On Gordon Pask[1]

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When I think of Gordon Pask, then two thoughts touch my soul. First, a deep sense of friendship that emerged almost immediately after I met him not quite 40 years ago. Second, the joyous and exhilarating experience of being in the presence of a genius. Unfortunately, the word "genius" has lately been severely degraded to mean somebody who may have an IQ of 500, or who has a memory like an elephant, or who can rattle off all capitals of Europe, including that of Liechenstein. When I think of genius, I am not thinking of somebody who can do things much better and much faster than I can do them, but of one who reaches into other dimensions of mentality for which I have no organs, no senses, no language.

Although I can imagine such qualities in a person causing in others envy, anger, a sense of inferiority, for me it is uninterrupted pleasure and joy, because the world becomes richer by this stream of unexpectables and unpredictables emanating from a genius, that is, from a genius like Gordon Pask.

Perhaps I could make all this more tangible, if I tell of my first encounter with Gordon, and our subsequent togetherness.

1956/57 was a crucial period in my life, because I shifted gears in my professional activities. The scientific competence I brought to America, when my family and I emigrated from Austria in 1949, was physics, particularly plasma physics and microwave technology. Based on this background, the University of Illinois appointed me to direct the Electron Tube Research Laboratory of the Department of Electrical Engineering, and, apparently, we did our work to the satisfaction of all parties involved. But also, immediately after my arrival in the United States, I had the great fortune to be invited to join a group of thinkers and doers who, under the umbrella of "Cybernetics", met annually for a few days in New York. These meetings were sponsored by the Josiah Macy Jr. Foundation.

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The philosophical curiosity that I brought from Europe received a tremendous boost by the topics, by the dynamics of the conversations, and by the spirit of the members of that group, whose names read like a Who's Who of American Scientists. There was, of course, Norbert Wiener, the papa of Cybernetics, John von Neumann, the papa of programmable computing machinery, Gregory Bateson, the papa, as many say, of family therapy, his wife of that time, Margaret Mead, the mama of effective anthropology, Warren McCulloch, the grandpapa of Artificial Intelligence, etc, etc.

For five years I had been the editor of the transactions of these meetings[1], a labour of love that drew me deeper and deeper into the emerging problematic that searched for an epistemology in which the observer is included in the domain of his observations. I became addicted to these dangerous thoughts and decided to establish a locus where one could pursue such notions.

The direction of the Electron Tube Research Lab I passed on to the younger generation, and persuaded my former sponsors to underwrite the efforts of a new laboratory for which I invented the fancy name "Biological Computer Laboratory", or BCL for short. Its aim was an interdisciplinary study of the physiology, the theory, and the epistemology of cognitive processes in the individual and in the social context. Now, the problem was to find people who would participate in such a venture.

One of my first steps was to go to big conferences where I could expose myself to large audiences and meet with many people. The second International Congress of Cybernetics was to convene in September of 1958 in Namur, Belgium, and it appeared to me a perfect hunting ground for my purpose. Since Cybernetics had at that time a great attraction for many young and dynamic people with a variety of interests and competences, I thought there may be some who would feel comfortable with BCL's interdisciplinary programme.

I submitted my paper "Some Aspects in the Design of Biological Computers"[2], and was scheduled to speak last in an afternoon session, that was to last 2 hours with three other presenters preceding me, and a gentleman from France chairing the session.

Fortunately, and I say again "Fortunately!", I was well acquainted with the ritual that is re-enacted on occasions when a Frenchman chairs a meeting, namely, that he will with his introduction take up most of the session, leaving for the other speakers some crumbs to be picked up in a few minutes. Hence, I was prepared to deliver my story in 10 minutes or less.

Exactly as I anticipated, the chairman displayed his profound knowledge of the history of biology, the history of thought in the 20th Century, the emergence of notions, beginning (fortunately not with the Sumerians) but with the Greeks , and so on and so forth, relishing the perfection of every sound the French language can offer. Barely 30 minutes were left, when he introduced the first speaker, who was abruptly cut off after a few introductory remarks, with the others suffering a similar

fate. Thanks to my premonition, I could get through my story during the remaining minutes with a beginning, a middle, and an end.

