PCT INTRODUCTION AND RESOURCE GUIDE

Created by Dag Forssell. Updated June 16, 1997

UNDERSTANDING PURPOSEFUL BEHAVIOR

Perceptual Control Theory (PCT) gives an intuitively satisfying explanation for purposeful human behavior, were purpeseful behavior is also known as control.

Hierarchical PCT (HPCT) outlines a hierarchical arrangement of multiple control systems as a testable explanation that allows for the complexity of our experience.

PCT focuses on how we look at and experience things, and the way these perceptions are compared with experiences we want. PCT explains how thoughts become actions and feelings and why stimuli appear to cause responses.

PCT improves our understanding of human interpersonal behavior, including conflict, cooperation and leadership in families , education, business and society.

LOOK UNDER THE HOOD OR TAKE A TEST RIDE?

To illustrate, think of people as cars directed by voice commands. The cars sometimes respond the way you want them to, sometimes not. No-one has been able to peek under the hood and figure out what makes them tick, but "theories" abound, are widely accepted and have become engrained in our language. PCT describes a physical mechanism you can test and use to visualize the internal structure at work in purposeful behavior. This means that PCT lays the foundation for a new science which explainsCin terms of physical processes, not word picturesChow living systems function at all times. To look under the hood, proceed to other books and programs in this guide.

If you would rather begin with a test ride, to get a feel for a PCT-inspired approach to understanding human relationships, I suggest you read *Freedom From Stress* by Edward E. Ford. Watch as Ed takes you on a test drive using PCT to show how people cause their own problems. This easy-to-read counseling story deals with relationships at work, with spouses and with children.

WHAT PCT IS

(See also PCT in a nutshell, The nature of HPCT).

Let me relate PCT and HPCT to "reverse-engineering." Suppose you manufacture electronic products and your competitor has just introduced a marvelous product of unknown design. It is difficult to figure out how the new device was made, because it is made up of millions of components. To "reverse-engineer" it you:

1) describe what the device does (how it behaves) in some detail, and

2) suggest physical explanations. Based on these, you design and test a circuit or mechanism which performs just like the unknown product in *all* circumstances.

Now you can claim that you understand at least one way the unknown device might actually work B and you are probably certain of many ways that cannot work.

PCT proposes an organization or physical model of the nervous system. We can test the PCT model by letting it behave *by itself*, and compare the result with the behavior of the real thingCpeople. Since it is ourselves we reverse-engineer, we naturally require that the explanation and model we come up with feels right; that it intuitively makes sense to us when we are told how we work. Simulations and personal experience indicate that PCT is a valid model. PCT appears to be the first approach to explaining human behavior that holds up to critical scientific scrutiny and is worth refining.

PCT proposes a physical structure or architecture of the human nervous system, observable both at the macro level of major action and at the micro level of individual muscle fibers. This comprehensive proposal is grounded in the physical sciences and is detailed and universal enough to allow anyone interested to carry out the basic experiments that illustrate how purpose works, resulting in the human behavior we observe in ourselves and people all around us, all the time.

APPLYING PCT

To drive a car, it is important to know how the controls work, but it is not necessary to understand how the controls are designed in detailCyou can leave that to the engineers.

To apply PCT in daily life, it is important to understand the basic conceptCwhy the controls work the way they doCbut it is not necessary to understand all the technical detailsCyou can leave that to the PCT researchers.

When you understand the basic concept of PCT, you will observe yourself and others and at the same time visualize the internal mechanism in action. Your understanding of the internal mechanism will give you greater ability to enjoy your ride through life and to show others how to enjoy theirs, too.

WHERE PCT COMES FROM

PCT is the creation of one mans background, curiosity and determination. William T. (Bill) Powers learned about control systems and analog computersCkey for the development of PCT. He studied physics and other applied physical sciences necessary to reverse-engineer the human nervous system.

Bill's seminal book *Behavior: The Control of Perception,* published in 1973, is still in print and is must reading for the serious PCT student. When you order it, you will no longer get a jacket, so I have reproduced the original book jacket. Note comments by Russell L. Ackoff, Carl R. Rogers, and Thomas S. Kuhn among others. A prolific, lucid writer, Bill has also collaborated in the creation of a college text. *Living Control Systems I & II* are collections of his papers.

