Chronicle of the Death of a Laboratory: Douglas Engelbart and the Failure of the Knowledge Workshop

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It is common knowledge that California, especially the San Francisco Bay Area is the birthplace of modern computing. Between 1945 and 1970 people such as Frederick Terman, professor of electronics at Stanford University, or William Shockley, co-inventor of the transistor transformed the once rural Santa Clara County south of San Francisco into Silicon Valley, the fast growing industrial centre of high-technology.[1] But the Bay Area of the 1960s is not only well known for technical ingenuity but also as the stronghold of social movements (anti-Vietnam, civil rights, women's liberation), that are often subsumed under the term 'counter culture'.[2] It is sometimes overlooked that there was an intense interaction between these two developments, at least during a short time around 1970. In this chapter we will analyse the creative and destructive effects of this interaction. Therefore it focuses on Douglas C. Engelbart and his computer science laboratory at the Stanford Research Institute in Menlo Park, CA.

DOUGLAS CARL ENGELBART: A REDISCOVERED PIONEER OF PERSONAL COMPUTING

Until recently very few people knew 'Doug' Engelbart (born 1925) outside the computer science community. But after he had received some of the major computer science awards for his pioneering work in interactive computing—including the National Medal of Technology, the highest award in its class in the United States, in 2000—there has been a growing interest in Engelbart's contribution to today's computing. Especially the 'mouse', the now ubiquitous input-device developed by Engelbart's research group at the Stanford Research Institute (SRI) in Menlo Park, California obtained much interest, as if it had been Engelbart's only goal to develop the second most successful input device besides the keyboard.[3] On the other side many of today's computer scientists like to claim Engelbart

as the father of 'Hypertext' and 'Computer Supported Co-operative Work', which is certainly not wrong, but nevertheless not the whole truth.[4]

Even more surprising is that the participation of Engelbart's laboratory in the development of the Pentagon's Advanced Research Projects Agency Computer Network (ARPANET) in the late 1960s and early 1970s is hardly known though the early history of the ARPANET has been arguably well covered in the literature.[5] We do not intend to provide a detailed synthesis of these studies but merely address their coverage of the Network Information Center (NIC) inside Engelbart's laboratory. In nearly all of these studies, Engelbart's laboratory never gets more than a couple of paragraphs, even in lengthy publications. Engelbart's Augmentation Research Center was indeed the second node on the ARPANET, after the University of California in Los Angeles and before the University of California in Santa Barbara and the University of Utah, and served as the NIC from the design of the network to the mid-1970s. In this context, earlier developments at Engelbart's Augmentation Research Center (ARC) took a different meaning when it became time to move to the next development step. Thus it seems worthwhile to take a closer look at Engelbart's research in networking, his motives, his methodology and especially at the reasons for his failure.

AUGMENTATION OF HUMAN INTELLECT: CO-EVOLUTION OF MAN AND MACHINE

Engelbart likes to tell the story of how he became committed to 'improving mankind's capability for dealing with its pressing problems, especially those over-taxing our collective capability to cope with complexity and urgency'.[6] Thus at the end of the 1950s he came up with a vision of a 'Tool for thought'[7], a means for 'augmenting human intellect'. In Engelbart's own words 'augmentation of human intellect' meant:

> increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems. Increased capability in this respect is taken to mean a mixture of the following: more-rapid comprehension, better comprehension, the possibility of gaining a useful degree of comprehension in a situation that previously was too complex, speedier solutions, better solutions, and the possibility of finding solutions to problems that before seemed insoluble. And by "complex situations" we include the professional problems of diplomats, executives, social scientists, life scientists, physical scientists, attorneys, designers–whether the problem situation exists for twenty minutes or twenty years. We do not speak of isolated clever tricks that help in particular situations. We refer to a way of life in an integrated domain where hunches, cut-and-try, intangibles, and the human "feel for a situation" usefully co-exist with powerful concepts, streamlined terminology and notation, sophisticated methods, and high-powered electronic aids.[8]

He became convinced that the electronic computer was a medium for improving idea development and group communication and therefore was the perfect means to achieve his ambitious goals.

Since Engelbart was trained in systems engineering and influenced by cybernetics and Artificial Intelligence (AI), he chose a development method that was different from other research and development project in computer science and engineering of the time. After he had read the works of Benjamin Lee Whorf[9] whose ethno-linguistic writings influenced many scientists during the late 1950s, he was convinced that technological systems were not only shaped by humans but also shaped human thinking themselves. Man and machine could not be treated separately in such a technological system. Thus Engelbart concluded that developing a tool for 'augmenting human intellect' had to be a co-evolution of man and technology.[10]

These considerations resulted in the concept of 'bootstrapping', which meant to build a tool, testing it during the inventive process, and then refining it.[11] Bootstrapping had the additional advantage that it was possible to present quick results to those military agencies that were providing growing funds to Engelbart and his Augmentation Research Center after 1963. Finally, bootstrapping enabled development work in a field that was scarcely understood. In 1962 Engelbart wrote hopefully that 'we do *not* have to wait until we learn how the mental processes work... but getting started now will provide not only orientation and stimulation... but will give us improved problem-solving effectiveness with which to carry out the pursuits.'[12]

