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Guest Column: In Defence of Pure Cybernetics

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> Metaphysics is a subject much more curious than useful, the knowledge of which, like that of a sunken reef, serves chiefly to enable us to keep clear of it." —Charles Sanders Peirce, "How to Make Our Ideas Clear"
>
> Cybernetics ... will only attain its true stature if it recognises itself as the science that reaches out for that which is hidden." —Gotthard Gunther[2]
>
> We can no longer afford to be the knowing spectators at a global disaster. We must share what competence we have through communication and cooperation in working together through the problems of our time. This is the only way in which we can fulfil our social and individual responsibilities as cyberneticians who should practice what they preach. —Heinz von Foerster, "Responsibilities of competence"[3]

The Problem

Cybernetics aims to be a unifying transdiscipline and a metadiscipline (Scott, 2002). As the science of control and communication, it has a clear role to play in facilitating effective communication and identifying pathologies of communication in human systems (Scott, 1997). As a transdiscipline, cybernetics has a vital role to play in bringing sense and order to the emerging global conversation (Scott, 2010). In his book, *Ecological Communication*, Luhmann (1989) asserts that there is too much excitement (noise and redundancy) in the marketplace of ideas and a lack of resonance with (a disconnect from) vitally important matters of the moment concerning the ecosystem. In this context, cybernetics can serve as a useful noise filter and variety attenuator.

My comments can be applied more generally to the political marketplace, where humans—using a variety of media—look for ideas worth buying into and selling on. Examples of this problem are many. In academia, there is a surfeit of publications and, to my eye, fewer and fewer scholarly safeguards concerning the quality of what is published, not least in the social sciences. Somewhat ironically, there are many publications that debate this issue. As examples, see Ziman (2000) and O'Donnell (2019).

Unfortunately, cybernetics, too, has become a victim of the academic excesses, giving the innocent reader less and less clarity about the discipline's aims and what it

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2. Retrieved April 22, 2018 from http://www.vordenker.de/ggphilosophy/c_and_v.pdf
3. Retrieved September 13, 2016 fromhttp://ada.evergreen.edu/~arunc/texts/cybernetics/heinz/competence/competence.pdf

offers. This is a sad and tragic state of affairs given the many problems that humankind is currently facing (Scott, 2009).

In this short paper, I discuss the general issue of problems of communication and how cybernetics can help. I also discuss, with examples, how this role may be obscured.

Cybernetics as a Transdiscipline and Metadiscipline

Although it is possible from historical perspective to discern the influence of cybernetics in biology, and the behavioural and social sciences, I think it is important to make these influences clear. To a large extent, scientists are quite uninformed of work in other disciplines, much of which may be relevant for their interests. This is why the role of cybernetics as a unifying transdiscipline is so useful and important. Mutual ignorance of each other's work prevails between psychologists, sociologists and cultural anthropologists. There is also mutual ignorance between subdisciplines and between specialist lines of research within those subdisciplines. There is a need for variety management. Cybernetics can act as a filter for the bewildering variety generated by scientific research and scholarship. Isomorphisms and homomorphisms of formal concepts can be identified, as can redundancies of terminology. In other words, the major achievements of the early generations of cyberneticians in bringing unity and order to a wide range of disciplines need to be replicated. This calls for richer understandings of what cybernetics can contribute to the social sciences. Cybernetic understandings can provide useful unifying syntheses of the biological, psychological and social. As examples, I point to my own work (Scott, 2007) and also to the work of Gordon Pask (1975b, 1976) and Richard Jung (2007). There have also been significant contributions from Heinz von Foerster and Humberto Maturana. From this latter pair, we have the very useful dictums, "Anything said is said by an observer" and "Anything said is said to an observer" (von Foerster, 2003, p. 283).

Accordingly, cybernetics pays close attention to the pragmatics of conversation between human observers. Using Occam's razor and a careful analysis of the distinctions made reveals the noise, redundancy and contradictions to be found in much academic discourse. To paraphrase Gordon Pask (see next section), the metaphors we humans manipulate, sometimes with cavalier abandon, need to be justified, to stand up to critical examination using logic and evidence. As an example of such criticism, I recommend the book, *Fools, Frauds and Firebrands* by Roger Scruton (2015).

