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Red Helmsman: Cybernetics, Economics, and Philosophy in the German Democratic Republic

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RED HELMSMAN: CYBERNETICS, ECONOMICS, AND PHILOSOPHY IN THE GERMAN DEMOCRATIC REPUBLIC

by

KEVIN T. BAKER

Under the Direction of Jared Poley

ABSTRACT

Cybernetics, despite being initially rejected in the Eastern Bloc throughout the 1950s for ideological reasons, rose to a high level of institutional prominence in the 1960s, profoundly influencing state philosophy and economic planning. This thesis is an examination of this transition, charting the development of cybernetics from the object of the *Sozialistische Einheitspartei Deutschlands's* (SED) opprobrium to one of the major philosophical currents within the party intelligentsia.

INDEX WORDS: East Germany, Marxism, History of science, Economics, Cybernetics, Philosophy, Cold War, Information theory, Georg Klaus, Walter Ulbricht

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DEDICATION

To my parents and to Sally.

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The September, 1953 issue of *The Rotarian*, the monthly magazine of Rotary International, spoke in breathless terms of the emergence of a new science and the monumental changes it would make in the lives of ordinary Americans. Called "cybernetics," this new science was described by the magazine as an "electronic brain system of industry," that has "made it possible for us to warm up an oil refinery, paper box factory, textile mill, chick hatchery, or card filing operation and run indefinitely—with nobody on the premises except perhaps a lone inspector or two." In the long term, the impact of cybernetics on industrial processes was imagined to "have a more profound effect on us than atomic energy."[1]

This conceptualization of cybernetics meshes nicely with the current understanding of the term. "Cybernetics" and the "cyber-" prefix are ubiquitous in contemporary culture, so ubiquitous, in fact, that words like "cyberspace," "cybercrime," and "cybercafé" no longer seem cutting edge, but the clichéd artifacts of 1990s Internet culture. In 1953, as in 2010, the colloquial understanding of the term "cybernetics" was fluid, used to describe the developing sciences of automation, computation, robotics, and artificial intelligence.

The original vision of cybernetics, however, was, simultaneously broader and more precise than any of these usages suggest. The product of wartime research into automatic control in anti-aircraft guns, cybernetics had profound impacts on diverse fields like anthropology, economics, cognitive science, and political science — all disciplines in which the cyber- prefix at first glance seems to be completely out of place. The task of cybernetics is to examine for isomorphic or structurally similar relationships between the organizations of different systems,

[1] Carleton Beals, "Cybernetics," *The Rotarian*, 1953, 14.

regardless if they are social, biological, or mechanical. The central idea is that purposeful systems with similar organizational structures behave in similar ways.

Although the intellectual descendants of cybernetics like artificial intelligence (AI) and systems theory have enjoyed a great deal of success in the United States, its own impact in America was essentially limited to the academy. Even in the universities, after a brief period of broad influence, it was largely subsumed by its numerous and broadly dispersed disciplinary offspring.

In the Communist Bloc, however, this situation was very nearly inverted. After initially being dismissed and harshly criticized for its alleged incompatibility with dialectical materialism, the state philosophy of the Soviet Union, party planners and scientists enthusiastically embraced cybernetics as an ideologically and scientifically modernizing force. Throughout the Communist world, the discipline was lavished with state funding and official praise. In the German Democratic Republic (GDR) in particular, a generation of young technocrats saw cybernetic methods as part of a solution to the perennial problems of inefficiency and rigidity posed by the traditional Soviet model of economic planning.

This introductory chapter serves as a contextual foundation for subsequent ones, exploring the early history of cybernetics and explaining the central concepts of the discipline. Through an examination of cybernetics and its failure to take root in its country of origin, this chapter gestures to larger issues this thesis addresses: the modification of cybernetics by the East German Marxist-Leninist philosopher Georg Klaus and its subsequent utilization by East German economic planners. After a brief account of the origins of cybernetics—which will provide the reader with a working understanding of cybernetics, its claims, and its terminology—

this chapter will also situate the remainder thesis within the broader historiographical matrices of East German history and the history of science.

1.1 Cybernetics, an Early History

On June 27, 1940, President Roosevelt issued an executive order establishing the National Defense Research Committee (NDRC, later the Office of Scientific Research and Development or OSRD).[2] This organization, headed by the MIT engineer Vannevar Bush, was tasked with the coordination of scientific research for the purpose of developing advanced weapons systems.[3] Among the highest priorities for the committee were the development of microwave radars and anti-aircraft fire-control systems—both projects of the utmost strategic importance to the British, who were embroiled in a defensive air war with Nazi Germany.[4]

Norbert Wiener, a highly-regarded and almost comically eccentric MIT mathematician, was assigned to work in the fire-control division of the NDRC. Wiener's project was to develop a system that would improve the accuracy of anti-aircraft guns. This was no simple task—it required the nearly instantaneous mechanical correction of the gun to compensate for aircraft velocity and evasive maneuvers taken by the enemy aircraft. Working with Julian Bigelow, a young electrical engineer, Wiener constructed a model fire control system. Given the enormous number of possible trajectories, Wiener opted for a probabilistic approach, which brought into accounted for the past locations of the aircraft and the physical limits placed on its maneuvering. By extrapolating the most probable flight trajectory, the gun could "predict" the aircraft's

[2] The NDRC was superseded a year later by the Office of Scientific Research and Development (OSRD) which continued the committee's work. It is perhaps most famous for being the supervisory body for the Manhattan Project.
[3] Order Establishing the National Defense Research Committee, June 27, 1940, Folder: Vannevar Bush, President's Secretary's File (Franklin D. Roosevelt Administration), 1933 - 1945, Franklin D. Roosevelt Library and Museum Website; version date 2009
[4] Report of the National Defense Research Committee-6/27/40-6/28/42, Folder: Vannevar Bush, President's Secretary's File (Franklin D. Roosevelt Administration), 1933 - 1945, Franklin D. Roosevelt Library and Museum Website; version date 2009

location, greatly improving accuracy.[5] Wiener imagined both the enemy aircraft and the anti-aircraft gun as both being part one closed system, with the gun exhibiting goal seeking behavior, though environmental inputs, or in engineering jargon: "feedback."

Wiener, feeling that his contributions to the war effort were being undervalued by the OSRD, abruptly resigned from the project in March 1942.[6] Although Wiener's fire-control project did not have any immediate wartime impact, it did mark a turning point in the mathematician's thought. Working with Bigalow and the Harvard neurobiologist Arturo Rosenblueth, Wiener began to systematize his findings into more general philosophy of goal-seeking behavior that would apply to both mechanical and biological systems.

The first published summation of this approach came a year later in the journal *Philosophy of Science*. In the article, "Behavior, Purpose, and Teleology," Wiener, Rosenblueth, and Bigalow sought to rehabilitate the idea of teleological (or goal-seeking) behavior, which had been widely disparaged by behaviorists in the 1940s.[7] In this paper, the three men develop the idea that purposeful behavior is the product of circular-causal systems in which a system continually responds to feedback.

The clearest way to explain this is by example. The basic unit of analysis in cybernetics is the loop, a closed system that senses an environmental change, or feedback, and then responds, causing another change in the environment. There are two varieties of feedback: positive and negative. Positive feedback refers to a system in which the environmental input generates more of itself in a manner that gradually leads to runaway growth. Microphone feedback is a good

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[5] For an exhaustive treatment of this subject see Wiener's work on the subject, nicknamed by OSRD scientists the "Yellow Peril" for its yellow report cover and its legendary difficulty Norbert Wiener, *Extrapolation, Interpolation, and Smoothing of Stationary Time Series, with Engineering Applications.* (Cambridge, MA: Technology Press of the Massachusetts Institute of Technology, 1949).

[6] Peter Galison, "The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision," *Critical Inquiry* 21, no. 1 (Autumn): 240.

[7] Arturo Rosenblueth, Norbert Wiener, and Julian Bigelow, "Behavior, Purpose and Teleology," *Philosophy of Science* 10, no. 1 (1943): 18-24.

example of this kind of feedback: sound enters the loop through the microphone and is amplified through a speaker. That sound emitted by the speaker is then picked up by the microphone and amplified; the cycle continues and a runaway effect, the screeching of the speaker, is produced.

Negative feedback works on the opposite principle: feedback enters the system and the system in turn responds by acting in an opposite manner; this has the effect of controlling and stabilizing the environmental input. The classic example of a negative feedback system is the thermostat. Feedback enters the system as a result of an environmental change, in this case a temperature increase, the system then responds by controlling the temperature through the use of a cooling device. Negative feedback systems, in short, act when "a disturbance occurs in a system, [which] causes an undesired output" and responds by subsequently generating an "error signal [that] flow[s] down the forward path to make necessary corrections."[8] Negative feedback systems are self-regulating and seek to preserve equilibrium.

Both of these kinds of feedback systems can be observed in a variety of situations: the runaway effects of positive feedback, demonstrated in the microphone feedback example, can also be observed in the self-reinforcing effects of hyperinflation, the accumulation of platelets in a blood clot, or the stockpiling of weapons in an arms race. Likewise, the equilibrium-seeking behavior of negative feedback systems has been observed in the homeostatic behavior of organisms, or in potlatch systems where distributive stratification is rectified through socially-prescribed feasts and gift-giving.[9]

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[8] Julius T. Tou, *Digital and Sampled-Data Control Systems*, McGraw-Hill Electrical and Electronic Engineering Series (New York: McGraw-Hill, 1959), 1.

[9] For analysis of early works on biological feedback systems see Frederick E. Warburton, "Feedback in Development and Its Evolutionary Significance," *The American Naturalist* 89, no. 846 (1955): 129-140; For a concise summary of systems theoretical and social ecological approaches to potlatch see Bonnie J. McCay, "Systems ecology, people ecology, and the anthropology of fishing communities," *Human Ecology* 6, no. 4 (1978): 399-400.

As shown in the examples above, the language of purposeful behavior in feedback loops applies equally to social, biological, and mechanical systems. The processes in which purposeful behavior is achieved in all of these systems is isomorphic, that is it to say it is structurally similar. Wiener and Rosenblueth in a later article articulate this notion of functional equivalence of goal-oriented behavior across the mechanical/biological divide in the form of a rhetorical question: "Let us consider a car following a man along a road with the clear purpose of running him down. What important difference will there be in our analysis of the behavior of the car if it is driven by a human being, or it is guided by the appropriate mechanical sense organs and mechanical controls?"[10] The implied answer is that there is no important difference.

Following the conclusion of the war, the Josiah Macy, Jr. Foundation organized a series of conferences devoted to the exploring the issues raised by Wiener, Rosenblueth, and Bigalow in "Behavior, Purpose and Teleology." The first of these conferences, entitled "Feedback Mechanisms and Circular Causal Systems in Biological and Social Systems," took place in the spring of 1946 in New York City. The participants and the foundations judged this conference so productive that another was quickly organized for that fall.

These conferences were by design radically interdisciplinary boasting attendees from across the physical and social sciences. The conferences were also very informal; although papers were presented, they were often highly speculative in nature and primarily served as a jumping-off point for discussion sessions. These sessions were the real highlight of the proceedings; during these informal talks the invited participants would draw links across disciplinary boundaries.

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[10] Arturo Rosenblueth and Norbert Wiener, "Purposeful and Non-Purposeful Behavior," *Philosophy of Science* 17, no. 4 (October 1950): 319.

Owing to their informal nature, no written record was kept of the first five Macy Conferences. On the suggestion of Norbert Wiener, Heinz von Förster, an Austrian physicist and later founder of the Biological Computer Laboratory at the University of Illinois at Urbana-Champaign, was tasked with preparing transcripts of the subsequent conferences. By the sixth meeting in 1950, the conference's name was changed to "Cybernetics: Circular Causal and Feedback Mechanisms in Biological and Social Systems." All told, ten meetings were held, with the last Macy Conference taking place in the spring of 1953.

Emblematic of the kind of work that was influenced by the discussions at the Macy Conferences was Gregory Bateson's *Communication, the Social Matrix of Psychiatry*, co-written with the psychiatrist Jurgen Ruesch. The book's central argument is that "communication is the matrix in which all human activities are embedded" and that the communicative environment shapes the cultural contours of the patient-therapist relationship.[11] To demonstrate its claims, the authors pull ideas (in the spirit of the Macy Conferences) from a variety of disciplines, synthesizing "psychiatric, psychological, and anthropological concepts…with theories derived from cybernetics and communication engineering."[12] Drawing on concepts from cybernetics, the book imagines psychiatry as a kind of feedback system:

> The functioning of a patient in an interpersonal situation can only be ascertained if the psychiatrist exposes himself to the impact of the messages of the patient, and once he has received these, if he watches the impact of his own communications upon the patient. In such a circular system the observation of feedback operations enables the psychiatrist to correct messages received and sent…[13]

Like Wiener's anti-aircraft fire-controls, the patient-psychiatrist relationship is an iterative process in which responses to environmental data are observed and then corrected. Where the

[11] Jurgen Ruesch and Gregory Bateson, *Communication, the Social Matrix of Psychiatry*, First Edition. (New York: Norton, 1951), 13.
[12] Ruesch and Bateson, *Communication, the Social Matrix of Psychiatry*, 14.
[13] Ruesch and Bateson, *Communication, the Social Matrix of Psychiatry*, 86.

purpose of fire-control systems was the destruction of enemy aircraft, the goal of the patient-psychiatrist system is the achievement of culturally-normative thoughts and behaviors. As Wiener has noted, these same principles can be applied across the social, biological, and physical sciences—indeed the discovery of isomorphic or analogous system structures across disciplinary lines is one of the cornerstones of the discipline .

Despite its initial success in the United States, as the 1950s wore on cybernetics as an individual field of research began to decline. Owing largely to the unavailability of funding, the field was largely superseded by a variety of fields inspired by cybernetics—AI, computer science, game theory, and others—that received massive military grants.[14] Cybernetics, after a brief period of official condemnation, became the subject of increasing attention in the Communist Bloc in the late 1950s. By the 1960s the social and economic applications inspired many reformist tendencies within Eastern Europe's Communist Parties. One of these internal reform movements in East German, proposed major institutional changes, most notably to the organization of the country's planned economy, which despite being one of the strongest in the Soviet sphere of influence was dogged by shortages and inefficiencies.

1.2 Historiography

The English language historiography on cybernetics in East Germany is very limited; no full-length studies have been devoted to the topic and only a few journal articles have appeared on the subject. Two happy exceptions to this are a book chapter devoted to the subject in Peter C. Caldwell's Dictatorship, *State Planning, and Social Theory in the German Democratic Republic* and an article by Benjamin Robinson appearing in the November 2003 issue of *Modernism/modernity* entitled "Socialism's Other Modernity: Quality, Quantity and the Measure

[14] For an excellent examination of this, see Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (The MIT Press, 1997).

of the Human" [15] Both of these works, while dealing with roughly the same subject matter of this present work, have very different goals: Caldwell examining the contradictions in economic planning and social theory in the GDR, and Robinson exploring the philosophical and literary parameters of East Germany's socialist modernity.

