University in May 1973, are still applicable to his *Mathematical Reflections* in this MONTHLY, 81 (1974) 827-853. For Professor Bochner's analysis of Charles S. Peirce's mathematical treatment of the continuity concept in the overall framework of Peirce's philosophical system reflects a lack of acquaintance with a large segment of basic material in that area of Peirce's writings.

Skepticism about the viability of Peirce's concept of continuity was laid to rest by Hilary Putnam in 1989 during his presidential address at the Peirce International Congress at Harvard — it is published in *Reasoning and the Logic of Things (RLT)*.[3] It's appropriate that Putnam's essay appeared there in view of Eisele's defense against Bochner's claim, because true to her word, the Cambridge Conferences Lectures (*RLT*) had lain unknown and unedited until their reconstruction and publication in 1992. Carolyn would be happy to know that for those lectures, Peirce was billed as a mathematician.

After I had become well acquainted with Carolyn, when I often remembered this event an ironic phrase would pop into my mind: "What a man she is!" (Actually, I have never met a man who could match Carolyn's fighting spirit.) Such ironic language also captures another aspect of Carolyn's life, and may have been a major wellspring for her remarkable spirit. That is, she was raised and began her adult life in a period when women were systematically discouraged from developing a life in the academic or professional world. In this she was a sister of Christine Ladd-Franklin, that other distinguished female student of Peirce, who also suffered discrimination from the academic establishment of her day.

After Carolyn completed Hunter High School, her parents were less than enthusiastic about her desire to attend Hunter College, preferring for her instead a life of caretaking either for them or for a husband and children. But she did graduate from Hunter College in 1923. Later in 1925 she earned a MA degree from Columbia University. She tried to continue work toward a PhD at the University of Chicago, but conditions prevented her completing the program. Carolyn's love for learning aided her to obtain an education in the face of long

odds. No doubt in this formative period her spirit was often called upon to carry her through hardships we now find difficult to imagine. Since 1923 until retirement she was continuously employed by Hunter College, first as an Instructor, then working through the ranks to full Professor in 1965. At an early period in her association with Hunter, she became well-known among students as a brilliant teacher. She became Professor Emeritus at Hunter in 1972. The speciality in which she became a world-acknowledged mistress was the History of Mathematics, particularly as it applied to Peirce Studies.

A life-changing event came her way in 1949. I have heard her tell the story many times — now I wish I had recorded all the details. But I can give the outline. One of Carolyn's mentors in New York City was Professor Cassius Jackson Keyser (an editor of *Scripta Mathematica*) who in 1935 authored "A Glance at Some of the Ideas of Charles Sanders Peirce."[4] Keyser also wrote biographical essays on Peirce in *Portraits of Famous Philosophers Who Were Also Mathematicians*[5] of 1939, and "Charles Sanders Peirce as a Pioneer" in 1941.[6] The key point about Keyser is that he had known[7] Peirce and was a strong admirer. Thus Carolyn's admiration for Peirce was learned only once removed from the original.

She was inspecting the Plimpton Collection at Columbia University and came across what was then a surprising letter from Peirce to Plimpton, the latter having hired the former as a consultant to his project of acquiring a magnificent collection of early mathematical publications.[8] This letter, and others, clearly showed that Peirce was a master of the history of science as well as the history of mathematics. While she had known about Peirce, she had not realized the extent and depth of his activities as a mathematician or scientist. She showed copies of her discoveries to a close friend who remarked, "I think you have discovered gold." She had indeed, for her article in 1951 launched a long fruitful international career of essays and editions on Peirce as mathematician and scientist. The result of this distinguished research output was, as remarked earlier,[9] bountifully sufficient to establish what I called "Eisele's Law," the principle that Peirce was primarily a scientist and mathematician whose work in philosophy grew out of those more basic pursuits. (This is in sharp contrast to the view widely accepted by 1950 that Peirce's scientific work was a mere hobby or casual money-making enterprise, an activity to which his heart was not given.) A corollary of Eisele's Law is that Peirce's philosophy cannot be properly understood without a grasp of his efforts in mathematics and science. This was the basis of her well-known criticism of the *Collected Papers of Peirce,* namely that the editors had on many occasions dropped portions of completed essays whenever mathematics was involved, or omitted large quantities of relevant mathematical writings. Just how large this omission was we were to discover when at the 1976 Bicentennial International Peirce Congress in Amsterdam, Carolyn unveiled for the first time her edition — the *New Elements* — of Peirce's mathematical writings which spanned four thick volumes.