As pointed out by many, our use of language can entrap and confuse us in our rich use of metaphor (Lakoff & Johnson, 1980) and our proneness to faulty reasoning and logical fallacies, for example, assuming that anything that has a name must exist or have a definable *essence* (variously called hypostatisation, reification, the fallacy of misplaced concreteness).

Explanation in Cybernetics

I think all of us who love cybernetics have drawn inspiration from W. Ross Ashby's (1956, p. 1) bold declaration that "The truths of cybernetics are not conditional on their being derived from some other branch of science. Cybernetics has its own foundations." He goes on, "Cybernetics ……takes as its subject-matter the domain of 'all possible machines'" (Ashby, p. 2). This is followed by "Cybernetics, might, in fact, be defined as the study of systems that are open to energy but closed to information and control—systems that are 'information-tight'" (Ashby, p. 4). Here, Ashby is reflecting cybernetics' primary concern with circular causality and anticipating later emphases on organisational closure.

Ashby highlights two primary uses of cybernetics: "It offers a single vocabulary and a single set of concepts for representing the most diverse types of systems …[and] … it offers a method for the scientific treatment of the system in which complexity is outstanding and too important to be ignored" (Ashby, 1956, pp. 4–5). There are perhaps those who would disagree with Ashby's claim that cybernetics provides "a single vocabulary and a single set of concepts" (Ashby, p. 4), pointing to the enormous proliferation of specialist vocabularies and conceptual schema within cybernetics and the broader field of the systems sciences. However, I suggest that in this variety, there is enormous consensus and that there is an underlying structure of primary concepts and distinctions that makes cybernetics what it is, much of which is captured in Ashby's formal approach. In 1995, I attended an international multidisciplinary conference, entitled *Einstein meets Magritte,* and witnessed much difficulty, even distress, as physicists, philosophers, artists and humanists attempted to communicate with each other about a range of issues, many of global concern. Within the larger conference there was a symposium, convened by Francis Heylighen, called "The Evolution of Complexity," with fifty or so participants, including management scientists, biologists, systems scientists, psychologists, neuroscientists, sociologists, engineers, computer scientists and physicists. The remarkable thing about this symposium, in contrast to the main conference, was that there was much effective interdisciplinary communication. This was because all the participants did have some grounding in concepts to do with complex systems and cybernetics. Indeed, many of the participants drew directly on Ashby, himself. Thus, was the master vindicated.[4]

As a young man, I was persuaded not only of the value of cybernetics as a unifying transdiscipline but also that cyberneticians were not naive or trivial in their epistemologies, that there was a deep sense of metadisciplinary self-awareness in their shared enterprise. I learned that there was an informal collegiate that included, amongst others, Gregory Bateson, Warren McCulloch, Heinz von Foerster, Gordon Pask, Stafford Beer and Humberto Maturana. There appeared to be a tacit

4. In cybernetics, living systems, individuals and collectives, are categorised as self-organising and autopoietic, self-creating (Maturana & Varela, 1980). I like von Foerster's succinct definitions: "Autopoiesis is that organization which computes its own organization," and "Autopoietic systems are thermodynamically open but organisationally closed" (von Foerster, 2003, p. 281).

understanding that, whatever their differences, they all had a reflexive sense of responsibility for their being in the world and were united in their commitment to a common good.

Concerns with the epistemology of the observer were made explicit in a coming together of ideas in the late 1960s and early 1970s. I have alluded to some of these events in more detail elsewhere (Scott, 2004). What I have in mind are Spencer-Brown's (1969) emphasis on the primacy of the act of distinction; Pask's articulation of a cybernetic theory of conversations (Pask, 1975b); Gunther's (1971) concept of life as polycontexturality: the intersection of observers' perspectives, including perspectives of others' perspectives; von Foerster's distinction between a first order cybernetics, the study of observed systems, and a second order cybernetics, the study of observing systems (von Foerster et al, 1974, p. 1); Maturana's 1970 arguments for the closure of the cognitive domain based on an account of the operational closure of the nervous system.

