The Survival Value of Informed Awareness

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Abstract

Various hypotheses about the importance of psycho-neural concomitants are reviewed and their implications discussed for the "easy" and "hard" problems of consciousness—especially, as viewed by cognitive and ecological psychology. In Ecological Psychology these concepts meld into *informed awareness*, and are argued to play an important, perhaps, indispensable role in goal-directed actions and thus to have survival value. The significance of informed awareness is illustrated in several real-world goal-directed tasks.

Introduction

"Perhaps no aspect of mind is more familiar or more puzzling than consciousness and our conscious experience of self and world" (Van Gulick, 2004, p. 1).

This pessimistic appraisal is not overstated; for philosophers have argued for centuries about the nature of consciousness without reaching a consensus—disagreeing whether consciousness entails mind-body dualism, physical reductionism, or epiphenomenalism. More recently, materialists and radical behaviorists have argued that consciousness does not exist, while logical positivists, seeing its verification so problematic, banished it to the limbo of meaningless concepts. In the current climate, however, consciousness is treated with more deference, being recognized as a problem uniting psychology, neurophysiology, cognitive science, and even physics.

This revival of interest owes much to the seminal work done in Europe more than a century ago by Wilhelm Wundt, the father of experimental psychology, and by his brilliant English student, Edward Titchener, who imported these interests into America. Other hypotheses about consciousness are also discussed that help set the stage for the hypothesis eventually introduced.

The so-called "easy" and "hard" problems tie together many of the historical threads— from Wundt and Titchener to Chalmers and Gibson. We follow these threads and knit them together to form the fabric of our own thesis that consciousness construed as *informed awareness* has survival value. Where traditional approaches emphasize the phenomenology of consciousness, its contents, referents and neurophysiological support, our emphasis is different. Instead, we focus on the putative pragmatic value of

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consciousness that allows agents to notice the information needed to remain adaptive in a complex and challenging environment. In brief, we argue that where determining the nature of consciousness has proven difficult—even intractable, studying its ecological significance (at least in many cases) seems straightforward. Examples are discussed that support this idea.

The paper is in three parts: Part I introduces historical analogs of the easy and hard problems of consciousness and discusses implications for contemporary approaches. Part II discusses the pragmatic and evolutionary implications of information and consciousness when construed by ecological psychology as "informed awareness." Finally, Part III presents our thesis and evaluates its implication for consciousness studies.

Part I: Consciousness: Approaches and Problems

Wilhelm Wundt (1832-1920) resisted the lure of scientific materialism spawned by the success of classical mechanics, and in 1879 founded the first experimental psychology lab in Leipzig. Because of its scientific pretensions, his laboratory soon became the Mecca for scientists who wished to study mind. Wundt made a succinct and incisive argument opposing reductionism thusly: "Materialism is contradicted by the fact of consciousness!" He then initiated a monumental experimental program called *voluntarism* (sometimes wrongly identified with later "structuralism") with two main goals: first, to discover all simple constituents of experience and, second, to formulate laws for combining those constituents into complex ideas—a process called *creative synthesis*, or, alternatively, *psychic resultants*.

Creative synthesis included the combining of simple passive ideas by association and an active process of apperception. This process was similar to John Stuart Mills "mental" chemistry where something new emerges from combining parts into a whole. This active process is a person's volition to focus thinking in a logical and meaningful direction. Because voluntary purposive thinking was central to his concern, Wundt called his approach *voluntarism*; and defined psychology as the study of consciousness of all things—eschewing the distinction between inner and outer experiences as being artificial.

Wundt provided guidelines by which participants could give precise reports of their immediate experiences. Unfortunately, this method failed to replicate over laboratories, or even over expertly trained experimenters within the same laboratory. Thus in spite of its worldwide appeal, voluntarism was eventually rejected as a failed attempt to elevate the study of consciousness to being a science. Nevertheless, despite its ultimate failure, Wundt's program had a lasting influence on the new field's attitude toward the study of mind—if not on its methods.

In 1892 E. B. Titchener, Wundt's brilliant English student, transported the voluntarist program from Leipzig to Cornell University in America, where he added a plank to its platform and renamed it *Structuralism*. Unlike Wundt, he insisted that the introspective

search for simple mental aspects and their laws of composition should be supplemented by a search for their neural correlates. Titchener also rejected Wundt's notion of 'creative synthesis' of mental contents as being a mistake that made consciousness study unscientific.