While the *New Elements* was a water-shed accomplishment, I regard her top masterwork as the lesser-known and still under-used *Historical Perspectives on Peirce's Logic of Science: A History of Science*.[10] This work shows the exceptional range of Peirce's efforts in scientific logic and the history of science. It also meets a principal objection to Eisele's Law, the claim that Peirce described himself as a logician, and thus (the conclusion is drawn) he has to be basically a philosopher. The objection is met by noticing Peirce's acknowledgement that his logic is far wider than contemporary formal logic: it is instead the "Logic of Science" (a phrase not unique to Peirce, but found in the writings of his contemporaries such as S.P. Langley), and whatever Peirce did in philosophy was done there as scientific work, not as a practitioner in the sense of contemporary humanities.

Carolyn's remarkable leadership emerged at several crucial points in the development of Peirce Studies. One in particular needs to be recorded. By 1974 there had been no international Peirce congress. During Klaus Oehler's visit to Texas Tech University, members of the Institute for Studies in Pragmaticism asked him to assess the prospects of convening soon an international Peirce congress in Europe. His evaluation was positive, although he was not available at the time to guide the project. Soon efforts began on the continent — under the leadership of another gentleman — to organize such a meeting for summer of 1976. Carolyn agreed to be the organizer of participants in the Americas. By December 1975, however, Carolyn was abruptly and arbitrarily notified by the European organizer that the congress was off. A memorable meeting was held late that December in Carolyn's New York apartment. Those who were present will probably always remember it. The place was full of Peirceans as Carolyn outlined the arbitrary cancellation coming out of Europe, made more bitter by the fact that approximately forty American scholars had agreed to attend and make presentations. Carolyn felt that if we stoically accepted this harsh ending of a promising conference, it would be a severe blow to Peirce Studies. Many of the persons attending that meeting in her apartment wanted to accept the arbitrary dismissal of the project. The Texas Tech contingent and Matthew Fairbanks (University of Scranton) urged that we go ahead with Carolyn as our new leader. She later mentioned that because two Texans and a Pennsylvanian had supported her, she resolved then and there to take charge. This she did, and because she had many European contacts, acquired over the years of presenting essays at world congresses in mathematics and history of science, she assembled a marvelous European contingent and sponsorship. One particularly brilliant coup was the patronage of the US Ambassador to The Netherlands, Kingdon Gould, Jr. It seems he had overlooked arranging for a celebration of the Bicentennial of the United States within his host country for the summer of 1976. Carolyn convinced him to make the Peirce Congress his event.[11] This he did, using his influence and some of his budget to aid the Peirceans to obtain a berth in the Grand Hotel Krasnapolsky in downtown Amsterdam. As the saying goes, the rest is history.[12]

What an amazing debt we owe to Carolyn for having the sheer guts and the spirited leadership ability to make that first International Peirce Congress happen! The late Ed Moore, who had been an advocate of giving up on an international congress after the first European organizer abruptly withdrew, in his most gentlemanly and gracious style, hosted a special dinner after the Congress concluded in Amsterdam. Not everyone could attend, but many stayed for the purpose. During the meal, Ed stood, raised a glass, and said words similar to these: "Carolyn, I honestly didn't think you or anyone else could have made this highly successful first Congress happen under the adverse conditions you inherited, so I counseled waiting; I was wrong — you did it, and I want to say loudly, *Well done!*"

On the second of April 1980 Carolyn at last became rightfully known as Doctor Eisele. Those who were "in the know" understood that this was indeed an earned degree, for she had met the requirements for a PhD many times over. I quote from the appropriate resolution:

> WHEREAS, Professor Carolyn Eisele is a distinguished scholar of the History and Philosophy of Science and Mathematics; her research, publications, and service activities are widely and deeply respected among the international community of scholars in her field of study; she has unselfishly and continuously made significant contributions to scholarly programs at Texas Tech University... Now, therefore, be it resolved that the Board of Regents of Texas Tech University confer upon Professor Carolyn Eisele the honorary degree of Doctor of Humanities.

A couple of years later in 1982, Lehigh University, Bethlehem, Pennsylvania conferred upon Carolyn the degree of Doctor of Science. I was privileged to be present at both events, and after her second degree, I enjoyed kidding her that she was a walking and talking College of Arts and Sciences. Perhaps the reason this seemed humorous is because it was literally true (humor, many times being nothing more than a restatement of an obvious but unnoticed fact). I should have also added, "The Texans and Pennsylvanians struck again."

Two other of her passions were the Phi Beta Kappa Society in which she served as a Senator for many years, and the History of Science Society in which she was an active member throughout her career. I recall attending one History of Science Society meeting during which she invited me to sit at her table at the concluding banquet. "There is someone here I want you to meet," she said. It was Bern Dibner, the man behind the Burndy Library, which now resides in the Smithsonian Institution. Dibner's long-term support of the History of Science Society is legendary. Such were Carolyn's friends in the organizations she supported — everyone seemed to know her.