Whilst, from the outset, cybernetics was concerned with circular causality and feedback in biological and social systems, von Foerster's distinction provided an architecture for the discipline, where the natural and artificial sciences are classified as first order and the social sciences as second order. "Social cybernetics must be a second order cybernetics—a cybernetics of cybernetics—in order that the observer who enters the system shall be allowed to stipulate his own purpose … If we fail to do so, we shall provide the excuses for those who want to transfer the responsibility for their own actions to somebody else" (von Foerster, 2003, p. 286).

With second order cybernetics, the observer is explaining herself to herself in a never-ending hermeneutic narrative and conversational circularity, a spiral of storytelling, agreements, disagreements, understandings and misunderstandings. Here, we see the limits on what can be modelled, what can be explained. As Pask (1969) points out, these limits should not be taken as a reason for despair, rather they show the open-ended and creative nature of our attempts to understand ourselves and the world we live in. We can hope for deeper and better understandings of what it is to be human. A few years later, Pask provided a definition of cybernetics that been widely cited in the cybernetics community, "Cybernetics is the science or art of manipulating defensible metaphors; showing how they can be constructed and what can be inferred as a result of their existence" (Pask, 1975a, p. 13).

A key feature of cybernetic explanations is the use of models. The British cybernetician, Frank George, proposes that a theory is a model together with its interpretation (George, 1961, see pp. 52–56), where a model can be anything: marks on paper, a computer program, a mathematical equation, a concrete artefact. The key idea is that a model is a non-linguistic part of the theory. It is a form, a structure, a mechanism that can be manipulated by an observer and which maps onto the "real" system that the theory is concerned with. Contrast this with many so-called "theories" that are to be found in the humanities, where metaphors and analogies are liberally deployed, without formal (non-linguistic) justification. Models are to be found throughout the sciences. What makes a model cybernetic is the inclusion of

circularity, for example, in a model of a control system, such as a thermostat, in general, a model of a process that acts on its self.[5]

The mapping between a model and the system modelled has the form of an analogy relation, such as, "A is to B as C is to D," where A and B are parts or states of the model and C and D are parts or states of the system modelled. There may of course be a number of such relations. It is also relevant to note that metaphors are abbreviated analogy relations. For example, the term "The ship of state" is asserting that steering a ship is analogous to governing a nation state. Pask's definition of cybernetics (above) not only captures the idea of constructing and validating models, manipulating carries with it the idea that the observer is in a circular relation with the model and the system modelled and defensible carries with it the idea that the observer is a member of a community of observers.

In the discussion of explanation in cybernetics that follows, the reader may find it helpful to recall Aristotle's doctrine of the four causes necessary to have knowledge of the world around us. In brief, the four causes are *material cause* (what a thing is made of), *necessary cause* (what had to happen to bring the thing about), *formal cause* (the form or idea of a thing), and *final cause* (the purpose to which a thing is put).

Erhardt von Domarus, in his 1967 thesis, "The Logical Structure of Mind," offers a variant on Aristotle's schema. He takes the concept of an occasion of experience from the organic realist process philosophy of Andrew North Whitehead and applies it phenomenologically to the experience of an observer. For von Demarus, such an occasion of experience has four aspects: passage in time, extension in space, idea (the forms distinguished by the observer) and intention (the purpose of the observer).

In similar spirit, Richard Jung in his 2007 book *Experience and Action*, develops a cybernetic phenomenology in which he distinguishes four explanatory metaphors: two for things that move or behave (*ens movens*): organisms (which respond to stimuli) and machines (which perform); and two for things that show purpose (*ens volens*): mind (intentions to act) and templates (a semantic plexus, rules for conduct).

Pask's (1975) cybernetic theory of conversations makes an analytic distinction between two types of organisationally closed system: biomechanical unities (which he refers to as *Mechanical Individuals*) and psychosocial unities (which he refers to as *Psychological Individuals*). A social actor is a psychosocial unity embodied in one or more biomechanical unities. To model human cognition, learning and communication, Pask uses a process metaphor, which he refers to as the *symbolic evolution of concepts*, where concepts are program-like procedures that are constructed by Psychological (P) Individuals in response to the symbolic provocations that they receive from other P-Individuals, with whom they are in conversation, and from the consequences of the sensorimotor activity of the Mechanical (M) Individual(s) that embodies that P-Individual. A concept is a process that recognises, recalls, constructs or maintains actions and experiences. (Pask uses the general term *relation* to refer to

