Perspective

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Consciousness as Control and Controlled Perception - A Perspective

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Abstract

Consciousness has been under intense scrutiny by researchers and philosophers for countless centuries and yet it remains mysterious. It is still not clear what consciousness is or what it is for. A fundamental problem that may be hampering substantial progress in consciousness studies is the lack of a clear understanding of the nature of the brain. It is unremarkable to suggest that consciousness is related, in some way, to brain activity, so without an authentic appreciation of what that activity is, it is improbable that an accurate and coherent articulation of consciousness will be delivered. In this paper, Perceptual Control Theory (PCT) is offered as a solution to the puzzle of the brain. From the perspective of PCT, the brain is a control system. The organization and functioning of this control system architecture is described and then the implications for the way in which we consider consciousness are discussed. Some current ideas about consciousness are overturned while others are preserved but integrated and synthesized into a coherent framework with negative feedback control as the unifying phenomenon. By recognizing consciousness as both, a phenomenon created by a massively interconnected network of sophisticated control systems that can, among other things, produce language, imagine, plan, and contemplate, and a property of this massive network, PCT provides us with the opportunity to rethink concepts as fundamental as: causation; stimulus and response; and objectivity and subjectivity.

Keywords: Consciousness; Control; Playfulness; Perceptual; Inter-subjectivity; Conversations; Awareness

Introduction

Consciousness as control and controlled perception

I was standing at the window of my hotel room on the 11th floor appreciating the early morning light while I gazed out at the ocean and watched dolphins swimming along parallel to the beach. After a few minutes I began to wonder "What do those beautiful creatures do all day?". I became intrigued at how they fill in their time when they're not eating or mating. I acknowledged their "playfulness", and I recognized that what I meant when I thought of them as playful was that they seem to do things which we humans call "playing". But what else do they do? As I was mulling over this subject I found myself thinking, "Well, what do we do all day?". That was a light bulb moment and I started to think "Is that what mental activity, or awareness, or consciousness is? Is that our "playing"?" Is what happens in our mind just what happens in creatures that have evolved or developed the complexity of perceptions and brain capacities that we have developed?

Questions about the nature of consciousness have been some of the most vexing questions of humanity. Dennett [1] goes as far as to suggest that human consciousness is the "last surviving mystery" (p. 21). For centuries, consciousness has captured the attention of countless philosophers, neuroscientists, psychologists, and other researchers. Great minds through the ages have been mesmerized by the topic yet, despite the extent to which it has been relentlessly pursued, consciousness remains impervious to our probing.

One of the barriers to making substantial progress in our consciousness studies may be our inadequate knowledge of the brain. Our knowledge is inadequate in the sense that we do not have a generally accepted, unambiguous model of how the brain works. Trying to understand something as intimately connected with the brain as consciousness becomes highly problematic in the absence of a plausible account of the mechanics of the brain. One suggestion for brain organization and function is outlined in a robust and elegant scientific theory that is still not widely known or understood. The principles of this theory hold intriguing, and perhaps confronting, implications for our understanding of consciousness.

The theory discussed in this paper offers the possibility that, with regard to understanding consciousness, we may be in a similar position to that of the astronomers from previous centuries who subscribed to a geocentric view of the universe. When Galileo introduced the idea of a heliocentric solar system, this turned astronomy, literally, upside down. Part of the difficulty in understanding consciousness may stem from our current perspective on the problem. This perspective not only includes consciousness but incorporates our knowledge of the brain as well. An important part of the quest to

understand consciousness more clearly, therefore, may be to develop a different way of looking at the problem.

Two points need to be stated at the outset of this paper. First, a number of the references used could be considered dated by conventional academic standards. The dates of some of the references indicate how enduring problems of consciousness are and the value there may be in introducing a new perspective. Secondly, throughout the paper, the ways in which the theory concurs, and differs, with current ideas in the consciousness field will be highlighted. Sometimes, there is a great deal of overlap, and at other times, there is a marked divergence. Even where there is a concordance of concepts, however, the contention in this paper is that the new theory has something to offer in terms of the coherence of its overall framework and the strengths of its foundation.