Robinson's project is an interesting one, focusing on East German modernity and problems of qualitative and quantitative distinction. In doing so, he examines the work of Georg Klaus and the East German literary figure Franz Fühmann (1922-1984). He argues that these two writers were "not concerned with the empirically achieved and measurable quality of daily life in East Germany, but the possibility of apprehending an underlying qualitative difference between their system and that of the West, where their system figures for them as both present actuality (*energeia*) and future potential (*dynamis*)."[16] Fühmann and Klaus, he argues, were engaged in a task of distinguishing a distinct form of modernity, socialist modernity, from that of Western capitalism, Fühmann in his fiction and Klaus in his construction of cybernetic models and appraisal of socialist science. As such, these writers were forced to interrogate the priorities of their society and to tease out the qualitative differences between the two systems. More importantly, Robinson articulates the philosophical stakes in tackling the problem of differentiation between the two societies, he writes "what is at stake in the discussion of socialism is not a distinction between two views of the world, but between two ontological totalities, each systematically organizing their worlds."[17]

The final chapter of Caldwell's *Dictatorship, State Planning, and Social Theory in the German Democratic Republic*, "From Planning Metaphysics to Cybernetics" analyzes three

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[15] Peter C. Caldwell, *Dictatorship, State Planning, and Social Theory in the German Democratic Republic.* (Cambridge, UK: Cambridge University Press, 2003); Benjamin Robinson, "Socialism's Other Modernity: Quality, Quantity and the Measure of the Human," *Modernism/modernity* 10, no. 4 (2003): 705-728.
[16] Robinson, "Socialism's Other Modernity: Quality, Quantity and the Measure of the Human," 704.
[17] Robinson, "Socialism's Other Modernity: Quality, Quantity and the Measure of the Human," 722.

figures in East German cybernetics, Georg Klaus, Uwe-Jens Heuer, an East German legal theorist, and Gunther Kolmey, a GDR economist. Caldwell focuses his attention on Klaus's 1966 *Kybernetik und Erkenntnistheorie* and its implications for the GDR's New Economic System, (a subject that will be the focus of a later chapter). On a broader level, in this chapter and throughout the book, this is an injunction that the scholar of the GDR take Marxism-Leninism seriously. While our works have different focal points, in this respect they share a common spirit.

A final work, one that examines neither cybernetics nor East Germany, has shaped my thinking on the subject. Andrew Cross's 1991 article "The Crisis in Physics: Dialectical Materialism and Quantum Theory" examines the controversies surrounding dialectical materialism and quantum theory in the post-World War II communist world.[18] The dialectical materialist view of physical nature, as summarized by Cross is as follows. In dialectical materialism the universe is composed of "objectively existing matter, forming a complex, interconnected unity."[19] Matter is understood to be in a permanent state of flux, and motion (and thus energy) is seen as an attribute of matter, not a separate thing. And perhaps most importantly, human knowledge of the physical universe is seen to be provisional and historically conditioned.[20]

For reasons too complex to detail here, quantum mechanics was seen by (Soviet and non-Soviet) communist philosophers as being philosophically opposed to dialectical materialism. In response to this perceived crisis in physics/philosophy, one American-born, communist theoretical physicist, David Bohm, sought to reconcile the two fields. Bohm's "hidden variables"

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[18] Andrew Cross, "The Crisis in Physics: Dialectical Materialism and Quantum Theory," *Social Studies of Science* 21, no. 4 (November 1991): 735-759.
[19] Cross, "The Crisis in Physics: Dialectical Materialism and Quantum Theory," 737.
[20] Cross, "The Crisis in Physics: Dialectical Materialism and Quantum Theory," 737.

interpretation of quantum mechanics was experimentally indistinguishable from the then standard Copenhagen interpretation, but did not share the former field's perceived "idealism." Bohm's mechanics, like Klaus's cybernetics, received little attention outside of communist circles, but both made acceptable a field with important practical benefits for East German society.

The primary locus of application, both real and theoretical, for cybernetics in East Germany was in the economic sphere. Walter Ulbricht and other proponents of cybernetics saw in the discipline a panacea for all of the GDR's structural economic problems. By mathematically modeling the nation's economic system, engineers, factory managers, and other technicians could transform the republic's lagging economy into a technologically advanced socialist powerhouse, all without recourse to market mechanisms. The emphasis placed on the potential for cybernetics to reform and revitalize the East German economy and the ultimate failure of this reform brings my study into dialog with a highly developed literature on the East German economic system.

Jeffrey Kopstein's *The Politics of Economic Decline in East Germany, 1945-1989*, approaching the subject from the perspective of a political economist, offers a convincing explanation for the failure of the East German economy.[21] In brief, Kopstein's argument is that in order to reform the economic sector, the East German *Sozialistische Einheitspartei Deutschlands*, (the SED) would have to embark on a number of politically dangerous policy changes such as wage, work norms, and price reform. These kinds of reforms would have had the potential to generate unrest that might surpass the 1953 workers' revolt and destabilize the regime. Hemmed in by the politically conscious working class, the SED instead sought a solution

[21] Jeffrey Kopstein, *The Politics of Economic Decline in East Germany, 1945-1989* (University of North Carolina Press Enduring Editions, 2009).

in a series of Soviet-style work campaigns, collectively comprising what Kopstein calls a "campaign economy."[22] Furthermore, consistent with my own argument, the author argues that the New Economic System opened up a fault-line between party apparatchiks and the technical intelligentsia, and that Kurt Hager's attack on cybernetics in the November 1971 issue of *Einheit* marked one of the final battles between party officials and the technical intelligentsia.

Raymond Stokes, in his *Constructing Socialism: Technology and Change in East Germany, 1945-1990,* also pursues an economic line of inquiry, albeit from a different angle.[23] The central issue the book seeks to address is the longevity of the GDR, a state, which, after all, lasted longer than the Third Reich or Weimar Germany. Stokes offers science and industrial technology as the reason for the SED's long tenure in power, with the narrative of socialist technological progress legitimizing the regime. Interestingly, *Constructing Socialism* departs from the standard narrative of technology in the GDR, arguing that East German scientists and engineers were highly innovative in the face of crumbling capital stock and international economic marginalization.

The role of the East German technical intelligentsia occupies a central place in my thesis, thus an examination of this group and its place in society is necessary. Fortunately a number of excellent studies on the technical intelligentsia in the GDR exist. Dolores Augustine's *Red Prometheus: Engineering and Dictatorship in East Germany, 1945-1990* offers an excellent examination of the relationship between the technical intelligentsia, primarily engineers, and the SED.[24] She argues that many engineers who were carry-overs from the Nazi-era considered themselves "apolitical experts" and viewed themselves as disengaged from ideology. In the early

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[22] Kopstein, *The Politics of Economic Decline in East Germany, 1945-1989,* 12.
[23] Raymond G. Stokes, *Constructing Socialism: Technology and Change in East Germany, 1945-1990* (The Johns Hopkins University Press, 2000).
[24] Dolores L. Augustine, *Red Prometheus: Engineering and Dictatorship in East Germany, 1945-1990* (The MIT Press, 2007).

years of the GDR the technical intelligentsia was generally treated well, accorded reasonably high status and allowed a good deal of autonomy on research projects. This changed after the building of the Berlin Wall. No longer fearing the departure of skilled engineers through the open Berlin border, the status and treatment of the technical intelligentsia, already distrusted for their bourgeois backgrounds, declined.

Recently, the economic history of the GDR has seen an upsurge in scholarly attention. Motivated by an effort to examine the methods by which the SED was able to secure a baseline of popular legitimacy and to present East Germany as the exemplar of a uniquely socialist brand of modernity, these recent texts have examined the way ordinary East Germans navigated and negotiated their country's consumer landscape. Donna Harsch's *Revenge of the Domestic,* for example, examines the ways that women placed pressure on the SED, spurring the regime's shift from having an almost single-minded productivist economic outlook, to becoming a "welfare dictatorship" which placed an emphasis on consumer, domestic goods.[25] Judd Stitziel's *Fashioning Socialism* similarly explores the consumer landscape of the Republic, arguing that "fashion in the GDR embodied the ambiguities and contradictions that arose on the seam between socialism and capitalism, between images of abundance and experiences of scarcity."[26] In doing so, Stitziel claims that politics was effectively displaced onto consumption; thus consumer abundance was the measure of the regime's legitimacy.

These works offer a necessary corrective to the Cold War characterization of the GDR as the "Second German Dictatorship," a totalitarian *Unrechtstaat* that enjoyed no popular legitimacy and whose citizens were deprived of all agency. After *die Wende,* the landmark

[25] Donna Harsch, *Revenge of the Domestic: Women, the Family, and Communism in the German Democratic Republic* (Princeton University Press, 2006).
[26] Judd Stitziel, *Fashioning Socialism: Clothing, Politics and Consumer Culture in East Germany* (Berg Publishers, 2005), 168.

example of this was the proceedings of the *Bundestag*'s Enquete Commission (1992-1994), whose 18 volume report, as A. James McAdams put it, refused to view "the Communist system as anything less than an undifferentiated evil."[27] The work of scholars like Harsch and Stitziel, as well as Katherine Pence and Paul Betts in their important edited volume *Socialist Modern*, have gone a long way to providing a more nuanced view of East German society.[28] These works join an older literature on East German dissidents that has explored the ways that intellectuals like Robert Havemann or Bärbel Bohley navigated the matrix of orthodoxy and state repression to make their voices heard. While these studies provide an important and necessary account of resistance to the SED, these East German dissidents should not be taken to be representative of the population of intellectuals as a whole.

Other older texts like Thomas A. Baylis's *The Technical Intelligentsia and the East-German Elite: Legitimacy and Social Change in Mature Communism* and *The Changing Party Elite in East Germany* by Peter Christian Ludz while outdated, still present ideas that my thesis will have to take into consideration.[29] These texts offer competing structuralist accounts of the formation and makeup of the SED party elite.

The following chapter, "Feedback" will provide an extended discussion of cybernetics from a theoretical and philosophical perspective, addressing the reception of the science in the GDR and the broader Eastern Bloc. Although it begins with an examination of the early rejection of the science in the Soviet Union, the primary focus of the chapter is the writings of Georg Klaus (1912-1974) an East German philosopher and cybernetician. Klaus's reconciliation of

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[27] A. James McAdams, *Judging the Past in Unified Germany* (Cambridge University Press, 2001), 112.
[28] Katherine Pence and Paul Betts, *Socialist Modern: East German Everyday Culture and Politics* (University of Michigan Press, 2008).
[29] Thomas Baylis, *The Technical Intelligentsia and the East German Elite: Legitimacy and Social Change in Mature Communism,* (Berkeley: University of California Press, 1974); Peter Christian Ludz, *The Changing Party Elite in East Germany* (Cambridge, Mass: MIT Press, 1972).

cybernetics with Marxist-Leninist theory was almost single-handedly responsible for cybernetics' rise to prominence in the GDR.

In his works, Klaus strips the objectionable linguistic, logical, and metaphorical foundations of the Anglo-American version of cybernetics and replaces them with locally appropriate Marxist stand-ins. In doing so, he casts cybernetics as an "auxiliary science" of Marxism-Leninism, rather than a field of study in its own right. Klaus's philosophical task involves removing the extant philosophical and scientific underpinnings of an idea and re-articulating them in a pragmatic and situationally appropriate manner—a process analogous to porting software from one operating system to another. In both cases, many of the surface features remain the same, yet the underlying "code" changes radically. Through an examination of Klaus's project to reconcile cybernetics with dialectical materialism, this chapter presents arguments on the nature of East German science, cross-Bloc scientific transfer, and the localization of knowledge into pre-existing epistemological frameworks.

Where the primary consideration of the second chapter was theoretical matters, the third chapter "Control" focuses resolutely on praxis. This chapter examines the ways East German theorists, planners, and other functionaries sought to refashion the state, the economy, and society along cybernetic lines in the 1960s. This was a broad-based plan of reform, which involved the construction of cybernetic models of a myriad of social interactions, ranging from the operation of state-owned enterprises to the nature of the student-teacher relationship.

The main proponents of cybernetics within policymaking circles were a group of young technocrats, who Peter C. Ludz described in his 1968 book *Parteielite im Wandel* (translated in 1972 as *The Changing Party Elite in East Germany*) as members of an "institutionalized counter-

elite."[30] In addition to providing an examination of the ideology of these functionaries, this chapter will also examine cybernetics as a site of generational and factional dispute; a conflict the "institutionalized counter-elite" would ultimately lose.

The thesis will close with some remarks on the fate of cybernetics and an examination of its theoretical and conceptual heirs. In addition, the conclusion will seek to rehabilitate cybernetics from its reputation of a science of social control and manipulation, examining the potentially emancipatory character of cybernetics.

[30] Ludz, *The Changing Party Elite in East Germany*.

2 Feedback: Georg Klaus, Socialist Cybernetics, and the Boundaries of East German Orthodoxy

In 1967, the West German weekly *Der Spiegel* commented on the emergence of a new language being spoken by Walter Ulbricht, the head of the Socialist Unity Party (*Sozialistische Einheitspartei Deutschlands*, SED), and a generation of young technocrats in East Germany—the language of cybernetics. For these party officials, cybernetics, the study of communication and control in social, mechanical, and biological systems, represented a way to circumvent the inefficiencies that dogged planned economies. Using the methods of cybernetics, these young technocrats believed that they could construct models of a socialist economic system that maximized efficiency, ensured adequate distribution of resources, and generally avoided the common pitfalls of economic planning. Most importantly, by simulating market mechanisms cybernetic models would hypothetically eliminate the need for the massive legions of party functionaries that collected and analyzed economic data. Indeed, *Der Spiegel* reported that one group of technocrats nicknamed their new modeling computer "the functionary guillotine."[31]

Cybernetic ideas, however, were not always welcomed in the German Democratic Republic (GDR) or in the broader communist world. In the infancy of the field in the early 1950s, cybernetics was brutally attacked in the East German party press for its bourgeois origins and its perceived incompatibility with Marxism-Leninism, the state philosophy of the GDR. Yet by the mid sixties, a hybrid cybernetic/Marxist-Leninist philosophy was hailed by the SED, generally regarded as one of the most dogmatic and repressive state parties in Eastern Europe, as the saving grace of the GDR's planned economy. Articles espousing cybernetics as an "extremely useful scientific instrument of socialist economic management" appeared in *Neues*

[31] Neue Welt," *Der Spiegel*, July 24, 1967, 52.

Deutschland, the communist party newspaper, and *Einheit*, the SED's theoretical organ.[32] Even Walter Ulbricht, the General Secretary of the SED, sang the praises of cybernetics in official pronouncements and in the press and made the discipline a cornerstone of his New Economic System.[33] The young technocrats quoted by *Der Spiegel* and many others with the ranks of the SED thought by using the systems-analysis methods of cybernetics the East German economy could be made efficient and competitive with the capitalist West.

A combination of factors explain the gradual, but never universal, acceptance of cybernetics within East German policy-making circles. The Khrushchev-era thaw relaxed the insistence on orthodoxy in the sciences, allowing for more frank discussions of scientific matters throughout the Soviet Bloc. In East Germany a new generation of pragmatic specialists who saw themselves as non-ideological engineers emerged and formed a receptive audience for cybernetic ideas.[34] But more than any other factor, the tireless efforts of the East German philosopher, logician, and cybernetician Georg Klaus (1912-1974) to reconcile cybernetics with dialectical materialism eventually ensured official acceptance of the discipline. This chapter is an examination of that reconciliation. In dozens of books, articles and other writings between the late 1950s until his death, Georg Klaus sought to reconcile cybernetics with dialectical materialism, the official state philosophy of the Soviet Union and its satellites, including the GDR.

This was no easy task in the philosophically constricted atmosphere of the GDR, as Heinz Liebscher, a student and long-time collaborator of Klaus, noted:

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[32] Helmut Koziolek, "Die Marxsche Analyse der gesellschaftlichen Production und die Lehre von der sozialistischen Wirtschaftsführung," *Einheit: Zeitschrift für Theorie und Praxis des wissenschaftlichen Sozialismus* 22, no. 7 (1967): 833-847.
[33] See, for example Walter Ulbricht, "Significance and Vital Force of the Teachings of Karl Marx for Our Era," in *On Questions of Socialist Construction in the GDR. From Speeches and Essays.* (Dresden: Zeit im Bild, 1968).
[34] For an extended treatment of this group, see Augustine, *Red Prometheus*.

