

REPLY TO QUESTIONNAIRE

Edward N. Lorenz

1. I have one sister, Margaret (now Margaret Ensor), who is two years younger than I am.
2. As a child I was interested in many things, but particularly arithmetic, and later astronomy. I always had a good time playing with other children, but I was not particularly athletic, and preferred amusements like jigsaw puzzles and eventually chess. I later became captain of my high school and then my college chess team.
3. I was born in West Hartford, Connecticut, a fairly well-to-do suburban town of about 8000, which had grown to about 25,000 by the time I reached high school. It was bordered on the east by Hartford, a city of about 150,000 and the capital of Connecticut, and on the west by open country and hills. Most residents of West Hartford worked in Hartford, and at first did most of their shopping in Hartford; later West Hartford acquired a sizable shopping district but few industries. Most of the houses in our neighborhood were new, and young families were moving in, so I always had plenty of children to play with.
4. I seem to remember best our family vacations in pleasant places like the sea shore or the mountains. These were happy times. I cannot recall any particular experience that had a lasting effect on me; instead everything developed gradually.
5. My mother, née Grace Norton, was born in Auburndale, Massachusetts, a well-

to-do suburb of Boston, in 1887. She had an older sister, an older brother, a younger sister, and a younger brother. After her father's untimely death when she was still a girl, her mother moved with the children to Chicago, where she presently founded the University of Chicago's department of home economics. My mother graduated from the University of Chicago, and afterwards taught school and also became involved in many civic organizations.

Following her marriage she became active in civic organizations in Hartford and later West Hartford, and served for a while on the West Hartford town council and the school board, until her early death in 1940. Despite her busy schedule, her devotion to my father and to my sister and myself could not have been surpassed. She was responsible for my interest in games, and particularly chess, and I feel that she taught me more than anybody else about life.

6. My father, Edward Henry Lorenz, was born in Hartford, Connecticut in 1882. He attended Hartford High School and then graduated from Trinity College with all A's before the age of twenty, after which he continued his studies at the Massachusetts Institute of Technology, which was then located in downtown Boston. He was keenly interested in sciences of all sorts. He was small in stature, but was an excellent distance runner, and at M.I.T. he held the record for the two-mile run.

He became a mechanical engineer, working all his life for one company. He was still working actively at the time of his death at the age of 74. He was a dedicated husband and father. He taught me most of what I learned

about science, and particularly mathematics, as a boy. My early love of the mountains was acquired from him, but also from my mother, who was equally fond of the out-of-doors.

7. From the time I can remember I always wanted to do something with numbers.

There was a period when I was sure that I wanted to be an astronomer, and this desire only increased when I read that astronomers often had to add long columns of numbers; this was long before the days of computers. As I grew older my interest turned back to mathematics. The weather always fascinated me, but only as a hobby, and it was only after reaching adulthood that I made the change from mathematics to meteorology.

8. My wife, née Jane Loban, was born in Dayton, Ohio in 1919 but lived most of her early years in Cedar Falls, Iowa, a town of about 15,000, adjacent to Waterloo, a city of about 80,000. Her early childhood seems to have been much like mine, except that she acquired a love for the arts instead of the sciences as she grew older. Her consuming interest was flying, and she flew small airplanes before she was old enough to drive a car. She graduated from the University of Northern Iowa, and because of her interest in flying she studied meteorology; it was actually through meteorology that we met.

Following our marriage in 1948 we settled down in Cambridge, Massachusetts, and we have always lived in one town or another in the Boston area. Our older daughter Nancy, our son Edward, and our younger daughter Cheryl were born in Boston. As children they showed all the interest in games and

puzzles that I had. They never acquired much interest in team sports, but they all became first-class downhill skiers, and for several years many of my winter weekends were spent taking one or all of them, usually with my wife as well, to some ski area north of Boston; this, of course, was just what I had hoped would happen.

Nancy is now a lawyer, working for Greater Boston Legal Services, and she is married to Dennis Michaud, who grew up not far from Boston. They have a five-year-old son Nicholas and a two-year-old daughter Sarah, whom we see and take care of almost every week, and we feel that they are an important part of our family. Edward is an Assistant Professor of Economics at Notre Dame University in South Bend, Indiana, and Cheryl is an experimental psychologist at the Oregon Research Institute in Eugene, Oregon. Cheryl's former jobs include being a National Park Ranger at the bottom of the Grand Canyon.