The problem and a possible solution

Different scholars offer different explanations for the kind of thing a brain is. For example, Baars maintains that the primary function of the nervous system is to encode knowledge, Dennett suggests that brains are for generating expectations, Hameroff's attitude is that the brain is an information processing system, and Churchland and Churchland assert that the brain is both a causal machine and a non-linear dynamic system [2]. In the spirit of shifting from a geocentric to a heliocentric view of the universe, the stance in this paper is that, while the brain might be considered to do some, or all the things just described, none of these ideas about the brain are entirely correct. The position of this article is that the brain is a control system. It is a massively interconnected network of control systems organized hierarchically and in parallel.

Perceptual Control Theory [PCT] outlines the organization and dynamics of the brain from a control systems perspective [3]. Greenfield asserts that we need an approach which is like the physical sciences in the sense of a framework with laws, rules, and principles that everyone can "buy into" [2]. PCT may be that framework.

When the brain is recognized as a control system, and the phenomenon of control is understood accurately, many of the current problems in studies of consciousness disappear. PCT does not *solve* the current riddles of consciousness as much as it *dis-solves* many of them. PCT is an appropriate response to Blackmore's [4] suggestion that we may need to throw out our most basic assumptions and start again. According to Powers, PCT is not a means of finding new answers to old questions [5]. PCT suggests we need new questions with the most basic question being "how do living things actually work?".

Perceptual control theory

PCT is an explanation of the phenomenon of organic control. From the perspective of PCT, things that live are autonomous control systems. Control is a natural, physical phenomenon in the same way that gravitational and electromagnetic forces are natural phenomena. For the life sciences, control may well be the fundamental new principle that Searle insists is needed [2]. Other scientists have recognized elements of this phenomenon. Damasio [6], for example, describes the dynamic process of homeostasis which he maintains begins in unicellular living creatures and Deacon [7] proposes that our experience of consciousness has its precursors in the adaptive processes of life. Powers [3], however, was the first to articulate the mechanics of control as it applies to living organisms. One of the early pioneering scientists of PCT, W. Thomas Bourbon, explained:

The business of turning parts of the environment into yourself and defending yourself against the inevitable disintegration–that is what control is all about. That is life. Rocks don't do that. Every cell in an organism like us does that. Every gene in a creature like us does that. Every complex self-replicating molecule in every living creature does that. (personal communication, November 2000).

According to Powers [3] control is the "achievement and maintenance of a preselected perceptual state in the controlling system, through actions on the environment that also cancel the effects of disturbances" (p. 296). Negative feedback is the central mechanism of control and has been identified at all levels of functioning including biochemical, physiological, psychological, and social [8].

Negative feedback is the process of keeping the difference between a specified internal state and the corresponding experienced external state at a minimum. The central feature, then, of negative feedback, is error reduction. When there is a difference between the specified state and the experienced state the system acts to eliminate that difference.

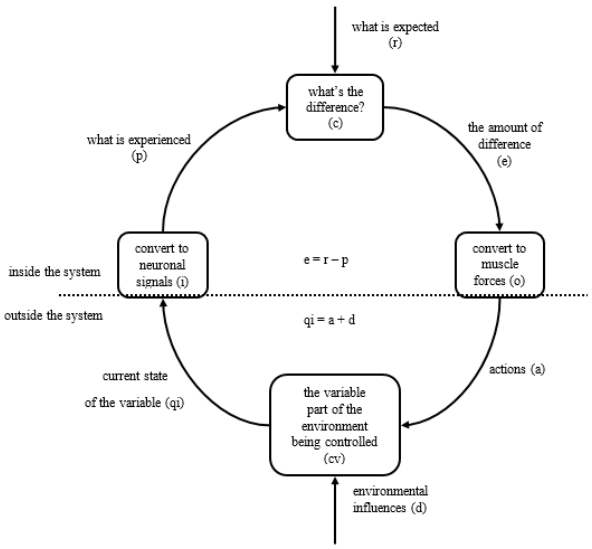

Figure 1 The basic unit of PCT: A closed causal negative feedback loop [4].

Figure 1 depicts the basic building block of the organization of the brain. It is a closed causal negative feedback loop **(Figure 1)**. A horizontal line demarcates the inside from the outside of the system and two fundamental equations that are solved simultaneously describe the relationships on either side of the boundary line. The equation inside the system states

that the error signal (e) is the difference between the perceptual signal (p) and the reference signal (r). The equation outside the system states that the input quantity (qi) is the combination of the actions (a) of the system and environmental disturbances (d). The way in which the equations are expressed in terms of the notation and symbols used sometimes varies, [9-13] but these fundamental relationships remain the same. It is important to acknowledge that, from a PCT perspective, error does not imply "bad", it just means "different".

