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Aldo, friend and magister

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Our dear friend Aldo de Luca passed away on last October 16, 2018. The lines which follow will not be a scholarly resumé of his (scientific) life as a true homage to him would have required. Simply, I am unable to do it. For various reasons. I had been tempted to say that his interests have been so ample that one single person could hardly report with competence the deepness of all his scientific achievements. But, although the previous statement is true, I must confess that this is not the point in question here. The fact is that while trying to fix on the paper some points, my mind immediately begins to move around. My efforts to stop it, at best, limit the area of the roaming but no more than that. Others, perhaps, will remember, list and testify the profoundness of his technical results, here one can find only a messy report of some wanderings of my mind, certainly useless for knowing what the "scientist" Aldo has achieved, but - maybe - the simple witnessing of some intricacies of his interests can help for asking (asking, not answering) some questions about Aldo as a person.

To report some data and facts is considered unavoidable but I shall not be reciting his cursus honorum. I limit myself to provide some essential information. Aldo took his degree in Physics in 1964 at the University of Naples discussing a thesis on General Relativity. His encounter with Cybernetics happened very soon when he began what, at the time, was called "Scuola di perfezionamenti in Fisica teorica", a novelty, an invention of the theoretical physicist Eduardo Caianiello, a sort of post graduate School whose Opening Lecture, the first Academic year had been given by Werner Heisenberg. But this unusual thing was also the Trojan horse for entering into new unexpected and unknown fields. Besides this School, Caianiello, in those years, had founded a new Institute of Theoretical Physics and a Cybernetics research group. And around these frontier activities (they were such in those remote years) many other things and scientific activities were happening, among which an important event was the Ravello 1964 Summer School on Automata Theory [1] . "In this occasion", Aldo wrote, "I was lucky enough to meet the greatest scientists in the field" and, in informal discussions, he repeatedly talk about the unexpected discovery (for a young researcher accustomed to the world of the "continuum" techniques of General Relativity) of an equal richness owned by discrete structures unveiling the treasury of recursiveness and the theory of computation. He has remembered these years, their novelty for him (but not only for him) in two published memoirs [2, 3]. Maybe he has written other things which are still unpublished as his manuscript "The Mind as a Mechanism of the Brain" which he mention in his [2], a paper

from which the following passage is taken:

"Our group of Cybernetics at the Institute of Theoretical Physics, directed by Caianiello, was of a real interdisciplinary nature, consisting of Physicists, Chemists, Mathematicians, Logicians, Engineers, and Biologists, including collaborators expert in the humanities such as natural languages. Every week we had a very interesting general meeting where research projects were discussed by all of us, each one giving a contribution on the base of its own experience and competence." (page 668 of the electronic edition)

He stressed also the strong international character of the research of the group (but this, in a sense, is nothing more than witnessing its high scientific level). What was (and is) really a novelty is the possibility of having an open discussion, its informality and the fact that it was about truly interdisciplinary arguments. Something that, unfortunately, can appear unusual also from today perspective. Another quote can help focusing the atmosphere:

"The researchers gathered every week with Eduardo, when the various problems we dealt with were put on the carpet, and everyone contributed to the discussion based on their skills and experiences. The atmosphere was beautiful and extremely stimulating; I remember the meetings that took place almost every Wednesday at Villa Virgiliana, in Cuma, next to the Antro della Sibilla, where we went around 3 o'clock in the afternoon; there was no one besides us, just a blackboard and a stove because in winter it was very cold; around 5 o'clock you could hear a gong and we found on a table, in the living room, tea served by an elusive waiter. The debate was free and open, on problems ranging from neurological models to problems of very subtle and demanding maths." (page 34 of [3])

This is the atmosphere were the "fuzzy entropy" was conceived. I refer to [4] for details of the way in which we arrived at this idea. Aldo (as also myself) was conscious that to contribute to a very recent research field is something different than to work in classical fields: very challenging and truly demanding. This awareness characterized all our discussions (along the Seventies of last Century) about the possibilities offered by Fuzzy sets approach for affording the presence of uncertainty in systems of different nature. Surprisingly, also starting from different points, we were always able to find an agreement. This was a novelty since, when discussing of interpretative questions regarding analogous questions in the setting of

quantum mechanics, our fierce fightings never arrived at a composition. I want to add here that although the active work of Aldo in Fuzzy set theory lasted for no more than fifteen years, his interest for its general questions was present forever and he often remembered the contribution he had done in this very young field. As an example of the way of working of Aldo let me recollect that in his [5] he started from noticing some mathematical properties and ruminating about them he arrived at the conclusion that these results could be inserted in the general scheme of the measures of fuzziness. So, he did not start from questions posed by the field of investigation but from some mathematical aspects that he picked up as meaningful. This was typical of him in a twofold sense. First, the deepness of his approach to a problem was always the same both in attempting to prove some formal properties and in analyzing a conceptual question. Secondly, and crucial for him, to find out mathematical characterizations was the mark of having really settled a piece of work. A nice mathematical property was a strong indication that a conceptual question could be clarified. The mathematician's conceit, one could say, but, in a while, we shall see that Aldo's thought is more complex and intricate than that. Let us come back to Cybernetics. As he wrote:

"The great novelty of Cybernetics was the introduction, in the setting of the physical sciences, of a new entity called information of fundamental importance in the communication of human beings and machines. Information and its measurement are, however, intuitive concepts which have a wide 'semantic halo' so that several formalizations are possible." ([2], page 669 , my italics)

It is very likely that neither Aldo nor myself (this is certainly true for myself) would have thought to such a thing like "fuzzy entropy" in a different cultural scientific context and let me stress that it is the simultaneous presence of what I underlined in italics that could have favored the birth of this new idea. From the descriptions offered above Cybernetics could appear as a sort of Garden of Eden, and - perhaps - it was really so for a few years. But, soon, something began changing:

