The Soft Infrastructure of Data Exhaust at RAND

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Interior of SAGE blockhouse that has come to disrepair, Stewart International Airport- Newburgh, New York

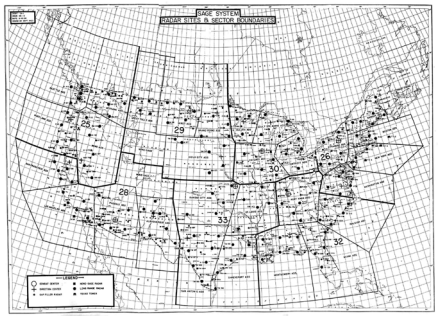
SAGE Blockhouse

On a distant lot at the edge of a decommissioned air force base sits the ominous ruins of the most expensive project in human history. New hotel developments are breaking ground while the Stewart International Airport hums along in the distance and disinterested security guards patrol vacant ruins. The history of SAGE and the Systems Research Laboratory tells an intriguing story about contemporary architectures of subjection.

In 1950, the RAND Corporation Think Tank, responding to internal military reports calling for more computing power in the early detection of enemy aircraft, established Project SAGE, or The Semi-Automatic Ground Environment. After years of development, on September 15th, 1958, the Semi-Automatic Ground Environment Radar Direction Center became operational at what was then Stewart Air Force Base. Constructed of lead-reinforced concrete, the "Blockhouse" was a 4-story high windowless bunker with 24-inch thick walls and no distinguishing features. SAGE was designed and built in such a nondescript manner that few but those with a security clearance knew what took place there. Each of the 24 machines in the Blockhouse weighed 24 tons. Each link in the network was a "black box" of informational processing. There were 23 such centers throughout the SAGE network, each a windowless block of concrete connected through electronic communications lines.

Now, despite its tellurian interiors and the enormous material heft of these imposing bunker architectures, the 'soft infrastructures' of human performance were key in the SAGE system. At the scale of the individual radar site, the "men" in the "man-machine" system were station operators who plotted aircraft tracing their locations and directions using the radar of the time. The machines, of course, were the networks of radar sites, computers, and graphic interfaces. The plotter's role would be to decide to scramble fighter jets to respond to the threat. Decision-making was the lifeblood for the entire system. So, as SAGE began in its infancy, it became clear that human performance and the emerging field of human resources were important battlegrounds in the Cold War.

To improve the performance of SAGE, The Systems Research Laboratory (SRL) was established in 1952 to study man-machine interfaces and to simulate the performance of human subjects in stressful situations. The lab was established to test institutional behavior and to organize decision-making systems in the service of survival in worst-case scenarios. Air Force personnel scanned the skies, prepared at the touch of a button to intercept enemy planes with remote-controlled surface-to-air missiles. The data of their performance, responding to simulated Russian invasions, were transmitted



Map of SAGE Radar Sites and Sector Boundaries, 1958

from 21 different radar sites over phone lines to the SRL. At large, RAND was obsessed with questions of distributed network communications where so-called weak links in the network would "perform and behave the best under system-wide stress" because redundant and unreliable links would be more likely to survive physical destruction. The more distributed and de-centered, the stronger the network.

To study the procedures of decision-making in high-pressure situations, RAND modeled the SRL as a scale replica of the McChord Field air defense radar station in Tacoma, Washington. Initially, the laboratory was located in the back room of a pool hall due to the limited space at RAND's early Santa Monica headquarters. This life-sized model of real-life scenarios was directly influenced by the economic behavioralist Robert Freed Bale's situation room. The development of Bales' "observational situation" was indispensable for early experiments in behavioral data extraction. It allowed researchers to construct a controlled environment that divided human actions from their situated context while producing a database to construct a universal model of human behavior. The situation was not linked solely with one institution or function. Its practices mutated across various facets of society, from economics to popular culture. The situation operated in diverse settings such as the "sitcoms" of the 1950s and the white house "situation room" designed to contain geopolitical conflict in a microcosm of communicational command.