To counter creative synthesis, Titchener introduced the concept of the "stimulus error." The *stimulus error* is committed whenever mental experiences are described by meaningful conventional labels, such as, 'the smell of roses,' 'the taste of honey,' a person of tall stature,' 'the sound of a waterfall,' etc. Instead, one should describe experiences solely in terms of their simplest attributes: color, texture, potency, etc. Examples of the stimulus error were,. Wundt retaliated against Titchener's exclusion of psychic resultants by claiming this made psychology sterile, eliminating its most fundamental character and significance.

Voluntarism and Structuralism were gradually diluted by the eclecticism of functionalism, which allowed introspection, behavioral methods, or any other method deemed useful. Their demise was virtually complete by the time Behaviorism prospered. Still, fascination with consciousness did not disappear from scientific psychology any more than it did from folk psychology. In fact, over the ensuing years, interest has waxed more than waned, no doubt because scientists and nonscientists alike find that introspection is as natural as it is unavoidable. Where the cognitive revolution of the 1960's reclaimed consciousness studies, current cognitive neuroscience has successfully promoted it. However this is not to say the issue of its scientific legitimacy has been completely settled or its character well understood. Efforts continue.

The Easy and Hard Problems

Chalmers (1996) has identified two problems faced by serious students of consciousness—the "easy" problem and the "hard" problem. The beauty of this distinction is that it portrays the conflicted concerns of Wundt and Titchener in a new light and channels renewed interest in solving these two perennial problems. Solution to the hard problem involves discovering the alignment between experiences and their concomitant neurological events, an effort with which Titchener would have strongly concurred. By contrast, solving the "hard" problem assumes solution to the "easy" problem but goes beyond mere correspondence to show how the character of experience necessarily derives from the character of physiological events (Figure 1).

> **The "easy" problem:** *Y corresponds to Z;* does not entail *Y resembles Z.*
>
> **The "hard" problem:** *character of Y resembles character of Z;* entails *Y corresponds to Z.*
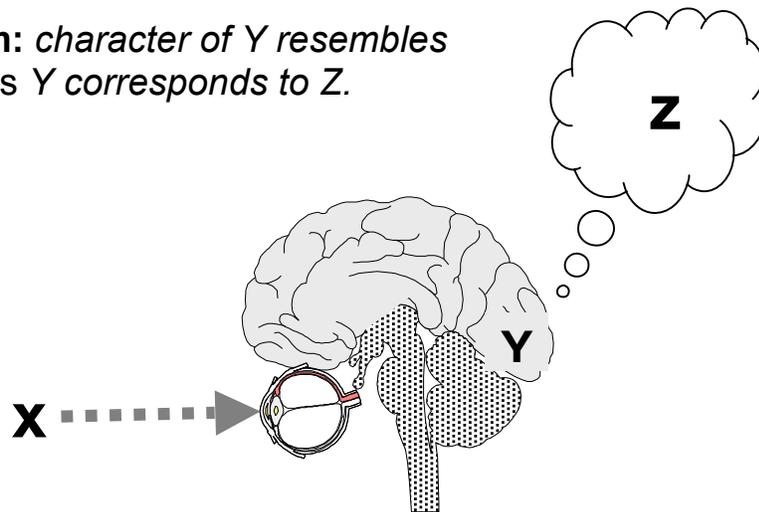>
> **Z**
>
> **Y**
>
> **X**

Figure 1: The "Easy" and Hard" Problems Illustrated.

Although Wundt did not seek neurological foundations for experience, he should have liked the hard problem. For its existence seems to vindicate the need for a process of creative synthesis—but one capable of extracting a super-resultant from superposing inner psychical resultants and outer neurological resultants. Still, though Wundt might eventually have come to appreciate the hard problem, so Titchener would have continued to disdain it for encouraging the stimulus error and thus, in his mind, posing a thwart to achieving a science of consciousness.

Ironically, by broadening of this process, Wundt would simply have re-discovered the Gestaltist's principle of Psycho-neural Isomorphism. This principle says the character of ". . . molar events in experience are structurally identical to the corresponding molar physiological events in the brain" (Henle, 1928, p. 25). This is of course a neurological interpretation of the Fechner-Spinoza Concomitancy Hypothesis mentioned earlier, which hypothesizes an in principle basis for solving the "hard" problem but fails, as do all known concomitancy hypotheses, to offer any practical guidelines for actually identifying the concomitants.