It is beyond the scope of this paper to outline all the important concepts of PCT. The focus of this paper is to explore some of the fundamental implications of a functional understanding of organic control for consciousness studies. Further detail about PCT can be obtained from sources provided in the reference list. An important point to note, however, is that, as a functional model of brain structure and function, **Figure 1** is intended to be a depiction of neural organization. Sensory organs such as eyes and ears, for example, are input functions that convert light rays and sound waves into perceptual signals.

Important lessons from PCT

Perhaps the most important conclusion of PCT concerns what it is that a control system controls. Powers' [3] insight was that a control system controls its perceptual input not its motor output. All theories that purport to explain the control of behavior or actions are incorrect from a PCT perspective. Graziano's [14] conceptualization of the brain as an information-processing machine that takes in data, transforms it, and uses it to help guide behavior is an unworkable description when applied to a living control system. Maxwell's [15] notions of the brain controlling action or controlling the animal are similarly incorrect and Morsella's, Krieger's, Gray's, and Bargh's [16] suggestion that consciousness is related to action production is, at best, too vague to be helpful, and, most probably, incorrect. Robinson [17], too, mentions setting a course of action.

Control systems do not set action. They *vary* their output (action) so that their input remains in its reference state. It would be impossible to pre-specify or set, for example, all the actions required to use an automobile to relocate oneself from home to work. Yet, this happens countless times a day across the globe. Control systems accomplish such tasks easily by setting reference states (a final destination, a speed at which to keep the automobile moving, a safe distance between one's automobile and the next one, etc.) and then varying their actions as required by current environmental conditions to eliminate the difference between what is experienced and what is specified.

Knowing reality

The "mantra" of PCT is that "It's all perception" and this mantra is to be taken literally. A control system has no knowledge of "reality" or an "objective" world. The only thing it knows of the world "out there" is its own perceptual signal. Nor does it know anything about its actions or motor output other than by the perceptual consequences that are produced. According to Powers [18], "Whatever you do alters your perceptions: that's how you know you're doing something." (p. 282). PCT certainly acknowledges that there is a "real" world "out there" but it also emphasizes we can never experience this world directly. Our only experience of the "real world" is what is represented by our perceptions.

The dance between inside and outside

Studying **Figure 1** with an understanding of control helps to clarify some anomalies in our ongoing interaction with the environment. Why, for example, do we get interested in *this* rather than *that*? How can two people be at the same event but notice different things and remember the occasion differently? These happenings occur because we are *environment controlling* rather than *environment controlled*. What functions as an environmental disturbance at any point in time is *defined* by the reference signals inside the system. If something in the environment does not alter a perception in relation to its reference state independently of the actions of the system then it is irrelevant to that system. We are not born as blank slates. Even newborn babies have different references for how much they like to be fed or held. They might also have different references for noise or light that is "just right". From even before we are born the dance between the inside and the outside of the system begins. What is important to the system is determined by these early references, and the experiences that are created through the ongoing interaction with the environment guide the further development of the perceptual hierarchy.

Objectivity and subjectivity

From a PCT perspective, therefore, we can rethink notions of subjectivity and objectivity. In the final analysis, we are only ever left with our own subjectivity. Even when we are "objectively" observing another person's behavior, we can only ever do that from our own subjective vantage point. The hard problem proposed by Chalmers in 1994 [4], therefore, dissolves under the scrutiny of PCT because objectivity and subjectivity become redundant concepts. This approach is very much in line with Velman's [19] notion of scientific objectivity in which he maintains that the notion of an "observer free" objectivity is not possible and that "intersubjectivity" is a more useful construct.

Organization is crucial

In a control system there is no "controller" to be found [20]. Control is a phenomenon that arises when a system, organized in a specific way, interacts with its environment [20]. It is the organization of a control system that is critical for the efficient functioning of a control system and the manifestation of control. The organization of a control system also means that the ordinary physical laws of lineal cause and effect need reconsideration. While it is true that creatures which are constituted of matter obey laws that pertain to matter, it is *not*

true that they obey *only* the laws pertaining to matter [13]. "Laws that apply to lumps of material do not necessarily apply when the material is organized in ways other than lumps. If you analyze an airplane chemically or physically, it will prove to be made of material that can't, in their raw form, fly. Yet they can be organized to fly" (p. 17) [13]. Gazzaniga [21] makes a similar point when he explains that you could not understand traffic patterns by examining a brake pad. It is the organization and the level of analysis that is critical.