Carolyn Eisele, Doctor of Humanities, Texas Tech University, 1980

I attended a number of national and international meetings in her company, usually with Max Fisch along as well. Often I inherited the task of chauffeur which I was happy to perform because the fruitful three-way conversation during these drives typically centered on Peirce. Carolyn was an Episcopalian, and I can recall on many conference trips she would want to be taken to the main cathedral — in Europe, typically the Catholic cathedral. There she would inevitably "burn an altar candle for Charley", as she described it. After all, Peirce was her fellow Episcopalian, and both of them — as well as I can determine — saw no conflict between right religion and right science. In decades of study of the matter, I also haven't detected any such conflict. A few colleagues have improperly chided her for what they took to be religious eccentricities.[13]

Carolyn often told me about events in her life, events which were amazing in their own everyday fashion. By this I mean that there is a kind of amazement which precisely concerns an ordinary thing, the mode of recognition of which is an extraordinary mode. For instance, during a trip to Germany in her youth, Carolyn recalled sharing a railroad passenger compartment with a "strange little man in an ill-fitting brown uniform." They had absolutely no conversation. He seemed nervous and didn't even acknowledge her presence. At the next station she looked out the window after he left the train. A crowd of people met him and made quite a fuss. "I later realized it was that rat Hitler," she remarked.

Persons sometimes ask me why there is a supplement (in *Transactions* volume 7, 1971, pages 37-57) to the Robin *Catalog*[14] of Peirce's Harvard manuscripts. The answer is that during one of her research trips to see the Peirce papers, Carolyn often walked past an old wooden desk in a hall in Houghton Library at Harvard. One day, she said, her feminine intuition spoke: "Look inside." The desk was stuffed full of Peirce papers that had been lost by the Library. Her prompt action brought us this large find of misplaced Peirce writings.

Then again she once told me of visiting the Smithsonian Institution "Castle," the original ornate red-brick Victorian headquarters building still a feature on the National Mall in Washington. She was there to do some research, and became disoriented in the building's maze of hallways. An older grey-haired employee of the Smithsonian happened to see that she might need assistance. She explained her purpose was to track information about Charles Peirce in thus-and-so room within the building.

"Oh, Professor Peirce," Carolyn reported the gentleman to have said, "Oh yes, I remember Professor Peirce.[15] He often came here before and after 1900 to talk with Secretary Langley. I can still remember them arguing very loudly about the pros and cons of successful mechanical flight."

Samuel Pierpont Langley (1834-1906),[16] of course, executed now-famous pioneering experiments on flight. And, like Peirce, he was a man who was derided during his life, but whose work is presently acknowledged as a major contribution. There are air bases, aerodynamic institutes, and air medals

nowadays named after him. Those who laughed at him are now forgotten. Joseph LeConte (friend of Ben Peirce and the Florentine Academy,[17] late official of the Confederacy, the undergraduate teacher/mentor of Josiah Royce,[18] famous professor of geology and natural science in the post-Civil-war University of California) declared publicly and solemnly in 1888, prior to Langley's flight researches, that heavier-than-air flight was in the same scientific class with perpetual motion machines and squared circles.[19] Many other established scientists agreed with him.

Carolyn wryly remarked at the end of the story of her Smithsonian visit, "Do you think Charley's ideas might have helped Langley with his aeronautical work?" The answer to Carolyn's question (as she likely was aware) is probably "Yes, Peirce's thinking may have helped Langley develop his studies on flight." As a tribute to Carolyn, and as an illustration of her method and insights, I will sketch a defense of an affirmative answer to that question.