A deeper problem is the likelihood that localization of concomitants is a faulty concept. For if the concomitants are functionally distributed over many locations, or worse, vary over time, then finding them might not be feasible. The Gestaltist's dynamical field concept seems more promising but has different limitations (Kadar and Shaw, 2000; Lehar, 2003).

Other hypotheses for resolving the problem of consciousness are the Fechner-Spinoza Concomitancy Hypothesis and James' Neutral Monism. These alternative hypotheses

however postulate a solution to the problem rather than finding one. Gustav Fechner, like Spinoza, postulated the existence of a psychophysical correspondence—a restatement of the "easy" problem rather than a scientifically earned solution. It asserts, *for every physical event there is a concomitant mental event, and for every mental event there is a concomitant physical event* (Bain, 1873). At best, it assumes license for a neuropsychological fishing expedition to find valid inner and outer event pairings and avoids the issue of how experience arises, where its content comes from, and only addresses those aspects of the physiological processes to which an experience corresponds.

The English philosopher, Bertrand Russell (1927), offered a variant on William James' Neutral Monism. Russell's view is admirable for its clarity and brevity: *The brain is the mind looked at from the outside and the mind is the brain looked at from the inside.* This is a kind of perspectival 'realism'—instead of mind-body dualism where there are two incommensurate *kinds* (of fundamental 'stuff'), there is a single 'kind' viewed from two different perspectives. This view is consistent with Wundt's claim that there is really no difference between "inner" and "outer" experiences with respect to 'kinds' but goes beyond Wundt in claiming there is a significant difference between perspectives that most philosophers take as different 'kinds.' Again, this is not a solution to the easy problem but a way of explaining away any need for a solution. Since the perspectives are assumed to share the same neutral referent, they cannot help but be coordinated.

Unfortunately, this view either exacerbates the hard problem or trivializes it. It exacerbates it by treating the perspectives as so different the mind-body problem is unavoidable; or trivializes it by emphasizing that since the two perspectives derive from the same neutral object, their characters do not differ in kind. Hence this hypothesis hardly seems helpful.

A facile solution to both the easy and hard problems, respectively, would be to somehow combine the concomitancy hypothesis with the perspectival realism hypothesis and thereby cover our bases. For this strategy to work, the "somehow" would have to be principled; *the character of the correspondence would have to guarantee the correspondence of the characters.* To do so, the meaning of the experience would have to pick-out the corresponding neurological event and the character of the neurological event would have to pick-out the corresponding meaning. Unfortunately, nothing in either hypothesis tells us how this might be done. Let's examine this criticism more closely.

Concomitancy, or correspondence, entails nothing more than correlation between two series and says nothing about the character of the items correlated—whether the pairing is mental-physical, mental-mental, physical-physical, or even a meaningless abstract-abstract pairing. Perspectival realism fairs no better; for there must be something which coordinates contrasting perspectives by anchoring them to something that is not itself a perspective. A perspective of a perspective makes no sense; every perspective must have an object which it relates to an observer. No observer, no perspective and no object, no perspective. Perspective-taking requires the observer

taking the perspective, the object on which the perspective is taken, as well as of course the perspective itself.

Finding no help from these views, where do we go from here? Next, we will consider the easy and hard problems from the perspective of ecological psychology. Can such a reformulation fare any better?

Part II: Informed Awareness

The fact that creatures (e.g., humans, others?) experience conscious awareness is still somewhat an evolutionary mystery, although many reasonable hypotheses have been offered. One hypothesis about the 'why' of consciousness is that it helps integrate global information and allows focusing in on specific information that remains on call but pre-conscious. "The information carried in conscious mental states is typically available for use by a diversity of mental subsystems and for application to a wide range of potential situations and actions" (Baars, 1988).

Another possible function it serves is making control more flexible and sophisticated, hence more adaptive. Also, it is believed that unconscious automatic processes may be more efficient and rapid than conscious processes, they also seem more rigid and predetermined (Anderson, 1983). Typical accounts of skill learning or its tuning by monitoring subtleties to be exploited or avoided give conscious awareness a central, even necessary role to play (Schneider and Schiffrin, 1977). Thus consciousness may be the most important ingredient in dealing with the unpredictable, novel, or unexpected—those unplanned for occurrences (Penfield, 1975; Armstrong, 1981).