The first step was to augment the facilities available to the ARC staff themselves, a bootstrapping operation to speed the development of even more sophisticated tools. The results of the ARC group were impressive. Not only were a number of studies conducted on new methods of communication with the computer that finally resulted in the development of the 'mouse', but a system was developed–the On-Line System or NLS–which embodied a number of aspects relevant to Engelbart's initial goals. The system, which was presented by Engelbart and his group at the Fall Joint Computer Conference on 9 December 1968, provided an integrated 'knowledge workshop' for the person, not an isolated bunch of tools. The idea was to demonstrate what it might be like to perform one's work through such a computer system: writing, editing, running programs, scheduling, etc. The use of the mouse, and the novel five-finger keyset, while requiring a little time for new users to get used to, offered a fast and smooth way for the user to input, edit and format information. Although a standard keyboard was also provided, many operations could be performed by a combination of mouse and keyset commands, with the user's hand never having to move on the keyboard.[13] This demonstration that is sometimes called the 'mother of all demos' was 'one of the most impressive things I'd ever seen in my life,' recalls Charles Irby who worked for Engelbart in the early 1970s. 'People were spellbound. It seems so trite today. At that time, no one had ever done anything like that before… It

just sent chills down your spine. The audience was totally enthralled by it.'[14]

Thus by 1969 Engelbart and a team that had grown to some 30 people had a highly developed system that served a single user as a 'vehicle…to roam over "information space"' as Engelbart's student David Evans wrote in his dissertation. But he also complained that the On-Line System did not meet all the demands formulated in Engelbart's initial plan, because it was only a 'highly developed monologue support system' and did not include any means for supporting the collaboration of knowledge workers, maybe even at places spread all over the country.[15] A large-scale network, as the ARPANET that was being built since 1969, could best achieve communication and collaboration among users.

THE ONLINE-SYSTEM AND THE NETWORK INFORMATION CENTER

The early developments of the ARPANET occurred when Engelbart was starting to think about the diffusion of the On-Line System, that he framed in terms of bootstrapping cycles. In fact, at the time of the preparation of the 1968 demonstration, Engelbart envisioned the fate of the system out of his laboratory, in the building of a community of users that would differ, to a certain extent, from the reflexive users of the first phase.[16] These users of the network were still supposed to be computer programmers: that was the case of the earliest ARPANET users, because networking was thought to be a natural extension of Time-Sharing-projects of the early 1960s. By 1966 most of the major computer science centres (at least those funded by ARPA) had Time-Sharing Computers that were running in isolation. For an exchange of software it was still necessary to send magnetic tapes through the country. Thus it was an economic necessity to

> make every local resource available to any computer in the net in such a way that any program available to local users can be used remotely without degradation... The resources, which can be shared in this way, include software and data, as well as hardware... An effective network would eliminate the size and distance limitations on [local] communities.17

As early as 1966, Robert Taylor, then director of ARPA's Information Processing Techniques Office (IPTO) (ARPA) and a committed sponsor of ARC since the early 1960s, discussed the opportunity provided by a network project with Engelbart. Engelbart's reactions, at first, were not too different from those of most other contractors: He remembers thinking 'Why would anyone want to do that?' But Engelbart could not seriously reject the offer to participate in IPTO's next big project and after more thinking; he soon realised how 'it would fit into the community goals' that he had been thinking of.[18] During the Ann Arbor contractors' meeting in April 1967, Engelbart therefore volunteered to establish the Network Information Center in his laboratory. This decision, however, was not exactly well accepted by his staff when he came back to SRI and told them that he had

volunteered for the Network Information Center.

In spite of these early negative reactions, planning for the Network Information Center inside the lab started with the first Network Working Group (NWG) meetings, in 1967. Until 1970, several ARC staff members participated to those meetings and represented SRI and the laboratory. Elmer Shapiro was only associated to Engelbart's laboratory, but he provided an important link to the NWG.

ARC's limited technical contribution to the development of the ARPANET seems to be bound to certain people like Elmer Shapiro, Bill English, and Jeff Rulifson. All of them were ARC veterans who had already joined Engelbart's lab in the mid-1960s and were instrumental in the creation of the On-Line System. Along with other ARC members they left the laboratory in 1970-1 and joined the newly founded Xerox Palo Alto Research Center (PARC) that was going to take a leading role in the development of personal computing and local networks and during the 1970s. As a result the technical contribution of the ARC members slowed down significantly in 1972. In 1974-5 it resumed under the impulse of Jon Postel and Jim White who had been involved in networking projects at the University of California in Los Angeles and Santa Barbara before coming to SRI in 1973. Thus, from 1974 on, NWG contribution from ARC was limited to the work of two staff members who were not part of the early NLS development group in the laboratory.[19]

Nevertheless, planning of the ARPA Network Information Center started as early as 1967 with the mandate to organise the Network Information Center as a depository for information relevant to ARPANET users, including network protocols, and other information pertinent to ARPA resource-sharing.[20] In particular the Network Information Center was to collect all information concerning network practice; it would create reference documentation and integrate external information into a common database. Finally it was to be responsible for the maintenance, update and dissemination of hard-copy information to all users and a general query service and a telephone hotline. Engelbart also believed that there was an expressed 'desire to make use of SRI computer aids for composing, studying, and modifying documentation' and thus to become users of the On-Line System.[21] Over the next years Engelbart became more and more convinced that the Network Information Center could be the starting point for an extension of his research program. In his bootstrap program the homogeneous group of computer programmers was replaced by a group of NIC users who were still computer professionals but with more varying qualifications. Thus, by 1970, he wrote that running the Network Information Center 'offers new ways to experiment with collaborative dialogue. As we ourselves learn how to deal with it... we expect to begin offering use of our ''Dialogue support system'', through the network, to people scattered over the country who want to do collaborative things in pursuit of Network activities'.[22]

In Engelbart's mind, forming an on-line library was a way to enrol the ARPANET users in using the On-Line System over the network. According

to Engelbart, however, his first attempts to do so met a relative lack of interest amongst both his sponsors at the Information Processing Techniques Office and his fellow contractors. His ARPA assignment to establish the Network Information Center was typically vague, and 'contained no specific guidelines as to what form NIC services should take.' On the other hand, when he took the initiative to ask his fellow contractors what services they expected from the NIC, he got another vague and 'often contradictory' response. Some thought that 'there was little need for the NIC,' when some others thought that the Network Information Center should 'supply initiative and leadership in the development of overall Network conventions and methodologies'.[23]

The emerging discrepancy between Engelbart's plan to use the NIC as a means for his ambitious goals and the rest of the community's persistent idea of the NIC as a network library became the core of a fundamental crisis when the Network Information Center finally went on-line in late 1971.