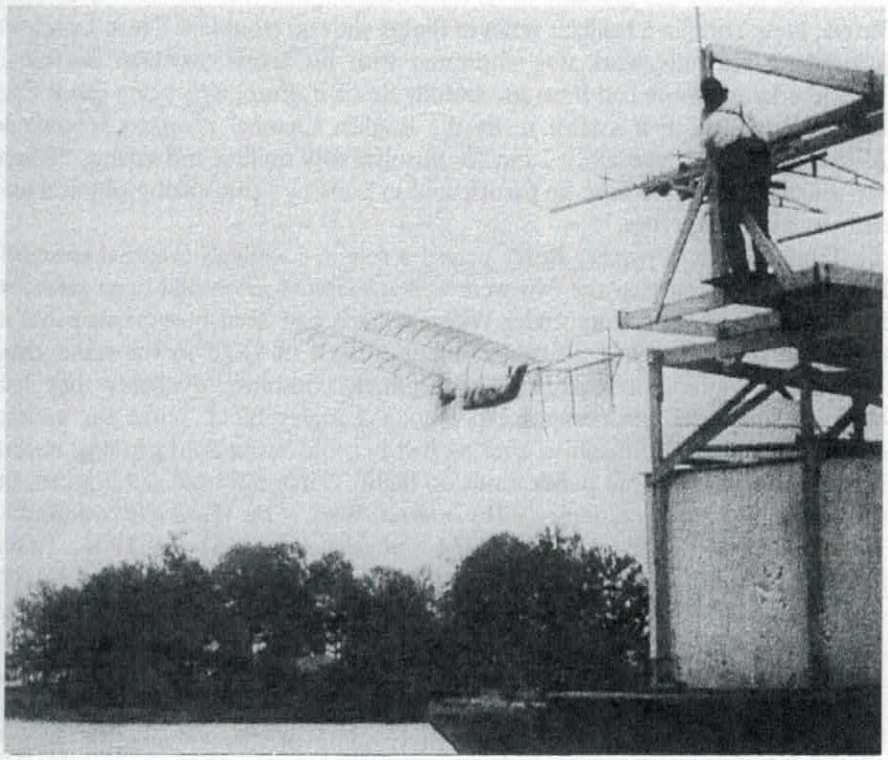
Langley and Peirce through Eisele's Eyes

What would have drawn Peirce to Langley or vice versa? One major reason: Peirce was strongly interested in aerodynamics through his study of gravity using pendulums. He had consulted with Clerk Maxwell in London during the 1870s on the problem of aerodynamic resistance of pendulums oscillated in the atmosphere (air resistance being a possible source of error for such pendulum experiments). Langley was a fellow physicist who, like Peirce, had a strong background in astronomy.

Langley's work on aerodynamics and heavier-than-air flight began in 1887[20] with a series of studies and experiments on the lifting force and resistance of surfaces set at different angles to an air flow. He was approaching the subject from the perspective of fundamental physics. First he wanted a deep understanding of the phenomena. After attaining that, circumstances led him to move to practical applications. Initial results of this experimental labor were published as *The Internal Work of the Wind*. This article, which was widely distributed in the U.S. and in Europe, raised fundamental questions of aerodynamical physics which required basic research to answer.

During the 1890s Langley built a number of small rubber-motor powered and larger steam-powered model flying machines to demonstrate mechanical flight. He named these devices *Aerodromes* (Greek: Air Runner).[21] In 1898 the United States Army appropriated $50,000 for the construction of a larger aerodrome capable of carrying a soldier. (Peirce manuscripts 1010[22] and 1013-14[23] have been dated 1898, hence we may surmise that they might have originated through requests from Langley who was beginning to consider manned flight after finishing his experimental work with models.) The record shows that Langley was approached to do this work by Army leaders who foresaw the use of aircraft in warfare. On 6 May 1896 Langley ruined LeConte's reputation as a prophet by twice successfully flying his unmanned steam-powered

aerodrome number 5 (fourteen foot wingspan) on the Potomac; this event was a sensation in the world press.