Seeing how control works is better than reading about it. For demonstration programs simulating an analog control system on a digital PC with tutorials, simulations, explanations and discussions, see *PCT demos* and *PCT texts*.

In this guide, I have included two short essays: *An essay on the obvious,* p. 9-10 and *Things I'd like to say if they didn't think I'm a nut*, p. 11. Bill writes about what is required for psychology to start over as an applied physical science.

RESEARCH AND DEVELOPMENT

See information on the Control Systems Group (CSG) and E-mail network, CSGnet, and DOS diskettes.

APPLICATIONS AND LITERATURE

The information on in this introduction on books, articles, seminars, video tapes and computer diskettes should be self-explanatory. Welcome to PCT!

Dag C. Forssell
Valencia, California
Dec, 1996

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BEHAVIOR: THE CONTROL OF PERCEPTION by William T. Powers

A reproduction of the original book jacket:

"Powers' Behavior: The Control of Perception gives social scientistsCfinally--an alternative to both behaviorism and psychoanalysis. It provides a way, both elegant and sophisticated, to include the basic contributions of both without being partisan or converted. It allows us to bring the soma, culture, society, behavior, and experience into a single framework. We now know much more than we did before this book was published.

> --Paul J. Bohannan, Stanley G. Harris Professor of Social Science, Northwestern University; author of *Divorce and After, Social Anthropology*, and other books.

The highly original thesis of this remarkable book is deceptively simple: that our perceptions are the only reality we can know, and that the purpose of all our actions is to control the state of this perceived world. This simple thesis represents a sharp break with most traditional interpretations of human behavior. The theory set forth and developed in detail in this book proposes a testable model of behavior based on feedback relationships between organism and environment, which can reconcile the conflict between behaviorists and humanists and for the first time put us on the road to an understanding of ourselves that is at once scientific and humane.

The model advanced here explains a range of phenomena from the simplest response of a sensory nerve cell to the construction of a code of ethics, using cybernetic concepts to provide a physical explanation not only for physical acts but also for the existence of goals and purposes. A hierarchical structure of neurological control systems is proposed that is at least potentially identifiable and testable, in which each control system specifies the behavior of lower level systems and thus controls its own perceptions.

The model incorporates the "programming" of behavior in the course of human evolutionary history, the nature and significance of memory, and the reorganizations of behavior brought about by education and experience.

Written with verve and wit, with many illuminating examples and interesting thought questions, *Behavior: The Control of Perception* may well prove to be one of the truly seminal works of our time; at least, this is suggested by the distinguished scholars who read the manuscript in advance of publication (see back cover).

The book suggests many new interpretations of neurological, behavioral, and social data, an immense range of new experiments that will modify the model advanced here, and much new insight into such crucial psychological and social processes as education, the resolution of conflict, and the problems of mental illness.

ABOUT THE AUTHOR

William T. Powers received his B.S. in physics and did his graduate work in psychology at Northwestern University. He has consulted for The Center for the Teaching Profession, and was formerly Chief Systems Engineer of the Department of Astronomy at Northwestern. He has published articles in psychology, astronomy and electronics, and has invented and designed a number of electronic instruments.

OPINIONS ON BACK COVER:

Russell L. Ackoff, Silberberg Professor of Systems Sciences, University of Pennsylvania; Past President of the Operations Research Society of America; author of *The Design of Social Research*, co-author of *On Purposeful Systems, fundamentals of Operation Research*, and other books.

> "Publication of William Powers' book, *Behavior: The Control of Perception*, is, in my opinion, a major event in the development of the psychology of

> perception. The completely new approach he has developed using cybernetic concepts cannot help but be seminal, instigating a new and important line of investigation of a wide range of psychological phenomena in addition to perception. His new way of looking at and conceptualizing old things will help to open the way for a series of important discoveries, and these--because of the rigorous framework he provides--are likely to be sounder scientifically than most of the earlier work that they will displace."