Analogue not digital

Negative feedback is a dynamic process where the different signals and functions are always "on" and always active. The error signal does not wait until the perceptual signal has finished changing before it begins to change. As the perceptual signal changes, the error signal changes. From a PCT perspective, we are *analogue* not *digital* systems yet, generally, the activity of living is still treated as a "stop and start" process. Blackmore [4], for example, describes sequences such as activity beginning in the prefrontal region and sending connections to the premotor cortex, or brains beginning a plan for action, then giving rise to thoughts about the action, then the action happening. Control systems, however, are always "on" so questions such as "what starts the action off?" [4] would not be asked in a PCT paradigm. This helps to clarify a large body of research in the consciousness area concerning the timing of the action and the decision to act [4]. This arbitrary demarcation in time would not be considered significant from a PCT perspective. Blackmore [4] notes that the whole idea of timing is problematic. PCT helps explain why it is problematic.

The problematic link between "will" and "action"

A recurring conclusion from studies investigating the timing of "will" and "action" is one such as "the conscious decision to act occurred approximately 350ms after the beginning of the RP" (p. 139) [22]. A finding such as this would be unremarkable for a system that controls its perceptual input rather than its motor output. Since, for a control system, "It's all perception", and this is an analogue system where all components are changing at the same time, the only thing research participants in these studies can report is their perception of what happened.

Gazzaniga [21] suggests that the brain acts before it is conscious of it. By referring to **Figure 1,** it can be appreciated that, for the research participants to move their hands, there must be a reference signal to move their hand, a perception that they haven't moved their hand, an error signal, the movement of the hand, and the awareness (perception) that their hand had moved. Even this description is constrained by the nature of language with some words coming after other words, so a misleading linear process is conveyed, and the seamless simultaneity of the processes is missed. It is certainly the case that some things happen after other things, but with a negative feedback process, the distinction between causes and effects becomes blurred as effects circle around to become the next cause with the previous cause turning into an effect. All this changing happens at the same time so as effects are turning into causes so too are causes becoming effects.

The distinction between mind and body

PCT provides a novel perspective regarding the distinction between mind and body or the mind and the environment. To understand the functioning of a control system, the entire system as depicted in **Figure 1** needs to be considered. Arbitrary distinctions between mind and body or thought and action do not "carve nature at its joints" and are rarely helpful. To understand the experience of living, organic control systems need to be considered holistically as they are controlling.

Table 1 Different concepts related to consciousness and what their status would be from a PCT perspective.

Concepts that would become redundant	Concepts that could be integrated into a unifying framework	Concepts that are new or at least not widely accepted or understood and that suggest a different approach to understanding and studying the process of living
Linear causality	A hierarchy of complexity	Circular causality
The brain as an information processing machine	The relevance and importance of language	The phenomenon of control
Zombies	The illusion of free will	The brain as a control system
The Hard problem	Adaptive homeostatic processes	Functional models
Objectivity and Subjectivity	Intersubjectivity	Reorganization and its links with consciousness
Distinguishing between the brain and the mind	Systems	Modes of control
Control of motor output		Control of perceptual input

Rethinking consciousness

If we start from the premise that the brain is a living control system that controls its input rather than its output, we can rethink consciousness. Many of the concepts and ideas that are relevant to a PCT perspective have already been described by others, but they have not yet been integrated into a coherent account in the way that they can within a PCT framework. When consciousness is examined through a PCT lens, the mystery largely disappears, and we are left with an experience that is comprehensible in terms of controlling agents with the perceptual complexity that humans possess. In the next section, the ways in which different aspects of current consciousness studies can be reconsidered will be discussed. Some areas of current concern about consciousness such as objectivity and subjectivity, mind and body, inside and outside, causality, and when does consciousness start have already been discussed and will not be repeated here. **Table 1** lists some of the concepts in current consciousness discussions that would become redundant, some that could be integrated into a new unifying framework, and some that are new or not widely recognized or understood.