Langley's Aerodrome Number 5 in Successful Flight, 6 May 1896

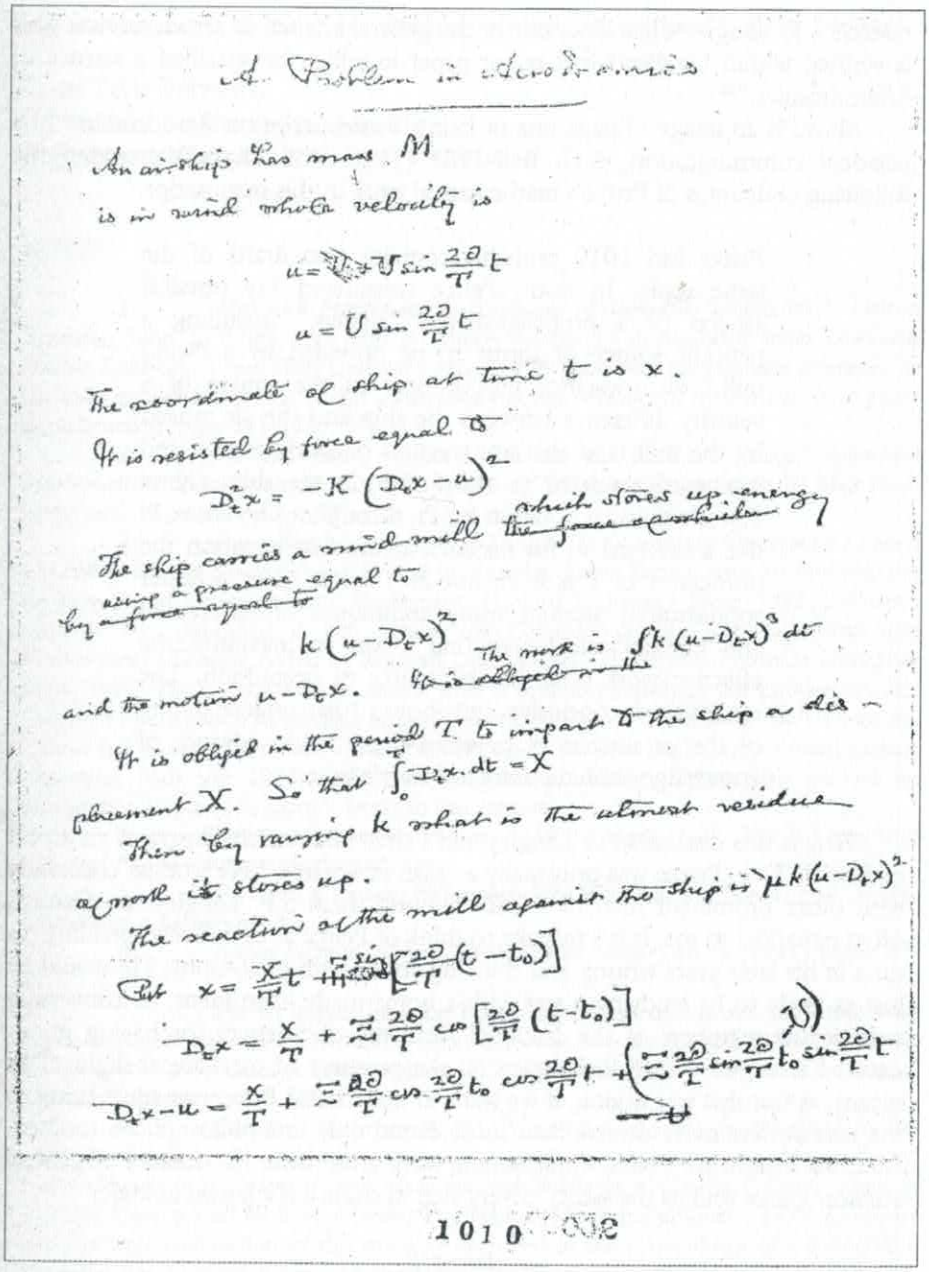
After the Army appropriation of 1898, development of the man-carrying aerodrome was begun and eventually tested in October and then again on 8 December 1903. The team had launched larger engine-powered test models, as well as the man carrier, from a catapult mounted atop a houseboat operated in the Potomac. Both attempts at piloted flight were embarrassing crashes just off the end of the catapult, which in hindsight probably occurred because a minor launcher part failed, or through the launcher acceleration being too great. Charles Manly, the pilot and Langley's chief associate in the project, a sane and gentle man, when fished out of the Potomac after his second crash over water, broke out in a "most voluble series of blasphemies."[24] Langley was ridiculed by the press. Nine days later at Kitty Hawk, North Carolina, the Wright brothers made their famous flight. Langley died with a broken heart in 1906. Ironically, in 1914, after renewed encouragement from the Army (they hoped their investment in Langley's craft could be vindicated), Alexander Graham Bell (a Regent of the

Smithsonian) and Glenn Curtiss (aviation pioneer) repaired Langley's Aerodrome with the assistance of Charles Manly, removed the catapult carriage, installed floats, and guided the machine in its otherwise original configuration over Lake Keuka, New York, in a brilliant series of flights with no trouble.[25] Thus, Langley's painstaking scientific work was vindicated with his actual machine. Earlier in 1907 the Langley *type* had been successfully flown in Europe by none other than Louis Bleriot, the first aviator to fly the English Channel (*Langley Memoir on Mechanical Flight*, page 283). I can see Carolyn slyly smiling and saying, "Peirce was vindicated too, because he participated in Langley's painstaking physical and mathematical researches."