Donald T. Campbell, Professor of Psychology, Northwestern University; Past President Of the Division of Personality and Social Psychology of the American Psychological Association, co-author of *Unobtrusive Measures* and other books and articles.

> "Powers' book is, I am convinced, the very best job to date in the application of feed-back theory (servo-system theory, cybernetics) to psychology. Unlike all of its many predecessors, Powers' book comes up with elegant, relevant, and novel detail. It is the first to really capture the promise of cybernetics. It achieves this by bringing to psychology the concept of the 'reference signal' from servo-system theory, and by an explicit hierarchy of 'orders' of control systems."

Thomas S. Kuhn, Professor of the History of Science, Princeton University; author of The Structure of Scientific Revolutions.

> "Powers' manuscript, *Behavior: The Control of Perception*, is among the most exciting I have read in some time. The problems are of vast importance, and not only to psychologists; the achieved synthesis is thoroughly original; and the presentation is often convincing and almost invariably suggestive. I shall be watching with interest what happens to research in the directions to which Powers points."

John R. Platt, Research Biophysicist and Associate Director of the Mental Health Research Institute, University of Michigan; author of *Perception and Change: Projections for Survival and Step to Man.*

> "Powers has made an important new synthesis in applying the concept of hierarchical levels of feedback-control systems to brain organization and behavior. His ideas throw new light on neural and brain structure, the role of reafferent stimulation in perception and behavior, hierarchical control mechanisms, goal-seeking and feedback at different levels of organization, and epistemology. The book is written in an easy and personal tone with numerous illuminating examples to illustrate the main new points, and with interesting thought-questions at the end of each chapter."

Carl R. Rogers, Resident Fellow of the Center for Studies of the Person, La Jolla, California; Past President of the American Psychological Association and recipient of its Distinguished Scientific Contribution Award in 1956; author of *Freedom to Learn*, *On Becoming A Person*, and other books.

> "Here is a profound and original book with which every psychologist--indeed every behavioral scientist--should be acquainted. It is delightful to have a person of such varied and unorthodox background come forth with a unique theory of the way in which behavior is controlled in and by the individual, a theory which should spark a great deal of significant research."

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FOREWORD TO *LIVING CONTROL SYSTEMS II*

In 1979, Bill Powers wrote a prophecy: "A scientific revolution is just around the corner, and anyone with a personal computer can participate in it.... [T]he particular subject matter is human nature and in a broader scope, the nature of all living systems. Some ancient and thoroughly accepted principles are going to be overturned, and the whole direction of scientific investigation of life processes will change." (William T. Powers, *The Nature of Robots: Part 1: Defining Behavior*, BYTE 4(6), June, p. 132) Powers foresaw the overthrow of the idea that either stimuli from the environment, or commands from the mind or brain, are sole causes of behavior. In its place, he offered the concept that people (and in their own ways all other organisms) intend that they will experience certain perceptions and behave to cause the perceptions they intend. The social, behavioral, and life sciences had simply missed the fact that living things control many features of their environments. Powers acknowledged that fact, and he realized that to an organism the environment exists only as perceptions, hence his insight that organisms act to control their own perceptions. His formal statement of the new concept was control theory, and he said amateurs, working with personal computers on their tables at home, would be major players in the revolution. Thirteen years later, the revolution is not accomplished, but it is underway.

Powers' perceptual control theory is new, but he is not the first to describe many of the key ideas in the theory. Over 2200 years ago, Aristotle wrote about intention--"that for the sake of which," the desire or wish that causes actions that result in a particular end. Aristotle used many examples in which a person acts to produce an intended object, such as a bed, statue, tray, or house. The person's intention to create the object is the "final cause" of the actions that produce the object. Aristotle wrote that, depending on the condition of the world and the intention of the person, the same actions sometimes produce different ends, and different actions sometimes produce the same end. All of that sounds like good control theory, so why are those ideas considered revolutionary today?

For many centuries, Aristotle's ideas disappeared from Europe and were preserved by scholars in the Arab world. They returned, in altered form, to a Europe dominated by Christian theology. Theologians changed "final cause," which to Aristotle often meant only a person's intention to manufacture a bed out of wood, into God's original plan for the linear unfolding of history, from creation, to Calvary, to Apocalypse, to the end of time. Aristotle's original idea was unrecognizable.