> the GDR lacked any united front of a philosophical avant-garde, there were only "Winkelrieds'' (an expression which Klaus claimed for himself) who had the courage to press ahead and "to steer the arrows of the opponent onto himself."[35]

Like Arnold von Winkelried, the legendary martyr of the Old Swiss Confederacy who threw himself on the pikes of advancing Hapsburg armies, breaking their lines and ensuring victory for his comrades, Klaus saw himself as engaging in a sometimes self-destructive battle against traditionalist elements in the party from the late 1950s until his death in 1974. Klaus's, however, was a peculiar form of opposition. Unlike Robert Havemann, a chemist and an East German dissident (who Klaus himself attacked in the party press as revisionist), he was never reprimanded by the party, much less expelled.[36] Instead, for a number of years during the 1960s, Klaus was one of the most important philosophical voices in the country, with articles (and citations of his works) frequently appearing in East Germany's most important philosophical and theoretical journals, *Einheit* and *Deutsche Zeitschrift für Philosophie*. Many of his ideas profoundly influenced the course of SED policy, especially in the economic sector, where he advised the planner and Politburo member Erich Apel in the reform of state-run enterprises (*Volkseigener Betrieb*, VEB).[37] His great success led to East German defectors referring to him in 1964, according to one CIA report, as "a new and more effective Havemann."[38]

Adopting a metaphor from computer science, I refer to Klaus's project as "localization." In the software industry, localization refers to the repackaging of a piece of software for a different cultural environment. This requires more than a simple process of translation. It entails

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[35] Heinz Liebscher, "Philosophie in der DDR," Unpublished Manuscript, n.d., 16, http://www.heinzliebscher.de/Unveroeffentlichte/PhilosophieDDR.pdf.
[36] Robert Havemann was an East German chemist, communist, and Nazi resister who was expelled from the SED and eventually placed under house arrest for challenging the party's alleged philosophical dogmatism in public lectures.
[37] Ilse Spitmann, "East Germany: The Swinging Pendulum," *The Problems of Communism* 16, no. July-August (1967): 16.
[38] Central Intellegence Agency, "The Prussian Heresy: Ulbricht's Evolving System," Intelligence Report, *CIA FOIA Electronic Reading Room*, June 29, 1970, 4, http://www.foia.cia.gov/CPE/ESAU/esau-45.pdf.

an overhaul of the user interface, tailoring the logical and metaphorical attributes of a program to local conditions. The resultant piece of software is functionally equivalent to the original, despite its lexical, logical, and metaphorical alterations. Similarly, Klaus's philosophical task involved removing the extant philosophical and scientific underpinnings of an idea and re-articulating them in a pragmatic and situationally appropriate manner. In doing so, Klaus cast cybernetics as an "auxiliary science" of Marxism-Leninism.[39]

Klaus's project of localization, however, was fraught with complications. Seeking to demonstrate the commensurability of cybernetics with Marxism-Leninism, the philosopher went to great lengths to demonstrate parallels between the two fields, often recasting Marxian concepts like the base-superstructure model of society in cybernetic terms. This practice, while rhetorically effective, led to accusations that Klaus was replacing Marxism-Leninism with cybernetics. Charges like this ultimately led to the discipline's demise in the GDR in the early 1970s, but only after a period of considerable influence in East German policy-making circles and within the country's philosophical and theoretical journals.

This chapter examines the hybrid Marxist-Leninist/cybernetic philosophy of Georg Klaus. It begins a brief reception history of the discipline in the Eastern Bloc. The remainder of the chapter will focus on the life and work of Klaus, providing a close examination of the contours of his project of localization.

2.1 Exchange: Cybernetics in the Soviet Bloc

Unlike in the United States, where cybernetics was met with overwhelming, if somewhat naïve, popular enthusiasm, the initial reception of cybernetics was icy in East Germany and the broader Communist world. In the early 1950s, Marxist theoreticians from around the Eastern

[39] Georg Klaus, *Kybernetik und Gesellschaft* (Berlin: VEB Deutscher Verlag der Wissenschaften, 1964), 71.

Bloc generally agreed that cybernetics and dialectical materialism, the philosophy of Karl Marx and the official ideology of the various communist parties in Eastern Europe, were fundamentally incommensurate.[40] Soviet and other Eastern Bloc commentators chided the new field as "obscurantist," dismissed it as a "pseudoscience" that subscribed to an "idealistic epistemology,"[41] and referred to the new field's practitioners as "semanticist-cannibals." Articles and essays with vitriolic titles like "The Science of Modern Slaveholders" and "Cybernetics—a 'Science' of Obscurantists" filled the pages of academic and popular periodicals in the early postwar years. [42]

The primary critique leveled against cybernetics by communist theoreticians in this early period was that cybernetics was an "idealist philosophy" that privileged the world of ideas over that of concrete material reality. These critics of Wiener and cybernetics repeatedly cited Lenin's 1908 philosophical work *Materialism and Empirio-criticism*, in which he defends the materialist worldview against alleged idealistic influences. In it Lenin wrote:

> Such is the first cause of "physical" idealism. The reactionary attempts are engendered by the very progress of science. The great successes achieved by natural science, the approach to elements of matter so homogeneous and simple that their laws of motion can be treated mathematically, encouraged the mathematicians to overlook matter. "Matter disappears," only equations remain.[43]

For Lenin, this desire of scientists to push for the use of mathematical models and toward deeper abstraction of the material world is reflective of a reactionary, idealistic *Weltanschauung*. In such a worldview "the process of abstraction, represents physical objects in a purely logical way as

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[40] Following East German practice, I use "dialectical materialism" and "Marxism-Leninism" interchangeably.
[41] Maxim W. Mikulak, "Cybernetics and Marxism-Leninism," *Slavic Review* 24, no. 3 (1965): 22.
[42] Slava. Gerovitch, *From Newspeak to Cyberspeak: a History of Soviet Cybernetics* (Cambridge, Mass.; London: MIT, 2004), 119.
[43] V.I. Lenin, "Materialism and Emperio-Criticism," in *V.I. Lenin: Collected Works*, vol. 14, 3rd ed. (Moscow: Progress Publishers, 1972), 308.

nonmaterial, which leads to the ideal of the 'disappearance' of matter."[44] Likewise, for critics of "cybernetic idealism" as they called it, the highly mathematicized, abstract field of cybernetics in general and cyberneticians' understanding of the concept of "information" (discussed at length below) in particular was deeply problematic. Furthermore, as a theory of the operation of *systems*, cybernetics was viewed by these thinkers as completely removed from considerations of material reality.

A less substantial, but no less vitriolic, line of criticism of cybernetics offered by Marxist writers stemmed from the discipline's alleged status as a "bourgeois science." Representative of this rhetorical trend is the entry for cybernetics in the 1954 Soviet *Short Philosophical Dictionary*. In this volume, the field is derided as both a "reactionary pseudo-science" as well as "an ideological weapon of imperialist reaction."[45] In this view, the content of science in general and cybernetics in particular is a product of the mode of production; like culture as a whole in the Marxist conception, science is part of the social superstructure which is directly determined by the economic base. To these commentators it naturally followed that cybernetics, a science founded in capitalist America with the philanthropic support of the Macy Foundation (founded by a shipping and petroleum heiress), would necessarily be reflective of bourgeois, "imperialist" ideology. The disparity between the frenzied media portrayals of this new science and its concrete accomplishments did nothing to subdue this suspicious response.

The death of Stalin in 1953 and the subsequent ideological thaw led to a liberalized atmosphere in the sciences, both in the Soviet Union and its satellite countries. This general trend was accelerated after a new party line was promulgated in Soviet science. In the spring of 1954

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[44] "The Philosophic Legacy of V. I. Lenin in the Struggle for Materialism in Science," *Mechanics of Composite Materials* 6, no. 2 (March 1, 1970): 177 Translated from Mekanika Polimerov, No. 2 pp. 195-196 March-April 1970.

[45] David Mindell, Slava Gerovitch, and Jérôme Segal, "Cybernetics and Information Theory in the United States, France and the Soviet Union," ed. Mark Walker (London; New York: Routledge, 2003), 81.

the Party Central Committee criticized the Soviet scientific community for its rigid dogmatism in the agricultural sciences, typified by the disastrous, ideologically-charged genetic ideas of Trofim Denisovich Lysenko.[46]

In November of 1954, amidst this atmosphere of comparative scientific freedom in the USSR, the Austrian-born, Soviet mathematician E. Kolman[47] presented a lecture entitled "What is Cybernetics?" before the Academy of the Social Sciences of the Communist Party of the Soviet Union.[48] While the majority of this lecture amounted to a thoughtful, measured introduction to cybernetics (along with formal and symbolic logic) for the general scientific audience, it also contains an important political component. Kolman began the lecture by taking to task Soviet and Bloc theoreticians who focused too much on the "bourgeois," "reactionary" origins of cybernetics and dismissed its practical value. Remarking on the absurdity of some of the charges that were being directed toward the science, Kolman argued:

> of course nothing is easier than to declare cybernetics to be a mystification, a pseudo-science, etc. But it seems erroneous to suppose that our opponents occupy themselves with nonsense, spend enormous amounts of money, create entire institutes, call national conferences, publish special journals—all in order to discredit Pavlov's teachings and to drag idealism and metaphysics into psychology and sociology. There are more effective and less expensive ways of carrying on idealist propaganda and warlike agitation than preoccupation with cybernetics.[49]

Clearly believing that cybernetics holds much potential value for Soviet society, Kolman proffered an impassioned defense of the subject, citing passages from Marx, Engels, Lenin, and Stalin for ideological support. This lecture, which was published in the Soviet journal *Voprosy Filosofii* (Questions of Philosophy), contributed to a reappraisal of the previously taboo field of

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[46] Mikulak, "Cybernetics and Marxism-Leninism," 453.
[47] Variously transliterated as Ernst Kolman or Arnošt Kolman. I have maintained the transliteration provided within a given source.
[48] For an interesting, albeit brief, biographical sketch of Kolman see G. G. Lorentz, "Mathematics and Politics in the Soviet Union from 1928 to 1953," *Journal of Approximation Theory* 116, no. 2 (June 2002): 169-223.
[49] E. Kolman, "A Soviet View of Cybernetics," trans. Anatol Rapoport, *Behavioral Science* 4, no. 2 (1959): 134.

cybernetics. While Kolman was transferred to Prague for presenting this lecture, his efforts were not in vain.[50] In translation, the lecture stimulated discussion on the subject in the international Marxist community. It appeared, among other places, in the French Marxist journal *La Pensée*, and more importantly for the sake of this study, as a scientific supplement to the East German serial *Forum* in 1955.[51]

With Soviet opposition to cybernetics largely removed by 1955, and the Kolman translation offering a cogent, albeit brief, Marxist defense of the science, most of the ideological (and geopolitical) obstacles to a reappraisal of cybernetics in East Germany were overcome. In this new, more "relaxed" ideological climate, the task of explicating and propagating the science fell to Georg Klaus, a philosopher, chess master, and long time communist, who played a central role in the rehabilitation of cybernetics in East Germany.

2.2 Encoding: Georg Klaus, a Biographical Sketch

In Georg Klaus, a man with almost unparalleled political credentials, cybernetics could not have found a better defender in the ideologically charged atmosphere of East Germany. Had Klaus not had a fairly unblemished history as a life-long Communist, a party organizer, and a jailed opponent of fascism, it is hard to imagine he would have had the success he did promoting his scientific philosophy. Klaus was born in Nuremberg in December of 1912 into a proletarian household—his father was a railroad worker and his mother a housewife. From a young age, he showed great academic aptitude, and in 1932 enrolled at the University of Erlangen with the intention of getting a degree in mathematics. With the ascendency of the Nazi party in 1933, he was prevented from continuing his studies for political reasons; he was the leader of the Northern Bavarian section of the *Kommunistische Partei Deutschlands* (KPD). Following his removal

[50] M. Csizmas, "Cybernetics—Marxism—Jurisprudence," *Studies in East European Thought* 11, no. 2 (1971): 92.
[51] E Kolman, "Was ist Kybernetik?," *Forum* 23, no. 9 (1955): Supplement.

from the university he was arrested on counts of high treason and incarcerated for a total of five years between 1933 and 1939, spending two of these years at Dachau. During this time in prison, Klaus developed mathematical models for chess games, his lifelong pastime.[52]

Klaus was released from prison on April 20, 1939 as part of an amnesty program on the occasion of Hitler's birthday but as a communist was prevented from continuing his studies. After his release, he worked for three years at a pencil factory in Kassel before being drafted into the *Wehrmacht* to fight on the Russian Front. He saw enemy action and was wounded three times. After the war he spent a brief period in an allied POW camp in Belgium, before returning to Bavaria to resume his prewar political activities and to agitate for the merging of the KPD with the *Sozialdemokratische Partei Deutschland* (SPD).[53]

Klaus left Bavaria in 1947 and traveled to the Soviet Zone to continue his studies at the University of Jena. There he completed his doctoral studies and was immediately hired as a lecturer of dialectical and historical materialism in the Jena Department of Social Sciences. In 1953 he was appointed professor of logic and epistemology at the Humboldt University in Berlin, where he simultaneously held the post of rector. Most of his pre-cybernetic work in this period was concerned with materialism and attacks on logical positivism, as with his 1957 book *Jesuiten, Gott, Materie*.[54] In 1959 he was appointed chair of the working group for philosophy at the Academy of Sciences. In addition to being a champion of the philosophy of cybernetics, Georg Klaus was also a staunch advocate for the establishment of the microelectronics industry in East Germany, which saw a massive investment in computing infrastructure after the adoption

[52] Jochen Cerný and Lothar Berthold, eds., "Georg Klaus," *Wer war wer, DDR: ein biographisches Lexikon* (Berlin: Ch. Links, 1992).
[53] Cerný and Berthold, "Wer war wer, DDR."
[54] Georg. Klaus, *Jesuiten, Gott, Materie: des Jesuitenpaters Wetter Revolte wider Vernunft und Wissenschaft* (Berlin: Deutscher Verlag der Wissenschaften, 1957).

of the New Economic System (NES) in 1963.[55] At the time of the GDR's fall, it had the only significant microelectronics industry in Eastern Europe outside of the Soviet Union—a circumstance largely attributable to his profound influence.[56]

By 1962, a health problem stemming from his internment in Belgium recurred and began to worsen; yet despite continuous declines in his health, Klaus continued publishing until the year of his death in 1974. He spent the last years of his life bedridden and, no longer able physically to write, he penned his last publications with the aid of a dictaphone.[57]

2.3 Allopoiesis: The Cybernetic Socialist Philosophy of Georg Klaus[58]

In spite of this prolonged period of ill health, Georg Klaus was the most prolific and effective spokesman for cybernetics in the GDR. This effectiveness, as I have already noted, was due to Klaus's extraordinary ability to deflect criticism through the proper use of Marxist-Leninist language. This rhetorical acumen allowed Klaus to ward off charges of revisionism when articulating his hybrid Marxist/cybernetic philosophy.

The party was hardly unified in its acceptance of cybernetics. Although the post-Stalinist thaw and the widely distributed Kolman lecture had the effect of allowing for the possibility of discussion of the discipline, many SED officials, especially those subscribing to a more traditionalist outlook, still viewed cybernetics with deep suspicion throughout the 1960s. The views of the East German party ideologist Hermann Ley, one the main opponents of cybernetics in the GDR, are representative of this suspicion. Writing in his 1961 book *Dämon Technik?*, Ley argued:

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[55] Dolores L. Augustine, *Red Prometheus*, 265.
[56] Benjamin Robinson, "Socialism's Other Modernity: Quality, Quantity and the Measure of the Human," 705.
[57] Robinson, "Socialism's Other Modernity: Quality, Quantity and the Measure of the Human," 705.
[58] An allopoietic system is one that creates a product distinct from itself, as with a factory assembly line.

> In [Wiener's] ideas everything that the bourgeois ideology could produce by way of misunderstanding in the mind of an expert comes together. Wiener's fetish is information technique. He reduces man to some special modern problem, although he describes the humane use of man in the subtitle of his book [*The Human Use of Human Beings*]: it is a case of leaving technology and natural science and entering a false utopia and philosophy.[59]

Officials like Ley saw cybernetics as a product of the capitalist world, irrevocably tainted with the stain of bourgeois ideology.