"Cybernetics was quite vital and developed in Italy up to the middle of the seventies ... However, since the beginning of seventies the term Cybernetics was less and less used and often replaced by the term Computer Science or by the new term Informatics. At the present, practically no one in Italy and only a few in the world uses the term Cybernetics. ... Why this

decline of Cybernetics? ... In my opinion the main reason for decline is that the original research project was much too wide and ambitious, and the results obtained on the main problems (understanding high mental functions like intelligence) were very modest and often far from the effective and practical needs of science and technology. In a way, in some respects analog to what occurred to Science after the Renaissance, from Cybernetics several scientific disciplines were originated and, successively, separated." ([2], page 668)

These general considerations held also for the CNR Institute of Cybernetics which had inherited the scientific activities of the original smaller "cybernetic group" at the Institute of Theoretical Physics. In fact, "The Institute of Cybernetics was a sort of an incubator that allowed, starting from the initial program of Cybernetics, to create and develop within itself much more specialized research related to the new emerging disciplines. There was in a short time the transition from an interdisciplinary research to a multidisciplinary one ... Subsequently, especially following the presence in the Institute of Marco Schützenberger for over a year, the scientific interests of some of us were oriented towards theoretical computer science." ([3], pages 35-36)

It is at this point that Aldo became profoundly involved in these challenging new questions that mark the birth of "theoretical informatics" as such, as a separate and distinct scientific activity, something of which Aldo was one of the first and main protagonists in Italy and in Europe. I refer to [4, 5] for a detailed overview of his results and for a more or less complete list of his publications. My point is that more than traces of the original formative cybernetic period remained in Aldo's subsequent scientific life, as a sort of imprinting.

But before doing that let's recall other steps of his career. In 1971 he obtained the "libera docenza in Cibernetica e Teoria dell'informazione" (the old "venia docenti"), just before the abolition of this old and venerable institution of which he was also one of the youngest recipients. After a period of about fifteen years spent as a researcher in CNR, he moved to the University as a full professor of Algebra at the University of Naples Federico II in 1980 and, later, of Informatica teorica first at the University of Rome "La Sapienza" (from 1985 to 2003) and, again, in Naples from 2003 to 2010 when he retired becoming "professor emeritus" the subsequent year. Let me also remember an important Seminar he gave at the Accademia dei Lincei

on the "General Theory of Codes", on 12 February 1982, as well as a three years sabbatical leave at the Centro linceo interdisciplinare "Beniamino Segre" of the same Academy.

The few points I shall discuss now are a following of what I have written above in underlining the variety of Aldo's interests. Not for stressing his erudition, something he did not appreciate, but for throwing some light on the origin of his peculiar way of facing problems, in a word, of his creativity. Aldo was truly a mathematician, but his scientific history associated with his peculiar experience made him a mathematician with unusual features. Caianiello was right in fearing that "Aldo could escape along the mathematical tangent". A phrase often repeated to complain the fact that starting from a specific problem, Aldo - without neglecting it - could anyway become more attracted by unexpected mathematical promising new avenues which were not strictly connected to the starting point. Notwithstanding this, he always preserved his original mental attitude of a physicist in asking the "deep motivation" of a new afforded question. Something that was at the root of the efficacy of his way of presenting and discussing any topic (old, new, in fieri, along its development). Motivation and perspectives were the place where to ground any discussion, not the technicalities. These were important only as a tool. I have directly witnessed this way of doing in our private discussions, especially in the Seventies, a period in which we interacted almost daily, but anyone can testify that this was a feature of his talks and seminars. What struck me, however, was the discovery - through the testimony of some of his students - that this was a feature also of his routine lessons of the standard courses. One of them explicitly told me, with great admiration, that not only no technical argument was presented without some (non technical) motivation but also some grounding of the problems was indicated, helpful for fixing them in a more general framework; moreover, each lecture could, in a sense, be followed autonomously (as a sort of mini seminar) since at the beginning he cared to provide the basic elements necessary to follow the new presented items. This was associated to a sort of friendly attitude towards the students, tuning the tone and style of his presentation to the audience; a sincere but distant friendship, we should specify, without too much familiarity, something that would have destroyed the correct relationship "teacher-student".

This is one of the reasons why Aldo must be remembered as a "magister" not only for his great capacity and ability as a mathematician, as

an innovative researcher and as a wonderful teacher but above all for his ability to capture and absorb all the new present in the things, persons, atmospheres, concepts which he had occasion to cross, molding in such a way his peculiar scientific and human style. The subsequent transmission of these novelties to other people, happening silently, tacitly, through a way of doing that we could define embodied, without any form of detached and ex-cathedra teachings or, even less, boring moral preaching. This must be connected, I am sure, to his declaring himself "anarco-individualist", not in a ideological sense, but - on the contrary - for stressing, exactly, a strong anti-ideological choice. A meditated attitude, more complex and articulated than it appeared and than he would have explicitly admitted in a discussion.

When I went to Naples for a last farewell to Aldo, I took the plane. Usually I prefer the aisle seat but this time, strangely, having been assigned the window seat, I did not ask to change. By chance, then, I noticed that - unusually - the airplane was approaching the airport from the sea and not from the interior air corridor. By surveying, then, Posillipo, the Phlegraean Fields and the bay of Pozzuoli I saw from the window the road that for a few years, following 1969, we had daily traveled to join the Institute of Cybernetics. In the first months after my arrival, thanks to his friendship and courtesy, with his car, an old Fiat 600 if I remember well. I wish to interpret this unfrequent rout as a sort of tribute that also the airplane wanted to pay to Aldo.

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