Most early European scientists worked within Christian theology, embracing its notion of linear time and its implication of linear cause and effect. Many of these scientists mistakenly assumed that the original concept, that a final cause is a goal, implied that the future influences the present--a clear violation of the assumed linear flow of cause and effect. Eventually, potentates of The Church and potentates of Science came to a falling out over dogma. Those who established the canon for Science had yet another mistaken reason to reject final cause: they said it represented an appeal to the supernatural, in the form of God as agent. The idea that there is purpose or intention in the behavior of any living thing was pronounced "unscientific." Most aspiring behavioral and biological scientists still affirm that credo.

When William James wrote one hundred years ago, the ideas of purpose and intention were popular again. James said purposive behavior is the distinguishing feature of intelligence--of life. He said that in a variable world an organism's behavior necessarily varies to produce unvarying intended results. James wrote that people do not intend their specific actions; they intend to experience perceived consequences of their actions, then they vary their actions any way necessary to produce those perceptions. For a while, it looked as though the idea of intention might take hold, but once more the idea was purged from the sciences of behavior and life. Orthodox scientists asserted that intention implies final cause, which necessarily implies an appeal to supernatural forces and to a temporal reversal of causality. Purposive behavior was banished, on the one hand by behaviorists, environmentalists, and reflexologists who claimed that events in the environment determine behavior, and on the other by those who claimed that instincts acting as internal stimuli cause behavior. People on either extreme

believed their positions were dramatically different, but they all portrayed behavior as the end result of a linear chain of cause and effect.

Powers writes at a time when purpose and intention remain unacceptable to most scientists. Behaviorists still believe environmental "stimuli" have the "power" to control behavior; and most cognitive scientists and neuroscientists say the mind-brain issues "commands" that cause muscles to produce appropriate behavior. Cognitive-neuroscientists frequently claim behaviorism is dead and a cognitive revolution has swept the behavioral and life sciences; in return, behaviorists pronounce themselves very much alive, and some portray cognitive theorists as "creation scientists," bent on keeping alive the concept of soul-as-mind. Once again, each camp believes its views differ markedly from those of the other, but both embrace the wearisome model of linear cause and effect--a model that was necessary a few hundred years ago to establish the physical sciences, but a model that mistakenly rejects what Powers recognizes as the defining properties of life. Neither wing of the cause-effect orthodoxy recognizes the abundant evidence that organisms control many parts of their world. But revolutions have a way of changing the minds of the orthodox.

Powers turned the millennia-old idea that living systems act to produce intended perceptions into a formal theory of behavior: perceptual control theory. Perceptual control theory identifies behavior as the necessarily variable means by which organisms control their perceptions of the world. Working first on a build-it-yourself computer (the one he used when he wrote his prophecy), then on a first-generation IBM personal computer, Powers created elegant demonstrations in which the simple-idea-turned-formal-model generates remarkably accurate quantitative simulations and predictions of behavior and its consequences. He identified a first principle for behavioral, social, and life sciences and showed the way to a new foundation of theory and method.

For several years, only a few people followed Powers' lead, and even fewer gathered the data and performed the modeling that could establish control theory as an alternative to traditional science. But interest in the theory grew -- a tribute to the dogged efforts of William and Mary Powers, over three decades, to maintain the visibility of the theory. During most of that time, Powers published only one book and a few papers. More recently, information about control theory burst into wider circulation through two functions of personal computers that no one predicted in 1979: desktop publishing and electronic-mail networks. Those applications freed perceptual control theory from the heavy hands of editors and reviewers who routinely rejected manuscripts on the theory. They were true defenders of cause-effect orthodoxy, rejecting control theory as uninteresting and unnecessary, or as merely another way to describe things that were already understood. The new media let many people see control theory, then judge it on its own merits. The once-small circle of people aware of the theory grew into a network spanning the world, including people from many disciplines, specialties, and professions. And the demand for Powers' writings grows.