After my talk, when I was just stepping down from the podium, I found myself surrounded by young people telling me with excitement that about an hour ago they had heard a similar paper by an absolutely fabulous man, and they wanted me to meet him. I was ready to do so, but the problem was where to find him.

We began by combing through the charming narrow streets of Namur where in the warm and soft air of fall most of the coffee houses served in the open, surrounded by flowers and under colourful parasols. Alas, they did not see him here, they did not see him there.

But after turning another corner, my friends pointed to a swarm of people, apparently surrounding an invisible table at its centre: "There he is! That must be Gordon Pask!" They pushed me through the outer shell of this cluster and, indeed, there was sitting at a table a leprechaun in a black double-breasted jacket over a white shirt with a black bow tie, puffing a cigarette through a long cigarette holder, and fielding questions, always with a polite smile, that were tossed at him from all directions. "Not born by woman, but created by a thunderclap" was the perfect description by a friend of mine, a woman, who in course of the years grew as fond of this apparition as I did.

Since I did not hear the lecture[3], I could only guess from the questions and answers what is was all about. Two items attracted my attention most. One was the repeated use of the term "teaching machine" (which I later learned was the title of one of Pask's papers) juxtaposed with a "learning machine" in connection with a suggested "exchange relation", so that teaching must have a component of learning, and learning of teaching. There was one aspect that was implicit in this dialogue and fascinated me most, an aspect which Pask made explicit later in his paper, that is, as he put it: "that the real use of teaching machines, translating devices, or whatever they are called, is the practical means of associating men with machines, or, if you will, allow the rather bizarre list of components which I suggested a moment ago, of associating man with man."

The second item was the notion of "growth"[4], which gave me a real jolt, because back in the United States I was preparing with one of my sponsors an international conference on growth, specifically organizational growth, that is, systems that spontaneously increase their internal organization. Thus, I joined in the general discussion, and after a few more questions and answers it became quite clear to me that we both might enjoy co-operating in the evolution of BCL.

When later the cluster of the curious dissolved, I introduced myself, and since we stayed in the same hotel, walked home together. To my surprise and joy, the wonderful Ross Ashby, who knew Pask and whom I knew from the Macy Conferences[5], was also listed as a guest, and when I proposed to dine together, Pask and Ashby insisted that I should meet Stafford Beer, the managerial cybernetician, who had given one of the keynote addresses[6], and who had recently completed a

successful re-organisation of one of Britain's major industries which was stuck in a pre-war bureaucracy and suffered from a post-war disorientation. By nature jovial and hospitable, he generously invited us all to join him for dinner at the superb restaurant at the Citadelle de Namur, overlooking the illuminated city, and to celebrate our togetherness with caviar and champagne. I sensed that by his creating a spirit of conviviality, I was at ease to ask Pask to join us at BCL, and for Pask to accept that offer. Two years later, Stafford Beer played the same catalytic role in helping me to persuade Ross Ashby to become a member of our laboratory.

A month or two after this "historic" meeting in Namur, Gordon Pask arrived in Champaign-Urbana, the seat of the University of Illinois, about 120 miles south of Chicago, just in time to participate in the preparations for the very ambitious conference on growth and organisation that was to take place in Chicago on May 5 and 6 of 1959, and whose title had in the meantime converged simply and clearly to "Self-Organizing Systems."[7]