Ecological psychology would agree generally that conscious awareness facilitates the detection and use of information; in principle, it can improve its integration, specification, interpretation, application, and generalization, as well as making control more flexible and coordinated over a wider range of situations and tasks. Including all these, ecological psychology places special emphasis on the adaptive value of being aware of ones needs, wants, intentions, preferences, values, priorities, and goals with respect to actual or potential situations. A deliberate decision is made to move from consciousness as an intransitive state to awareness of something, where the greater the ecological significance of this something, the more likely it will be attended to. Gibson (1979) explains it this way:

"Perceiving is an achievement of the individual, not an appearance in the theater of his consciousness. It is a keeping-in-touch with the world, an experiencing of things rather than a having of experiences. It involves awareness-of instead of just awareness. *It may be awareness of something in the environment or something in the observer or both at once*, but there is no content of awareness independent of that of which one is aware" (Gibson, 1979, p.239; emphasis added).

To introduce the easy and hard problems into ecological psychology, certain fundamental concepts are needed. Using these concepts, our strategy will be to

structure problems in a way that provides sites where awareness serves the perceptual control of intended action.

The hypothesis of the concurrence of the two kinds of information coordinates the inner and the outer sources of information without intending any recourse to dualism. It is the relationship, rightly or wrongly, upon which the conclusion that perception can be *direct* was drawn (not assumed as commonly believed. See Shaw, 2003, for this argument). Gibson's elaboration of this reciprocity also suggests one way that the easy problem might be addressed. Since reciprocal relationships are *one-to-one* and *onto* they define a correspondence.

This reciprocal relationship addresses the easy problem but, as it stands, it does not yet address the hard problem. To address the hard problem, the information about the self and the information about the environment must share a dimension of mutual information. Where the key ingredient of the easy problem is reciprocity, the key ingredient of the hard problem is mutuality. Two things are *reciprocal* if reference to one entails reference to the other—a purely formal relationship, while two things are *mutual* if they resemble one another in some way—a shared dimension of meaning; hence a semantic relationship. From a mathematical point-of-view, a relationship that is both mutual and reciprocal is called a *duality*—not to be confused with the philosophical notion of dualism where, because two things are fundamentally incommensurate kinds, they are essentially unrelatable.

The next quote from Gibson makes it clear that dualism is not intended. Rather he refers to reciprocity, or the concomitancy, as demanded of the easy problem, as also being mutuality, or resemblance, as demanded of the hard problem:

"But they [self-experiences] should not be thought of as a different realm of existence or a different kind of reality than the ecological, nor are they "mental" as against 'physical. . . . Awareness of the persisting and changing environment (perception) is concurrent with the complementary awareness of the persisting and changing self . . . (Gibson, 1978." Cited in Reed & Jones, 1982, p. 418)

Or, even more explicitly, Gibson says:

"What a thing is and what it means are not separate, the former being physical and the latter mental, as we are accustomed to believe. . . . The perception of what a thing is and the perception of what it means are not separate, either" (Gibson, 1971. Cited in Reed & Jones, 1982, p. 408).

 "An important fact about affordances of the environment is that they are in a sense objective, real, and physical, unlike values and meanings, which are often supposed to be subjective, phenomenal, and mental. But, actually, an affordance is neither an objective nor a subjective property; or it is both if you like. An affordance cuts across the dichotomy of subjective-objective and helps us to understand its inadequacy. It is both physical and psychical, yet neither. An affordance points both ways, to the environment and to the observer" (Gibson, 1979/1986, p. 129).

Ecological psychology is science of agents—individuals whose actions are successful if they maintain appropriate contact with a potentially changing reality where threats and opportunities abound. On the spot, opportunistic awareness of what is changing and what is persisting is demanded for doing so. Direct perception is evolution's way of allowing agents to maintain "situational awareness" so that its actions are appropriately grounded by the detection of the relevant invariant information. In short, grounded situational awareness is the agent's direct perception of what surrounds it, what is changing, and what is emerging (Shaw, 2003).