In the Foreword to the first volume of Living Control Systems, Richard Marken wrote about the difficulty he experienced several years ago when he tried to locate published material by Powers. Volume I was a collection of Powers' published work But Powers has
written far more than he has published. When he writes, Bill does not revise his drafts. If he encounters a block or is dissatisfied, he starts over. He has cast aside several beginnings of books and many drafts of chapters and papers that he never submitted, or that were rejected by editors and reviewers. Most of us would be happy if any of our publications equalled the quality of the work Bill put away in drawers and boxes and, more recently, on disks.

Over the years, only a few people have had a chance to read parts of Bill Powers' unpublished work. The opportunity to rummage about, looking for those gems, was at least part of "that for the sake of which" some of us travelled to his "laboratory" in the back room of his home in Northbrook, Illinois. When Mary and Bill decided to move to Colorado, Edward Ford, a counselor in Arizona, suggested that the mandatory gathering of possessions into boxes provided an excellent chance to select part of Bill's unpublished work for an edited volume. Greg Williams, a frequent visitor to Northbrook, journeyed

there from Kentucky for the last time to gather the pages and disks and take them away so he could select the pieces in this volume.

This volume contains a small sample of the previously unpublished material from the years when Bill and Mary Powers were in Northbrook. If you want to rummage through the next accumulation, you must travel to the new site of The Laboratory of William T. Powers. That is the locus of many of today's clearest insights into purposive behavior. Over the millennia, that locus has moved from Aristotle's Lyceum, to James' Harvard, to Northbrook, and now to a house atop a ridge near Durango, with a view of the San Juan Mountains, located only a few miles away, across a broad valley--a view that, years ago in Illinois, Mary and Bill Powers said they intended to see out their back door. Stated intention, actions, and perceived consequences that match the intention. It looks like control to me!

February 1992

On the Phenomenon of Control. In the foreword above, I sketched a history of the often-rejected idea that living things act to control their own experiences. There is also a long history of devices that mimic control by a person. In classical times, observers of manufactured control devices often identified them as "mysterious" or "miraculous." There were lighted lamps in which the wicks and oil were never consumed, and vessels in which, no matter how much was consumed, the levels and flows of water or wine never changed, and statues that seemed to move of their own accord. The "miraculous" phenomenon of control was there for all to see, but the ingenious devices that actually controlled were hidden from view and the principles of control went unrecognized.

Centuries later, the metaphor of the machine was dominant in European thought. People were compared to lineal machines, embodying discrete, sequential cause and effect. The idea that people resemble machines soon gave way to the still-popular assertion that people are lineal cause-effect machines. Overextended metaphors aside, the design, and eventually the theory, of control devices moved on, from a variety of hydraulic and mechanical governors and regulators in the 1600s and 1700s, to electronic controllers in the 1920s and 1930s. Today, control devices are ubiquitous, yet most people who say a person is a machine (probably a computing machine), mean people are lineal cause-effect machines, not controllers or regulators.

To most people, the phenomenon of control typically goes unnoticed or unacknowledged, whether the controller is a living system, or an ingenious device. Control: it is everywhere, and everywhere it is denied.

December, 1994. W. Thomas Bourbon
University of Texas Medical School-Houston

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PCT IN A NUTSHELL

The most obvious phenomenon of life is this:

> We act to make our wants come true and stay true until we change the want.

This phenomenon can be seen in ourselves and all around us all the time--ranging from very short to very long time frames: milliseconds to years.

* You want to bend a finger: You bend it.
* You want to draw a circle: You pick up a pencil, sharpen it, place a paper on your desk--and draw a circle.
* You want a college degree: You apply, take classes and tests, sustain yourself and persevere--and get your degree.
* You want to develop a product: You --, --, --, and the product is ready.

This phenomenon deserves an explanation. PCT in a nutshell:

> You continually compare the mental image or specification of what you want, your purpose, which we call a reference perception, with the corresponding mental image of what is, which we call present perception. From this comparison emerges a difference signal (corresponding to dissatisfaction) which causes action--your means to influence your world and your present perception of it. Effective action causes this present perception to conform to the reference perception. Action ceases when your present perception agrees with your reference perception.