How can we show that Peirce played a role in Langley's eventual triumph? First of all it is clear that the two were well acquainted. Each had been assistants in the Harvard Observatory under Winlock. Each had been busy participants in the National Academy of Sciences, having entered in 1876 in the same class. They were Washington scientists and routinely consulted. Probably they had been on the same astronomical expeditions. Langley hired Peirce for various chores around the Smithsonian after he had become Secretary, including having Peirce translate European publications on flight. Peirce reviewed publications on aviation in *The Nation*. Langley's *The Internal Work of the Wind* was reviewed at *N*2(1894):18-19[26] and again at 33-34 (see also page 65). In 1901, Peirce reviewed (*N*3:29-31) a volume on ballooning. In 1902, in a long review (*N*3:99-103) entitled "AVIATION," Peirce discussed two books: *Travels in Space: A History of Aerial Navigation* (by E.S. Seton and F.L. Tomlinson) and *Aerial Navigation: A Practical Handbook on the Construction of Dirigible Balloons, Aerostats, Aeroplanes, and Aeromotors* (by Frederic Walker). Particularly in the latter piece, Peirce showed a good understanding of current work on aircraft which he most likely acquired, I surmise, through collaborating with Langley.

We have seen that Peirce in 1898 also drafted an article, "The Prospects of Air-Sailing,"[27] in which he analyzed Langley's soaring-bird thesis, stated the need for a mathematical model of aviation, considered Langley's approach which involved flight using an on-board power source, and advanced his own solution which featured sailing in a winged vessel just as soaring birds do, including transit over a long distance using only wind power and "the internal work of the wind." This feat envisioned by Peirce in 1898 is now routinely accomplished by sailplane pilots throughout the world.

In another manuscript from 1898 (which is number 1010 in the Robin *Catalog* and which is there described as having the title "A Problem in Aerodynamics") Peirce took steps to provide a mathematical model for powered flight. That this was indeed for Langley, and therefore probably shown to him in some form, can be seen by looking carefully at the handwritten title on the front page of the MS: there Peirce wrote "A Problem in Aerodromics." *Aerodromics* clearly refers to Langley's Aerodrome, his successful design for a heavier-than-air flyer. Given Peirce's approach to the ethics of terminology, this is clearly a



A Problem in Aerodromics

An airship has mass M is in wind whose velocity is

$$u = U \sin \frac{2\theta}{T} t$$

The coordinate of ship at time t is x.

It is resisted by force equal to

$$D_t^2 x = -K \left(D_t x - u\right)^2$$

The ship carries a mid-mill which stores up energy by using a pressure equal to

$$k \left(u - D_t x\right)^2$$

and the motion $u - D_t x$. The work is $\int k \left(u - D_t x\right)^3 dt$

It is obliged in the period T to impart to the ship a displacement X. So that $\int_0^T D_t x \cdot dt = X$

Then by varying k what is the ultimate residue of work it stores up.

The reaction of the mill against the ship is $\mu k \left(u - D_t x\right)^2$.

Put $x = \frac{X}{T} t + \frac{T}{2\theta} \sin \left[\frac{2\theta}{T} \left(t - t_0\right)\right]$

$$D_t x = \frac{X}{T} + \frac{2\theta}{T} \cos \left[\frac{2\theta}{T} \left(t - t_0\right)\right]$$

$$D_t x - u = \frac{X}{T} + \frac{2\theta}{T} \cos \frac{2\theta}{T} t_0 \cos \frac{2\theta}{T} t + \left(\frac{2\theta}{T} \sin \frac{2\theta}{T} t_0 \sin \frac{2\theta}{T} t - U\right)$$

1010

Peirce MS 1010, ISP sheet 2, "A Problem in Aerodromics"

reference to Langley's machine, not to the general science of aerodynamics. This is verified within Langley's first major paper in which he specified a science of "Aerodromics."[28]

Above is an image of page one of Peirce's manuscript on Aerodromics. In a personal communication, R.G. Beil PhD (Theoretical Physics) provided the following evaluation of Peirce's mathematical work in this manuscript.

> Peirce MS 1010 probably contains two drafts of the same topic. In both, Peirce considered key physical aspects of a propeller-driven "airship," including a periodic source of thrust to be provided by a "wind mill," air resistance proportional to the square of a velocity difference between the ship and the air moved by the mill, and the conservation of work/energy and momentum related to the forces on the ship. (Note Peirce's unusual notation for Pi; throughout he wrote Pi like a reversed 6, for instance in the first equation the numerator of T is 2 Pi, not 20.) Peirce made a rather sophisticated attempt using techniques of differential and integral calculus to find a way to maximize the effective work done by the source of propulsion. The results are inconclusive, but show a basic understanding of the parameters of powered flight far in advance of knowledge contemporary in Peirce's time.