ENHANCEMENTS TO NLS: JOURNAL AND MAIL

Confronted with such an uncertain situation, Engelbart decided that the Network Information Center should provide two kinds of specific services: basic library services and on-line services. Basic library services covered the trivial aspects of the NIC management and were concerned with typical information retrieval services such as accumulation, indexing, referencing, and storage of a 'physical collection of information items in various sizes and media'.[24] On-line services, on the other hand, constituted a more interesting challenge for Engelbart and his staff, since it meant harnessing the capabilities of the Network to provide such services.

It is at this level that Engelbart planned the remote use of his On-Line System over the network, first with a typewriter-oriented version, and later with the display terminal-based On-Line System. From 1969-1971, during the planning stages of the Network Information Center, Engelbart and his staff created several enhancements to NLS to provide these on-line services. In 1969, they worked on the design of a windowing capability for the system, and implemented the Mail and the Journal features of NLS. In 1970 and 1971, these features were in regular use in the laboratory, and they implemented a version of NLS for the then popular PDP-10 TENEX operating system. This latest enhancement made sense, not only because ARC was acquiring a Digital Equipment PDP-10 Computer to replace its SDS 940 Computer, but also because the PDP-10 was the time-sharing system used at most contractors' sites. In April 1971, nine of the 25 computers connected to the ARPANET were DEC PDP-10s.[25]

The Journal feature of the On-Line System had already been conceptualised in 1966 as a tool for improving the effectiveness of management work, but specification and implementation did not start before 1969. Just the name 'Journal' gives a hint of what Engelbart and his student Dave Evans had in mind. The Journal should have the same importance for computer augmented teamwork as scientific journals had for traditional

knowledge work. Every NLS entry was eventually recorded in a permanent database. NLS' ability to forge linkages between Journal entries created a new form of documentation and communication that was called 'recorded dialog'. For handling the vast amount of documents (more than 30,000 entries in five years) the system provided features for the indexing and retrieval of data. At the time of its submission, the Number System automatically transferred a mail message to a read-only file identified by its unique catalogue number. Catalogue indexes based on message identification, name or ident of its author(s) and keywords were available. The user could consult such catalogue indexes when editing a message, in order to link it to previous messages. Other features allowed the use of 'irregular Augment files' such as those (text or graphics) that other NLS users were working on but that they had not submitted to the Journal yet, if those people made them accessible. The system also provided a way of analysing a set of recorded dialogue, such as all the passages relevant to a given issue (identified by keywords or comments). After a phase of habituation the Journal proved to be a powerful tool for the quick informal dissemination of information, for discussing immature ideas. It is less certain if the Journal ever became a tool for 'qualitative planning' as its creators originally intended it. However the collected Journal entries give us a valuable insight into the atmosphere and day-to-day work at ARC from 1971 onward.

Since all users of NLS were logged onto the same Time-Sharing-Computer that was running the Journal it was no problem to distribute documents to particular people who were also users of the same machine. The recipient of a message was notified to have a look at a certain document that was filed to the Journal. In this way sophisticated mailing lists could be realized without too much effort. Finally Engelbart was a strong supporter of Time-Sharing and understood the Network Information Center as a centre for *all* kinds of information and communication in the network community. In this respect there was no need to develop programs that transmitted messages from one computer to another.[26]

The NLS Mail and Journal features never had exposure outside ARC. The availability of a number of simple but not very powerful electronic mail applications prevented NLS mail feature to become predominant in the context of network mail between 1971 and 1977.[27] ARC/NIC staff members still contributed to the Mail Protocol discussions, but they were in no position to impose NLS mail as the application of choice. They still used it internally, however, in connection with the Journal. For Engelbart, NLS' Mail, and Journal features were crucial components in the second phase of his research program that had moved from the augmentation of individuals to the augmentation of communities of people working collaboratively. This was in fact J.C.R.Licklider and Robert Taylor's original idea: to conceive the computer as a communication medium, as an interpersonal interface.[28] But for Engelbart, the implementation of such an interpersonal interface also supposed an active research on the human side of the system, on the ways to improve group collaboration to take advantage of the newly acquired computers aids.

OF MICE AND HUMANS

We now focus on one of the social experiments that Engelbart carried out at ARC in 1972. Explicitly devoted to the 'human side' of the system, these experiments reveal the problems of the laboratory at the time of the beginning of the implementation of the ARPANET and the early developments at Xerox' Palo Alto Research Center. Engelbart designed one integrated experimental plan in three distinct activities that he launched separately between the end of January and May 1972, in three internal memos in the NLS Journal: 'To launch PODAC', 'To launch LINAC'; and 'To launch FRAMAC'.[29]

The line activity (LINAC) was designed 'to carry out activities within the framework that move [the laboratory] toward the goals'. The framework activity (FRAMAC) was designed to 'discuss and set the framework goals'.[30] In the next section, we start with a look at the Personal and Organizational Development Activity (PODAC), which was meant to compose 'the people's organization, representing all of the human beings that work in/for ARC'.[31]

Stirring the PODs

The PODAC episode ran in the laboratory between 25 January and 11 September 1972. We have noticed previously that the ARC technical contribution to the Network Working Group slowed down in 1972. The PODAC episode might explain part of this situation, since it created a crisis inside ARC. Engelbart conceived PODAC as 'a separate organizational set-up from that for which we departmentalize our activities... in the business of setting and pursuing our goals.' PODAC participation for a weekly meeting of at least two hours was mandatory for the staff members, and the whole ARC staff was distributed in four groups, called PODs, 'aiming for balanced representation in age, sex, professional training, length of association with ARC, and work roles.'