The net result of this circular loop of interacting elements and signals is purposeful behavior. A self-directing "living control system" controls its present perception so that it agrees with the internally specified reference perception. The living control system shapes its world the way it wants to perceive it and keeps it that way. When disturbances (external influences, stimuli) affect something the living control system has a reference perception for, it will act to restore its perception (resist the disturbance, response).

Conventional scientific attempts to explain behavior have not recognized or clearly understood the obvious phenomenon of control discussed above, and are misleading. Behavior is neither just caused by stimuli in the environment nor is it blind execution of internal plans. Behavior is not an end result. It is an integral part of the closed loop process which controls perception. As can be seen from this summary, the explanation for the phenomenon of self-direction or control includes an explanation for the appearance of stimulus-response, but without the notion that the organism is conditioned or reinforced; that the behavior is shaped or that it is motivated by reward or punishment. It also includes an explanation for the appearance of plan-execution, but without suggesting blind computation.

PCT provides the first explanation for this pervasive phenomenon of control that can stand up to scientific scrutiny. When you understand the details of this technical explanation, you under- stand how autonomous control is synonymous with freedom and how it gives rise to conflict or cooperation--depending on what is wanted, how it is perceived, by whom and to what degree.

With an understanding of PCT, many apparent mysteries of human behavior can be seen for what they are: manifestations of self-direction or control, given a wide variety of reference perceptions, present perceptions, circumstances and external influences in a world where autonomous living control systems interact. The mysteries simply vanish, and the terminology that went with them becomes irrelevant.

Dag Forssell May, 1994

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. . I'm reminded of a lot of the "new physics" stuff that's been going around--The Emperor's New Mind, The Quantum Self, chaos in the brain, and so on. I'd like to say this about that:

AN ESSAY ON THE OBVIOUS

William T. Powers January 1991

I think that all attempts to apply abstract physical principles and advanced mathematical trickery to human behavior are aimed at solving a nonexistent problem. They all seem to be founded on the old idea that behavior is unpredictable, disorderly, mysterious, statistical, and mostly random. That idea has been sold by behavioral scientists to the rest of the scientific community as an excuse for their failure to find an adequate model that explains even the simplest of behaviors. As a result of buying this excuse, other scientists have spent a lot of time looking for generalizations that don't depend on orderliness in behavior; hence information theory, various other stochastic approaches, applications of thermodynamic principles, and the recent search for chaos and quantum phenomena in the workings of the brain. The general idea is that it is very hard to find any regularity or order in the behavior of organisms, so we must look beyond the obvious and search for hidden patterns and subtle principles. But behavior IS orderly and it is orderly in obvious ways. It is orderly, however, in a way that conventional behavioral scientists have barely noticed. It is not orderly in the sense that the output forces generated by an organism follow regularly from sensory inputs or past experience. It is orderly in the sense that the CONSEQUENCES of those output forces are shaped by the organism into highly regular and reliably repeatable states and patterns. The Skinnerians came the closest to seeing this kind of order in their concept of the "operant" but they failed to see how operant behavior works; they used the wrong model.

Because of a legacy of belief in the variability of behavior, scientists have ignored the obvious and tried to look beneath the surface irregularities for hidden regularities. But we can't develop a science of life by ignoring the obvious. The regular phenomena of behavior aren't to be found in subtleties that can be uncovered only by statistical analysis or encompassed only by grand generalizations. The paydirt is right on the surface.

The simplest regularities are visible only if you know something about elementary physics--and apply it. Think of a person standing erect. This looks like "no behavior." But the erect position is an unstable equilibrium, because the whole skeleton is balancing on ball-and-socket joints piled up one above the other. There is a highly regular relationship between deviations from the vertical and the amount of muscle force being applied to the skeleton across each joint. There is nothing statistical, chaotic, or cyclical about the operation of the control systems that keep the body vertical. They simply keep it vertical.

The same is true of every other aspect of posture control and movement control, and all the controlled consequences of those kinds of control. Just watch an ice-skater going through the school figures in competition. Watch and listen to any instrumentalist or vocalist. Watch a ballet dancer. Watch a stock-car racer. Watch a diver coming off the 30-meter platform. Watch a programmer keying in a program.