In response to attacks of this kind, Klaus essentially accepted the premise that cybernetics was marred by its association with capitalism. The following passage from Klaus's 1964 work *Kybernetik und Gesellschaft* (Cybernetics and Society) is emblematic:

> Cybernetics develops in both capitalist and socialist countries; however, its optimal development occurs only in socialist nations and is possible on the basis of the Marxist-Leninist philosophy. The major obstacles which arise from the private ownership of the means of production stand in the way of a completely successful application of cybernetics in capitalist society. The reasons that the classics of Marxism in the nineteenth century have stated that capitalism cannot develop an objective science of society…are not contradicted by the use of cybernetics in any way.[60]

By accepting the argument of party conservatives, namely that science is a superstructural phenomenon shaped by the economic base, Klaus argued for the necessity of his own adaptation. If cybernetics is flawed on the basis of its association with capitalism, this does not delegitimize it; rather it necessitates the development of a socialist cybernetics, geared toward the interests of the working class. As Klaus argued in the same text, science is not and cannot be politically neutral, "it serves the interests of the respective ruling class [and] today performs a specific social function in the struggle between contrasting social systems."[61] A socialist cybernetics, it follows, would adhere to socialist principles.

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[59] Quoted in Csizmas, "Cybernetics—Marxism—Jurisprudence," 96.
[60] Klaus, *Kybernetik und Gesellschaft,* 9.
[61] Georg Klaus, "Kybernetik und ideologischer Klassenkampf," *Einheit: Zeitschrift für Theorie und Praxis des wissenschaftlichen Sozialismus* 25, no. 9 (1970): 1180-1181.

With the social legitimacy of cybernetics at least tentatively established in the GDR, Klaus was left to more substantive debates. Here, I will focus on two lines of argument, meant to be representative of Klaus's broader project of localization. First, I will discuss Klaus's encounter with a specific cybernetic concept, information, and the methods he used to contextualize this idea within with a Marxist-Leninist framework. Secondly, I will examine how Klaus created cybernetic models of social processes as a method of demonstrating the commensurability of the two modes of analysis.

Probably the most contentious idea in cybernetic thinking to Marxist-Leninist philosophers was the concept of "information," a term which has an idiosyncratic meaning in cybernetics. This idea emerged from a 1948 paper by the Bell Labs scientist Claude Shannon entitled "A Mathematical Theory of Communication."[62] This article, published in two parts in July and October 1948 issues of the *Bell System Technical* Journal, not only generated excitement among the Macy Cybernetics group, but spawned the discipline of information theory.

The most straightforward way to explain information theory is through an overview of the binary numeral system. In this scheme, binary digits, commonly known as "bits" replace the numbers on the familiar base-10 scale. Binary numbers are written on a base-2 scale, so that the number one is 1, two is 10, three is 11, four is 100 and so on. The number one/1 can be said to have a bit size, or in information theoretical terms an "entropy" of 1 bit, while the number two/10 has a size of two bits, and the number four/100 has a size of 3 bits and so on. As the reader has probably deduced, the bit size increases every time an additional digit is added. This increase happens on a logarithmic scale; every time the number 2 is iteratively doubled (2, 4, 8,

[62] Claude E. Shannon, "A Mathematical Theory of Communication," *Bell System Technical Journal* 27, no. July and October (1948): 379-423 and 623-656.

16, 32, and so on) a decimal place is added. Shannon understood the information content of a given message in probabilistic terms: the larger the bit-count of a message the less statistically likely it would be. [63]

Shannon's conception of information in terms of probability had an important consequence; it allowed engineers and scientists to divorce the idea of information from its meaning, its context, and the medium or channel it was transmitted on. By removing the problem of semantics from information, could be treated simply as an engineering problem. As Shannon put it:

> The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point. Frequently the messages have meaning; that is they refer to or are correlated according to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem.[64]

As a result of the subordination of semantics in information theory, same theoretical models could be used to explain human communication, electronic communication, and even cellular communication.

For cybernetic thinkers in the West, the all-encompassing, medium-independent view of information took on nearly a metaphysical status. These cyberneticians and information theorists enthroned information, alongside matter and energy, as one of the core constituents of reality. Norbert Wiener described it this way in his 1948 book *Cybernetics*:

> The mechanical brain does not secrete thought (as the liver does bile), as the earlier materialists claimed, nor does it put it out in the form of energy, as the

[63] The following example may elucidate this point: suppose we decided to code the results of a coin toss in binary digits, so that a heads-up coin would be recorded as 1, and a tails-up as 0. The likelihood of duplicating one tails-up flip (coded as 0) is comparatively higher than duplicating the results of three coin tosses, say heads, heads, tails (110). Since the probability of duplicating the results of three random tosses is lower, this sequence contains more information. Similarly, binary numbers (analogous to our coin tosses) with higher bit sizes are less probable and are therefore said to convey more information.

[64] Shannon, "A Mathematical Theory of Communication," 379.

> muscle puts out its activity. Information is information, not matter or energy. No materialism which does not admit this can survive at the present day.[65]

Georg Klaus sought to reconcile the concept of information with dialectical materialism while maintaining the practical essence of the concept; his primary challenge was to create an appropriate ontological description of information. This involved some interesting maneuvering within the peculiar physical worldview of dialectical materialism. The conceptualization of Western cyberneticians like Wiener and Shannon that information as a third kind of thing – a reified concept that was neither matter nor energy – raised the suspicion of Marxist philosophers who saw this formulation as evidence of philosophical idealism within the new science. In the worldview of dialectical materialism, matter and the interaction of different material objects form the totality of experience. Even energy was not seen to exist independently of matter. Following Engels, Soviet Bloc scientists and philosophers understood energy as "the mode of existence, the inherent attribute of matter."[66] The idea of information as being something apart from matter flew directly in the face of dialectical materialism and its ontologically unified perspective.

Klaus, for his part, argued "the fact that information is not a physical object...is not an argument for the constitution of a 'third realm of being'" but did not reject the concept out of hand. Instead, he attempted to fit information into one of the already existing categories of dialectical materialism.[67] He did this by shifting information away from its ontologically independent position, and describing it instead, along with energy and substance, as a third inherent attribute of material existence. His conception of information differs from the

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[65] Norbert Wiener, *Cybernetics; or, Control and Communication in the Animal and the Machine* (New York: J. Wiley, 1948), 155.
[66] Friedrich Engels, *Dialectics of Nature*, trans. C. P Dutt (New York: International Publishers, 1940), 35.
[67] Georg Klaus, "Information," *Marxistisch-leninistisches Wo¨rterbuch der Philosophie* (Reinbek (bei Hamburg): Rowohlt, 1972).

description of the other two aspects of matter; Klaus argued that information should be viewed "neither as an object nor the property of an object, but as a property of properties (a second-order predicate)."[68] Where substance and energy are considered properties of matter (predicates), information is viewed as a property of those properties.

While Klaus conceded that this new attribute of matter was not previously accounted for in dialectical materialism, he insisted that information was predicated on material existence and that the concept had value to the philosophical enterprise of Marxism-Leninism:

> The concept of information and the results of information theory come within the worldview of Marxist-Leninist philosophy and complement it. Until the mid-20th century, we knew two words that appeared, quite rightly, to be the basic terms of our scientific worldview: the terms substance and energy. Cybernetics tells us that there is a third essential aspect of the matter...[the aspect] information. ... [The results of cybernetics have] proved that the informational processes in principle cannot be attributed to material or energetic processes. In some sense, with this our worldview [dialectical materialism] reaches a sort of culmination which is consistent with the level of knowledge of our century.[69]

Klaus's philosophical product is an information theory that was functionally and experimentally equivalent to its Western counterpart, but in line with the philosophical and political requirements of dialectical materialism. It allowed the East Germans to capitalize on the manifold practical applications of information theory, without compromising any philosophically entrenched positions.

On a higher, more systemic philosophical level, one of the most fundamental divergences in Western cybernetics from the principles of Marxism-Leninism, as Klaus and others saw it, was its lack of dialectical logic. As Klaus put it in 1970 "already the relatively short existing history of the application of cybernetics to social problems clearly shows that a correct philosophical basis (i.e. a dialectic-materialist basis) is a prerequisite for the production of

[68] Klaus, "Information."
[69] Klaus, "Information."

comprehensive objective knowledge."[70] The primary way Klaus sought to combine dialectical logic with cybernetics was through the cybernetic modeling of Marxian dialectical systems**.**

Indicative of this broader style is Klaus's conceptualization of Marxist contradiction. In his view, contradiction and revolution can be explained in the terms of a cybernetic system. According to Klaus's 1969 dictionary of cybernetics, these dialectical contradictions occur when "oscillations become ever stronger, eventually leading the system beyond its stability boundaries until its quality is destroyed."[71] For Klaus, the "system" takes the place of the Marxian economic base. Class conflict is conceptualized as an increasing tide of feedback into a system, which generates oscillations and, thus, instability. In cybernetics, stability does not refer to the rigidity of a system, but rather its dynamism. Stability is the ability of a system to adapt to different environments and changing conditions. A stable system is one responsive to feedback. Thus, a system (e.g. capitalism) that is no longer able to respond to feedback (e.g. the struggle of the working class) is destroyed by revolutionary force of feedback.

[70] Georg Klaus, *Kybernetik und Gesellschaft,* 55.
[71] Quoted in Benjamin Robinson, "Socialism's Other Modernity: Quality, Quantity and the Measure of the Human," 96.

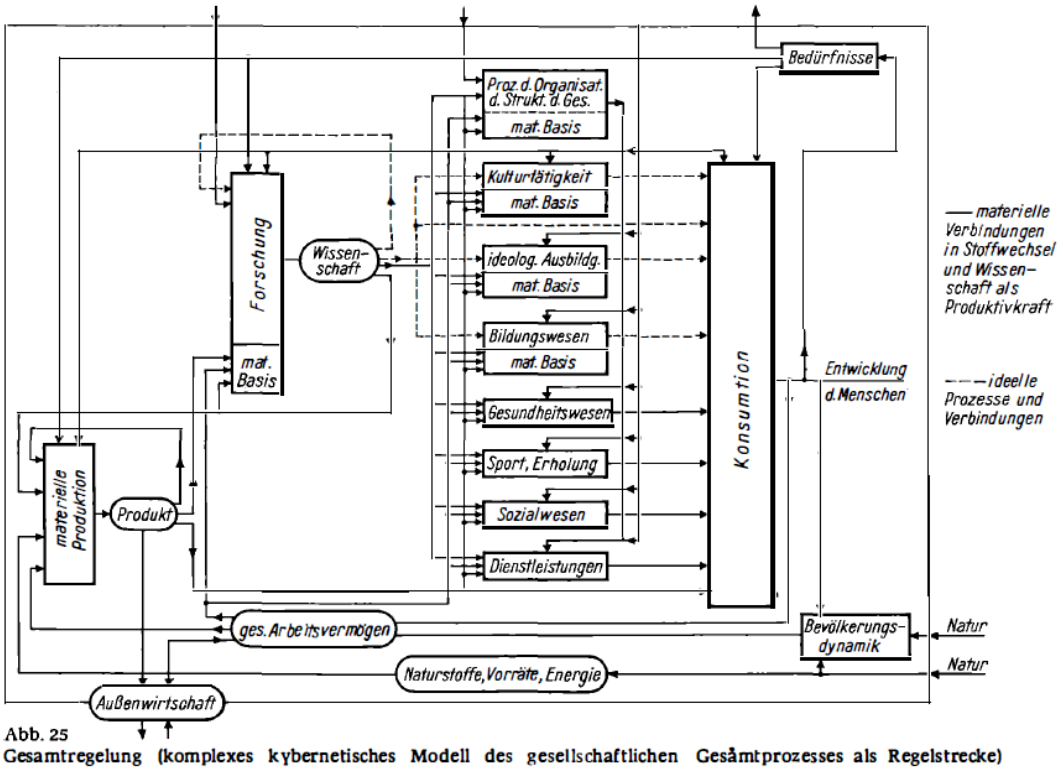

Figure 1 – From *Kybernetik und Gesellschaft* p. 150

Within Klaus's general discursive framework, several other Marxist concepts can be described in cybernetic terms, however this kind of description always comes with heavy qualifications and disclaimers. This passage from a September 1970 *Einheit* article entitled "Cybernetics and Ideological Class Struggle" is representative of the philosopher's broader argumentative style:

> The relationship described by Karl Marx of the value and price of goods in capitalism, for example, can be brought into a cybernetic control scheme. This complicated relationship is much more visible, the laws show themselves to some extent already in the visually pure topological scheme, etc. Have we substituted the Marxist theory of the relationship of product value and price by cybernetics? Of course not! The foundation on which this very simple kind of cybernetic economic system is based, has nothing to do with cybernetics. These things must be approached from a different science, from [Marxian] political economy.[72]

[72] Klaus, "Kybernetik und ideologischer Klassenkampf," 1183.

Klaus's philosophical task was often to argue for the complementarity of cybernetic analysis while being careful to not appear to supplant the domain of Marxist political economy. Despite this, Klaus often overstepped his self-imposed boundaries, providing totalizing cybernetic models which described society as a complex system composed of interacting, but still dialectical, subsystems. For example, figure 1 provides a complex, cybernetic model of society as a controlled system with superstructural phenomena such as cultural activities (*Kulturtätigkeit)* being determined, in a Marxian fashion, by the material basis of society. Despite his earnest attempts to stay within the boundaries ideological propriety, Klaus aroused the suspicion of his critics by blurring the distinctions between a cybernetic view of society and a Marxian view of society.

2.4 Conclusion

In his oft-cited 1993 article, "How to Be Universal: Some Cybernetic Strategies, 1943-70" Geof Bowker argues that cyberneticians in the United States and Western Europe thought of their new discipline as a universal science, a special "trans-discipline," whose methodology and terminology had transcendent utility, applying equally to both the physical, biological, and social sciences. This universality allowed researchers working in fields like sociology and biology to add new cybernetic terms like "feedback" to their studies, adding an aura of legitimacy and currency. In circular fashion, the usage of cybernetic terminology by researchers bolstered cybernetics' own claims of universality. As Bowker notes, language was the site of this exchange:

> A chief feature of the new language was that it operated as a kind of legitimacy exchange. ... An isolated scientific worker making an outlandish claim could gain rhetorical legitimacy by pointing to support from another field - which in turn referenced the first worker's field to support its claims. The language of cybernetics provided a site where this exchange could occur.

This process allowed cybernetics to effectively colonize the discursive terrain of a number of scientific fields, introducing its terminology into a variety of disciplines.[73]

The confrontation of cybernetics and dialectical materialism in the Eastern Bloc, and East Germany in particular, differs in one important respect from the relationships Bowker examines. In this case, both fields, Marxism-Leninism and cybernetics, were imagined by their disciples to be universal, all encompassing sciences. In this special circumstance, however, the universal discipline of cybernetics had to be subordinated to Marxism-Leninism, the state philosophy of the GDR. Klaus's project of localization, as I have argued, is the outgrowth of this process of exchange.

As I have argued, Klaus's localized version of cybernetics situated itself within the discursive space of dialectical materialism by attaching itself to locally appropriate Marxist-Leninist concepts and metaphors. Within this logic, as I have said, Klaus modified cybernetic concepts like information to make them more philosophically congruent with Marxism-Leninist princples. On the large scale, Klaus explained and defended the system perspective of cybernetics by creating cybernetic models mirroring Marxian conceptions of society and the progression of class conflict and revolution as cybernetic systems.

The goal of this project of "localization" was not only to create a coherent ideological product, but also to initiate a two-way transfer of legitimacy. From Marxism-Leninism, cybernetics was invested with the philosophical legitimacy of the state philosophy. Conversely, from its "auxiliary science," cybernetics, Marxism-Leninism received the scientific confirmation of an important and modern new science. We see this kind of two-way legitimacy exchange in a number of analogous systems. Bohm's interpretation of quantum theory, at least in part, served a

[73] Geof Bowker, "How to be Universal: Some Cybernetic Strategies, 1943-70," *Social Studies of Science* 23, no. 1 (February 1, 1993): 116.

similar purpose, reconciling dialectical materialism with quantum mechanics.[74] In our own cultural situation, we see a similar logic at work in the creation of the "Intelligent Design" theory, situating Darwinian evolution within a creationist context. All of these examples involve the localization of one universal disciple inside another. In all of these examples, the philosophical/scientific product is experimentally identical to the original, but with substantial conceptual and cultural adaptations.

