

## **PCT and MOL: a brief history of Perceptual Control Theory and the Method of Levels**

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**Abstract.** I have been asked to describe how Perceptual Control Theory (PCT) and Method of Levels (MOL) came into being, and as I approach the age of 82 that seems a prudent request. Some parts of the following should probably be taken more as a reconstruction than a verifiable record of the past, but I will strive for realism.

**Key words:** Control, mindfulness, psychotherapy process, systematic reviews.

### **Perceptual Control Theory (PCT): the cybernetics thread**

The roots of PCT lie not in psychology but in engineering. The basis of PCT is a body of knowledge called control theory, which is the mathematical description and analysis of control systems – machines in which causation runs not from a starting point to an end point, but in a circle. However, control systems were not initially constructed on the basis of any theory.

The construction of machines that work according to circular causality began, to our knowledge, some 2200 years in the past, when the Egyptian inventor Ktesibios built and described a float-valve controller for keeping the water in a water clock's reservoir precisely at a fixed level (see Cziko, 2000). A series of devices of this kind appeared from time to time in the Middle East and Europe before the Industrial Revolution, but that is all they were: devices of clever nature built by clever inventors, with lore but no science behind them. James Watt's flyball governor for steam engines was another such clever device, derived from the 'lift tenter' that regulated the speed of wind-driven grain mills. Decades later, James Clerk Maxwell tried to apply the calculus to analysing the behaviour of Watt's governor, and was able to determine some design principles for making this kind of controller both sensitive to speed changes and stable enough to hold a steady speed. Still later, on the verge of the 20th century, the steering mechanisms of steamships were designed in this closed-loop way, and prizes were given for the best mathematical analyses of them (some judged by Maxwell).

The transition from lore to science began in Watt's time and reached its modern form as the 1930s opened. H. S. Black (see [mit.edu/6.933/www/black.pdf](http://mit.edu/6.933/www/black.pdf)), of Bell Laboratories, was on

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his way to work on the Lackawanna Ferry in August of 1927 when he suddenly understood how to use negative feedback to achieve extreme stability and reliability in the repeater amplifiers for transcontinental telephone lines and transatlantic telephone cables (which were very hard to service). At that time I was almost 1 year old. He wrote some equations on a blank page in his copy of the *New York Times* that were the start of the true science and art of control engineering (for some reason it took him seven more years to publish the results). We can mark the decade of the 1930s, therefore, as the years during which control theory became useful as a way of helping us to understand purposeful systems – that is, systems organized to create and maintain some predefined condition, rather than simply responding to stimuli.

### The 1940s

The development of automatic control systems suddenly expanded with the advent of the Second World War as gun-pointers, autopilots, sound-tracking torpedoes, and other electromechanical systems were developed in great variety and numbers. Thus, when as a young boy of 17 fresh from high-school, I volunteered with parental consent to join the Navy to train and serve as an electronics technician (or at least, as the Navy put it for some mysterious reason, an Electronic Technician's Mate), I found myself on Navy Pier in Chicago learning about radio receivers, transmitters, radar sets, sonar equipment and negative feedback control systems. I found the idea of negative feedback a bit confusing at first, but got used to it. I had become, briefly and unknowingly, a descendant of Ktesibios.

On leaving the Navy I went into college to study physics and mathematics on the GI Bill, learned a bit more about negative feedback without thinking of Ktesibios, and also took some psychology courses. After graduation, with no prospects for further education, I dabbled in dianetics for 2 years – flirting with some cultish and otherwise dubious concepts, while learning something of use about people, perhaps. But fortunately that bubble collapsed and I went back into physics as a medical physics technician, and at the same time encountered, through a friend, a small book called *Cybernetics: Control and Communication in the Animal and the Machine*, by Norbert Wiener (Wiener, 1948). I had stumbled again into the stream of ideas that started with Ktesibios, this time awake.