It's true that when you see certain kinds of human activity, they seem disorganized. But that is only a matter of how much you know about the outcomes that are under control. The floor of a commodities exchange looks like complete disorder to a casual bystander, but each trader is sending and receiving signals according to well-understood patterns and has a clear objective in mind--buy low, sell high. The confusion is all in the eye of the beholder. The beholder is bewitched by the interactions and fails to see the order in the individual actions. When you understand what the apparently chaotic gestures and shouts ACCOMPLISH for each participant, it all makes sense.

Of course we don't understand everything we see every person doing. It's easy to understand that a person is standing erect, but WHY is the person standing

erect? What does that accomplish other than the result itself? We have to understand higher levels of organization to make sense of when the person stands erect and when not. We have to understand this particular person as operating under rules of military etiquette, for example, to know why this person is standing erect and another is sitting in a chair. But once we see that the erectness is being controlled as a means of preserving a higher-level form, also under control, we find order where we had seen something inexplicable. We see that an understanding of social ranking, as perceived by each person present, results in one person standing at attention while another sits at ease. Each person controls one contribution to the pattern that all perceive, in such a way as to preserve the higher-level pattern as each person desires to see it.

It seems reasonable that once we have understood the orderliness of simple acts and their immediate consequences, we should be able to go on and understand more general patterns that are preserved by the variations that remain unexplained. As we are exploring a very large and complex system, we can't expect to arrive at complete understanding just through grasping a few basic principles. We must make and test hypotheses. But if we are convinced that the right hypothesis will reveal a highly-ordered system, we will not stop until we have found it. If, on the other hand, we are convinced that such a search is futile, that chaos reigns, we will give up the moment there is the slightest difficulty and turn to statistics.

I claim that human behavior is understandable as the operation of a highly systematic and orderly system--at least up to a point. [See file UP_2A_PO.INT for comment]. I say that it is the duty of any life scientist to find that orderliness at all discoverable levels of organization, and to keep looking for it despite all difficulties. We must explore all levels, not just the highest and not just the lowest; what we find at each level makes sense only in the context of the others. We have a very long way to go in understanding the obvious before it will be appropriate to look for subtleties. I have no doubt that we will come across mysteries eventually, but I'm convinced that unless we first exhaust the possibilities of finding order and predictability in ordinary human behavior, we won't even recognize those mysteries when they stare us in the face. I don't think that anyone is prepared, now, to assimilate the astonishments that are in store for us once we have understood how all the levels of orderly control work in the human system.

We won't get anywhere by looking for shortcuts to the ultimate illuminations that await. Most of the esoteric phenomena of physics that are taught in school today were occurring in the 19th Century, as they always have. But who, in that century, would have recognized tunneling, or coherent radiation, or time dilatation, or shot noise? If we want to see a Second Foundation of the sciences of life, we have to begin where we are and build carefully for those who will follow us. If we succeed in trying to understand the obvious, the result will be to change what is obvious. As the nature of the obvious changes, so does science progress.

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THINGS I'D LIKE TO SAY IF THEY WOULDN'T THINK I'M A NUT Or,
Overgeneralizations that aren't that far over.

William T. Powers, 1989

When you study human beings, remember that you are a human being. You can't do anything that they can't do. You think with a human brain, experience with human senses, act on the world as human beings experience a world. Whatever you say about them is true about you. Whatever you can do, they can do.

Understanding human nature means more than having a large vocabulary. You experience the world at many levels, some lower than symbols and some higher. If you try to understand by using nothing but words, you'll miss most of the picture. What most people call "intellectual" is really just "verbal." If you always use the same terms to refer to the same idea, it's not an idea but a verbal pattern. Most important words don't mean much. Words that "everybody knows" don't mean anything. Words that are used to describe psychological phenomena are almost all informal laymen's terms that have negative scientific meaning: they imply the existence of things that don't exist, like "intelligence" or "aggressiveness" or "altruism." Or "conditioning" or "habits" or "aptitudes" or--see the literature.