Why is this discussion of Langley and Peirce relevant? It illustrates an aspect of Eisele's Law. Peirce was principally a "man of science." He worked constantly with other prominent men of science, among them S.P. Langley. As Carolyn often remarked to me, it is a mistake to think of Peirce as exclusively spending his time in his later years writing and thinking about high philosophy. He would be just as likely to be studying a star with a home-made instrument, or conversing with fellow members of the National Academy of Sciences, or having good-natured wrangles with S.P. Langley on the prospect of mechanical flight. This means, as Carolyn was urging, if we want to understand Peirce, we must bring to the task devices more diverse than those found only in a philosopher's toolbox. And, she taught us, Peirce's philosophic work arose from his mastery of general science. Peirce told us the same: "Every step in science is a lesson in logic."

Farewell

Another reason this essay has been difficult to write: Carolyn's career was huge and important. No small set of remarks are able to capture it. A book would be needed. Maybe someone will take up that task. Meanwhile, I conclude by urging the younger generation of Peirce scholars and historians of mathematics

and science always to remember and to study well the works of Carolyn Eisele.[29]

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www.pragmaticism.net or www.wyttynys.net

NOTES

1. *Men and Institutions in American Mathematics,* edited by J. Dalton Tarwater, John T. White, and John D. Miller, volume 13 in the book series *Graduate Studies,* Lubbock: Texas Tech University Press, 1976. I am sure the exclusive reference to the male gender in the title of this conference was not overlooked by Carolyn. Her paper is published at pages 111-122.

2. Carolyn Eisele, "Salomon Bochner on Charles S. Peirce," *American Mathematical Monthly* volume 82 (1975) pages 477-478; see also remarks by Max Fisch in the same location at pages 478-481.

3. *Reasoning and the Logic of Things: The Cambridge Conferences Lectures of 1898 by Charles Sanders Peirce.* Edited by Kenneth Laine Ketner, with an introduction by Ketner and Hilary Putnam, Cambridge: Harvard University Press, 1992; Putnam's essay is also published in the volume of Congress plenary lectures, *Peirce and Contemporary Thought,* edited by Kenneth Laine Ketner, The Bronx: Fordham University Press, 1995. The latter volume contains what is probably Carolyn's last publication, her Congress plenary speech, entitled simply, "Charles S. Peirce, Mathematician." There she reviews her career-long efforts to re-establish Peirce's place in the history of mathematics, beginning with the 1973 conference in Lubbock. Helena Pycior also penned an outstanding response to Eisele's works in this volume.

4. *Scripta Mathematica* volume 3 (1935) pages 11-37. This is a review of *Collected Papers* volumes one through five.

5. *Portraits of Famous Philosophers Who Were Also Mathematicians, Scripta Mathematica Library* no. 12.

6. *Galois Lectures, Scripta Mathematica Library* no. 5 (1941) pages 87-112.

7. For an insight into the Peirce-Keyser connection, see the letter from Peirce to Keyser dated 1-7 October 1908 in *The New Elements of Mathematics by Charles S. Peirce,* edited by Carolyn Eisele, volume 3/2, *Mathematical Miscellanea,* The Hague: Mouton Publishers, pages 889-899.

8. Carolyn's discovery in the Plimpton Collection is described in her article published in 1951 in *Scripta Mathematica,* reprinted as chapter two of her collected essays, *Studies in the Scientific and Mathematical Philosophy of Charles S. Peirce: Essays by Carolyn Eisele,* edited by R.M. Martin, The Hague: Mouton Publishers, 1979. Compare also her later recollection of this event as described in the proceedings of a colloquium honoring her: Carolyn Eisele, "Mathematical Methodology in the Thought of Charles S. Peirce," *Historia Mathematica,* volume 9 (1982) pages 333-341. See also in this issue essays honoring Carolyn written by Max Fisch, Hilary Putnam, Ernest Nagel, Joseph Dauben, and Kenneth Ketner. These articles are more than honorific because each presents important research results. For example, Putnam successfully corrected Peirce's

place in the history of logic, a step that was to be widely acknowledged by others at the International Peirce Congress in 1989.

9. "Carolyn Eisele's Place in Peirce Studies," *Historia Mathematica* volume 9 (1982) pages 326-332.

10. *Historical Perspectives on Peirce's Logic of Science: A History of Science*, edited by Carolyn Eisele, 2 volumes, Berlin: Mouton Publishers, 1985; references to this work will be identified by *HP* followed by numbers for volume and page.

11. This explains, for those who are curious, why the first international Peirce congress was a bicentennial and the second one in 1989 was a sesquicentennial. The first one celebrated the two hundredth birthday of the United States in a country which had aided the American Revolution, while the second congress celebrated the one-hundred-fiftieth birthday of Charles Peirce in his home town of Cambridge, Massachusetts.