### The 1950s

My foray into dianetics had left me with an unsatisfied need to understand human nature better, particularly my own but also that of others. What I had learned in my psychology courses did not seem to have much relationship to the way I worked, and after dianetics I was feeling more ignorant than I had been before it. Wiener's book electrified me. Since I had already learned something about the strange properties of negative feedback control systems, the parallels Wiener drew between artificial and human control systems had immediate meaning for me, and I could see that this was a powerful alternative to the stimulus-response psychology I had learned about in school. Control systems had goals and could achieve them by acting in a real world full of unpredictability and disturbances. They sounded a lot more like real organisms to me than did the automata I had learned about before.

In my spare time, therefore, I began to study control theory using engineering textbooks. I began thinking about how negative feedback could become the basis of a theory of human behaviour. With the strong support of Robert Kenley Clark, a physicist from Argonne National Laboratories who became interested in my ideas, I was able to take a position at the VA Research Hospital in Chicago where I could learn more while designing electronic systems for medicine. It was here I ran into analog computers, actually obtaining one for my own use and using it less as a tool than as a mentor. From the Philbrick analog computer I learned how negative feedback really works. I also joined my life with that of Mary Andrews, who became my wife, friend, advisor, and mother to my three children, and sustained me in all these efforts for the rest of her unselfish life.

For the remainder of the 1950s I worked with the help of Clark and MacFarland to see how negative feedback could form the basis for a behavioural model, drawing on engineering psychology and some writings of cyberneticists, mainly W. Ross Ashby, always with the idea of some day joining the cybernetics movement. After 7 years of work, the three of us published the first paper on what was to become PCT (Powers *et al.* 1960). By that time Clark and MacFarland had developed commercial interests involving consulting in feedback theory, and I decided to try to get a degree in psychology. Donald T. Campbell, a teacher in my undergraduate days, paved the way to a scholarship at Northwestern University, but with a wife and two and a half children, and an insistence on bringing feedback theory with me into a behaviouristic department, I lasted just 1 year. My part-time job at the Dearborn Observatory became full-time, and from then until retirement I earned my living designing electronic systems for science and industry.

During the next 13 years I managed to publish a few papers on what I now thought of as control theory, and started the work that culminated in *Behavior: The Control of Perception* (Powers, 1973) – with D. T. Campbell once again helping, this time by finding me a publisher at Aldine. I never again, until reaching retirement age, had the luxury of working full time on the theory, but with the help of Mary, and the support of many people who read my book, it became possible to contribute from the sidelines and gradually form the nucleus of the Control Systems Group (CSG), which started its annual meetings in 1985 (the 24th one occurred in 2008 as the CSG became international).

It was a considerable disappointment to find, in these later years that while most cyberneticists were very interested in communication and some were interested in my ideas, most of them were not much interested in control, and in fact many of them felt that control was something nice people should not do. What I had imagined as a sort of Azimovian Second Foundation full of engineering wizards constructing a new psychology proved to be more of a philosophical enterprise. So I found myself the owner of a lot of useless knowledge about control systems. I made a living from it for 40 years, but somehow the connection with cybernetics was never fully accomplished.

That is how PCT obtained its separate existence. It was a cast-off from cybernetics, as I gloomily might have said later on. It was a supplicant at the gates of psychology, never admitted to the inner courtyards but always showing a hopeful face outside the windows, with an occasional foot in the door. It attracted those who were dissatisfied with what psychology and its sister disciplines had produced, and it caught the attention of energetic people who saw in it what I did and shared my vision of a new science of life. They are the ones who should write the history of PCT since its baptism in the 1990s, because they are the ones who have made that part possible.

### Method of Levels (MOL): the psychological thread

When I was in high school in the 1940s, my mother was a Gray Lady, a volunteer who worked at a Veterans Administration Hospital in Illinois. She also volunteered me as an entertainer, bringing me with her occasionally to play boogie-woogie piano in the wards where she worked – those wards housed the young and old veterans classed as mentally incapacitated. It was there that I became interested in things psychological, and also lost any fear I had of people with mental problems. As a child just growing out of a long series of depressive episodes, I was quite aware that my status as a visitor was not as secure as it might have seemed. I was well received by people who seemed not much worse off than I was, many of whom tried to, and did, help me feel welcome and not to be afraid of them.