Knowledge isn't what you can remember or name: it's what you can work out from scratch any time you need to, from basic principles. The behavioral sciences don't have any basic principles. None, that is, that would survive scientific testing.

Statistical findings are worse than useless. They give the illusion of knowledge. Even when they're true for a population, they're false when applied to any given person. To rely on statistics as a way of understanding how people work is to take up superstition in the name of science. It's to formalize prejudice.

When you propose an explanation of human behavior, you ought to make sure that the explanation works in its own terms: what exactly does it predict? Most explanations in the behavioral sciences consist of describing a phenomenon, saying "because," and then describing it again in slightly different words.

Perceptual control theory may have a long way to go as a theory of human nature, but it's the only theory that deals with individuals and accepts them as autonomous, thinking, aware entities. You might say that thinking about them that way is what makes control theory possible to understand. Using control theory, you don't have to ignore individuals who deviate from the average. Using control theory you can propose explanations that you can test. Using control theory you can learn that scientific understanding isn't any different from ordinary understanding. A scientist would judge that a cooling device used in regions of very low ambient temperatures would be inefficient, and you can't sell a refrigerator to an Eskimo, either.

But never forget that science bought Phlogiston for 150 years, and stimulus-response theory--so far--for 350 years. We're still crawling our way out of one system of faith into the next, still looking for dry land and solid ground. Is control theory the new faith? Not as long as you can forget everything you've memorized and reason it out for yourself.

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THE NATURE OF HPCT

PCT offers a clear explanation for the pervasive phenomenon of simple control. HPCT outlines a hierarchical arrangement as the likely organization of multiple control systems in humans.

The kind of explanation HPCT offers for human behavior is the kind of explanation responsible for the successes of modern engineering.

Just hold up a finger in front of you and bend it. Notice that just before it bends, you will it to bend. The willing and the bending are facts we experience. How can you explain this phenomenon of behavior?

A "popular theory" approach has been to describe appearances in terms of themselves. Life scientists think and talk in terms of reflex, stimulus and response, affordances, conditioning, reinforcement, and cognition--terms which give phenomena new names without actually explaining them. Much research in the life sciences is focused on accumulating descriptions where weak statistical correlations suggest mysterious causal relationships.

An "engineering theory" approach is to suggest and describe the *properties* and *organization* of elements which when they interact with each other and their environment produce the kind of behavior we observe. Thus an engineering theory approach proposes a *model* or *simulation* of an underlying set of properties and causal relationships which are invisible and cannot be experienced directly, but where we gain confidence through repeated successful experimentation. Engineers learn to visualize and think in terms of models and simulations in the course of their training as they repeat the basic experiments which define the many invisible "laws of nature" or "first principles" of engineering science. In practice, engineers deduce properties of new designs from these first principles and the behavior of the designs from the properties. Engineers predict the performance of a design or model in various environments and circumstances. Thus they predict experiences they have not yet had, and with confidence. The in-depth understanding fostered by the approach of modern engineering theory is the reason for spectacular progress in the engineering sciences in the last several centuries.

Your bending of the finger (converting your thought into action) is an example of control with a changing reference signal. Behavior "emerges" from the natural properties of control systems as they interact with their environment. In engineering, control has been well explained only since the 1930's. In the life sciences of today, control is not yet part of the explanation for behavior. Thus life scientists attempting to explain "finger-bending behavior" do so without recognizing or understanding the organization and properties of the basic organizing principle of behavior.

HPCT offers a new explanation for human experience. It is technically elegant, conceptually simple, testable, and better than "common sense." The principles of HPCT are readily understood by any attentive person. In practice, a person who has learned HPCT can deduce properties of organisms and people from the principles of HPCT and see how the behavior and interactions of people "emerge" from those properties in different circumstances.

When you learn the explanations of HPCT, you can apply them to explain past experience as well as think ahead. Your own experiences suddenly make more sense to you, and you can manage and lead better in the future.

Dag Forssell, October 1994

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2013: Literature list originally featured here now obsolete. Deleted.

See www.livingcontrolsystems.com for up-to-date references.