Having Pask on a self-organizing-systems team is tantamount to having Pelé on a soccer team. We had prepared two major papers (Pask's "A Natural History of Networks"[8] and mine "On Self-Organizing Systems and their Environments"[9]), and an exhibit of about a dozen experiments (Pask's self-organizing "whiskers", Paul Weston's chaotic behaviour in recursively operating, topologically closed nets, and others) to be performed "live". To this end we rented a suite in the Hotel of the conference and of our stay, and decided to go by car to Chicago the night before. Two cars were needed, the first with me, taking most of the people, the second leaving much later, with Pask and helpers loading the equipment. After a 2 hours drive I had just pulled up at the entrance of the Hotel, when a car behind me came to a screeching halt. Two figures, I thought they looked like some of my students, their faces white as sheets, almost fell out of this car, barely finding their balance on the ground, when the driver's door opened, and a beaming Gordon hopped out: "Splendid! What a delightful drive!" And then the two figures: "Mostly he drove on the left hand side of the road. He thought he was still in England." That they survived this self-disorganizing experiment I took as a good omen. And indeed, our presence, our exhibits, and our papers fell on friendly ears.

Pask injected in our way of thinking at BCL the notion of "game" which, *in the* Paskian sense, is a hybrid, or should I say bridge, between von Neumann and Morgenstern's "Theory of Games"[10], and Wittgenstein's "Language Games"[11]. Crucial here is that language is not seen as a code with a one-to-one mapping to something (objects, "objects", etc), but as an activity grounded in dialogue, where "meaning" (Wittgenstein) evolves through interaction (von Neumann-Morgenstern), thus giving solid foundation to a formalization of Hermeneutics (context determines words, words determine context), and anticipating Deconstructivism (not the speaker, but the hearer determines the meaning of an utterance).

In the formalization of such an approach, the problem of "grouping" arises, that is, in how many different ways can N players form n distinct groups? It is necessary to know this, because one can then, on the one hand, distinguish between in-group and inter-group behaviour, or, on the other hand, may associate with this distinction

co-operative and competitive behaviour. If one adopts the latter perspective, one may call such groups "coalitions" of players.

On another occasion Gordon was invited to speak somewhere else, and I drove him to the airport of the University of Illinois which served the University's Institute of Aviation and also small commercial airlines with routes to St Louis, Chicago, Milwaukee, etc. Since I was interested in the combinatorial problem of forming coalitions, I wondered how many coalitions can be formed with N distinct elements. I mentioned this to Gordon on our way out, and told him that I thought that this could be handled like a distribution problem which asks: "In how many ways N(N,n) can one distribute N elements into n boxes." This is the binomial problem, and for this an answer is readily available:

$$N(N,n) = (N/n) = N!/(N-n)!n!,$$

and for all possible boxes to be considered:

$$\underline{N}(N) = \sum_{n=1}^{N} (N/n) = 2^n,$$

Gordon, always polite, said: "Yes, that would be correct. But you would be counting too many by identifying coalitions not only by its members, but also by an imagined location: and too few, by ignoring the difference that arises when in a particular coalition Mary replaces John." "OK", I said. "What would it be for 4 elements?" Without delaying for an instant, he said: "Fifteen." "What about 6?" I said. He: "Twohundredandthree". I: "And 8?" He: "Fourthousandonehundredandforty."

We arrived at the airport. I asked him again about these numbers and made a note of them. When I was back at the lab, I thought I could quickly establish an expression for these numbers. No luck! "Damn, how did he get them??" Moreover, adding insult to injury, I fancy myself to have a knack for combinatorics. Too bad! Finally, after two days and two nights of grinding my teeth, I found the solution. These numbers are the Stirling Numbers of the Second Kind S(N<n)[12], giving the number of ways N elements can form n coalitions (say 4 elements (a,b,c,d) into 2 coalitions (abc,d) (abd,c) (acd,b) (bcd,a) (ab,cd) (ac,bd) (ad,bc); that is, S(4,2)=7); hence, the total number of different coalitions N elements can form is

$$N(N) = \sum_{n=1}^{N} S(N,n),$$

Since at that time our philosopher and multi-valued logician Gotthard Günther also needed expressions for the Stirling Numbers of the Second Kind in order to calculate the number of "morphograms"[13] that can be constructed by admitting precisely n values in an N-valued system, namely

