Behavioral Systems Analysis: Fundamental concepts and cutting edge applications[1]

Part I Definition and Fundamental Concept

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Introduction

What is behavioral systems analysis?

Behavioral systems analysis is a set of concepts and techniques that help establish healthy school, workplace, and clinical environments. The concepts originated in two disciplines: behavior analysis and general systems theory. The techniques borrow freely from many areas but are selected, focused, and guided by behavior analysis and general systems theory. This series of papers describes a few of the most fundamental concepts and most useful techniques[2].

Why must behavioral systems analysis include both behavior analysis and generals systems theory?

Behavior analysis concepts help us understand how people function within the realities of the world they live in. General systems concepts help us understand how that world works. If we put the two areas of knowledge together we can do a better job of developing people's potential and enabling schools and workplaces to function more effectively.

Where has behavioral analysis been used?

Behavioral analysis has been applied to individuals within a wide variety of families, schools, workplaces, communities, and cultures. It has been applied to help people develop

- academic knowledge and skills (reading, writing, arithmetic, and content area knowledge, infancy through graduate school)
- a great variety of work and professional skills such as time management, self-management, teamwork, project management, and establishing constructive relationships at home or at work.

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[1] This series of articles is based upon a tutorial presented at the International Association for Behavior Analysis annual conference, 2002. The tutorials are intended to capture, preserve, and transmit the experience of senior members of the Association. The tutorial was invited by the Organizational Behavior Management Network and the Executive Director of ABA.

[2] The term "behavioral systems analysis" was first used by Richard Malott and Dwight Harshbarger in 1974. The area is also known by two other labels. Members of the Organizational Behavior Management Network use organizational behavior management as the preferred label. Members of the International Society for Performance Improvement (www.ispi.org) use human performance technology as the preferred label.

It has helped people bearing a great variety of labels and clinical diagnoses including:

workers, students, executives, professionals, dyslexics, developmentally delayed, gifted, Attention Deficit Hyperactivity Disordered, neurologically impaired, and many others. If it is related to behavior, behavior analysis applies.

Where has general systems theory been used?

General systems theory has been applied in the study of forests, families, weather patterns, business and governmental organizations, and many other topics. It was developed originally in response to the explosion in scientific knowledge; it was an attempt to identify concepts that were fundamentally similar across disciplines and specialty areas. General systems theory contributed greatly to the development of areas such as operations research, organizational theory, and environmental ecology. This work started people talking about the systems approach, meaning a careful attempt to find all the variables influencing an outcome: economic variables, psychological variables, cultural variables, ecological variables, and so on.

How are behavioral analysis and systems analysis integrated in practice?

The first integration was conceptual: how can behavior analysis concepts and systems analysis concepts help figure out how to deal with a difficult practical issue such as improving the effectiveness of a classroom or school or business. As that work progressed, general systems people began developing special tools and tactics. Two professional societies were formed to support the work: the International Association for Behavior Analysis (which includes the Organizational Behavior Management Network) and the International Society for Performance Improvement. The work has been incorporated into a dozen or so graduate training programs around the nation and around the world. Many of the people contributing to the work are members of the Cambridge Center for Behavioral Studies.

This series of papers describes some of the tools and techniques that are often used, cutting edge applications, and work going on now that will lead to useful tools to deal with problems that are still very difficult to solve.

So what?

I believe that if intelligent people understood the basics of behavioral systems analysis it could save them a great deal of frustration. After reading this series of papers and thinking through some of the issues you face, I hope you will agree that people of good will are now wasting much of their energy. They are spending huge amounts of time and money trying to use piecemeal tactics on matters that only respond to total system approaches. Intelligent consumers say no to piecemeal approaches. Intelligent consumers seek comprehensive approaches that are consistent with well-supported

theory. Intelligent consumers ask to see the data about effectiveness and ask about the specific methods used.

I believe, as do many of my colleagues, that the time has come to do two things:

1. describe what we do in ways that intelligent people can readily understand
2. share the concepts and tools in ways that support those who wish to become expert.

This series of articles is a step in that effort. The papers describe and illustrate seven fundamental concepts, share fifteen "lessons learned" about how to improve performance in real settings, and discuss examples of cutting edge applications.

The First of Seven Fundamental Concepts

Fundamental Concept One B = f (O, E,)

A Fundamental Principle of Psychology

There is one fundamental principle that most, possibly all, psychologists agree upon. We write the principle as B = f (O,E) and read it "Behavior is a function of interactions between a person (O) and that person's environment (E)."

Studying B to learn about O

One reason the B = f (O,E) principle is important is that it calls attention to the study of behavior (B). Most psychologists study behavior, not because they are interested in the behavior, per se, but for what it reveals about the person (O). Behavior is the window to the person. Psychologists want to know about person variables. Labels such as "attitudes," "motives," "values," "perceptions," "personality characteristics," "intelligence," "ADHD," and "developmentally delayed" describe person variables.