This kind of a 'social experiment' was not new to ARC or Engelbart. As an individual, Engelbart had had some experience with encounter groups and had generally felt that his interaction with these groups had helped him 'to understand himself better, to fully appreciate his attitudes and beliefs and integrate his thinking and opinions, and... to communicate better with the world outside himself'.[32]

PODAC became more personal at first: the personal development side of the activity, at first, took over the organisational side. Topics discussed covered 'raising kids, philosophies of life, likes and dislikes, funny incidents in our lives, the dope rackets, "hippies" as they are vs. as the general public thinks they are... you name it'.[33] At this level, we can see how the on-line computing culture at ARC was anchored in the general counter-cultural background of the Bay Area of the late 1960s.

More serious concerns about the organisational aspect of the activity were strongly voiced during some of the meetings: 'There was widespread dissatisfaction with the lack of well-defined roles, structure, and goals here

at ARC... there were objections and dissatisfactions expressed about how Doug performs his role. There is an impression that Doug goes off in a corner and hatches ideas. People are uncomfortable with all the surprises... Doug does not allow enough control, goal setting, participation for ARC in general.'[34] Several people also felt that ARC was becoming more and more a service operation and less and less research-oriented.[35]

After the initial three months devoted to experimentation, according to Engelbart's design, PODAC underwent an internal evaluation. Each POD was asked to reflect on its own experience and discuss it with other PODs.[36] This evaluation showed a differential gap in the level of success for each POD. Some PODs considered the experiment very successful, while others disagreed and wanted to end it. The final word eventually came from the chairman of the PODAC committee (PODCOM), Walter Bass:

> What evaluative processes have been attempted have reached no expressed conclusions, and we have no framework for PODAC evolution in which to discuss ANY specific proposals for changing (or not changing) the POD organization. Frankly we don't know what the hell is going on. In this context, the PODCOM reshuffling proposal is pure bullshit, and if that is the best PODCOM has to offer us, then perhaps PODCOM—and maybe the POD organization itself—has earned oblivion.[37]

However, this death was not the end of the social experiment dealing with personal and organisational development. Some staff members took up Engelbart's proposition to call on external help. As early as 21 April, one POD arranged for the visit of Gus Matzorkis, a consultant in organisational development, which was followed on 19 May by that of another, Dr Arthur Hastings. Gus Matzorkis eventually wrote a report based on his meetings with ARC members. The report, dated 30 June, was eventually submitted to the Journal on 11 September 1972. It marked the end of PODAC, and concluded that

> There is a largely unacknowledged clash of personal values systems in ARC... There is considerably more formality in the ARC work culture than appears at first glance...There is a tendency in ARC to sometimes be unduly tied down to the past, to be preoccupied with evaluating past decisions and events, to be carrying a load of yesterday's "unfinished business"... The relationships between Doug and ARC as a whole, and between Doug and various individuals and subgroups in ARC, set much of the tone and pace of the work culture and provide the immediate setting or background for the major issues and problems in the culture. This dominance of the leader/others relationships is stronger here than in most work cultures.[38]

No other PODAC-related Journal entries were submitted after this point. Both professional organisational consultants concluded that specific issues plagued the ARC work culture, issues that needed more than nice bull sessions to move toward a resolution. Most of these related to the specific

kind of leadership that Engelbart exercised on ARC and appeared finally as built-in problems in an organisation set up around one man's crusade. It is no wonder, then, that the last episode of this social experiment led more to 'personal' than 'organizational development,' and to still more conflicts between Engelbart and the participants in his crusade.

From the Organisation to the Persons: A Persecutory Account

Along with the search for professional help from organisational development consultants, some ARC members turned to the personal-development movements that were popular in the Bay Area at the end of the 1960s. In May 1972, one POD started to 'evaluate' an organisation called 'Erhard Seminars Training' (EST).

Paul Nathan Rosenberg, alias Werner Erhard, launched EST in October 1971, at the Jack Tar Hotel in San Francisco with nearly a thousand people in attendance.[39] A former car-salesman and self-taught individual who had been influenced by such self-help books as Napoleon Hill's *Think and Grow Rich*, Rosenberg created 'Erhard Seminars Training' as the kind of self-help program known to psychologists as 'Large Group Self-Awareness Training.' The seminar was built eclectically on the principles of Zen, Scientology and other such philosophies. 'Erhard Seminars Training' lasted for almost fifteen years before Erhard repackaged it as the Landmark Forum.[40]

One POD invited Stewart Emery from 'Erhard Seminars Training' to introduce the organisation to ARC, and Walter Bass attended some of their seminars.[41] He came back very enthusiastic about EST, saying that 'the EST course is worth $150' and that 'EST theory has a great deal in common with Augmentation Theory'.[42] He managed to communicate his enthusiasm to Engelbart, who soon reiterated his proposal to pay for half of the cost of EST to his staff members who were willing to participate.