5. In the philosophy of science, having a non-linguistic component in a theory is known as the *semantic view* and is distinguished from the *received view* of logical positivism, in which a theory consists of propositions placed in correspondence with observed facts (Suppe, 1977a. 1977b).

these products). The product may be another concept, as when concepts are constructed de novo in learning or reconstructed in remembering.[6] A P-Individual is an organisationally closed, self-reproducing system of concepts. As noted above, a social actor is a psychosocial unity embodied in one or more M-Individuals: a single person, who may converse with herself, or a self-identifying collective of some kind, where, through conversation, concepts and identities are created, shared, maintained and transformed. The collective may range in size from a small group, such as a family, up to an organisation or social institution, such as a sports team or nation state. An external observer may get to know a person or collective by observing behaviours and by becoming a participant observer.

The significance of these schema for cybernetics is that they make clear the richness of phenomena that the study of purposive systems must take into account, whether building purpose (anticipation, goal seeking, goal maintenance, adaptation) into mechanical systems or explaining and modelling purpose in biological, psychological and social systems. They show that first order and second order explanations are necessarily complementary.

Obscuring Cybernetics

There are those who combine cybernetics with other approaches and paradigms to construct what they argue are more complete or satisfying syntheses. I see this as unnecessary and, indeed, contrary to the role of cybernetics itself as a holistic, unifying transdiscipline. It is also disregards Occam's razor and adds to the noise and excitement in the academic market place. Two examples of these practices are the social systems theory of Niklas Luhmann and the cybersemiotics of Søren Brier.

Luhmann desires to have a macro-sociology which constructs the oxymoron of a non-living autopoietic social system. His work has become very influential, especially amongst European sociologists. He draws extensively on cybernetics, especially the work of von Foerster and Maturana.[7] However, he also incorporates ideas from traditions that are essentially alien to cybernetics, namely, Sigmund Freud's (1856-1939) depth psychology and Edmund Husserl's (1859-1938) phenomenology. In his theory, he distinguishes three main categories of autopoietic (self-reproducing) system: biological, psychic and social. He uses Freud's ideas to characterise psychic systems, which he distinguishes from biological and social systems. He takes from Husserl's ideas in his discussion of meaning making. Compared to Pask's, Luhmann's theoretical schema is unnecessarily complicated. Eva Buchinger and I have discussed these differences in more detail elsewhere (Buchinger & Scott, 2010). In Scott (2012), I criticise Luhmann's theory of meaning making for lacking a satisfactory model. Much as I like Luhmann's insights about excitement in the academic market place, I see him as guilty, like many others, of feeding that excitement, noise and redundancy by being so prolific in his writing.

6. For a more detailed account of these processes, with a computer program model, see Scott and Bansal (2014).
7. See, for example, chapters 11 and 12 of his grand opus, *Social Systems* (Luhmann, 1995).

Søren Brier and I have been friends for many years. I admire Brier as a most accomplished and creative historian and philosopher. Some months ago, it became apparent that we have differing views about cybernetics: its form, content and role, and, in particular, how it relates to the work of Charles Sanders Peirce (1839-1914). Søren invited me to set out my views, which I've now done in this short paper.

My understanding is that Brier sees traditional cybernetics, in a narrow fashion, as being largely functionalist and not addressing questions of meaning and subjective experience. Hence, he argues for the need for the augmentation of cybernetics by drawing on phenomenology (in the tradition of Husserl (1859-1938)) and Peirce's semiotics. Brier has created an all-encompassing metaphysical framework, cybersemiotics, that unites the natural and the interpretive sciences (by the latter, he appears to include both the social sciences and what others refer to as the humanities) (Brier, 2008). To meet this need, he draws extensively on Peirce's metaphysics in which Peirce's semiotics plays a central part.[8] I see these moves as problematic.