As long as Marxism-Leninism was seen as the senior partner in this exchange, it was not seriously challenged. Put another way, so long as cybernetics was a "Marxist Cybernetics" it was seen to be providing dialectical materialism with the confirmation and prestige of a modern new science, and as a useful tool in the project of building socialism. By the 1970s, the SED's Chief Ideologist (*Chefideologe*) Kurt Hager and other traditionalists within the party saw cybernetics as a dangerous, revisionist ideology. For officials like Hager and the new General Secretary Erich Honecker, the ideology of the young technocrats I opened the chapter with was no longer Klaus's "Marxist Cybernetics," but instead "Cybernetic Marxism." This clampdown on cybernetics and other internal reform movements accelerated the economic stagnation of the Brezhnev years and played an important part in the collapse of East Germany and the fall of the Soviet Union

The next chapter will examine the implementation of Klaus's philosophy and the factional disputes surrounding the cybernation of the East German economy. As evidenced by the young technocrats that this chapter opened with and their economic modeling computer "the functionary guillotine," there was more as stake in these debates than philosophical hegemony;

[74] For an excellent exploration of this issue see Andrew Cross, "The Crisis in Physics: Dialectical Materialism and Quantum Theory."

they encapsulated a generational conflict between old-guard party officials and young technocrats.

3 Control: Cybernetics, Market Simulation and State Planning

The CIA issued a report in 1970 summing up nearly a decade of developments in the GDR, which noted the emergence of a new "revisionist" ideology had emerged in the GDR: a so-called "cybernetic revisionism." Unlike "classical revisionism," which emerged from a humanistic reading of the Young Marx and found support among "artists, writers, and philosophers," this new cybernetic revisionism found adherents primarily among scientists and engineers and stemmed from a fusion of Marxist-Leninist philosophy with the writings of cyberneticians like Norbert Wiener.[75] The memo goes on to sketch an outline of this new ideological stance, noting its "implicit denial of the dialectic of history," and the "acceptance of central control and the primacy of an expanded elite, which includes the technocrats." This change was attitude was paired with "a critique of 'bureaucracy' and acceptance of an institutionalized check on the elites by popular economic desires (feedback)."[76] As this report notes, "conservative party cadres view[ed] this new revisionism as a real danger to themselves and their ideology," a demonstration of the immensely transformative (and politically disruptive) potential of cybernetics.[77]

As this CIA analyst recognized, the history of cybernetics was the GDR is intricately tied to the perennial problems of the East German economy. Emerging from the war and Soviet occupation with severe structural problems, East Germany looked to science and technology to remedy some of these issues. Cybernetics, in particular, was seen by a new generation of planners and technocrats as a panacea for the GDR, a solution to many of East Germany's problems with efficiency, labor productivity, and disorganization.

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[75] Central Intellegence Agency, "The Prussian Heresy: Ulbricht's Evolving System," ii, 2.
[76] Parenthetical comment appears in the original. Central Intellegence Agency, "The Prussian Heresy: Ulbricht's Evolving System," 7.
[77] Central Intellegence Agency, "The Prussian Heresy: Ulbricht's Evolving System," ii.

This chapter seeks to examine how heterodox (but hardly dissident) cybernetic thinkers like Georg Klaus worked within the political parameters of the SED to present radical alternatives to traditional, Soviet-dominated models of state planning. The primary motivation of this chapter is to reconstruct a locus of political contest in GDR: state planning debates in the liberalized atmosphere of the 1960s. While not representing a classical "public sphere," often portrayed as a necessary and constituent part of a "modern" society, these debates were the site of authentic, if non-public and discursively delimited, political contest. In doing so, this chapter is less concerned with the actual political successes of cybernetic reformers (who had an important, but highly mixed legacy) than it is with resurrecting the foundations of a substantial generational challenge to an older cohort of SED leaders.

In addition to being the site of pragmatic political concerns, cybernetics was also the site of generational, intra-party conflict. The proposed reforms offered by these young technocrats would have had the effect of divesting an old guard of SED officials of their powerful positions and placing them in the hands of distributed factory-level managers. This conflict was widely discussed in contemporary political science literature. Peter C. Ludz in his book *The Changing Party Elite in East Germany* and Thomas Baylis in *The Technical Intelligentsia and the East German Elite* took note of the changing composition of the East German elite in the 1960s.[78] More recently, Dolores Augustine's book *Red Prometheus* argues that ideologically motivated party bureaucrats repeatedly clashed with the "apolitical" technical intelligentsia. These "apolitical" engineers and specialists were adherents of an "ideology claimed not to be an

[78] Peter Christian Ludz, *The Changing Party Elite in East Germany*; Baylis, *The Technical Intelligentsia and the East German Elite: Legitimacy and Social Change in Mature Communism*,.

ideology," which placed scientific objectivity and the technocratic solutions of this group above politics.[79]

In a way, the local variant of cybernetics in East Germany amounted to the technical intelligentsia's own technology of revolution. It spoke the language of Marxism-Leninism while simultaneously negating the dialectical view of history and society. It described socialist society in terms of self-regulating systems and subsystems while obscuring those operating the technocratic levers and switches. In short, East German cybernetics offered a revolutionary and existential challenge to the SED party leadership, a challenge to which they responded in a delayed but overwhelming manner. After a period of initial influence under the patronage of Walter Ulbricht in the early and mid 1960s, cybernetics was the target of a conservative reaction in the wake of the Prague Spring, and it was ultimately suppressed with Honecker's ousting of Ulbricht as General Secretary in 1971.

3.1 Economic History

In order to get a proper sense of the place of cybernetics in East German history, it is first necessary provide some economic context. The Soviet Zone of Occupation (*Sowjetische Besatzungszone*, SBZ) emerged from the war with mixed economic prospects. Despite suffering from some of the most destructive effects of Allied bombing campaigns, most notably the Dresden firebombing, a substantial amount of the SBZ's industrial production capacity remained. The Soviet zone was also home to some of Germany's most important high-tech firms, such as the scientific equipment manufacturer Carl Zeiss headquartered in Jena, as well as some of the county's most prestigious research universities. In the dawn of the postwar period, it was not unreasonable to have an optimistic view of the Soviet zone's economic prospects. The effects

[79] Dolores L. Augustine, *Red Prometheus*, 23.

of Soviet occupation and Germany's partition, however, had a lasting negative impact on the SBZ's economy. With the exception of brown coal, the East was resource poor; it possessed almost no fuel reserves and limited mineral wealth, a situation that necessitated a dependence on the Soviet Union for many industrial inputs. As future events confirmed, the Soviet Union proved to be an unreliable trading partner, especially in periods of economic volatility.

The extraction of reparations was even more deleterious to East German economic prospects than the occupation itself. These reparations took three major forms: dismantling of East German capital stock, deportations of skilled and unskilled laborers to the Soviet Union, and the creation of Soviet-owned enterprises (*Sowjetische Aktiengesellschaften*, SAG) in the SBZ. Of these, the dismantling of East German industry had the longest-lasting impact—this often involved the complete disassembly of entire factories and their shipment to the USSR. By 1947, Soviet authorities had sent over 63,000 tons of German equipment to the USSR, with another 11,000 tons going to Soviet-aligned countries.[80] In addition to the expatriation of industrial capital, East German scientists, engineers, and technicians were also sent to the Soviet Union to run reconstructed German labs and factories.

After the establishment of the German Democratic Republic in October of 1949 and the formal division of the country, the economic situation continued to deteriorate. Worsening economic conditions lead to the so-called *Republikflucht*, literally, "flight from the republic," a mass exodus of thousands of East Germans to the Federal Republic. Since many of these *Republikflüchtling* were skilled laborers or members of the technical intelligentsia, this flight only exacerbated the existing labor shortages, already a chronic problem in the GDR.

These labor shortages led the SED, with the backing of the Soviet Union, to raise work norms throughout the Republic in an attempt to maintain or even to increase industrial output.

[80] "80% of Reparations Sent to Soviet Sphere," *New York Times*, November 17, 1947.

The East German working class reacted to this change in work norms by holding strikes and demonstrations. What started out as a small strike of around 300 East Berlin construction workers on June 16, 1953, mushroomed to a protest of about 40,000 demonstrators on the following day. Emboldened by their numbers, the protesters called for the resignation of the East German government. Although the uprising was put down by German police truncheons and Soviet tanks, the affair had a long afterlife in the collective consciousness, effectively shutting down the possibility of work norm changes in the future.[81]

The death of Stalin in 1953 and Khrushchev's secret speech of February of 1956 had the effect of liberalizing policy discussions through the Communist Bloc. After Władysław Gomułka's appointment to First Secretary of the United Workers' Party that fall, the Polish leadership began to sketch an economic reform package that would decentralize authority in the national economy and liberalize prices. Despite Gomułka's successful stand against Soviet intimidation (and East German denunciation), the boundaries of orthodoxy in the Khrushchev era were brought into sharp relief by the Soviet response to the Hungarian Uprising later that year.[82] With the exception of a few marginal alterations, the East German economy remained on the traditional course of multi-year planning; in fact Ulbricht and SED planning officials were among the most strident opponents of reformist currents throughout the Bloc. The oft-recounted declaration by Ulbricht in 1959 that the GDR would achieve consumer parity with the West by 1961 was never taken seriously by East German planning agencies and brought no substantial changes in policy.[83]

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[81] This point is argued convincingly throughout: Jeffrey Kopstein, *The Politics of Economic Decline in East Germany, 1945-1989*.
[82] Charles S. Maier, *Dissolution* (Princeton University Press, 1999), 85-86.
[83] Maier, *Dissolution*, 86.

The inflexibility of work norms, as a result of the 1953 uprising, combined with the *Republikflucht* presented East German economic planners with a seemingly intractable situation: they could neither anticipate labor supplies nor could they demand increases in worker productivity to correct for the shrinking labor pool. This made the long term, campaign-style planning systems that the GDR had inherited from the Soviet Union increasingly dysfunctional. As a result, in the early 1960s Ulbricht began to appeal to Moscow for a political solution to the Berlin problem and on August 13, 1961 construction of the Berlin Wall began. Despite ending the flow of labor to the West, the Wall did not deliver East Germany from its economic crisis and early the next year Ulbricht began discussing wide-ranging reform.[84]

3.2 Cybernetics and the Dawn of the Reform Period

It is perhaps surprising that the construction of the Berlin Wall, a symbol of East German intransigence, was succeeded by nearly a decade of economic and social reform in the GDR. It is especially remarkable that the motive force behind these reforms was Walter Ulbricht himself, who has traditionally been portrayed as an unreconstructed Stalinist. Ulbricht had earned a well-deserved reputation as a fierce opponent of "revisionist" ideological tendencies, not only within his own country, but throughout the Soviet bloc. Despite being a late convert to Khrushchev-era reformist ideas, the GDR made up for its tardiness with a comprehensive slate of reforms. From 1963-1965 these policies were implemented at a feverish pace. The reform agenda survived a brief setback after a clampdown by the Eleventh Plenum in 1965, but they were eventually crippled by the ideological reaction to Prague Spring in 1968 and finally ended by Walter Ulbricht's replacement by Erich Honecker in 1971.[85] Indeed, the period that followed the

[84] Jeffrey Kopstein, *The Politics of Economic Decline in East Germany, 1945-1989*, 48.
[85] Mary Fulbrook, *The People's State: East German Society from Hitler to Honecker* (Yale University Press, 2006), 252.

construction of the wall saw sweeping changes to the GDR's economic system, including a decentralization and reorganization of the country's lagging industrial sector, the overhaul of its educational system, and even the adoption of a new constitution in 1968.

This period also saw the rapid development of cybernetics as a field of scientific inquiry in the GDR, which had up until that point been the lonely reserve of a few philosophers and mathematicians like Georg Klaus. With official encouragement, cybernetics became a formidable transdisciplinary force within the East German academy and the fount of a variety of the reformist proposals of the New Economic System. [86]

In many ways, the story of official cybernetics in the GDR begins in February 1961, when Günther Rienäcker, the Secretary General of the German Academy of Sciences at Berlin (*Deutsche Akademieder Wissenschaftenzu Berlin* or DAW), formed a commission on cybernetics. The DAW charged this commission, which chaired by Georg Klaus, with preparing a scientific report on the status of cybernetics in the GDR. In pursuit of this goal, the commission organized a series of conferences devoted to exploring the interrelationship of cybernetics and a variety of scientific and philosophical disciplines. The titles of these conferences give an indication of the conceptual breadth of early cybernetic thinking in the GDR:

1. "Cybernetics—Philosophy—Society" held on April 24, 1961 in the editorial offices of *Einheit.*[87]
2. "Cybernetics Aspects and Methods in the Economy" which took place under the auspices of the Institute for Scientific Economies of the DAW on March 12, 1962.[88]
3. "Mathematical And Physical Technical Problems of Cybernetics" called by the Institute of Applied Mathematics and Mechanics of the DAW, held on March 20-23, 1962.[89]

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[86] Heinz Lippmann, "The Limits of Reform Communism," *Problems of Communism* 19, no. 3 (1970): 19; Spitmann, "East Germany: The Swinging Pendulum," 16.
[87] "Tagungsbericht: Kybernetik - Philosophie - Gesellschaft," *Einheit: Zeitschrift für Theorie und Praxis des wissenschaftlichen Sozialismus* 16, no. 7 (1961): Supplement.
[88] Heinz Liebscher, "Tagungsbericht: Kybernetische Aspekte und Methoden in der Ökonomie," *Deutsche Zeitschrift für Philosophie* 10, no. 9 (1962): 1186-1189.
[89] R. Thiel, "Tagungsbericht: Mathematische und physikalisch-technische Probleme der Kybernetik," *Einheit: Zeitschrift für Theorie und Praxis der wissenschaftlichen Sozialismus.* 17, no. 4 (1962): 104-110.

4. "Biological Medicine and Cybernetics" held by the Physiological Institute of Karl Marx University in Leipzig on October 6, 1962.[90]

The commission organized a final conference which was held in late October 1962 entitled "Cybernetics in the Sciences, Engineering, and Economy of the German Democratic Republic." This conference was intended as a synthesis of the former conferences and as a venue to provide the DAW with guidance for future research.[91] In addition to scholars from East Germany, it also attracted Czechoslovakian and Hungarian academics, including Arnošt Kolman, the mathematician who had inaugurated cybernetics' reevaluation in the USSR (see Chapter 2), who had returned to Prague in 1958 and became a member of the Czechoslovak Academy of Sciences.[92]

Attended by members of the Central Committee of the SED, the conference also served as a platform for scholars to promote cybernetics as a philosophically-acceptable science and to put forward cybernetically-influenced ideas of reform to high-ranking party officials. This conference was a watershed moment in the history of cybernetics in the GDR and its policy proposals and discussions are worth examining in detail, as they would set the tone for cybernetic reforms in the coming decade. Speaking to the assembled crowd in his address, Klaus argued for the utility of cybernetics and its synergetic relationship with Marxist theory:

> Cybernetics can assist in the deliberate formation of a social system, such as socialism, that is stable by nature. It may be considered a potent instrument of

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[90] Proceedings not available, mentioned in Georg Klaus, "Vorwart," in *Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR; Vortra¨ge und Diskussionsbeitra¨ge, gehalten auf der Konferenz der Kybernetik-Kommission beim Generalsekreta¨r der Deutschen Akademie der Wissenschaften zu Berlin zum Thema "Die Bedeutung der Kybernetik fu¨r Wissenschaft, Technik und Wirtschaft in der Deutschen Demokratischen Republik" am 16. und 17. 10. 1962 in Berlin* (presented at the Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR, Berlin: Akademie-Verlag, 1963), 7.

[91] Klaus, "Vorwart," 7.