The lack of Journal entries describing what happened next means that to document it, we have to turn from hard evidence to literature. Jacques F. Vallée gave a 'composite, imaginary, fictionalized' account of the EST episode at ARC in his 1982 book *The Network Revolution: Confessions of a Computer Scientist*.[43] Its portrait of the EST episode at SRI, however, is very thinly disguised. Vallée's narrative is a good source since he only applies a thin cover over reality: names are changed, issues are focused, the narrative is somewhat exaggerated, but Vallée mainly reports real events. In his narrative, Pacific Research Laboratory stood for SRI, 'Stanley' for Engelbart, the 'Systematic Thought-Enhancement Machine' (STEM) for NLS and/or ARC, and the Military Equipment and Gear Agency (MEGA) for ARPA. Vallée tells the story of an experiment that went amok, or how 'the human factors came back and took revenge'.[44]

It shows clearly, and from the inside, the importance of the human side of the experiment at work. Several aspects of this narrative echo Matzorkis' insights concerning the problems of the laboratory: the focus on one man's 'genial dream,' the turn to the organisation's past goals, the conformity. Moreover, its narrative abounds with mystic, religious/cultish aspirations to turn doom and tragedy into 'salvation' and 'transfiguration.' The crusade

was failing on the shore of the promised land, its prophet entrenched in its vision, its soldier-priest lost in self-doubt. The very nature of this exaggeration gives us a clue to an interpretation of the collapse of the laboratory: look for the religious aspect, the mingling of the personal (individual salvation), and the organisational (church-like) aspects of the story. This is why we propose to make use of a model that the religious scientist René Girard developed to analyse collective persecutions in times of crises, e. g. during the medieval plague epidemic or the French Revolution.[45]

Girard states that there are a number of texts that obviously exaggerate the historical events and reiterate the baseless or even obviously foolish accusations against the victims of a persecution. But he refuses to admit that those texts are worthless as a source for the historian. Instead he suggests that they include three types of stereotypes that help decipher the historical 'truth' behind the text. These stereotypes include (1) a situation of crisis of indifferentiation with its 'simultaneously monotonous and monstrous aspect', which turns into an (2) indifferentiating crime which turns a certain individual or group of individuals into (3) the designated criminals and therefore the designated victims of the persecutions, because they are paradoxically different and undifferentiated at the same time. The persecutory mechanism of the scapegoat is a social tautology: if there is a crisis, there must be a crime; if there is a crime there must be criminals; if there are criminals, they must be the cause of the crisis (or as Monty Python once genially put it, 'if she burns, she must be a witch').[46] As we shall now see the collapse of Engelbart's laboratory was a time of scapegoats and a murderous crowd: Vallée's story combines the three main stereotypes of a persecutory text according to Girard.

In the first stage of his story, Vallée exposes the first stereotype: a situation of crisis that is a crisis of indifferentiation. The STEM/ARC project as a whole has to prove that it is different, but is facing a paradoxical situation: its members can be mistaken for the 'lackeys of the Master of War,' since STEM is funded by MEGA. At this crucial juncture, the prophet himself is speechless. He has lost his ability to convey the Word. Too busy fighting these evil forces on their own ground, he cannot find the energy to guide his converts spreading the Word. The Word has already been given to them, anyway, they should be convinced but they doubt. This is where Werner Erhard comes in. Another prophet, master of the word, offers salvation: they can become what they are, persons. This is the ultimate meaning of personal development. They can re-differentiate, regain their individuality, and become again the 'clever opportunists' they claimed to be from the start.

Werner Erhard is another figure of the prophet, a quasi-equivalent of the first prophet, Engelbart. Walter Bass said so after his initiation, and even Eric Elsevier, Vallée's outsider, says so, as well. EST techniques are well designed for the gospel to work: public disclosure of the individual's whole being, good and evil, sometimes under stress, sometimes with pleasure. Carroll describes Erhard's method as 'often abusive, profane, demeaning, and authoritarian'. He quotes a former 'adept' who describes the Land-

mark Forum experience as follows: 'You can't go to the bathroom when you want, you take meals in groups, there are strict rules about talking and conduct, and the leader won't hesitate to shame you into compliance.'[47] And Vallée says 'they had gone through the humiliation, the stripping, the public flogging of their souls, the *animectomy*'.[48] This is the second stereotype of the persecutory account for Girard: the undifferentiation crisis as turned into an indifferentiating crime. The crime has been punished, and the sinners have repented. They are saved and they can go back to the Word. The crowd is turned into a mob by the seminars: mobile individuals who know their purpose and share it, thanks to the power of the church.

In Vallée's narrative, the persecutory account is framed into three phases corresponding to three groups of staff members ('waves') inside the laboratory. The redeemed mob of phase one takes on the role of the accuser, the 'persecutor' of Girard's model. The undifferentiation crisis is turned here again into an undifferentiating crime, according to the second stereotype of the persecution text. The undifferentiating crime of the Second Wave is motivated by the mimetic desire of the managers of the laboratory aspiring to be young and idealistic again. Here comes the third stereotype of the persecutory account into play.

The designated criminals are designated victims of the persecutions because they are indeed paradoxically different and undifferentiated at the same time. The managers are 'old Dinosaurs,' they have been working for the Monster. In this they are different from the first wave members, they even represent what the First Wave members fear: undifferentiation. The very presence of these 'confused managers' in STEM raises the doubt and indifferentiate the now redeemed members of the First Wave. Assuming that the Word cannot be wrong, and that the project is nevertheless failing, the managers must be guilty of the undifferentiating crime.

The Second Wave turns to EST for a different motive than the First Wave, but in the same fashion, as a crowd. They are not sinners, they might be traitors: who could say if the Word has really touched them? The redeemed converts of the first phase promise them the reward of acceptance at last. If they become 'developed persons' they will eventually fit in. It is the third ordeal. The Second Wave goes through the ordeal; it can now join the mob. The set is ready for the third phase.

In this final phase, the persecutory vocabulary is even clearer: the 'whole STEM project' is infected and 'must be saved', the mob looks for other 'victims.' The redeemed STEM members, sinners and traitors alike, are now 'apostles of EST.' The mob has become the majority and the link to the Prophet has been restored. But the persecution fails, because the remaining individuals resist the pressure. They are different, they cannot be accused of the undifferentiating crime: 'they are individuals who could stand on their two feet.'