The principle, B = f (O,E), captures the essence of a major issue in the field. The issue can cause great concern to any family with a "special" family member. "Is my child dyslexic because of something I've done? Maybe I should have read to him more when he was really little. Or is it a genetic defect? Uncle John had trouble with reading. If it is genetic, is there anything that can be done to help? If I've done something wrong, how can I avoid messing up his younger brother?" Parents get conflicting answers from different experts. About dyslexia, ADHD, autism, childhood schizophrenia, and an array of other topics.

The confusion and conflicting answers grow out of a very old controversy, the nature vs. nurture debate. The controversy should have been put to rest years ago, but it is debated to this day. The B = f (O, E) principle implies, correctly, that both O variables, nature, and E variables, nurture, are important. What a person does, B, is a function of both sets of variables. It is not either nature or nurture, it is both. How much of each is involved in a child's reading ability or other characteristic? There is no way to know for certain and knowing how much of each is not necessary to move forward to help the child develop her full capabilities, whatever they might be. For example, we know that a

couple might have one child who was very active in the womb and another who was much quieter. We know that those differences continue for some time, perhaps the children's entire lives. That much is fact. It looks like a "nature" difference. But if we think about it, we can see that it might be a "nurture" difference. The mother might have been ill during the first few weeks after one child was conceived and healthy during that period for the other child. Or the couple might have had different prenatal care for the two children or they might have fought a lot during that time for one child and been calm, caring and affectionate during that time for the other. The womb is a nurturing environment, subject to many environmental influences. We can not accurately assign the difference, at birth, to nature or to nurture. It just has to be a function of both sets of variables. But the difference is important: a child who tends to be very active gets very different reactions from the world that one that tends to be very quiet. One might become a bully, the other a victim; one might become a leader, the other a follower. Both are genetically capable of either leading or following and, in fact, both will probably be leaders in one setting and followers in another setting. They are capable of both sets of behaviors and the environment determines which set is functional at any given moment.

As it happens, there is a tendency among many mainstream psychologists to argue the nature side and for behavioral psychologists to argue the nurture side, but that is just a bad habit. I avoid the argument: "You are what you are genetically. I don't know how to give you a gene transplant; neither does anyone else--yet. But I can help you use everything you have to attain your goals." I do not for one minute say that the nature side is unimportant. I believe couples who like to plan things should get genetic counseling as part of family planning. But once genetic O variables are set, I focus on E variables.

Behavioral psychologists usually emphasize E variables. It is practical to do so. Work settings allow free manipulation of environmental variables; however, direct manipulation of person variables is usually impractical, illegal, or unethical. The tactic is to design the least restrictive workplace possible:

- Design workplaces to accommodate differences in O variables.
- Discriminate against "bad workplaces" not "unfit people."

An environmental approach does not ignore O variables; it manipulates E variables to support O variables. (Human factors engineering, ergonomic workplace design, etc. take this approach.)

Studying B to learn about B

While most psychologists study B to learn about O, behavior analysts take a different path. We believe that a science of behavior is both desirable and possible. Our reasoning goes something like this. Look a crime statistics—they show us how often certain behaviors occur. Look at economic statistics—they tell us how much and how often how many people buy or sell how much. When I go shopping, the salespeople want me to support the economy by behaving like a consumer. When I go to a restaurant, I choose the right amounts of healthy foods or I behave differently and load up on unhealthy calories. I drink and drive or keep the two behaviors separate. As a good citizen and parent I give time or money or votes to good causes and attend my children's

performances; as a poor citizen I do none of that. The President declares war; the General orders an attack; the private kills or gets killed—all are behaviors. Significant ones. The ones that drive societies and cultures and economies. Human behavior is important. Worth studying.

Behavior analysts study behavior, per se. Behavior is the subject matter. We focus, not on the mysteries inside O, but on the mysteries of O's behavior in interacting with E. How O's behavior interacts with E defines whether the behavior is functional or dysfunctional. E defines whether my behavior is "friendly" or "harassment." E defines whether my killing behavior is "hunting," "poaching," "negligent homicide," "first degree murder," or "heroism." Of course, people try to figure out what was going on in my head at the time, but they figure it out based external circumstances, E, and on my behavior, B. If they ask me about my intentions and I tell them what was going on in my head, they look at E to figure out whether I am "telling the truth" or "lying."

The choice to focus on B and its interactions with E as our subject matter sets us on a different path than the one taken by most psychologists. We like our path. They like theirs. That is OK. But it is a difference that makes a difference.

The first fundamental concept, B = f (O,E) shows our focus on behavior B. It also defines the point of agreement (we all study behavior) and the point of departure from mainstream psychology. Mainstream psychology analyzes O, behavior analysts analyze B. The departure does not mean that behavior analysts ignore the findings of mainstream psychology but it does mean that we view the findings in terms of the light they shed on how we can design or manipulate environmental variables to support functional rather than dysfunctional behavior.

A Fundamental Principle of General Systems Theory

B = f (O, E) is not only a fundamental principle of psychology, it is also a fundamental principle of all the social, natural, and biological sciences and, hence, of General Systems Theory. (I must take credit or blame for that assertion—I have found it in print anywhere.) An obvious and familiar example is the behavior of a river. How and where it flows is a function of environmental variables, the terrain through which it flows. How and where it flows is also a function of other more remote environmental variables such as how much snow there was in the mountains last winter, how much water was taken out for irrigation in the spring and so on. The behavior of the river is a function of interactions among properties of O (the water) and many events occurring in E. We could not possibly understand the behavior of the river by studying O, the water. Nor could we understand the behavior of the river without studying water. O and E, not one.