Discussion

Rethinking definitions of consciousness

Other scholars have noted the way in which consciousness and language are intertwined [1,4,23,24]. It could be the case that, when the level of perceptual complexity that allows us to produce words, to communicate, to imagine, to reflect, to ponder, to think, to wonder, to contemplate, and so on, developed, a consequence of this was that one of the things we developed was the ability to think about thinking itself.

The *concept* of "consciousness" then, and all the things that it incorporates such as "subjectivity" and the "self" including "I", can be thought of as creations of language and the imagination. This does not mean that consciousness and "I" do not exist but they exist in the same sense that unicorns, mermaids, and dragons exist. Perhaps with consciousness, the map *is* the territory.

So, is consciousness "real"? It is real in the sense that unicorns are real. There are books and movies and even statues about unicorns. Some people set goals to surround themselves by unicorns and they spend a lot of time thinking about them and collecting different forms of them. In the same way, some people have created a construct called "consciousness" which, as it happens, is still not as well defined as a unicorn is. Nevertheless, people spend time thinking and writing about the way they think of consciousness. They create questions and dilemmas to investigate their ideas of consciousness. They even disagree with others about what consciousness "really" is. From a PCT perspective, these sorts of debates would be like discussing whether a mermaid is more fish than human. It should be noted that I write these words with the full awareness that these ideas will be anathema to some people. Regardless, the suggestions being offered here might also provoke the opportunity for considering consciousness anew leading to greater progress in this area.

Suggesting that some consciousness questions are unimportant or irrelevant does not imply that all questions that could be asked about consciousness should be disregarded. In fact, PCT may help to guide the development of new areas of exploration concerning the experience of living that are currently captured by the topic of consciousness. From a PCT perspective "The ultimate authority is always direct experience." (p. 185) [25]. The "self", for example, is an important aspect of many people's existences. Indeed, serious mental health problems such as Borderline Personality Disorder and Dissociative Identity Disorder have disruptions to a sense of self at their core. From a PCT perspective, a "self" would be another control system with specifications for how "I" should appear, how "I" should conduct myself, what "friends" I should have, and so on.

Humans have the capacity to imagine an endless variety of things. We have the ability to imagine, to create, and to manipulate things that do not actually exist in the physical world. Some of these things, like skyscrapers and jumbo jets, become tangible objects, while other things remain imagined only. Sometimes through our imagining and creating we can make these things exist. Like imagining the existence of a planet and then finding a planet where we imagined there should be one. Or imagining people flying or walking on the moon. No other animal has this ability. The ability that provides us with imagination also gives us the power of language including the language of mathematics. This also answers the evolutionary question of why this ability might be important. It is important because it allows us to be the most successful creatures on the planet. It allows us to discover penicillin and electricity. It allows us to jump out of airplanes and create an Internet. It allows us to be creative and inventive and to do far more to our environments than any other animal.

Sometimes, however, we can become beguiled by our own cleverness. Blackmore [4] advises that the ease with which something can be imagined is not a good guide to its truth. We can invent things like memes and qualia and sunsets and the Loch Ness Monster. We can also create word sequences in the form of questions. Some of these questions need not ever be answered. We can ask questions like "How do you spin straw into gold?" or "What is it like to be a bat?". Our ability to construct certain word sequences does not mean that those word sequences warrant further attention. From a PCT point of view, many of the current consciousness questions such as "What does consciousness do?", "Could we have evolved without it?", and "Could consciousness be an illusion?" [4] should stop being asked because they are based on an inaccurate understanding of the activity of living.

It is certainly the case that important scientific discoveries would not have occurred without the persistent and single-minded pursuit of answers to difficult questions by astute thinkers. Being able to discern, however, the difference between a question worth answering and an unanswerable, redundant question, is also important for scientific progress.

Currently in the life sciences, because there is no readily agreed, coherent understanding of the nature of living, it is very difficult to know which the useful questions are, and which are the distracting ones. A consideration of PCT, and the continued development of its fundamental premises, may have the potential to unify the life sciences, to integrate many current areas of investigation, and to indicate where, and where not, to invest our research efforts.