The resisting victims are the real heroes of Vallée's account: 'this was revelation to Eric. He discovered the strength and the resilience of some team members whose real spirit he had never suspected'.[49] This is the

fourth and final ordeal, where the designated victims become the strong persons that they are, without the help of any prophet or church. The resisting victims are heroes because they already are fully developed persons with some faith of their own and the technological or managerial abilities to be contributing members of the organisation. They occupy strategic positions in the project and are essential to it. Of each of them, he says something like 'it was impossible to get rid of him'.[50] Therefore the end is clear. The prophet becomes the final victim, the ultimate scapegoat. The unlikely result of the fourth ordeal brings us back to the first ordeal, the ordeal of the Prophet. And the result is failure.

Using Girard's persecutory model to read Vallée's account of the EST episode might just be a way to reveal a possible line of interpretation of the collapse of ARC. Several other signs, however, allow us to justify such a preferred reading. Engelbart was on the board of 'Erhard Seminars Training' for a while in the 1970s, thereby giving some plausibility to the hypothetical prophetic equivalence called for in our interpretation. In an interview that one of us carried out, Jacques Vallée stood by his narrative, without the veil of fiction, this time.[51] Other staff members confirmed this reading through the recurrent use of a religious vocabulary[52] or the vividness of their memories some twenty years after the facts.[53] The EST episode affected ARC staff members in a definite way. Some gave up research, moved to communes; others became very sensitive to interactions.

It might still appear doubtful to use a model designed to read narratives of collective persecution in a case where the crowds and mobs are constituted of groups of less than 20 individuals. To this possible objection, we answer that we have looked here at a located instance of a much broader phenomenon. Personal development movements such as 'Erhard Seminars Training' were quite a massive phenomenon in the Bay Area in the late 1960s—and still are today. The conflict of values between hackers, hippies and straight managers, at a time when most of the funding in research in computing came from the military, is nothing special to ARC either.[54] These phenomena were actually going on long after the episode narrated here. Some of the key researchers at Xerox PARC had taken 'Erhard Seminars Training' too, for instance Robert L. Belleville.[55] Alan C. Kay, a leading actor at PARC even told us that this specific context might after all have been a condition of the innovative climate that flourished then:

> 'There was a whole 1960s thing... the Free University was in Palo Alto. There was a lot of stuff going on... psychodrama, EST was going on, Essalen, down in Big Sur, the Whole Earth Catalog was right across the street at that time to SRI... You know, I am from the East Coast and I found it too confining. California was wide open, particularly during this time: anything went. Of course a lot of people floundered... I think that it helped a lot that there was sort of the perfect climate to put an engineering cast into, because they were just naturally looser... It was a very nice set-up generally... a little crazy. We had some riots at Stanford and stuff, that were

> unfortunate, and other things. But basically it was a very good set-up I think'.[56]

In other words, we believe that the relatively small crowds involved at ARC in the EST episode are representative of a much larger phenomenon that actually characterised the Bay Area at that time. Jacques Vallée's semi-fictional narrative might be exaggerated, but because of this exaggeration it is the best account to read this episode. The next and final section of this chapter will bring us back to the real with the last significant episode of the collapse of the laboratory.

THE BREAKTHROUGH LAB AND ITS DISCONTENTS

The previous sections have shown that ARC was confronted with various problems with respect to the contractors' community. The original plan to further bootstrap the On-Line System with the participation in the Network Information Center first met a relative lack of interest from the contractors and a lack of specific guidance from ARPA. Later, the attempt to enrol the contractors with the help of NLS Mail and Journal features failed because of the availability of other mail applications that made the use of NLS unnecessary. In the early days of 1972, ARC was facing a tough situation: the relationship with its sponsors was getting very tense, as this excerpt from an internal ARC memo from Richard W. Watson reveals:

> I went to a NWG meeting at Ill. [University of Illinois] and found that while things were more sympathetic there, ARC and NIC were somewhat of a joke. Throughout the following months as I met people I knew, I was constantly asked why I had gone to work for the [ARC] scandel [sic] as some put it. I was constantly defending the project and saying wait you'll see type of things.[57]

Internally, various contributions to PODAC echoed this dissatisfaction from the ARPA sponsor. The minutes of a POD meeting held on 9 February, for instance, reported that 'dissatisfaction was expressed with the apparent tendency of ARC to design processes and systems that are hurried, short-term, make-shift efforts for an immediate, urgent need to produce something and then allow that process to remain without redesigning for long-term and more efficient job handling.'[58] Some basic problems of the Journal system handling were especially mentioned.

In several other POD meetings, the question of the new users' needs was addressed over and over again. Bootstrapping to the next circle of users meant that the laboratory should be able to shift its mode of operation to serve a community of users with different needs and aspirations. The emphasis, however, was put on bootstrapping NLS rather than on addressing the needs and aspirations of these new users. For the whole of 1972, the relationship with ARPA went through ups and downs, but the situation remained practically unchanged. In October 1973, in another internal memo Richard W. Watson summarized this situation.

Watson insisted again on the fact that 'there has been little or no feedback or guidance from ARPA in the intervening years as to what needs they would like to meet at what costs.' More importantly, he insisted that this lack of guidance had become an impediment to the actual functioning of the Network Information Center. For instance, Watson complained that ARPA had not set up any 'explicit procedures associated with new sites coming on the NET to assure that the NIC receives timely notification (or any notification for that matter) and other information it needs for its data bases.' The NIC's function was not only unclear, but also not exclusive enough since there was by then 'two or three other groups on the ARPANET providing related and occasionally redundant information services to the NET.'[59]

By late 1973, some inside ARC began to recognise that the very idea of bootstrapping NLS might be at the origin of some problems of the laboratory in its dealing with the ARPA sponsor: 'ARC management, including myself, have seen the importance of the NIC to ARC in terms of what the NIC can contribute to ARC's broader goals,' Watson wrote. Now he realised that 'the NIC has had to use NLS based technology to meet network needs and often has had to perceive these needs in NLS terms. This haw [sic] led to occassional [sic] distortions of actual needs and thus failures to perceive and meet actual network needs.' Although he insisted that this kind of distortion could go both ways, Watson believed that the core of the problem was that 'often NIC priorities have had to take second place to broader ARC objectives.'