$$M(N,n) = S(N^2,n),$$

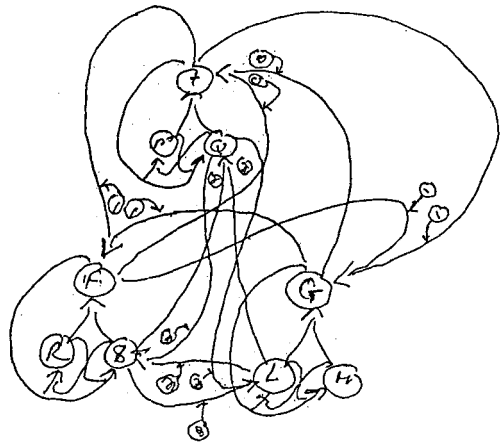
we asked Alex Andrew from England, who was visiting BCL, to generate a table of these numbers for N=1 to N=100[14]. He did this, indeed, on ILLIAC II with a program of 261 lines.

But how did Gordon do it?

Although I have not the slightest idea, I'm offering an answer. He did it like the prince in the Indian fairy tale who had to tell the number of leaves on a tree to get his beloved princess. He looked and said: "Fortythousandthreehundredand twentyseven." They counted 42,327, and he got his princess. Now, how did the prince do it? I have not the slightest idea, but I am suggesting an answer: He *saw* the "42,377-ness", as I can see "three-ness" when I see 3 coins on a table and thus need not "count".

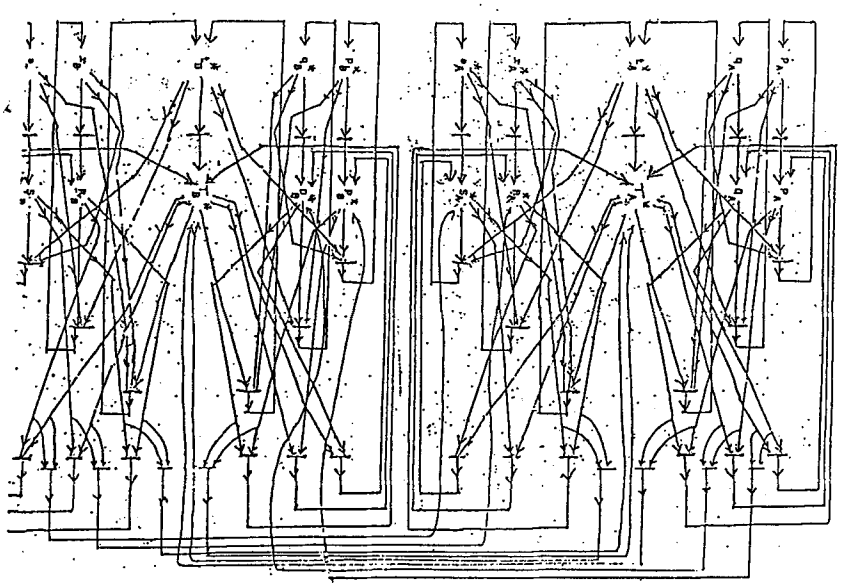
I am sure, not even Gordon has the slightest idea how he does it, but I am sure, he will give an answer. He probably will draw a diagram as this one (Fig. 1), which he drew for me in a few seconds when we once had a conversation about his "Conversation Theory".

Figure 1 *(Private Collection, Heinz von Foerster)*



If I were to ask him to explain this drawing to me, he would quickly draw another one, for instance (Figure 2)

Figure 2 *Some Generalizations of Conversation Theory and Protolanguage Lp. Systems Research Ltd, London*



and so on and so forth, because, I say, he just *sees* operational, functional, semantic, etc, relational structures at an arbitrary depth, a faculty for which I have no organs, no senses, no language.

Therefore, I call Gordon a genius. And, although I know that Gordon can be difficult, it is as this genius that I see him.

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