Bales worked at the Systems Research Laboratory in the early 1950s. The "human-engineering" of man-machine interactions expanded his situational rationality. Here, abstracted environmental constraints stood-in for all the limitations of human decision-making. The SRL became a "society in miniature" to study and experiment with organizational communications. His report for RAND titled *Description of Air-Defense Experiments* describes the situational rationality as a procedure of organizational behavior: "It appears that the step-wise operations involved in the total organization, as well as in component sections, could be tolerably well described as an interlocking series of some seven types of information-processing operations"[1]. The plotters in the SRL had a limited amount of information to guide their decision-making. They were essentially confined to their informational environment (situation), and through these constraints of organizational rationality, procedures must be derived to find satisfactory solutions. Plotters would report airplanes as they emerged on radar monitors generated by large computers. They would use red telephones to call out the coordinates and trajectories of the simulated invasion. However sophisticated, the computer-generated data simulation was, where the experiment fell short was in its realism. It was here that the director of the SRL sought to bring Herbert Simon into the fold due to his expertise in large scale studies of organizational behavior.

This is all pertinent because Bales' procedural situation gave Herbert Simon a language to implement what he called the bounded rationality of institutional behavior[2]. Bales, the Cowles Commission, and the development of the Systems Research Laboratory essentially provided RAND with the tools of algorithmic division of human labor that became the prototype for automated machine learning systems today. Humans were seen as information processors enslaved to the step-by-step logics of giant organizational apparatuses. The Systems Research Laboratory was not only important in the history of computation but also in its revolution of the division of labor[3].

The SRL team identifies stress as an informational problem. Human performers were modeled as mere information processors, and the reduction of noise was the goal for effective, quick, and efficient decision making. It is important to note here that despite the predominantly white male low-level military subject positions

1 Erickson, Paul, Judy L. Klein, Lorraine Daston, Rebecca Lemov, Thomas Sturm, and Michael D. Gordin. 2013. How Reason Almost Lost its Mind: The Strange Career of Cold War Rationality. University of Chicago Press, p.136

2 Simon, Herbert. 1957. Models of Man: Social and Rational; Mathematical Essays on Rational Human Behavior in Society Setting. New York: Wiley.

3 Noble, David. 2017. Forces of Production: A Social History of Industrial Automation. London: Routledge. p.71

of the plotters, all identity information was erased. Human efficiency under stress was still a problem to be solved. Large scale organizations were vulnerable to breakdowns in decision-making when the temporal risk of enemy planes would require a swift response time. To achieve a complex research and training regime, the team had to "simulate environments to get behaviors worth studying," they tried to make simulated decision environments "genuine enough for the crew to respond as if they were real"[4]. The environment of behavior the simulation occupied was what Simon would come to define as a "task environment". Simulation was seen to be a promising mode of training users of the man-machine interface because it offered "a feasible method for building organizational potential artificially when the price of failure in the real world (while learning) was prohibitive"[5].

The physical infrastructure of SAGE became the prototype for the modern internet. Yet the soft architectures of algorithmic human performance under stress gave modern machine learning programs their language and conceptual genealogy. The SAGE program code comprised a quarter-million lines of instructions, by far the largest software program. The SRL researchers eventually published a plan called *A Proposal For Air Defense System Evolution: The Transition Phase* [6]. This became the blueprint for an interface between computational information storage and real-time decision-making. This document came to be known colloquially as the red book or the SAGE bibles. All human behavior interfaced with computers of the time came to be studied by economists at RAND as economic behavior. This is because the organization of knowledge production was seen to be valuable in and of itself as efficiency in labor, consulting, and so-called immaterial informational economies began to take off in the mid-1960's. These developments, linking human performance with political economy and technological infrastructures, were just as important as the modems, CRT display screens, analog-to-digital conversion techniques, and real-time digital computation of SAGE.

The networks of human performance undergirded by this nationwide system of bunkers and communications infrastructures were key in establishing contemporary 'data-exhaust' systems where online actions are measured and collated to glean information on human behavior. The physical architectures of the SRL and SAGE allowed for the dematerialization, quantification, and exchange of human behavior. It provided a spatial environment, called a "task environment," where the plotters had a limited amount of information to guide their decision-making. Procedures must be derived to find satisfactory solutions. Just like modern-day data-exhaust procedures in online systems, subjects were divided from within by reducing and compressing identities into programmable decision-response protocols.