Also, Watson finally recognized the basic difficulty in carrying out research and service simultaneously on the same system: 'the system on which the NIC has been based was not originally designed explicitly for many NIC functions, and while it is being adapted to meet NIC needs as part of its development evolution, it is incomplete and not finished through to the level of detail necessary for many NIC needs.' In such a set-up, two distinct kinds of pressure apply: the system is under constant pressure to adapt to the needs of its clients and to the evolving representation of these needs, but also suffers from the pressure that the changes brought by the evolution of the research create. Watson insisted that 'these factors make it hard to create a stable plan and to carry it out as new factors are constantly appearing on a daily and weekly basis to shift priorities or over come some new glitch.'[60]

Elizabeth 'Jake' Feinler, who was by then in charge of the Network Information Center, was prompt to respond to Watson. What appeared in Watson's memo as the result of a built-in conflict in ARC/NIC design became for her a source of complaints about the NIC.[61] In 1973, there thus was still an internal division inside the laboratory over the decision to implement the Network Information Center on the basis of the further development of NLS. While Engelbart conceived of the Network Information Center as the vehicle to bootstrap NLS further, the Network Information Center insisted that it was an activity in itself that could be considered as a worthwhile research and development activity. Feinler sta-

ted in her memo that the Network Information Center could 'create a whole new research area of resource sharing and information retrieval.' But she also insisted that it would require that the Network Information Center should stop being considered as a 'foster child' and that it should receive 'adequate recognition and support from within.'

This final demand should be read in the context of the social experiments attempted by Engelbart with PODAC, LINAC, and FRAMAC. Feinler's plea and complaints actually referred to organizational and personal problems inside the laboratory. Watson only diagnosed an organizational problem stemming from the dual nature and the hierarchisation of the goals of the laboratory, but Feinler was clear in her evaluation about the personal problems that these organisational problems created. According to her, individuals contributing to the Network Information Center were still set apart as 'a nuisance' or 'system hogs' in late 1973. She finally insisted that the NIC members should be given 'equal footing within the framework of ARC.' Therefore, in late 1973, the problems that should have been dealt with in the PODAC experiment were still there. The EST episode that marked the end of the experiment, as we have seen, concluded in a failure to settle the differences between the ARC members and restore the link with Engelbart. A final contribution to this episode, dated from the end of 1973 too, will help us understand its conclusion.

Donald 'Smokey' Wallace, the model for Vallée's hero 'Guru,' summed up the situation of the laboratory in an internal ARC memo entitled 'Of Mice and Man (a Revelation)'.[62] His take on Engelbart's social experiments is worth commenting on here, because it explains how the nature of the relationships between Engelbart and his staff might have changed dramatically after the 1972 social experiments. If our analysis of Vallée's account of the EST episode is right, after PODAC and EST, the status of Engelbart in the laboratory changed drastically from 'hero' to 'victim.' We will see now that we could consider him a special kind of 'victim' that keeps some features of a 'hero,' namely a tragic hero.

For Wallace, PODAC was a definite 'experiment' that was aiming at creating conflict inside the laboratory ('no safe heaven in the PODs'). His 'Of Mice and Man' memo gives his own version of how Engelbart was actually 'fucking' with his staff members, who were 'the laboratory animals' in his experiments. For him, PODAC was an experiment in creating confusion and chaos in the laboratory: when something started to work Engelbart would change the rules and say that it was not the result that he expected. At the same time, Wallace notes the paradox: the augmentation framework was not changing. For Wallace, Engelbart is indeed the author of the indifferentiating crime that is at the core of the persecutory account. He insists that Engelbart had a problem with sharing the credits or even acknowledging references. For him, 'an awful lot of what was built [at ARC] had the personality of the various individuals who built it.' Engelbart might appear as 'the lone guy who invented all that stuff', when it was really built by all these people (who didn't get any credits),'almost by accident' in Wallace's mind, 'the best people in the industry at that time'.[63]

But the crucial point in Wallace's account is that there is an ultimate reason to this situation: Engelbart created chaos and confusion with his experiments in order to achieve a 'breakthrough.' For Wallace indeed: 'Granted some progress had been made but most people agree that a breakthrough in computer programming is necessary and maybe long overdue.'

For him, this breakthrough had not been achieved and thus was still needed in 1973 because 'programming (system design etc.) is a much more complex problem'[64] than the one addressed by earlier breakthroughs such as physics, etc. In his memo, Wallace proposed a variation on Engelbart's idea of complex/urgent problems. This first step in the memo therefore reaffirms Engelbart's original motivation. It relies on a confirmation of the same original premises, and therefore appears as a renewed adhesion to Engelbart's original purpose. The second step in the memo is an attempt to characterise the laboratory set-up that could create 'the conditions of an environment necessary to maximize the probability of a breakthrough of the desired type.' For Wallace, these conditions amount to a somewhat paradoxical purpose: sustain chaos and frustration of its staff, but in a productive way.