The general sense of the ecological approach—its assumptions, aims, and problems—can be obtained by taking a moment to ponder the quote with special attention being paid to the terms emphasized. Roughly, if in the above quote, one replaces the phrase "direct perception" with "noticing" little meaning is lost. An agent must notice environmental 'objects' with their parameters—i.e., what it is, where and when it is, what actions it affords, etc. defined relative to the agent and its parameters—i.e., body dimensions, needs, wants, etc. Of course, *to notice* is synonymous with *to be aware of*. Noticing object parameters is to be aware of information, or, more briefly, to exhibit informed awareness.

If evolution produces agents with the capabilities for survival, then there must have been functional and anatomical properties selected for. To the critic who wrongly surmises that ecological psychology has nothing to say about the brain and other physiological processes, Gibson wrote a whole book on the subject to clarify his position (Gibson, 1966). Here is a good summary statement:

"What might be a physiological or functional equivalent of the external information, if it cannot be anatomical? How could invariants get into the nervous system?" (Gibson, 1966, p.4). . . . Instead of looking to the brain alone for an explanation of constant perception. It should be sought in the neural loops of an active perceptual system that includes the adjustments of the perceptual organ. Instead of supposing that the brain constructs or computes the objective information from a kaleidoscopic inflow of sensations, we may suppose that the orienting of the organs of perception is governed by the brain so that the whole system of input and output resonates to the external information. . . . The function of the brain is not even to organize the sensory input or to process the data, in modern terminology. The perceptual systems, including the nerve centers at the various levels up to the brain, are ways of seeking and extracting information about the environment from the flowing array of ambient energy (Gibson, 1966, p. 5).

Not just information about the environment, of course, but information about oneself in relation to that surrounding environment as well. Figure 2 illustrates how information, awareness, and control interrelate to make an agent.
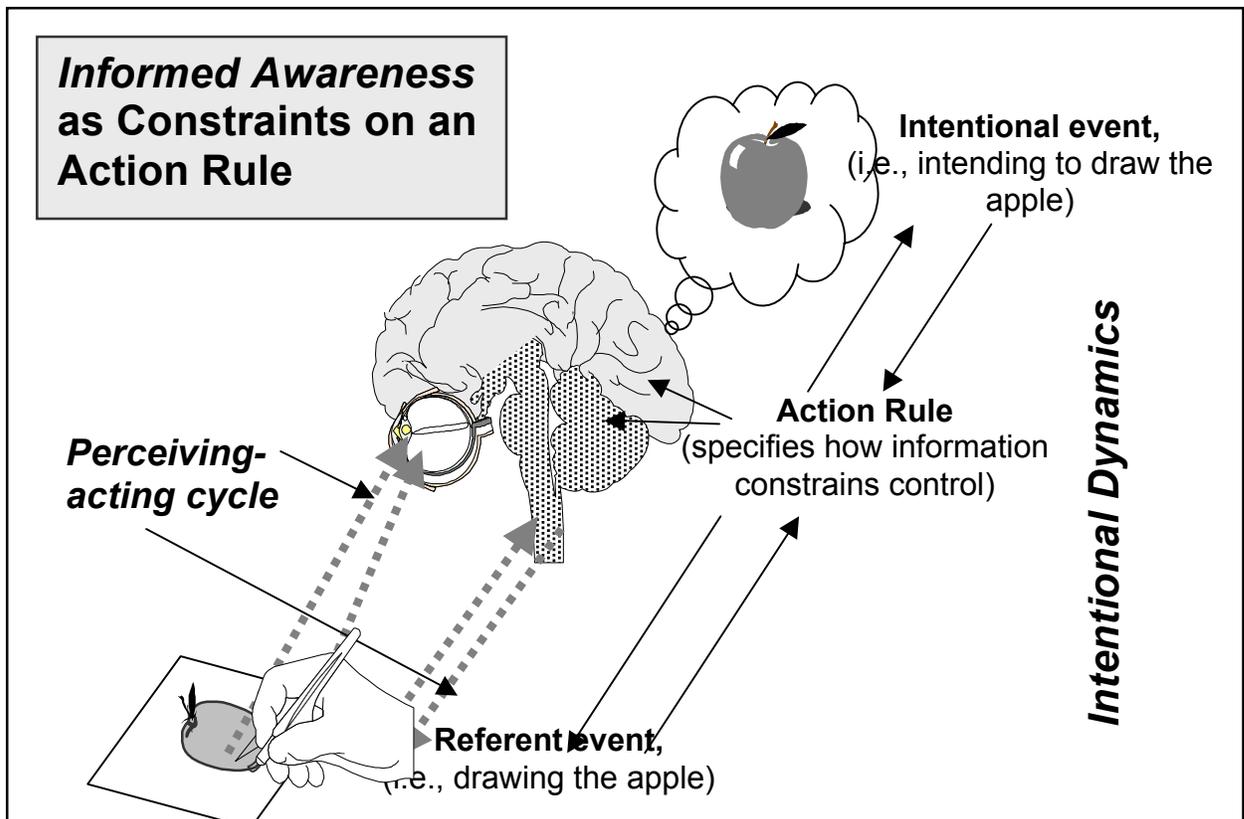
Figure 2: How an Action Rule is embedded in the ecological system with respect to information and control, intention and goal, and neuro-physiological support.