[92] Günther Rienäcker, "Begrüssung und Eröffnung der Konferenz," in *Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR; Vortra¨ge und Diskussionsbeitra¨ge, gehalten auf der Konferenz der Kybernetik-Kommission beim Generalsekreta¨r der Deutschen Akademie der Wissenschaften zu Berlin zum Thema "Die Bedeutung der Kybernetik fu¨r Wissenschaf, Technik und Wirtschaft in der Deutschen Demokratischen Republik" am 16. und 17. 10. 1962 in Berlin* (presented at the Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR, Berlin: Akademie-Verlag, 1963), 11.

> socialist planning and organization of the peoples' economy and of social relationships. In this capacity, the necessary utilization of cybernetics creates new large-scale tasks for historical materialism. As a theoretical foundation of automation, it constitutes a critical component of our modern productivity. It must, therefore, be integrated into the system of productive forces categorically investigated by historic materialism and it must be examined with respect to its effect on man and its impact on the overall system of social productive forces.[93]

Beyond simply serving as useful tool for socialist construction, Klaus argued that cybernetics, with its algorithmic and procedural focus, fulfills the philosophical imperative outlined in Marx's 11th thesis on Feuerbach: not just interpreting the world, but changing it. Klaus argued "cybernetics shows a characteristic trait which philosophically brings it close to certain Feuerbach theses of Marx. We refer to the predominance of the algorithm compared to the theorem. The theorem describes existence while the algorithm provides the incitement to action" Cybernetics, he continued "was born as a science of action designed to change the world."[94]

Arnošt Kolman continued the philosophical justification of cybernetics and defended the discipline from "certain [philosophical] excesses that can be found in our Marxist camp."[95] Kolman cited two reasons for the hostility of some Marxists to cybernetics. First, he blamed misinformation from "hearsay or popular publications" composed of "reactionary false conclusions" arrived at by capitalist practitioners for feeding this antipathy.[96] Secondly, he

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[93] Georg Klaus, "Philosophie und Kybernetik," in *Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR; Vortra¨ge und Diskussionsbeitra¨ge, gehalten auf der Konferenz der Kybernetik-Kommission beim Generalsekreta¨r der Deutschen Akademie der Wissenschaften zu Berlin zum Thema "Die Bedeutung der Kybernetik fu¨r Wissenschaft, Technik und Wirtschaft in der Deutschen Demokratischen Republik" am 16. und 17. 10. 1962 in Berlin* (presented at the Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR, Berlin: Akademie-Verlag, 1963), 24-25, 15-27.
[94] Klaus, "Philosophie und Kybernetik," 20.
[95] Arnošt Kolman, "Zu den jüngsten Auseinandersetzungen über philosophische Fragen der Kybernetik," in *Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR; Vortra¨ge und Diskussionsbeitra¨ge, gehalten auf der Konferenz der Kybernetik-Kommission beim Generalsekreta¨r der Deutschen Akademie der Wissenschaften zu Berlin zum Thema "Die Bedeutung der Kybernetik fu¨r Wissenschaft, Technik und Wirtschaft in der Deutschen Demokratischen Republik" am 16. und 17. 10. 1962 in Berlin* (presented at the Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR, Berlin: Akademie-Verlag, 1963), 47, 15-27.
[96] Kolman, "Zu den jüngsten Auseinandersetzungen über philosophische Fragen der Kybernetik," 48.

attributed the remaining hostility to deeply held (but ultimately mistaken) philosophical opinions of opponents who saw cybernetics as contradicting dialectical materialism.[97]

In spite of this vigilant defense of cybernetics, Kolman had a much more limited view of its role in a modern socialist society than did Klaus. Kolman argued "it is wrong to see cybernetics and cybernetic relationships everywhere… [t]o consider every interaction and reaction as feedback—and thus cybernetic in character—is in my opinion erroneous."[98]

The remainder of the conference was devoted to applied cybernetic methodology in the educational, psychological, biological, and, most importantly for this discussion, economic fields. Prof. Dr. Johannes Rudolf, the director of the Institute for Economic Planning, offered the most concrete discussion of cybernetic economic methodology. In his paper, "Cybernetics and Economic Planning," he characterized the GDR's socialist economic system as a cybernetic "dynamic self-stabilizing system," citing Klaus's *Kybernetik in philosophischer Sicht* for support.[99] Expanding on this proposition, Rudolf identified four major cybernetic elements in the East German economy; the control path, the measurement works, the correction works, control. The control path refers to the production process in the national economy. He subdivided this element into spheres (production, distribution, and consumption processes), areas of responsibility (marked by the responsible state planning agency), fields of production, and geographic region. The control path for Rudolf represented a generalized pathway of a commodity from a raw to a finished good through a chain of custody. The measurement works element refers to the "system of operational and economic accounting and statistics, planning

[97] Kolman, "Zu den jüngsten Auseinandersetzungen über philosophische Fragen der Kybernetik," 50.
[98] Kolman, "Zu den jüngsten Auseinandersetzungen über philosophische Fragen der Kybernetik," 50.
[99] Johannes Rudolf, "Kybernetik und Volkswirtschaftplanung," in *Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR; Vortra¨ge und Diskussionsbeitra¨ge, gehalten auf der Konferenz der Kybernetik-Kommission beim Generalsekreta¨r der Deutschen Akademie der Wissenschaften zu Berlin zum Thema "Die Bedeutung der Kybernetik fu¨r Wissenschaft, Technik und Wirtschaft in der Deutschen Demokratischen Republik" am 16. und 17. 10. 1962 in Berlin* (presented at the Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR, Berlin: Akademie-Verlag, 1963), 85.

proposals, projection, as well as visual controls in all its forms."[100] In a sense, the measuring works element of the national economy was thought of as the central data bank of the cybernetic control circuit, storing quantitative and qualitative information for later regulatory action. As Rudolf noted, "the sum of this information is the basis of scientific prediction and action for the central, branch, and local state organs."[101] The "correctional works" element encompasses the entire range of the state's ability to influence production, and it includes legislation, planning tasks, material supplies, wages, taxes, prices, and any kind of directive. Any economic action the state can take is included in this category. [102]

Rudolf left the final element, control, rather vague and defined it in contradistinction to capitalist control. As with much of the jargon of cybernetics, the term "control" has a meaning within the field that differs substantially from standard usage. Broadly conceived, control refers to the goal orientation of a system, in this case, society. Rudolf defines the control mechanism of capitalist society as "law of surplus value." Surplus value, very generally speaking, can be summarized as the difference between the value a laborer instills in a commodity and the exchange value a capitalist reaps.[103] This is the foundation of profit and capital accumulation. In socialism the analogous mechanism was the "law of planned proportional development." This law, as summarized by one Czechoslovak economist, was "the planned management of the economy from the center, accompanied by relative independence for enterprises and producer groups and the promotion of optimal development and structure."[104]

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[100] Rudolf, "Kybernetik und Volkswirtschaftplanung," 86.
[101] Rudolf, "Kybernetik und Volkswirtschaftplanung," 86.
[102] Rudolf, "Kybernetik und Volkswirtschaftplanung," 86-87.
[103] For an excellent primer on the subject see David Harvey, *A Companion to Marx's Capital* (Verso, 2010), 109-134.
[104] Jozef Hvorecký and Marian Sling, "The Material Balance of the National Economic Plan," *Eastern European Economics* 25, no. 3 (April 1, 1987): 63.

After laying out a schematic view of the socialist economic system, Rudolf moved to identifying "decisive moments" of control or regulation, or in the jargon of the field "leverage points," of that system. Broadly speaking, Rudolf listed these as material and human inputs, production relationships, international trade, the requirements of the individual and the state, and the distribution of the national income. As with all cybernetic systems, the national economy was not conceived of as an aimless loop of activity, but rather a goal-oriented system. Rudolf identified two main goals of this "control circuit," both conceived of in straightforwardly Marxian terms. The first of these was the "political goal of society," that is to say, the building of socialism to make way for an eventual (and inevitable) transition into communism. The second was the "general human goal of man's debate with nature" and the increasing fulfillment of the material and cultural needs of the population.[105]

After summarizing the general parameters and goals of the economic system, Rudolf concluded with an examination of a number of internal and external "disturbances" (or feedback), ranging from natural disasters, to changes in the international political order, and the increase in effectiveness in economic management methods. Rudolf noted, without going into any further detail that "the control [i.e. the state] must react to such disturbances by either changing the regulation magnitude or by creating conditions which allow the retention of the original setting."[106]

Prof. Dr. Herbert Luck, director of the Rostock University Institute for Political Economy, continued the discussion on the economic applications of cybernetics. He was more skeptical that Rudolf of the *a priori* existence of cybernetic systems in the overall economy, but he remarked that cybernetic "models allow us to simulate economic processes by means of

[105] Johannes Rudolf, "Kybernetik und Volkswirtschaftplanung," 87.
[106] Johannes Rudolf, "Kybernetik und Volkswirtschaftplanung," 86.

models so that cybernetic relationships, interactions, and laws of a structural nature may be recognized and utilized in economic research."[107] For Luck, the primary economic promise of cybernetics was its computational, not organizational, possibilities.

For these participants, cybernetic reforms offered a way for the SED regime to transform an ailing economy in a way that was compatible with Marxist-Leninist ideological dictates and did not place any serious economic burden on the East German population. In effect, what these young planners and philosophers were trying to do was to simulate markets, but in ways acceptable to party leaders and to responsible—at least nominally—to accepted theory. Since the idea of full market reform was outside of the realm of possibility for SED officials, cybernetic reformers sought to incorporate feedback and control systems within the structure of the GDR's national economy. In doing so, these planners attempted to solve the problems identified in the socialist calculation debates of the 1920s by the Austrian School economists, Ludwig von Mises and Friedrich von Hayek. As these economists saw it, in the absence of market generated price signals, economic planners could not attribute meaningful values to raw or finished goods. This, they argued, is the logical result of the "knowledge problem." In market systems, the argument goes, knowledge is dispersed and not always explicit; individual economic actors make decisions based on price signals, knowledge of local conditions, and what is called "tacit knowledge," that is to say, knowledge that the actor is only partially aware of and is incapable of properly communicating.[108]

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[107] Herbert Luck, "Einige Fragen der Anwendung kybernetischer Methoden in der Wirtschaftswissenschaft," in *Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR; Vortra¨ge und Diskussionsbeitra¨ge, gehalten auf der Konferenz der Kybernetik-Kommission beim Generalsekreta¨r der Deutschen Akademie der Wissenschaften zu Berlin zum Thema "Die Bedeutung der Kybernetik fu¨r Wissenschaft, Technik und Wirtschaft in der Deutschen Demokratischen Republik" am 16. und 17. 10. 1962 in Berlin* (presented at the Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR, Berlin: Akademie-Verlag, 1963), 92, 15-27.

[108] For a brief account of these debates see Joseph Persky, "Retrospectives: Lange and von Mises, Large-Scale Enterprises, and the Economic Case for Socialism," *The Journal of Economic Perspectives* 5, no. 4 (October 1, 1991): 229-236.

These participants sought address these problems in two different ways. First, by utilizing cybernetic insights about information and control flows, cyberneticians could organize the economic system in ways that maximized overall efficiency. If decision making were to be distributed at points within the economic system where actors had specialized knowledge, these actors could execute decisions based on local expertise (see the "black box" conception of state owned enterprises below for an example of this in practice). This method, in theory, required no additional use of computers; in fact, it was intended to diminish the overall need for computation, as central planners would only set targets, not engage in long-term prospective planning, and decentralized authorities would make decisions on the ground.

The other method, the creation of computationally complex cybernetic models, suggested by Luck, sought to attack the problem of inefficiency from another angle. Cybernetic modeling opened the possibility of experimentation in economic planning (heretofore a non-experimental discipline).The relative paucity of computing equipment, however, seriously constrained this dimension of cybernetic economics. As Luck noted, economic planners in Rostock, an important industrial center, only had access to one ZRA-1 (a computer introduced in 1956 by Carl Zeiss Jena).[109] This paucity of computing equipment—a problem which persisted throughout the GDR's existence—dampened the prospects for this variety of cybernetic application.[110] Organizational cybernetics, however, would become an important inspiration (and justification) for the economic reforms of the next decade.

[109] Luck, "Einige Fragen der Anwendung kybernetischer Methoden in der Wirtschaftswissenschaft," 93.
[110] Gary Geipel, "Politics and Computers in the Honecker Era," in *Science under Socialism: East Germany in Comparative Perspective*, ed. Kristie Macrakis and Dieter Hoffmann (Cambridge, Mass. Harvard University Press, 1999).

3.3 The New Economic System

In 1963, following a year of consultation with the Soviet economist Evsei Liberman, (whose October 1962 publication "Plan, Profit, Bonus" in *Pravda* initiated a round of serious debate throughout Eastern Europe) the SED unveiled the New Economic System (*Neues Ökonomisches System*, NÖS).[111] The NES was inspired by a similar set of reforms proposed by Nikita Khrushchev in the early sixties, but quickly became more ambitious than anything proposed by Moscow or any other Eastern European country (with the exception of Yugoslavia).[112] The reforms had two main goals: improving industrial efficiency without recourse to market reforms, and improving the "quality and qualifications of leading economic personnel without sacrificing a commitment to socialist values."[113] The most fundamental aspect of the reform was radical de-bureaucratization and devolution of responsibilities from central planners to lower-level authorities, but other changes like the retooling of the mechanisms of supply allocations, the development of incentive structures, and the initiation of price reforms were also important.[114]

Cybernetic ideas played an important role in this reform package. Several academics in attendance at the 1961 cybernetics conference, Klaus and Rudolf among them, were involved in the working groups that help craft the NES as well as in high-level discussions on scientific, technological, and economic policy throughout the 1960s.[115] Personnel changes in the upper echelons of the state planning organs also helped facilitate the rise of cybernetics. In 1963, Erich Apel (1917-1965) was named head of the State Planning Commission (SPK), the central

[111] Thomas Baylis, "Economic Reform as Ideology: East Germany's New Economic System," *Comparative Politics* 3, no. 2 (1971): 211; Charles S. Maier, *Dissolution*, 86.
[112] Jeffrey Kopstein, *The Politics of Economic Decline in East Germany, 1945-1989*, 11.
[113] Jeffrey Kopstein, *The Politics of Economic Decline in East Germany, 1945-1989*, 47.
[114] Michael Keren, "The New Economic System in the GDR: An Obituary," *Soviet Studies* 24, no. 4 (April 1973): 554-587.
[115] Klaus and Rudolf, for instance, were members of the "Science and Technical Policy" working group that advised the SED central committee. SAPMO-BA DY 30/3307 p. 10-12

planning organ of the GDR. Together with his protégé Günther Mittag (1926-1994), Apel played important role in the design and implementation of the New Economic System. A mechanical engineer by trade—he worked under Wernher von Braun in the Nazi rocket program during the war—Apel was highly receptive to cybernetic ideas and served as a patron for the GDR's technical intelligentsia until his suicide in 1965.[116]

Apel and Mittag modeled economic planning relationships in the NES on the idea of a "black box." In cybernetics, a black box is a system or object in which only inputs and outputs can be viewed while the internal mechanisms of the system or object are obscured. The relationships of *Volkseigener Betriebe* (People/State-Owned Enterprises, VEBs) to the superordinate body, the *Vereinigungen Volkseigener Betriebe*, (Associations of People's Enterprises, VVBs), for instance, resembles a black box. In this system, the planning authority, the VVB, views only the production inputs and outputs of the subordinate VEB, instead of micromanaging the entire chain of production. In such a system, changes to production processes within in a firm would be undertaken locally, in response to feedback (usually in the form of incentives) from the central planning authority. It was thought that this sort of black box modeling would ease the workload of central planners, who were burdened by great quantities of paperwork, and generally make industrial production more efficient.[117]

After the institution of the New Economic System, such ideas found expression the various official periodicals of the SED. The party press was filled with articles exploring the cybernetic contours of the new form of the socialist economy. The most important and visible forum for debates on cybernetics in the GDR was *Einheit*, the SED's theoretical journal. This publication was a mix of philosophical works on Marxist-Leninist theory and articles on the

[116] Augustine, *Red Prometheus*, 125-130.
[117] Benjamin Robinson, "Socialism's Other Modernity: Quality, Quantity and the Measure of the Human," 709-710.

practical application of the principles of dialectical materialism. *Einheit* (aside from the party's daily newspaper, *Neues Deutschland*) was the most frequently read publication among party officials and was an important vector for the propagation of cybernetic ideas—nearly every issue between 1963 and 1971 had a piece providing a cybernetic exegesis of the East German planned economy.