It was this interest that led me eventually to take a detour from physics through (alas) dianetics and into the work that led to PCT. It also accounts for the fact that one evening around 1953 I was talking with my friend Kirk Sattley about the odd way in which one can be discussing and thinking about one topic, while at the same time having thoughts in the background about the discussion, and wondered whether this dual view could be extended another level. We decided to find out. While one person listened and the other rambled, the rambler attempted to see whether discussing the background thought, bringing it to the foreground, would reveal *another* background thought, about the first one. It quickly became apparent, as we explored and repeatedly switched roles, that indeed this progression could occur, and that it was not often circular or ever limitless. It led, as we persisted, to an interesting state of mind in which one could be aware and observant, but disconnected from thoughts and feelings, a state which I have since learned has been called ‘mindful awareness’ and which we both found at the time to be extraordinarily peaceful.

Over the next 20 years both Kirk and I found that returning to this state was often a way of resolving problems, and from time to time I would wonder if it had some relationship to the control-system model on which I was working. By the time I was working on my 1973 book, I was testing this process with other people to see if they could do it, too, and to see if it had the same effects on them. There was even a chapter in the book, called ‘An experiment with awareness’, that attempted to define the process as a therapeutic method, which I called the ‘method of levels’, but the editor persuaded me to drop it because it did not seem to connect to the rest of the book.

Nevertheless, the subject kept popping up and I kept demonstrating the method to others and, at a rather sedate pace, pondering its relationship to the hierarchy of perception and control that was developing into PCT. Gradually, it became apparent that this method, relying as it does on internal control processes rather than external treatments, was entirely consistent with the basic concept of autonomous control behind the theory, especially the concept of reorganization, which is carried out by a living control system rather than being done to it. I kept trying to persuade the psychologists in our new Control Systems Group to give the method a trial, but it proved difficult for them to abandon methods with which they were familiar and, for all anyone knew, put their patients at risk, so a clean test of MOL did not come about for a long time. It was not until the late 1990s that Timothy Carey, an Australian psychologist and not yet a clinician, became interested, and in fact obtained his doctorate in clinical psychology for the express purpose of testing the Method of Levels. Not far behind him, Dr David Goldstein in New Jersey, who had started earlier, also began the difficult process of using the Method of Levels exclusively with some patients as a formal research investigation. Dr Carey took his

investigations to Scotland where he brought others into the effort, and with that I will leave that part of history to those who are making it.

### Conclusions

The two threads, the cybernetic and the psychological, are coming together now as PCT approaches maturity, and as I move noticeably past it. While the work is definitely still in progress, the basic concepts of PCT are apparently making sense to more and more people, including people who have had to make serious adjustments before concluding that something new and worthwhile is afoot. The clinical side is finally catching up to the theoretical and experimental side, making the whole approach more complete and useful. The number of students learning about PCT and MOL is rapidly increasing, and now that Timothy Carey has moved back to Australia and *Behavior: The Control of Perception* has been translated into Chinese, the mutation is spreading over four continents and may in fact lead to some major revisions of psychology as it was known in the 19th and 20th centuries. I trust and hope that all the appropriate babies are being rescued as the bathwater is discarded . . .

### Declaration of Interest

None.

### References

- Cziko G** (2000). The engineering of purpose: from water clocks to cybernetics, ch 5 (<http://faculty.ed.uiuc.edu/g-cziko/twd/pdf/twd05.pdf>). In: *The Things We Do. Using the Lessons of Bernard and Darwin to Understand the What, How, and Why of Our Behavior*. Cambridge, MA: MIT Press.
- Powers WT** (1973). *Behavior: The Control of Perception*. Chicago, USA: Aldine Publishing Co.
- Powers WT, Clark RK, McFarland RL** (1960). A general feedback theory of human behavior. Part II. *Perceptual and Motor Skills* **11**, 309–323.
- Wiener N** (1948). *Cybernetics: Control and Communication in the Animal and the Machine*. Cambridge, MA: MIT Press.

### Learning outcomes

After reading this paper, readers will:

- Understand how Perceptual Control Theory (PCT) emerged during the 1950s from the field of control-engineering.
- Understand how Method of Levels (MOL) was developed through the exploration of ‘background thoughts’ and merged with PCT in the 1980s and 1990s.
- Become aware of the spread of MOL and PCT in recent years.