12. See *Proceedings of the C. S. Peirce Bicentennial International Congress*, edited by K.L. Ketner, J.M. Ransdell, Carolyn Eisele, M.H. Fisch, and C.S. Hardwick, Lubbock: Arisbe Associates (copies available, PO Box 607, Lubbock, TX 79408), 1981. Fifty-five essays from the Congress were published in this volume. See also Joseph Esposito's charming and brilliant review of the Congress: "Semiotics and Philosophy at the International Peirce Congress," *Semiotica*, volume 19 numbers 3 and 4 (1977) pages 355-366.

13. Those persons deserve the same reply Carolyn quoted Peirce (*NEM4*: xxv) as having given to his critics: "I waft you a farewell sigh, — one of the downward kind."

14. Peirce's manuscripts are listed in Richard Robin, *Annotated Catalog of the Papers of Charles S. Peirce*, Amherst: University of Massachusetts Press, 1967, and reference is by *MS* followed by Robin's manuscript number.

15. It was customary in the Federal Service to refer to Assistants (Assistant Superintendents) in the Coast Survey, in which class Charles Peirce was employed, as "Professor." It was by no means an honorific title, but a serious label that recognized the important scientific responsibilities of such a post.

16. An excellent short biography of Langley is found in John D. Anderson, Jr., *A History of Aerodynamics and Its Impact on Flying Machines*, Cambridge: Cambridge University Press, 1997 pages 181-188. This work also shows the scientific history of the subject in the period we are now discussing. Langley, by the way, was said to be arrogant and pompous, who often inspected Smithsonian facilities wearing a morning coat, and who had on occasion been accused of taking credit for the work of others (page 186).

17. On the Florentine Academy, see K.L. Ketner, *His Glassy Essence: An Autobiography of Charles Sanders Peirce*, Nashville: Vanderbilt University Press, 1998.

18. On Royce's study with Joseph LeConte at the University of California, see John Clendenning, *The Life and Thought of Josiah Royce*, Madison: University of Wisconsin Press, 1985 pages 49-53, 63-64. It is clear that "Professor Joe," as he was affectionately known at Berkeley, professed a version of Ben and Charley Peirce's logic of science (philosophy reached through scientific method) to young Royce; Joe stood to Josiah in inspiration as Ben stood to Charley.

19. Joseph LeConte, "The Problem of a Flying-Machine," *Popular Science Monthly*, November, 1888 page 69. LeConte stated: "I am one of those who think that a flying-machine,... — i.e., self-raising, self-propelling — is impossible ... ." He went on to provide an "absolute demonstration" of his remark. Eight years later, Langley flew a steam

powered un-manned model successfully over a three-quarter mile course. LeConte might not have been out of his depth if he had read Peirce's "Fixation of Belief" with more care.

20. See S.P. Langley, *Experiments in Aerodynamics, Smithsonian Contributions to Knowledge* number 801, Washington: Smithsonian Institution, 1902 (first edition 1891); S.P. Langley, *The Internal Work of the Wind, Smithsonian Contributions to Knowledge* number 884, Washington: Smithsonian Institution, 1893; and S.P. Langley, *Langley Memoir on Mechanical Flight: Part 1 1887 to 1896, Part II 1897 to 1903* (Part II is by C.M. Manly, Assistant in charge of Experiments), *Smithsonian Contributions to Knowledge,* volume 27 number 3, Washington: Smithsonian Institution, 1911.

21. One is reminded of Peirce's doctrine of the Ethics of Terminology; see K.L. Ketner, "Peirce's Ethics of Terminology," *Transactions* 17: 327-347, 1981.

22. C.S. Peirce, *MS* 1010, "A Problem in Aerodromics." To my knowledge, this MS has not been published.

23. C.S. Peirce, *MSS* 1013-1014, "The Prospect of Sailing the Air," reprinted at *HP*2:922-939; see related material at pages 914-921, and 869-871.

24. Peter P. Wegener, *What Makes Airplanes Fly? History, Science, and Applications of Aerodynamics,* New York: Springer-Verlag, 1991, page 21.

25. C.R. Roseberry, *Glenn Curtiss: Pioneer of Flight,* Garden City: Doubleday and Company, 1972, chapter 21.

26. Citations in this form — *N*4:x — refer to *Charles Sanders Peirce: Contributions to* The Nation, edited by K.L. Ketner and J.E. Cook, 4 volumes, Lubbock: Arisbe Associates (copies available, PO Box 607, Texas 79408); the first number gives the volume, the second number gives the page.

27. *MSS* 1013-14, also in *HP*.

28. "Internal Work of the Wind," page 5.

29. I am grateful for the assistance of Clyde Hendrick, R.G. Beil, Scott R. Cunningham, Katie Ratliff, and Ashlee Dickerson in preparation of this essay.