To keep a variable in a reference state, that variable must be sensed on a moment to moment basis. That is, an entity must be conscious, in some way, of the ongoing state of that variable. If an organism can only detect very simple perceptions such as intensities, then it will have a very rudimentary form of consciousness. As the ability to control more complex perceptions develops, so too, consciousness becomes more detailed. As humans developed perceptual capabilities that provided them with the ability to use language and to imagine and to think, they experienced the unique feature of being able to narrate their activities and to even narrate the narration. Consciousness at this level of complexity seems to almost take on a life of its own and becomes a controlled perception. That is, we learn to think about consciousness and its features, such as a "self", we set references for what they should be and how they should feel, and then we act to keep our experiences in the reference states we have specified.

A fundamental lesson from PCT is that, for living things, control is the inescapable activity of living. We can never step outside that. Consciousness, then, is simply part of routine control and is experienced differently depending on the complexity of the perceptions that a system controls.

Rethinking "What is it like?"

The asking of Nagel's [26] famous question "What is it like to be a bat?", which became one of the definitional aspects of consciousness, is redundant in a PCT world. It is impossible to know how it is for a bat to be a bat and the only thing a bat will know is its own perceptual world. Humans cannot even know how it is to be another human let alone any other animal. No two people ever have the same perceptual capabilities or the same network of control systems. Moreover, no two people ever inhabit the same environment. Even identical twins do not share the same environment because Twin A is in the environment of Twin B and Twin B is in the environment of Twin A.

Blackmore [22] suggests that, with regard to the question of how subjective awareness arises from the objective actions of neurons and muscle cells, we either need to find an answer or discover what the mistake was that led us to pose an impossible question in the first place. PCT enables us to understand what the mistake was. The mistake was our understanding of the brain and how it works. And with regard to the question of what it like is to be another being such as an owl or a snake, Blackmore [4] suggests that this question is unanswerable and if a question is unanswerable the solution may be to stop asking it. Humphrey [27] also queries the sensibility of the "what is it like?" question. The question "What is it like to be a bat?" certainly expresses a conundrum but it is only a conundrum from a particular point of view in much the same way that we could consider the question "What is the most effective way of appeasing Ra, the god of the sun?" as a question conceived from a point of view. From the PCT point of view, the question "What is it like to be a bat?" presents no conundrum at all.

Rethinking what is in consciousness

We cannot direct consciousness in the same way that we might direct our car to the forest for a Sunday picnic. What we think of as consciousness occurs in that area of the network where there is the greatest error at any point in time. Dennett [1], for example, raises the possibility that consciousness may be a representation exceeding some threshold of activation. A "threshold of activation" would be very consistent with error from a PCT perspective. Robertson [28], for example, suggests that the focus of attention follows the largest-magnitude error signals anywhere in one's system.

Where we direct our attention is not a process in which there is a master controller who is guiding the focus of our mind. The process of "directing attention", from a PCT perspective, is driven by error. We are aware of, or attend to, or think about, or narrate, that place in which the greatest error (and error does not mean "bad") occurs at any point in time. This is very consistent with Gazzaniga's [21] stance that the brain works automatically. PCT's contribution is to explain *how* the brain works automatically.

Rethinking the first-person perspective and the third person perspective

Chalmers maintains that understanding the first-person perspective is at the heart of the science of consciousness [2]. In this regard, PCT offers an approach that could provide the new first-person methodologies that Varela claims we need [2]. PCT is very much an explanation of behavior from the first-person perspective, however, it brings rigor to the first person perspective through its emphasis on building functional models that simulate the phenomena being investigated. Because control systems control their input rather than their output, we cannot make assumptions about another person's conduct simply by noting the way they act or speak. In PCT research, determining what someone else is doing certainly involves observing their behavior but it also involves generating hypotheses and introducing disturbances systematically to refute or confirm the hypotheses. PCT research activity focusses on understanding the input that is controlled rather than categorizing the output that is produced. Given the relationship between the output and the environment, qi = a + d, observing changes in the system's output tells you more about current changes in environmental conditions than it does about the internal state of the system.

PCT, in fact, challenges the very way in which research is conducted. Currently, we are in the position of observing and measuring a research participant's *output* as a way of understanding their experience. This introduces a paradox. All

that a researcher has access to is research participants' observable behaviors, however, all that research participants have access to are their own private perceptions. Even if they provide reports to the researcher, all they can report on are their own perceptual experiences. Research from a PCT perspective, therefore, would focus on understanding controlled variables rather than the manipulation of independent variables and the measurement of dependent variables.