With respect to Brier's first move, the augmentation of cybernetics with phenomenology and semiotics, I have already spoken about the alien nature of Husserl's phenomenology in my discussion of Luhmann's theorising. With respect to the role of semiotics, I differ from Brier in that I see Peirce as being a major influence in the development of cybernetics, including many aspects of his semiotics, and that, with the rich enough view of what cybernetics offers, Peirce's contributions can be readily assimilated. Certainly, with respect to Peirce's metaphysical concept of Thirdness in the world, I know of no thinkers who have characterised themselves as cyberneticians who do not have Thirdness or some equivalent in their thought. All reject the reductionist materialism that has become the dominant paradigm in Western thought, academic and popular. At the risk of simplification, as examples, of purveyors of this latter paradigm, I cite Daniel Dennett, John Searle, Richard Dawkins, Stephen Pinker, Francis Crick and Roger Penrose.

With respect to Brier's second move, the construction of an all-encompassing metaphysical framework that unites the natural and the interpretive sciences. I wish to note that there are what von Foerster refers to as *undecidable questions* (von Foerster, 2003, pp. 291–295). Metaphysics provides answers to such questions. However, their adoption as answers to the undecidable are a matter of personal predilection. There is the danger that the answers become dogmas and that those who adopt them become resistant (and, indeed, blind) to alternatives. It is vital that in a world that is ineffable and ineluctable, one can know when to agree to disagree.

There is much more I could say about the richness and intriguing nature of Peirce's thought but space is lacking here. I would just like make two points. First, in my reading of Peirce (thus far), I have not found a coherent discussion in his accounts of signs of the differences between animal and human cognition and communication. As far as I know, Peirce did not deal with interpersonal perception and only briefly

8. There is a much wider field of scholarly endeavour that is covered by the labels *semiotics* and *semiology*, which, in my view, greatly add to the communication problems found in academia. For some account of this wider field, see Cobley (2001), and Cobley and Jansz (2012).

with developmental processes. There is now a rich literature on these topics, which are of interest to anyone (cybernetician, semiotician, linguist, social scientist, philosopher) studying human communication. I draw some of these threads together in Scott (2007).

My second point is that Peirce, in his discussion of the dynamics of protoplasm, comes close to the concept of a self-organising system but his formulation lacks the idea of organisational closure, that is, that the system reproduces itself as an organisation. This concept is at most implicit. His ideas are a mix of bioenergetics, of abstractly formulated constraints found in the concept of habit taking, and of his monistic formulation of synechism and hylozoism, the continuity between the psychic (awareness) and dead matter, expressed in terms of the activity (or lack of it) of molecules. To be fair to Peirce, he was writing some decades before the relation of the second law of thermodynamics to the question of what life is was set out by Erwin Schrödinger (1944) and before Heinz von Foerster, taking inspiration from Schrödinger, wrote the seminal paper "On Self-Organising Systems and Their Environments" (von Foerster, 1960).

Enriching Cybernetics

There is much other work, some of which predate cybernetics, that is largely compatible with cybernetics and can be readily assimilated into the cybernetics field. The developmental psychologist and genetic epistemologist, Jean Piaget is an early example. Piaget himself embraced cybernetics when it emerged. Other thinkers whose approaches are essentially cybernetic are found amongst psychologists, social psychologists, sociologists and cultural anthropologists who, like Piaget, have pragmatic, process-oriented understandings of how human development and learning is based on action, experience and social interaction. The list of such is long. Here are some examples of those who fit the bill quite well: William James, John Dewey, G. H. Mead, C. H. Cooley and Edward T. Hall.

Psychology as an empirical science embraces a wide range of methods and theories that take a phenomenological approach, only some of which have connection with the ideas of Edmund Husserl. There are overlaps with experiential psychology, humanistic (or whole person) psychology, all of which investigate the experiences and interpretations of human subjects. For now, it is sufficient to say that such studies can be carried on quite legitimately using cybernetic understandings of the human being as a unifying approach. There are many examples: the work of Pask and his colleagues in their studies of human learning; Piaget's, and Lev Vygotsky's, studies of child development; the work of the anthropologists Gregory Bateson and Roy Rappaport, and the empirical studies of learning to learn of Ranulph Glanville, and Laurie Thomas and Sheila Harri-Augstein.

There is a very broad sense, in which almost all research labelled *cognitive psychology* in the post-war years is cybernetic in orientation. This is because much of

this work emerged as a direct result of the influence of cybernetics (for an account of this, see Miller, Galanter, & Pribram, 1960).