So, despite the immense technological innovation brought on by the combined work of SRL and SAGE, perhaps most importantly, the research into "human factors" or what would be now called "human resources" via flight simulators, combat command centers, radar stations, and gunnery control is seldom the focus of media histories of computation. As Paul Edwards has called it in the "closed world" of computational bunkers, there also emerged a discursive political form[7]. The concrete miniaturization of complex systems replaced reality with simulation, and human performance derived in these test scenarios became the engine that fed the computational systems with the ever-important data for recursive modeling found in modern artificial intelligence systems. Perhaps most importantly, RAND's SRL was the spatial and ideological prototype for the neoliberal corporate landscape that is the predominant initiator of large scale artificial intelligence systems that we see today. AI is never initiated by an individual but by large scale capitalist interests made up of non-descript inte-

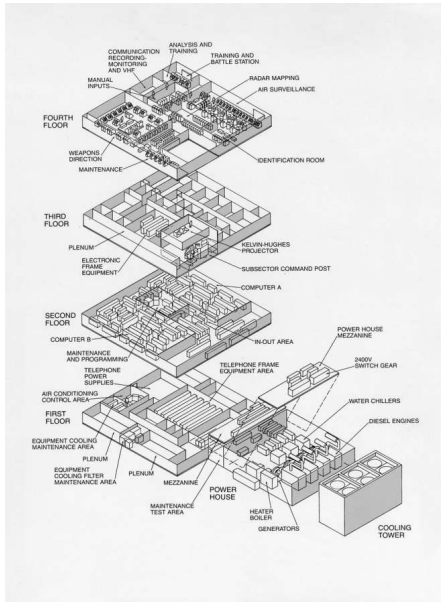
4 Chapman, Robert L.; Kennedy, John L.; Newell, A.; Biel, William C. 1959. "The Systems Research Laboratory's Air Defense Experiments". Management Science 5 (3). p.2

5 Chapman, Robert L.; Kennedy, John L.; Newell, A.; Biel, William C. 1959. "The Systems Research Laboratory's Air Defense Experiments". Management Science 5 (3). p.19

6 George Valley and Jay Forrester: 1953. Lincoln Laboratory Technical Memorandum No. 20, A Proposal for Air Defense System Evolution: The Transition Phase.

7 Edwards, Paul. 1997. The Closed World: Computers and the Politics of Discourse in Cold War America. Cambridge: MIT Press.

Plotter Using Graphic Interface in a SAGE test circa 1958



SAGE Blockhouse Interior Diagram

rior architectures that flatten subject, algorithm, scale, and time.

The SAGE Center on the Stewart Air Force Base closed in the late 1960s, its technology made obsolete by intercontinental ballistic missiles. Critics of SAGE and SRL, and their obscene budgets, claimed the system was successful only because enemies failed to attack. However, the performative nature of these systems, in their ideological function to suture Cold War subjects to automated capitalist decision-making and the performative containment of risk, was the true success of SAGE.

Kylie King's work is situated at the productive intersection of architectural design and strategic planning. She hails from the Appalachian region of Ohio. Her interdisciplinary research intervenes in the histories of architectural design, alternative economics, and critical theories of racial capitalism and white supremacy in a rural context. Kylie has presented her work at the HKW in Berlin, is a contributor to CARTHA, The Expanded Environment, and completed a MSc in Adaptive Reuse Architecture from the Rhode Island School of Design.

Brett Zehner is a media theorist and artist writing on technologies of resistance. Brett's dissertation project, Machines of Subjection, explores the ubiquitous emergence of predictive media in the form of machine learning. This research aims to conceptualize a new form of political power where individual decision-making is being replaced by the ubiquity of predictive computation. He is currently Ph.D. candidate at Brown University in Performance Studies and Computational Media and he holds an MFA from UC San Diego.