Part III: Thesis and Illustrative Cases

Gibson's rationale for characterizing perception as direct rather than indirect, or immediate rather than mediated, was to avoid Locke's problem: If to be aware of the world we must first be aware of our own ideas, then how do we ever get past the ideas to be aware of the world? If we cannot tell the difference between our ideas about the world and our made-up ideas, then how can we ever check the validity of our beliefs about the world against what is actually true? And, finally, if the above ignorance is inevitable, then how do we avoid solipsism—the belief that we are the only reality, and that it is of our own making?

This is not the place to defend this thesis that if perception were direct, then knowledge of the world would be possible, otherwise not. Rather we introduce the issue primarily to clarify a chief characteristic of ecological psychology that tends to be misunderstood because of the field's bias in favor of representational, or indirect, realism. It would be helpful if examples might be cited where direct perception seemed plausible. Here are a few candidate cases.

Case 1: Probing a cavity. Here is perhaps the simplest case of direct perception. I perceive the shape of the cavity in my back molar by probing its boundaries with a three

inch metal pick. Clearly I am in contact with this dental tool, which is in contact with my molar's cavity, but I am also in contact with my tooth. How can this be? It can because the probe (tool) is infomationally transparent to the object probed so that the probing action is guided by the geography of the cavity. To the extent that the probe is not transparent to this information to that extent the agent lacks the requisite informed awareness for success.

Let's generalize this case. Primary to direct perception is the demand that the medium (probe) be transparent to the flow of information specifying the target (cavity) to the agent. To be direct is an all-or-nothing proposition. For example, a ship whose signal gets weaker and weaker as it gets farther and farther from the shore remains in contact with its shore base so long as the signal can be detected. In general, it does not matter how remote the target is so long as the signal-to-noise ratio is favorable throughout the medium. Specification fills the gap regardless of its breadth or the complication of the medium. It could include the central nervous systems, tools, or other linkages, such as air or water in the case of optical information about a source.

Case 2: Intercepting a Target. Imagine that a pilot of a boat is given the task to intercept another boat. Is there a simple rule the pilot might follow that would guarantee a successful interception—even if the boat pursued carried out radically evasive maneuvers? There is and it goes like this: Select a mark on the windshield of your boat to be the foot of an imaginary lead-vector which you adopt as a sightline intersecting the other boat. So long as you keep the other boat targeted by the sightline, and keep your boats speed up, then regardless of what evasive actions taken, the other boat will eventually be intercepted. Minimally:

Keep your sightline zeroed in on the target boat!.

The concept of an action rule does not entail the rule to be a mediator of the action—either causally or psychological. Rules, as the philosopher, Wittgenstein taught us, can either be involved in an action as when you follow a recipe in cooking or a map when traveling, or be entailed by the action in the sense that it describes the constraints that are always observed to be satisfied when the action succeeds. Construed in this latter way, a rule for action expresses the invariant information to which an agent's control acts should conform, that is, the rule is a *control law*. A theory of how such action rules accomplish their ends is called *intentional dynamics*. Here, information and control are shown to be mutual and reciprocal just in case the action succeeds (Shaw et al. 1988,1992; 2003).