A Word About Metaphysics

I am my world. (The microcosm). —Ludwig Wittgenstein

In general, cyberneticians eschew metaphysical systems; their metaphysical assumptions are kept to a minimum and always include an awareness of the limits that our ways of knowing impose on what may be known. The focus is on epistemology and ethics rather than ontology (Scott, 2002). However, in second-order cybernetics, where the social is studied and characterised, there is an interest in how metaphysical systems are constructed and in how metaphysical assumptions affect praxis. This is cybernetics serving as a metadiscipline, with a serious interest in what are the consequences of holding particular beliefs and engaging in associated activity, and a concern to identify beliefs that are not well founded logically and empirically, and beliefs that are pathological because they are limiting and oppressive (Scott, 2014, 2015).

Cybernetics and the Communication Problem

We need tools for clear thought, for example, Occam's razor, Spencer-Brown's (1969) logic of distinctions, the first order cybernetics of deterministic systems (Wiener, Ashby, Beer, Pask), the meta-philosophy of Wittgenstein (1953) and his characterisation of language games. Wittgenstein (1953) exercises Occam's razor in his recognition that purely philosophical problems are pseudo-problems. With this statement, all purely philosophical distinctions such as mind/matter, self/world, freewill/ determinism) are recognized, by family resemblance as being of the same category or class, addressing undecidable questions. It is salutary also to consult the work of Alfred Korzybski on non-Aristotelian logic.[9]

Here, Peirce's ideas are very relevant. This is his view of how science works:

> The real, then, is that which, sooner or later, information and reasoning would finally result in, which is therefore independent of the vagaries of me and you. Thus, the very origin of the conception of reality shows that this conception essentially involves the notion of a community, without definite limits, and capable of an indefinite increase of knowledge. (Quoted from Peirce's article, "Some Consequences of Four Incapacities" in Hoopes, 1991, p. 82).[10]

Peirce invented pragmatism (which he renamed *pragmaticism* to distinguish his ideas from what he considered to be less rigourous formulations). Pragmaticism is about achieving clarity of meaning in communication.

9. Korzybski is famous for his oft-quoted aphorism, "The map is not the territory" (Korzybsky, 1933, p. 58).
10. Sørensen and Thellefsen (2009) provide a useful overview of Peirce's vision of how scientists pursue truth and meet their ethical obligations to the community of which they are a part.

> The whole function of thought is to produce habits of action. What a thing means is simply what habits it involves thus, we come down to what is tangible and practical, as the root of every real distinction of thought, no matter how subtle it may be; and there is no distinction of meaning so fine as to consist in anything but a possible difference of practice. (Quoted from Peirce's article, "Some Consequences of Four Incapacities" in Hoopes, 1991, p. 168).

Pask's cybernetic theory of conversations, with its account of forms of explanation, understanding, agreement and agreement to disagree, lays a similar emphasis on the importance of clarity in communication (Pask, 1975b, 1976). Pask does not draw directly on Peirce but he does draw on the broader pragmatic tradition found in American thought, notably, the work of Nicholas Rescher. He also draws on the writings on hermeneutics of Charles Taylor. In the 1970s, Pask and colleagues developed a rigourous methodology for knowledge and task analysis, which can be used by participants in conversation to express their beliefs and their understandings (Pask, 1975b, 1976; Pask, Kallikourdis & Scott, 1975). It is axiomatic in their approach that conceptual explanations should have a grounding in practice, in tasks that are performed (for example, by building a model or instantiating a concept by selecting from a set of possibilities).

Above all, we need to remind ourselves that, as insisted upon by Maturana and von Foerster, everything that is said is said by or to an observer. This means there is no authority or external reality that can be appealed to or hidden behind. As a participant in social interaction with other human beings (observers) one is asked to be present in the moment, to be here now, to be a cybernetician[11] and take responsibility for what one says and does. This requires, as far as possible, constant monitoring of what one is saying and doing and why one is saying and doing it.

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11. I say more about my concept of what it is to be a cybernetician in Scott (2019).