9. I had for a long time expected to be a mathematician, but it was not until after my graduation from Dartmouth College, when I was a graduate student in mathematics at Harvard University, that I decided that I wanted to teach and perform research in a university. Undoubtedly I was influenced by my fellow graduate students, most of whom also looked forward to university positions, there being relatively few other opportunities then for pure mathematicians. My decision remained unchanged, but it was a few more years before I decided that I would prefer a teaching and research career in meteorology to one in mathematics. I have never regretted the change, partly because many of the

meteorological problems with which I am involved are highly mathematical in nature.

10. Aside from my parents, the person who influenced me the most was the late Victor Starr, a professor of meteorology who became my immediate supervisor for my first job after receiving my doctorate. He became my mentor, as he did for so many other younger meteorologists, many of whom are now among the leaders in the field. In a day when there was still much confusion in meteorology, Starr's clear and deliberate analyses of some of the fundamental problems proved highly refreshing, and they removed any lingering doubts as to the desirability of my change from mathematics to meteorology.
11. The meteorological topic occupying most of my attention has gradually changed from the general circulation of the atmosphere—the global-scale weather patterns and their variations—to atmospheric predictability—the extent to which predictions of future weather are possible. There are still some unsolved questions regarding predictability, and I am actively seeking some answers. In the course of my work on predictability I became deeply involved with chaos; this term is presently used to describe phenomena that are deterministically governed but nevertheless exhibit irregular types of variation that resemble randomness. I am currently writing a book about chaos, addressed to non-mathematical nonspecialists, and this work is now about half complete.
12. The things that I remember best and cherish the most, in looking back over my scientific career, are the almost daily conversations with Victor Starr during the

more than twenty-five years that I worked with him, first as a protégé and then as a colleague. His clear explanations of some specific points, his enthusiastic far-reaching speculations regarding others, and his general comments about philosophical matters taught me more than anything else what meteorology and more generally what science really is.

13. The first thing that I would tell you as a young scientist is to be sure that the problem that you have chosen to study is relevant. I suppose that analogous advice to a young artist would be appropriate. By relevant I don't mean that everyone has to be interested in the problem, but the problem should have the potential of eventually occupying an important place in its field. If you can think of something that you have always wondered about, perhaps others have been wondering about it also, and you should pursue it actively. A good problem might be *why* some well-observed but inadequately understood phenomenon *must* occur, as opposed simply to why it may occur.

Next, your problem must be tractable. There is no point in pursuing the most relevant problem in the world if there is no way for you to solve it, or if your attempts cannot serve as guides for those who will subsequently attack it. Here you should recognize that tractability changes; for example, some formerly intractable problems were made tractable by the development of computers.

Finally, be sure that it is a problem for you personally. Abilities differ, and some persons will do better with a problem that requires one approach, while others are better suited for problems that yield to other approaches. A sincere

belief that the problem is relevant and tractable and a genuine enjoyment of work devoted to this problem may not be essential, but they can be extremely helpful.

14. My hobbies have varied over the years. From the ages of seven to fifteen I was deeply involved with stamp collecting, but have done little with it since then. My fondness for chess reached its peak in my high-school and college days, and it remains, although I have played few games lately.

My greatest interest since high school has been the mountains. Mostly I simply like to walk on mountain trails and reach the summits, although I have occasionally made some technical climbs that have required ropes. For a while I enjoyed skiing as much as climbing. My other great interest, which has lasted to this day, is music. Mostly I enjoy attending concerts or just listening to recordings, although for ten years or more I sang in a chorus, where our crowning achievement was a performance of Beethoven's *Missa Solemnis*.

15. I spent a most memorable two weeks in Japan in the autumn of 1960. The occasion was an international symposium on numerical weather prediction, held in Tokyo. The Japanese proved to be the finest hosts that I have met. Each foreign scientist had one particular Japanese scientist as his special host, to take care of any special needs that might arise. Following the meeting we were all treated to a weekend at the Kowaki-en Hotel in Kowakidani in the Hakone area; this was when the autumn leaves were at their peak of color. In Tokyo I recall a special holiday for children; I believe it was for three-year-old girls,

five-year-old boys, and seven-year-old girls. I enjoyed walking in the suburban regions and taking pictures of these happy children in their brightly colored dress, and I was struck by the devotion shown by their parents and the interest shown by all of Japan.

While I was in Tokyo I heard from many sources that Kyoto was a more beautiful city than any that I had seen. I always regretted that my schedule did not allow me to visit Kyoto—a situation that will soon be rectified.