A 1967 essay by Günther Mittag was among the more important examples of this broader trend. Mittag's article dealt mostly with the application of new technologies to socialist economics, although it concluded with a substantial section on cybernetics, electronic data processing, and operations research. The main goal of this section was to prove the utility of cybernetics, very broadly conceived for the East German planned economy. He argued that management should "focus its energy on ensuring that the production process, the flow of information and the responsibility of the collective will be regulated so as to achieve maximum stability."[118] Here, Mittag means "stability" in the cybernetic not the colloquial sense. In cybernetics stability does not refer to the rigidity of system but rather its dynamism. Stability is the ability of a system to adapt to different environments and changing conditions. A stable system is one responsive to feedback. Following Rudolf's description, this system (socialist society) would successfully deal with external and internal pressures marinating the goal-orientation of "planned proportional development."

Mittag's cybernetic understanding of the East German economy extended from macroeconomic concepts all the way down to the actions of an individual worker. On the social nature of labor, Mittag wrote:

> Man can indeed be interpreted as a regulator of social processes…. He is a rational being, acting consciously. The man asks the question, for whom he

[118] Günter Mittag, "Sozialistische Ökonomie und wissenschaftlichtechnische Revolution meistern," *Einheit: Zeitschrift für Theorie und Praxis des wissenschaftlichen Sozialismus*, no. 8 (1967): 979.

> works. The class-conscious worker will act differently under socialism than under capitalism. His action is determined by his own knowledge of class relations. This makes it clear that we can fully exploit the insights of cybernetics on the basis of Marxism-Leninism.[119]

By describing a Marxist-Leninist concept in cybernetic terms, Mittag engaged in a rhetorical strategy common among its East German proponents. By demonstrating the cybernetic characteristics of Marxist theory, they sought to underline the discipline's commensurability with dialectical materialism. Indeed, Georg Klaus and others went as far as to call Marx the first cybernetician. The philosophical opponents of cybernetics, however, saw the description of historical materialist processes from the systems perspective of cybernetics as an illegitimate usurpation of philosophical authority of Marxism-Leninism.

Mittag's specific recommendations, had they been fully adopted, would have been highly disruptive to the East German social order. For example, he calls for the "development of economic models with the aim of optimizing economic processes."[120] By shifting the nature of economic planning from party-directed production targets to mathematical economic models, the role of the party bureaucrat would have been supplanted, in the all-important realm of industrial production, by members of the technical intelligentsia.

Another article in *Einheit*, this one written by Wolfgang Salecker of the Central Institute for Socialist Economic Management for the December 1967 issue, dealt exclusively with cybernetics and the planned economy. In it, Salecker identified three main directions for the application of cybernetics in the GDR's planned economy. First, he argued for the utilization of cybernetics in scientific control systems in factories, collectives, ministries, and the VVB, which would have the intended effect of greatly boosting operational efficiency. Secondly, as with Mittag, Salecker called upon cybernetics to aid in the development of mathematical economic

[119] Mittag, "Sozialistische Ökonomie und wissenschaftlichtechnische Revolution meistern," 981.
[120] Mittag, "Sozialistische Ökonomie und wissenschaftlichtechnische Revolution meistern," 979.

models for the purpose of optimizing economic processes in the economy at large. Finally, he called for the utilization of the insights of cybernetics to rationally to design a new system for the rational division of labor in the planned economy as well as to devise a systematic organization of relations between state enterprises and central state organs.[121]

Although cybernetic ideas were discussed with great excitement in the pages of the party press and theoretical journals, within the VEBs themselves the application was limited. As Jeffery Kopstein notes, cybernetics and systems theory were "…generally the object of ridicule among middle- and lower-level enterprise personnel, as few could understand what they were studying or how it would apply to the production process."[122]

3.4 Visualizing Authority

The influence of cybernetics in the New Economic System was also apparent in the proliferation of schematic diagrams of the national economy. This new method of organizational diagramming, control flow diagrams (CFDs), represented organizational structures in an entirely new manner. Whereas older models, typified by the organizational tree, presented hierarchical relationships in a clear, static fashion, CFDs sought to model information flows and regulatory action within a system, imbuing organizations with a dynamic, almost kinetic quality. Beyond merely illustrating power relationships, these diagrams are images in the imperative mood, embodying not only hierarchical relationships but also structuring flows of information and chains of command.

Until the 1950s hierarchical organizational trees were the standard method for representing organizations. These charts have a long history; Diderot's *Encyclopédie* organized

[121] Wolfgang Salecker, "Kybernetik und sozialistische Wirtschaftsführung," *Einheit: Zeitschrift für Theorie und Praxis des wissenschaftlichen Sozialismus*, no. 12 (1967): 1475.
[122] Jeffrey Kopstein, *The Politics of Economic Decline in East Germany, 1945-1989*, 116.

all human knowledge within a hierarchical system.[123] Even older diagrams, like the great chain of being, arranged all forms of life and matter within a hierarchical structure. In diagrams like these, the operating metaphor is a genealogical tree, with its incumbent allusions to familial power structures. The primary philosophical concern in question in these organizational trees is ontology, specifically the social ontology of power. What matters in these charts is the position of actors within a hierarchical chain, leaving obscure the functional operation of the system.

Cybernetic diagramming differs in several important respects. Where organizational trees focus on the ontology of concrete power structures, the primary concern of CFD is praxis, modeling the ways that information and orders are transmitted through a system. Although this kind of organizational representation comes in a variety of metaphorical styles, the most common is the electronic circuit. In this kind of symbolic depiction, the transmission of information and activity through a system takes center stage, leaving questions of hierarchy either minimized or obscured.

[123] Robert Darnton, "Philosophers Trim the Tree of Knowledge: The Epistemological Strategy of the Encyclopedie," in *The Great Cat Massacre: And Other Episodes in French Cultural History*, 1st ed. (Vintage, 1985), 191-214.

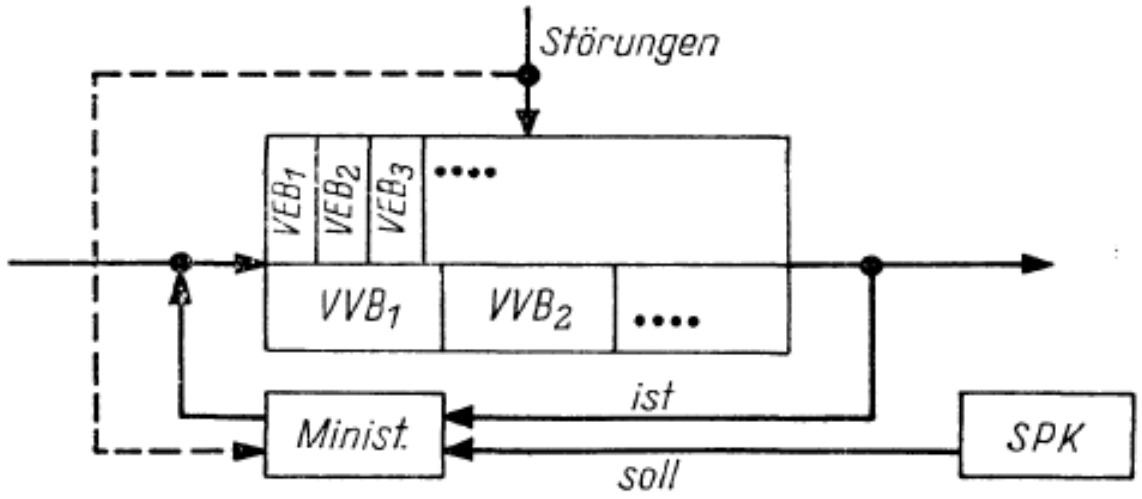

Figure 2 – from Löser, W., Zur kybernetischen Darstellung von ökonomischen Systemen, *Deutsche Zeitschrift für Philosophie*, 14:10 (1966) 1276-1283 p. 1282

Although cybernetic diagramming and modeling enjoyed considerable attention in the postwar capitalist west, particularly by the industrial firms advised by the management cyberneticist Stafford Beer, these representations were embraced with a surprising degree of enthusiasm in the German Democratic Republic during the reform period of the 1960s. Figure 2 provides a representative example of this style, schematically representing the organizational, regulatory, and command structures of the planned economy. As can be seen, the normal vertical metaphors of power are absent from this diagram; the superordinate body, the State Planning Commission, appears at the bottom left, with its position in the hierarchy only indicated by action, namely, its issuance of planning directives (*soll*). The amorphous, simulated "market" of East Germany, meanwhile, is represented by the flow of economic facts (*ist*) into the ministries and any of a host of "disturbances" (*Störungen*) are represented as being completely external to the system. During the implementation of the New Economic System, the schematic representation of the organization of the planned economy shifted completely from hierarchical organizational charts, to cybernetic CFDs like Figure 2.

The reforms proposed by advocates of a cybernation of the GDR's economy would have had the effect of displacing the role of party economic planners with autonomous, independent technocrats. The conflict that ensued in committee chambers and in the party press essentially represents a battle between SED bureaucrats and members of the technical intelligentsia over control of the means of production. Since in the economic system of the GDR the state nationalized the means of production, this conflict did not take the shape of a struggle for property ownership. Rather, it manifested itself as a struggle over the day-to-day administration of state-owned industry. By describing the functioning of state and industry in the scientific language of cybernetics, the hierarchal distinctions apparent in GDR society could be obscured by the technical intelligentsia behind discussions of self-organizing systems and responsive feedback. More fundamentally, cybernetics, with its totalistic, system-level analysis provided the GDR with a method of describing itself as a self-regulating system lacking the dialectical contradictions of capitalist society. In short, East German cybernetics, for all its talk about self-regulation, required a helmsman, a regulator, to steer the cybernetic ship of the East German economy, a role that would be played by the technical intelligentsia itself. Ultimately, owing partially to fears on the part of bureaucrats that decentralization was eroding the authority of the SED, the NES was scrapped in 1968 and replaced with the Economic System of Socialism (ESS).[124]

The Economic System of Socialism did not amount to a clean break with the NES; in many areas of the economy the trend toward decentralization continued and deepened. In the case of a minority of industries, however, the SED directed party planners and ministry bureaucrats to reassert central control. This was particularly true of structurally important sectors of the GDR economy like machine tool building, chemical and plastic production, and

[124] Thomas Baylis, "Explaining the GDR's Economic Strategy," *International Organization* 40, no. 2 (1986): 385.

microelectronics. By selectively focusing administrative attention, labor, and investment on the production of capital goods and high-tech components, Walter Ulbricht and Günter Mittag, now the Central Committee Economic Secretary, sought to overtake the West in a number of key industries. This strategy, paradoxically known in the party press as "overtaking without catching up" (*Überholen ohne Einzuholen*), was intended to position the GDR as a global leader in a number of selectively chosen industries. The gains in efficiency and productive capacity in these sectors of the economy would, it was thought, filter out to the broader economic landscape, gradually bringing living standards into a state of parity with the West, with the goal of eventually overtaking it.[125]

3.5 Normalization in Prague, Normalization in East Germany

The fate of reformist cybernetics and, more broadly, the Economic System of Socialism, was tightly bound with the events of the Prague Spring in Czechoslovakia in 1968. As in the GDR, many of those involved in the internal reform movement of the Czechoslovak Communist Party took inspiration from cybernetics.[126] The subsequent Soviet crackdown (which was backed by East German troops) had the effect of slowing the pace of any reforms throughout the Communist Bloc. Policies that could be conceived of as "revisionist" or that ran afoul of the "Brezhnev Doctrine," which offered a *post hoc* justification of the Soviet invasion of Czechoslovakia were modified or rolled back. In East Germany, the SED eliminated or severely circumscribed policies that decentralized decision-making, including many of the cybernetically-inspired organizational reforms that were part of the ESS. [127] The return of conventional socialist economic policy, embodied in the rigid planning methods of Brezhnev and driven home by the

[125] Interestingly, several of the SED informants interviewed by Kopstein saw nothing contradictory about this phrase Jeffrey Kopstein, *The Politics of Economic Decline in East Germany, 1945-1989*, 65.
[126] Gil Eyal, *The Origins Of Postcommunist Elites: From Prague Spring To The Breakup Of Czechoslovakia* (Univ Of Minnesota Press, 2003), 24.
[127] Charles S. Maier, *Dissolution*, 89.

example of Czechoslovakia, put reformers on the defensive throughout Eastern Europe. In the GDR this ideological reaction continued until December, 1970 when the SED finally abandoned the ESS.[128]

With the fall of Walter Ulbricht from power in May 1971, cybernetics lost an important advocate. Ulbricht's replacement Erich Honecker and his circle were not as receptive to the arguments of Klaus, and cybernetics fell from official grace in this period. Leading the charge against the science was Kurt Hager, a Politbüro member and the chief ideologist of the SED. In the Novemeber 1971 issue of *Einheit,* Hager launched a blistering attack against cybernetics and its East German proponents. While accepting the role of "legitimate" research in cybernetics in the GDR's scientific community, he denounced works that tread on the philosophical hegemony of Marxism-Leninism:

> Dialectical and historical materialism cannot and must not be substituted with individual sciences or be transformed into an appendage of such sciences. The necessary employment of sciences like cybernetics, communication theory, and operations research, from the point of view of applied mathematics or the concrete management of the economy, may not lead to the fact that terms and concepts from these sciences step into the place of Marxism-Leninism. We restrict the importance of individual sciences which address questions like system and structure control and regulation, but for the management of all social processes with the construction of the socialism, for the guidance of the revolutionary class conflict there can be only one science, and this is the Marxism Leninism.[129]

Hager goes on to argue that "trying to describe the nature of socialist society with the cybernetic concept of a system has the effect of undermining the socioeconomic and class content of socialism."[130]

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[128] Maier, *Dissolution,* 92.
[129] Kurt Hager, "Die entwickelte sozialistische Gesellschaft: Aufgaben der Gesellschaftswissenschaften nach dem VIII. Parteitag der SED," *Einheit: Zeitschrift für Theorie und Praxis des wissenschaftlichen Sozialismus,* no. 11 (1971): 1215.
[130] Hager, "Die entwickelte sozialistische Gesellschaft: Aufgaben der Gesellschaftswissenschaften nach dem VIII. Parteitag der SED," 1215.

In his repudiation of cybernetics Hager returned to the rejectionist tropes of the 1950s. By arguing that the systems-view of society undermined the class content of socialist society, however, Hager did something new. The basic argument was that by interjecting the language of cybernetics into the discourse of the party, the cybernetic revisionists remove the class-conscious, polemic nature of party rhetoric. This process, Hager warned, would have the effect of changing the party's mission. In short: "the party would stop being a Marxist-Leninist party."[131]

3.6 Conclusion:

Writing in 1976, after the replacement of Walter Ulbricht by Erich Honecker, the Czech political commentator, Jaroslav Krejčí, remarked:

> So far, cybernetic and similar considerations seem to be, to borrow [Gabriel] Almond's terms, a part of the exoteric (i.e. window dressing) rather than the… operative…doctrine of the party, yet what is still more important is that the cybernetic, technocratic orientation seems to have suffered a setback by the replacing of Walter Ulbricht by Honecker as First Secretary of the SED.[132]

The second point made by Krejčí is undisputed—East German cybernetics never fully recovered following the fall of Ulbricht from power. The first point, that the cybernetic rhetoric of the SED amounted to little more than "window dressing," however, assumes a uniformity of outlook and ideology within the party that never existed. A conservative faction within the SED consistently distrusted cybernetics for its alleged bourgeois origins and its lack of ideological rigor. On an even more fundamental level, however, these officials found the ideology unacceptable, since it decentralized decision making, and removed the party (and these party members) from the economic levers of power. In the place of these bureaucrats would be career technocrats, goal-

[131] Hager, "Die entwickelte sozialistische Gesellschaft: Aufgaben der Gesellschaftswissenschaften nach dem VIII. Parteitag der SED," 1215.
[132] Jaroslav. Krejcí, *Social Structure in Divided Germany* (London: Croom Helm, 1976), 144.

oriented technicians that may not share the Marxist-Leninist convictions of orthodox SED officials.