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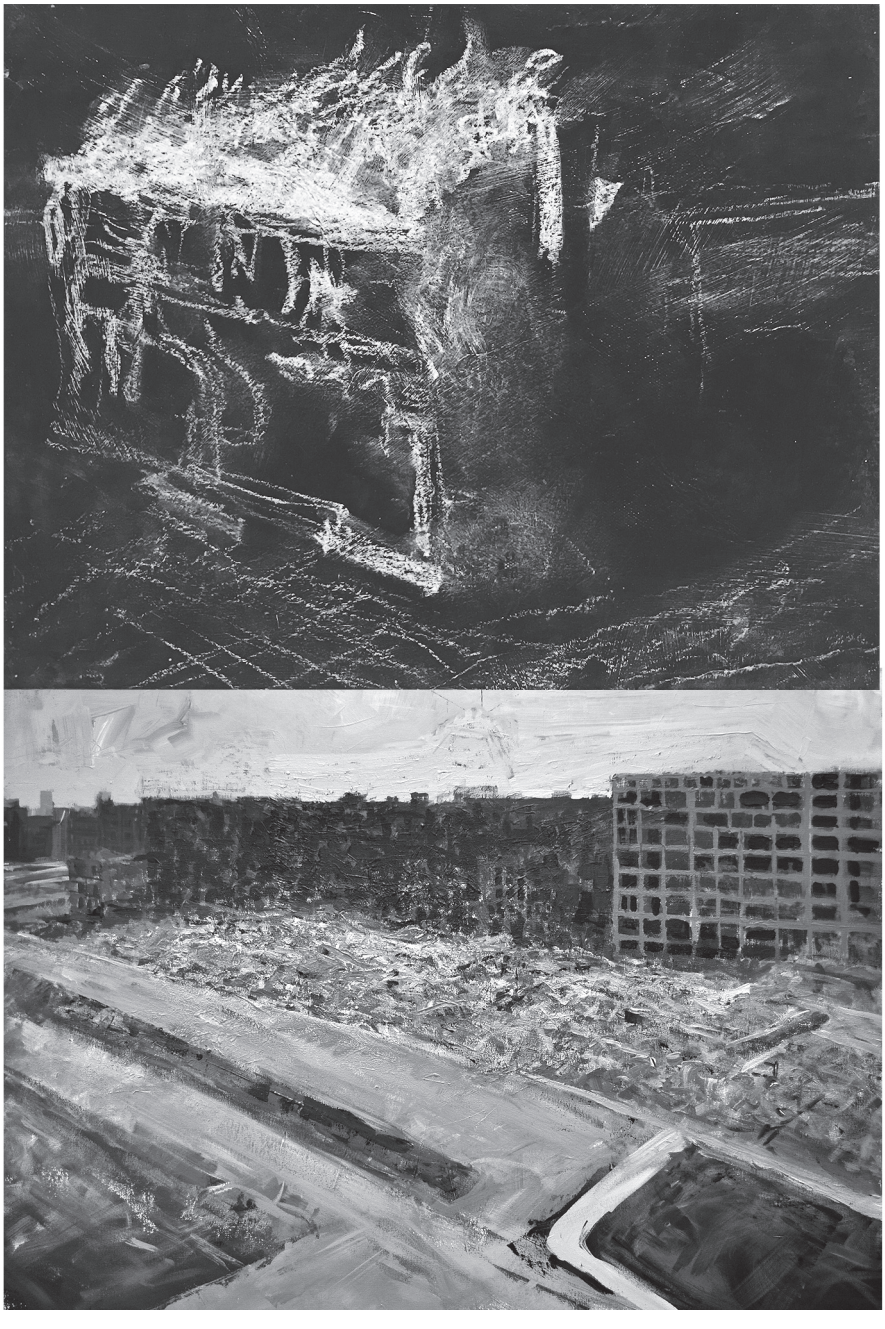
Mitcham, J. (2017). *The Future Is but the Obsolete in Reverse* (Still 15, detail 2).
Painting and drawing stop-motion animation combined with live action video.



Mitcham, J. (2017). *The Future Is but the Obsolete in Reverse* (Still 6 [top] and Still 16 [bottom]). Painting and drawing stop-motion animation combined with live action video.