The behavior of a tree is also a function of environmental variables. Consider how the limbs grow. Walk through a forest and notice that some limbs grow up and over and around other limbs of other trees. Some limbs do not find a path to the sun and die in the shade of more robust limbs. How rapidly the tree grows is a function of E variables such as the amount of moisture, the combination of minerals in the soil, the action of insects, etc. Whether it has large leaves or small needles is a function of O variables.

Consider the behavior of chemicals, as studied in a high school chemistry class. Students study chemical behavior by manipulating E variables. Manipulations include heating substances, putting them in a near vacuum, and combining them with other chemicals. And on it goes.

I lack the data and the expertise to know for sure that my assertion is true but I believe that B = f (O,E) is a general principle of all sciences. I mention the principle in part to show that behavior analysts are not alone in the belief that studying behavior is both practically important and scientifically respectable.

Three Lessons Learned From B.F. Skinner

Three of the first and most important things I learned as a graduate student in Harvard's psychological laboratories follow:

1. Learn all about the pigeon! (O)
2. Learn all about the apparatus! (E)
3. Manipulate E, Measure B!

I had to learn all about the pigeon because my first research was to be in studying the behavior of the pigeon. Skinner, while a graduate student at Harvard, had studied in Walter Crozier's physiology laboratory. He taught, by example and by standards, that knowing as much as we can about O is essential to good research. I studied from a very large book that summarized and illustrated most of what was known about the physiology and the neuroanatomy of the pigeon.

I also had to learn all about the apparatus. Frankly, I was dismayed at first. The apparatus used in the lab was quite complex. We used telephone switching relays, programmed by attaching hundreds of wires (students use computers now.) I wanted to learn psychology, not the operation of electro-mechanical circuits. I wished we could rely on technicians to program the apparatus for us. But lab culture and folklore contained too many stories of errors that came about as a result of failures to understand the apparatus. Each graduate student had to decide how expert to become but it was very clear that excellence demanded full knowledge. I am ashamed to say that we demonstrated youthful arrogance by laughing at researchers who decided that expertise in how the apparatus worked was not necessary.

Manipulate E and measure B was an easy and obvious lesson—except that measuring the right B often required building special apparatus. Manipulating specific E variables also frequently required building new apparatus. The research culture contains many stories of scientific breakthroughs coming about as a result of the ability to build new apparatus to measure new phenomena. The history of the natural and biological sciences is full of such examples.

The three lessons I learned in the first semester of graduate school are ones that I have had to learn again and again over the years as I worked outside the walls of the lab. These three lessons, in fact, describe the road to success in practical endeavors. The

lessons provide tactical guidelines we can and should use in projects intended to improve performance in education and commerce.

- "Learn all about O" signifies that we should always learn as much as we possibly can about the person or persons or departments or businesses we intend to work with.

- "Learn all about E" signifies that we should always learn as much as we possibly can about the workplace or marketplace or economic and social environment within which clients function.

- "Manipulate E, measure B" signifies that we must find ways to identify, manage, or manipulate the relevant environmental variables and we must find ways to monitor or measure the behavior that we are trying to improve.

Everything I have to say below about cutting edge applications will come back to these three lessons. B = f (O, E). But before going there, allow me to share Part I of this series of articles:

- describes behavioral systems analysis as an approach that draws from two disciplines, behavior analysis and generals systems theory
- asserts that knowledge from both disciplines is important for practical work because
    - behavioral knowledge about how each person will act within a specific environment and
    - general systems knowledge about how organizations and other living systems function

  is essential in today's complex world
- describes B = f (O, E) as the fundamental concept of the biological, social, and physical sciences, psychology, and general systems theory.

six more fundamental concepts. (Applying the 3 lessons effectively requires knowledge and expertise that has been developed in the years since I left graduate school behind.)

Conclusion—an invitation to think

You are invited to think about what you have just read. One way to do that is to think about answers to one or more of the following questions.

1. If you were talking to a psychologist, what are two or three questions you could ask to determine whether the person has chosen to study mainstream psychology or behavioral approaches?
2. Do you agree that mainstream psychology's decision to emphasize O variables is OK?
3. Do you agree that behavioral psychology's decision to emphasize the how B interacts with E variables is OK?
4. Do you believe that people following each path could and should learn from one another?

5. What are some of the human issues, problems, or topics that you are most interested in?
6. Do you have any clues yet about how behavioral systems analysis concepts might help you understand any of the issues? (Suggestion: think a little about the E variables involved.)

The next article in this series deals with the most fundamental concept in behavior analysis. The concept is the one that defines all the principles of behavior.

Reference

Malott, R.W. (1974). A behavioral systems approach to the design of human services. In D. Harshbarger & R.F. Maley (Eds) *Behavior Analysis and Systems Analysis: An integrative approach to mental health programs.* Kalamazoo, MI: Behaviordelia.