4 Conclusion: Technology of Control, Technology of Liberation

The narrative this thesis has put forward—one in which cybernetics, initially rejected in East Germany for ideological reasons, rose to an impressive degree of influence and prominence, only to be erased from the philosophical landscape not even a decade later—seems, on some level, incomplete and altogether too clean. After all, it seems remarkable that a philosophy that served as an important guiding force in the GDR's policy-making circles could vanish from the intellectual scene overnight. By the time of Honecker's elevation to General Secretary of the SED in 1971, cybernetics had built itself into a major force within the party and the academy and it seems implausible that the story should end there.

In many ways, the story of cybernetics in the GDR, while differing substantially on questions of scale and official support, shares important features with the history of the science in the United States. Both countries experienced an intense, albeit brief, period of interest from industry and the state presided over by a strong central personality: Norbert Wiener in America and Georg Klaus in East Germany. In both countries when official support for the discipline waned, cybernetics fragmented, leaving fields like general systems theory, artificial intelligence, operations research, network theory, and industrial automation in its wake. This should not be surprising; cybernetics was never so much a discipline in its own right as it was a methodological approach, a way of looking at the world, an interdiscipline. It was also an empire-building science, seeking to subsume other fields of inquiry, from cellular communication to aesthetic theory, within its paradigm.[133]

[133] See, for example Edward A. Shanken, "From Cybernetics to Telematics: The Art, Pedagogy, and Theory of Roy Ascott," in *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*, ed. Roy Ascott (Berkeley: University of California Press, 2003).

When the ideological attacks of the Honecker regime began, cybernetics began to fracture and its subfields began to emancipate themselves from the imperial aegis of the interdiscpline. This entropic process was accelerated by the illness of Georg Klaus, who despite still writing on cybernetics until his death in 1974, was bedridden and unable to exercise any considerable amount of influence. By that point, however, cybernetics as unified field of inquiry was effectively moribund; after 1972 there was a conspicuous decline of articles on the subject in the party press.

Although the 1970s saw a precipitous decline in the credibility of cybernetics within SED circles, the same was not true of other high tech fields. The allied fields of information technology (IT) and automation became the subject of increasing interest in East Germany, especially after 1976. Responding to erratic fuel and raw materials imports, and dwindling labor supplies, SED leaders instituted a policy of *Intensivierung* (intensification), which saw renewed attention to microelectronics and computer-controlled machine tools.[134] In many ways IT and automation filled the discursive roles previously held by cybernetics—both were seen as ways to rationalize the planned economy but without the requirement of institutional overhaul and decentralization. As with cybernetics, however, the prospects of these high technology fields were dampened by internal political contradictions and complicated, often acrimonious relationships within the broader socialist community.

Throughout the last two decades of its existence, East Germany had the most developed high tech sector within the CMEA (Council for Mutual Economic Assistance, also known as COMECON). During the late 1970s, the bloc countries cooperated on the production of high tech equipment, distributing component production throughout the CMEA countries. During this period the GDR ran high balances of trade on high tech components, but received very few

[134] Geipel, "Politics and Computers in the Honecker Era," 230.

finished goods. In this climate, East Germany embarked on an autarkic plan of microelectronics, centralizing research (buttressed by the industrial espionage of Western products) and production within the country. The result was a highly expensive and only marginally successful IT sector; despite some successes, East German computer production never came close to satisfying internal demand.[135] More dangerously, as Gary Geipel has noted, "while information technologies brought about stunning change in other societies…IT development in East Germany was seen as a replacement for economic reform and political change."[136] This ideology was explicitly integrated into Erich Honecker's rhetoric; speaking to Western reporters in 1987 he argued that microelectronics and IT put the GDR "…in the position of continuing our tried and trusted course of economic and social policy, in spite of complicated international conditions."[137]

The experience of cybernetics, computers, and socialist modernity in the GDR poses the inevitable counterfactual question: could cybernetic reforms, earnestly adopted, combined with a baseline of computational power, have rejuvenated the East German planned economy? This question, of course, can never be answered, but the history of Allende's Chile provides an interesting if fleeting, clue. In 1971, just as the last stage of the backlash against cybernetics in the GDR was beginning, the new socialist president of Chile, Salvador Allende, met with the British cybernetician Stafford Beer to discuss the reconfiguration of the Chilean economy along socialist and cybernetic lines.[138] Although the 1973 Pinochet coup cut the experiment short, the Chilean cybernetic command system, known as "Cybersyn," achieved reasonable success with very limited technology. Composed of a network of telex machines (technology developed in the

[135] Gary Geipel, "Politics and Computers in the Honecker Era."
[136] Gary Geipel, "Politics and Computers in the Honecker Era," 246.
[137] Quoted in Gary Geipel, "Politics and Computers in the Honecker Era," 246.
[138] Eden Medina, "Designing Freedom, Regulating a Nation: Socialist Cybernetics in Allende's Chile," *Journal of Latin American Studies* 38, no. 3 (2006): 571.

1930s) ,which connected factories to a central operation room in Santiago, the Cybersyn system succeeded in maintaining the flow of goods during the 1972 CIA-backed truck driver strike.[139] Although key aspects of the system were never completed (including CHECO, a project to model the Chilean economy and serve as a experimental platform to test policy changes), Cybersyn proved to be a flexible and responsive way to handle the unexpected contingencies that repeatedly rattled the planned economy of the GDR.

Although the example of Allende's Chile provides an interesting example of the use of cybernetic methods in a more humanistically inclined socialist state, it is also important to note that cybernetic and systems theoretical approaches have not only been used as the tools of "control" from above, but also as resistance and destabilization from below. To take one topical example, the strategy of Julian Assange of WikiLeaks is motivated by a systems understanding of state secrecy networks. In his short "manifesto," "State and Terrorist Conspiracies," and elsewhere Assange appropriates theoretical models designed for detecting and destabilizing covert terrorist networks, and deploys them in an attempt to undermine that state secrecy apparatus.[140]

In Assange's thought covert organizations, whether state, corporate, or terrorist, are best understood as distributed cybernetic communications networks. Assange sees the "leak" as a tactic for disrupting a convert network's information sharing pathways; since the publication of a leak provokes a response that degrades the efficacy of a network (i.e. it eliminates members/nodes and, thus, reduces information sharing). The content of the leak is not important, what really matters is the reaction the leak generates; the overall goal is to reduce the number of actors and communications links in a covert system in an effort to reduce the system's power.

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[139] Medina, "Designing Freedom, Regulating a Nation," 593.
[140] Julian Assange, "State and Terrorist Conspiracies", July 31, 2006, http://cryptome.org/0002/ja-conspiracies.pdf.

The morality and effectiveness Assange's enterprise are up for debate, but this example should make clear that we should not view cybernetics and systems theory solely as tools for social engineering and control, or as a necessarily constituent technology of Donna Haraway's "informatics of domination," a scientific system that translates the "world into a problem of coding, a search for a common language in which all resistance to instrumental control disappears and all heterogeneity can be submitted to disassembly, reassembly, investment, and exchange."[141] I think this is an incomplete picture—as a science of the operation of systems, cybernetics is equally suited for control and resistance. In cybernetic terms, if one understands the "stability parameters" of an oppressive system, one knows how to take that system down.

[141] Donna Haraway, "A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s," in *The Postmodern Turn: New Perspectives on Social Theory*, ed. Steven Seidman (Cambridge University Press, 1994), 102.

5 References

Primary Sources

Archival Sources

CIA FOIA Electronic Reading Room
Franklin D. Roosevelt Presidential Library and Museum
Stiftung Archiv der Parteien und Massenorganisationen der DDR im Bundesarchiv (SAPMO-BA)

Newspapers and Periodicals

The American Naturalist
Behavioral Science
Bell System Technical Journal
Deutsche Zeitschrift für Philosophie
Eastern European Economics
Einheit
Forum
Mechanics of Composite Materials
New York Times
Philosophy of Science
The Problems of Communism
The Rotarian
Slavic Review
Soviet Studies
Studies in East European Thought

Conference Proceedings

Kybernetik in Wissenschaft, Technik und Wirtschaft der DDR: vortra¨ge und Diskussionsbeiträge gehalten auf der Konferenz der Kybernetik-Kommission beim Generalsekreta¨r der Deutschen Akademie der Wissenschaften zu Berlin zum Thema "Die Bedeutung der Kybernetik fu¨r Wissenschaft, Technik und Wirtschaft in der Deutschen Demokratischen Republik" am 16. und 17. 10. 1962 in Berlin. 1963.

Books and Pamphlets

C˘ erný Jochen, and Lothar. Berthold, eds. "Georg Klaus." *Wer war wer, DDR: ein biographisches Lexikon*. Berlin: Ch. Links, 1992.

Engels, Friedrich. *Dialectics of Nature*. Translated by C. P Dutt. New York: International Publishers, 1940.

Klaus, Georg. *Marxistisch-leninistisches Wo¨rterbuch der Philosophie* Reinbek (bei Hamburg): Rowohlt, 1972.
———. *Kybernetik und Gesellschaft*. Berlin: VEB Deutscher Verlag der Wissenschaften, 1964.
———. *Jesuiten, Gott, Materie: des Jesuitenpaters Wetter Revolte wider Vernunft und Wissenschaft*. Berlin: Deutscher Verlag der Wissenschaften, 1957.

Ruesch, Jurgen, and Gregory Bateson. *Communication, the Social Matrix of Psychiatry*. First Edition. New York: Norton, 1951.

Tou, Julius T. *Digital and Sampled-Data Control Systems*. McGraw-Hill Electrical and Electronic Engineering Series. New York: McGraw-Hill, 1959.

Ulbricht, Walter. "Significance and Vital Force of the Teachings of Karl Marx for Our Era." In *On Questions of Socialist Construction in the GDR. From Speeches and Essays.* Dresden: Zeit im Bild, 1968.

V.I. Lenin. "Materialism and Emperio-Criticism." In *V.I. Lenin: Collected Works*, 14:17-398. 3rd ed. Moscow: Progress Publishers, 1972.

Warburton, Frederick E. "Feedback in Development and Its Evolutionary Significance." 89, no. 846 (1955): 129-140.

Wiener, Norbert. *Cybernetics; or, Control and Communication in the Animal and the Machine.* New York: J. Wiley, 1948.
———. *Extrapolation, Interpolation, and Smoothing of Stationary Time Series, with Engineering Applications.* Cambridge, MA: Technology Press of the Massachusetts Institute of Technology, 1949.

Unpublished Manuscripts

Assange, Julian. "State and Terrorist Conspiracies", July 31, 2006. http://cryptome.org/0002/ja-conspiracies.pdf.

Liebscher, Heinz. "Philosophie in der DDR." Unpublished Manuscript, n.d. http://www.heinzliebscher.de/Unveroeffentlichte/PhilosophieDDR.pdf.

Secondary Sources

Augustine, Dolores L. *Red Prometheus: Engineering and Dictatorship in East Germany, 1945-1990*. The MIT Press, 2007.

Baylis, Thomas. "Economic Reform as Ideology: East Germany's New Economic System." *Comparative Politics* 3, no. 2 (1971): 211-229.
———. "Explaining the GDR's Economic Strategy." *International Organization* 40, no. 2 (1986): 381-420.

———. *The Technical Intelligentsia and the East German Elite: Legitimacy and Social Change in Mature Communism,*. Berkeley: University of California Press, 1974.

Bowker, Geof. "How to be Universal: Some Cybernetic Strategies, 1943-70." *Social Studies of Science* 23, no. 1 (February 1, 1993): 107 -127.

Caldwell, Peter C. *Dictatorship, State Planning, and Social Theory in the German Democratic Republic.* Cambridge, UK: Cambridge University Press, 2003.

Cross, Andrew. "The Crisis in Physics: Dialectical Materialism and Quantum Theory." *Social Studies of Science* 21, no. 4 (November 1991): 735-759.

Darnton, Robert. "Philosophers Trim the Tree of Knowledge: The Epistemological Strategy of the Encyclopedie." In *The Great Cat Massacre: And Other Episodes in French Cultural History*, 191-214. 1st ed. Vintage, 1985.

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

Eyal, Gil. *The Origins Of Postcommunist Elites: From Prague Spring To The Breakup Of Czechoslovakia*. Univ Of Minnesota Press, 2003.

Fulbrook, Mary. *The People's State: East German Society from Hitler to Honecker*. Yale University Press, 2006.

Galison, Peter. "The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision." *Critical Inquiry* 21, no. 1 (Autumn): 228-266.

Geipel, Gary. "Politics and Computers in the Honecker Era." In *Science under Socialism: East Germany in Comparative Perspective*, edited by Kristie Macrakis and Dieter Hoffmann. Cambridge, Mass. Harvard University Press, 1999.

Gerovitch, Slava. *From Newspeak to Cyberspeak: a History of Soviet Cybernetics*. Cambridge, Mass.; London: MIT, 2004.

Haraway, Donna. "A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s." In *The Postmodern Turn: New Perspectives on Social Theory*, edited by Steven Seidman. Cambridge University Press, 1994.

Harsch, Donna. *Revenge of the Domestic: Women, the Family, and Communism in the German Democratic Republic*. Princeton University Press, 2006.

Harvey, David. *A Companion to Marx's Capital*. Verso, 2010.

Kopstein, Jeffrey. *The Politics of Economic Decline in East Germany, 1945-1989*. University of North Carolina Press Enduring Editions, 2009.

Krejcí, Jaroslav. *Social Structure in Divided Germany*. London: Croom Helm, 1976.

Lorentz, G. G. “Mathematics and Politics in the Soviet Union from 1928 to 1953.” *Journal of Approximation Theory* 116, no. 2 (June 2002): 169-223.

Ludz, Peter Christian. *The Changing Party Elite in East Germany*. Cambridge, Mass: MIT Press, 1972.

Maier, Charles S. *Dissolution*. Princeton University Press, 1999.

McAdams, A. James. *Judging the Past in Unified Germany*. Cambridge University Press, 2001.

McCay, Bonnie J. “Systems ecology, people ecology, and the anthropology of fishing communities.” *Human Ecology* 6, no. 4 (1978): 397-422.

Medina, Eden. “Designing Freedom, Regulating a Nation: Socialist Cybernetics in Allende’s Chile.” *Journal of Latin American Studies* 38, no. 3 (2006): 571-606.

Mindell, David, Slava Gerovitch, and Jérôme Segal. “Cybernetics and Information Theory in the United States, France and the Soviet Union.” edited by Mark Walker, 65-95. London; New York: Routledge, 2003.

Pence, Katherine, and Paul Betts. *Socialist Modern: East German Everyday Culture and Politics*. University of Michigan Press, 2008.

Persky, Joseph. “Retrospectives: Lange and von Mises, Large-Scale Enterprises, and the Economic Case for Socialism.” *The Journal of Economic Perspectives* 5, no. 4 (October 1, 1991): 229-236.

Robinson, Benjamin. “Socialism’s Other Modernity: Quality, Quantity and the Measure of the Human.” *Modernism/modernity* 10, no. 4 (2003): 705-728.

Shanken, Edward A. “From Cybernetics to Telematics: The Art, Pedagogy, and Theory of Roy Ascott.” In *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*, edited by Roy Ascott. Berkeley: University of California Press, 2003.

Stitziel, Judd. *Fashioning Socialism: Clothing, Politics and Consumer Culture in East Germany*. Berg Publishers, 2005.

Stokes, Raymond G. *Constructing Socialism: Technology and Change in East Germany, 1945-1990*. The Johns Hopkins University Press, 2000.