Rethinking zombies

The thought experiment of zombies is another non-problem from within a PCT framework. Given the way in which a control system is organized and interacts with its environment, it is inconceivable for there to be a creature that can control but that is empty inside the system. A brief return to **Figure 1** will confirm that it would be impossible for a zombie to act and talk and behave in the same way as a living person *but be empty on the inside*. Being empty on the inside would essentially involve erasing the top half of **Figure 1.** Understanding that people are living control systems and appreciating how control systems are organized allows the zombie argument to disappear.

Rethinking free will

PCT provides substance and coherence to the arguments that suggest free will is another illusion we have created such as Gazzaniga's [21] position that free will is a "miscast concept" (p. 219). Each of us is a network of massively connected control systems. As such, we control the perceptions that are specified within that network.

We can also clarify the difference between freedom and free will from a PCT perspective. When considering people as controlling agents, being free means being in control [29]. A big problem for controllers is having their ability to control restricted or diminished in some way. In fact, PCT provides a blueprint for successful social living which is for each of us to find a way of controlling the things that are important to us without preventing other people from doing the same thing. Freedom or autonomy, therefore, are important considerations for living control systems and PCT provides a framework within which the impact of such things as impoverished environments can be more fully appreciated. Control, for example, is central to the social determinants of health [30].

Free will, however, implies arbitrarily deciding any course of action. Having free will seems to suggest that a Hindu could decide to live as a Christian for the weekend or a Vegan could choose to order the pork belly with caramel dressing while dining at a restaurant. Decisions and options can only ever be made from within our own perceptual hierarchy. PCT, therefore, introduces the rather enigmatic situation that organic control systems are autonomous and need freedom to function optimally, but they do not have unrestricted free will.

While people need freedom to control the things that are important to them, their freedom to act in certain ways is always constrained by other goals they have. Thus, there is always a *relativity* [20,29] to the goals about which we are organized. So, my freedom to use force to take as much money as I want from a bank is constrained by *my own* goals about avoiding arrest, staying out of jail, and maintaining an existence as a law-abiding citizen. A person's propensity to speak their mind might be pursued *relative* to other goals concerned with social acceptance and the maintenance of friendships.

Rethinking stimulus and response

The framework of PCT provides an opportunity to revise the language that is used as well as the concepts that are adhered to. Gazzaniga [21] suggests we need a new language to describe the reciprocal influence of mental processes and the brain. Here, Gazzaniga [21] is referring to the mind/brain distinction in which something we call a "mind" emerges from the processes of a physical brain. The new language that is needed could be the language of control and circular causality introduced by PCT.

The reason that the terms "stimulus" and "response" have been so difficult to define unambiguously is because, from a PCT perspective, they don't exist. The reason that there is no one-to-one correspondence between a "stimulus" and a "response" is because environmental events can only be disturbances to controlled states of the system or part of the system's feedback function (how output is connected back to input). From a PCT perspective we are not shackled by environmental stimuli [31]. When a state which is being controlled is disturbed, the system will act to correct that disturbance but, since the actions are not being controlled, they will vary depending on the circumstances of the environment. Therefore, there is no unique one-to-one mapping of the brain's activities and the output of the individual [32]. PCT, therefore, enables a different perspective on events previously considered to be repeated stimulation from an independent source. What is *observed* to be repeated stimulation from an external perspective may or may not be *experienced* as repeated stimulation from the point of view of the individual being "stimulated".

Concluding Remarks

PCT offers a new approach to understanding consciousness. On a general level, the first person perspective of PCT and the rigorous scientific methods it employs provide a useful way of bridging scientific and philosophical discourses. If philosophy is understood broadly as the examination of general and fundamental problems concerning matters such as existence, mind, reason, and consciousness, given what has been outlined in this paper, the contribution of PCT might become apparent. By conceptualizing life as autonomous, organic control, and understanding the implications of this particular form of conceptualization such as control of input and circular causality, philosophers have a new framework from within which to consider some of their most vexing puzzles.

By supposing that the activity of living is a process of control, and by understanding control as the varying of motor output to maintain perceptual input in stable reference states, the mystery of consciousness dissolves. The beauty, however, can remain. Even though we now understand that the earth orbits the sun rather than the other way around, we still refer to sunrises and sunsets and we still marvel at their magnificence. Control is one of nature's greatest accomplishments and consciousness as a controlled perception may well be the most stunning of our human perceptual capabilities.