In this clever justification, the personal problems created for the various individuals staffing the laboratory appear finally as a necessary consequence of the organisational set-up needed to maximise the chance of a breakthrough. These problems, however, should not exceed a certain level:

> care must be taken that the frustrations level of the participants must not become so high, or the incremental rewards so low, as to cause the subjects' to leave the lab or for the apparent normalcy of the project to become unstable. Such tools as apparent, inept or indecisive management, fuzzy goals and unclear departmental or functional lines can, and should, be used as effective devices in creating an atmosphere of 'creative frustration'.

In spite of its apparent paranoid character, Wallace's memo achieves one crucial move: it restates and therefore reaffirms the goal of the laboratory and justifies Engelbart in organising it (or, rather, in disorganising it) the way he did. The Prophet turned victim reappears as a hero because even if he is blamed, this blame is the necessary price he must pay to carry the Word: the Prophet becomes a tragic hero. The end eventually justifies the means, even if these means 'tamper with the lives of the staff in a very significant way.' Ironically enough, the very word 'breakthrough' was also at the core of the EST gospel, which considered the experience of such a 'breakthrough' as one of the most important goal of the Seminars. Wallace's argument is therefore tantamount to a renewal of faith, if not in the person of the Prophet, at least in his revelation.

In his memo, Wallace insists that he has shared his model with some of his colleagues, and that 'it has been as revealing to them as it has been to me.' Numerous other renewals of trust in the Journal archive seem to confirm this point. Even Elizabeth Feinler, for instance, concluded

her 'demanding' piece with the following statement:

> Up until now systems have emphasized the output of one knowledge worker or have amassed the work of scores, but few systems have come to grips with the problem of easy interchange between the two so that an individual is able to build, tear-down, and rebuild from a combination of his own input matched against or added to the vast input of others. This is where the excitement is, this is where the pay-off lies, and this is my view of Doug's dream of a knowledge workshop.[65]

Inside ARC, therefore, the conclusion of the PODAC-EST episode represented the beginning of the collapse of the laboratory. Engelbart's vision was still accepted as the ultimate goal to pursue, but the means to reach this goal were by no means the object of a consensus among the staff workers. If his prophecy was still accepted, the Prophet had become a tragic hero, since it was clear already by that time that he would not succeed in realising the prophecy. Externally, on the other hand, Engelbart's system was redesigned at PARC in a very different perspective, centred on 'user-friendliness': Engelbart's vision of the personal interface gave way to a modeless interface where the focus was on the screen and where manual input settled for a combination of a mouse and QWERTY keyboard that made no sense to him. In the context of the early days ARPANET, alternative systems provided a much more diffused way to establish connections across the network. The Network Information Center continued facing a lot of problems, and Engelbart and his staff's contribution to the building of the ARPANET came to be definitely translated as a 'joke.'

CONCLUSIONS

This set of reasons, internal collapse, and external disregard, sealed the fate of Engelbart's vision and led to his relative failure. Staff members continued to leave the laboratory, and the sponsors slowly pulled out. ARPA ceased its funding in 1974, and SRI eventually sold the project to Tymshare in 1977. The system was sold again to McDonnell Douglas in the early 1980s, and Augment (the new name of NLS) slowly faded into oblivion. When one of us met Engelbart in the early 1990s, he was indeed a 'bitter man,' desperately trying to continue his evangelism from the two offices that Logitech, a leading mouse manufacturer, was giving him to locate his 'Bootstrap Institute.' His 'bitterness,' however, stemmed from the inherent difficulties of technology transfer ('bootstrapping to wider masses of users') and not from the weakness of his vision.

The research and development process for a technological system such as personal and distributed computing is complex and highly uncertain. For us, the main uncertainty resides in the process by which one gets others to accept one's research agenda by convincing them that the problems they wish to solve can be best solved by using one's methods. The agenda of an actor will not necessarily prevail, even if rational reasons can be advanced

retrospectively about the social or technological characteristics of his solution. In this perspective, innovation-development is a socio-technological process, a social shaping through negotiation of the technology and its uses, as well as the shaping of social groups involved in the innovation development process, their identity, their ideology, etc.

Success or failure of the technology transfer in such a complex technological system depends on the stabilisation of the chain of associations in the social and technological networks involved in the process. Geographical, psychological, and social characteristics of the technology transfer finally sum to the necessary contextual conditions of the process. We conclude that the understanding of the user's need in each phase of the process (from experimental research to widespread diffusion of the technology) is very important for the success of the transfer process. In this perspective, the technology transfer process is best seen as a social process organised by the ultimate purpose of marketing a product that consumers will buy or at least, use regularly.

Each phase of the technology transfer process presents unique social characteristics, and what makes for success at a certain phase does not necessarily promise success for a later phase. For instance, the strength of ARC's innovative work in personal computing technologies did not guarantee its success in the later phases of the technology transfer. Overall success requires dramatic changes in strategies on the basis of new perspectives of the user. These changes are often so 'revolutionary' for an organisation accustomed to work on a given representation of the user, that they appear quasi-impossible to implement. In this paper, we have seen that the organisational setting of ARC, with this dual purpose as a laboratory and a service facility, can be read in the perspective of the process of the realisation of the user. What seemed at first an opportunity to Engelbart (on the ARPANET, he thought, there was the community of users he had been dreaming of), soon became the source of unbearable organisational and personal tensions.

Today, Engelbart is no longer a 'bitter man': the massive success of the World Wide Web has put his work in the forefront again. NLS is now very often considered as the precursor of today's hypermedia, the original application in computerised systems of the principle of hypertext envisioned by Vannevar Bush. Other institutions like Xerox PARC, Apple, Microsoft, CERN and Netscape have carried out to its term the technology transfer process, on a path of trial and errors where often only the last man gets the rewards.[66] After having celebrated Engelbart's famous San Francisco demo as the predecessor of modern computer technology in 1998, we ought to remember that the path of successful technology development indeed includes all these 'genial errors'—and takes time.

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