References

1. Dennett D (1991) Consciousness explained. Penguin Books, London, UK.
2. Blackmore S (2005) Conversations on consciousness. Oxford University Press, Oxford, UK.
3. Powers WT (2005) Behavior: The control of perception (2nd edn). Benchmark, New Canaan, CT, USA.
4. Blackmore S (2005) Consciousness: A very short introduction (Very Short Introductions). Oxford University Press, Oxford, UK.
5. Powers WT (1986) Intentionality: No mystery. Beh and Brain Sci 9: 152-153.
6. Damasio A (2010) Self comes to mind: Constructing the conscious brain. Pantheon Books, New York, USA.
7. Deacon TW (2012) Incomplete nature: How mind emerged from matter. W. W. Horton & Company, New York, NY, USA.
8. Carey TA, Mansell W, Tai SJ (2014) A biopsychosocial model based on negative feedback and control. Front of Hum Neurosci 8: 94.
9. Marken RS (1989) Behavior in the first degree. In WA Hershberger (Ed) Volitional action: Conation and control. Elsevier, Amsterdam, Netherlands. pp 299-314.
10. Marken RS (2013) Making inferences about intention: Perceptual Control Theory as a "Theory of Mind" for psychologists. Psych Rep 113: 1269-1286.
11. Powers WT (1990) Control theory: A model of organisms. Sys Dyn Rev 6: 1-20.
12. Powers WT (1992) Some implications of feedback theory concerning behavior. In WT Powers, Living control systems II: Selected papers of William T. Powers. Control Systems Group, Gravel Switch, USA. pp: 1-10.
13. Powers WT (2008) Living control systems III: The fact of control. Benchmark, New Canaan, USA.
14. Graziano M (2016) Most popular theories of consciousness are worse than wrong: The play to our intuitions, but don't actually explain anything.
15. Maxwell N (2011) Three philosophical problems about consciousness and their possible resolution. Op J Phil 1: 1-10.
16. Morsella E, Krieger SC, Gray JR, Bargh JA (2009) The essence of conscious conflict: Subjective effects of sustaining incompatible intentions. Emotion 9: 717-728.
17. Robinson DN (2008) Consciousness and mental life. Columbia University Press, New York, USA.
18. Powers WT (1989) Degrees of freedom in social interactions In WT Powers, Living control systems: Selected papers of William T. Powers. Control Systems Group, Gravel Switch, KY, USA. Pp 221-235.
19. Velmans M (2009) Understanding consciousness (2nd ed). Routledge, East Sussex, UK.
20. Powers WT (1989) An outline of control theory. In WT Powers, Living control systems: Selected papers of William T. Powers. Control Systems Group, Gravel Switch, KY, USA. pp 253-293.
21. Gazzaniga MS (2011) Who's in charge: Free will and the science of the brain. HarperCollins, New York, USA.
22. Blackmore S (2012) Consciousness: An introduction (2nd ed). Oxford University Press, New York, USA.
23. Hofstadter D (2007) I am a strange loop. Basic Books, New York, USA.
24. Jaynes J (2000) The origin of consciousness in the breakdown of the bicameral mind. Mariner Books, New York, USA.
25. Powers WT (1992) Control theory, constructivism, and autopoiesis. In WT Powers, Living control systems II: Selected papers of William T. Powers. Control Systems Group, Gravel Switch, KY, USA. pp 175-188.
26. Nagel T (2000) What is it like to be a bat? In DR Hofstadter and DC Dennett (Eds.), The mind's I: Fantasies and reflections on self and soul. Basic Books, New York, USA. pp 391-403.
27. Humphrey N (2011) Soul dust: The magic of consciousness. Quercus, London, UK.
28. Robertson RJ (1990) New views on some perennial problems. In RJ Robertson and WT Powers (Eds), Introduction to modern psychology: The control-theory view. Control Systems Group, Gravel Switch, KY, USA. pp 209-219.
29. Marken RS, Carey TA (2015) Controlling people: The paradoxical nature of being human. Australian Academic Press, Samford Valley, Australia.
30. Marmot M (2015) The health gap: Improving health in an unequal world. Bloomsbury, London, UK.
31. Gazzaniga MS (1989) Organization of the human brain. Science 245: 947-952.
32. Hood B (2012) The self illusion: Why there is no 'you' inside your head. Constable & Robinson, London, UK.