Case 3: Controlled Descent. Assume a helicopter flight instructor has the task of teaching novice pilots how to make a safe vertical landing. Is there a simple Action Rule that might help them succeed? Indeed there is one actually used by flight instructors: As you descend *keep the optic flow rate constant and expanding symmetrically around the target!* To succeed, a pilot must have informed awareness of the craft, landing target, and wind conditions. For the quick and subtle control responses called for, the information detected must be immediate and direct (Figure 2).
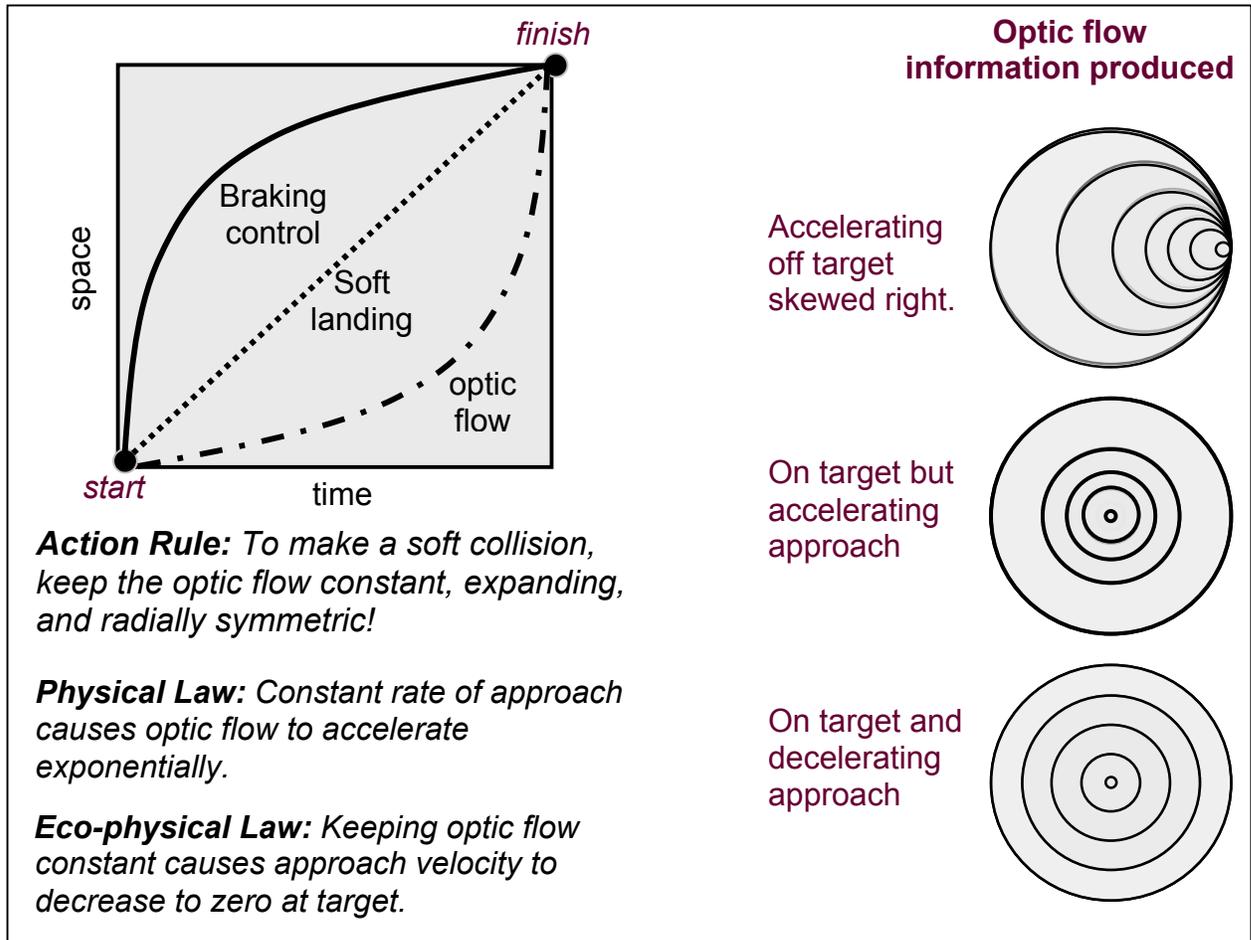
Figure 2: Action Rule as the Coupling of Physical and Ecological Laws

We have now established the background needed to motivate our thesis, which can be summarized in an anecdote. A chronically color-blind girl, Mary, undergoes a new treatment that allows her to see the color red. Would this new-found perceptual ability make her more fit to survive? She lives on the coast and loves to swim in the ocean. One summer a dire warning is issued by the Center for Disease Control to avoid contact with a deadly red tide (mutant red algae) that causes a fatal infection. Clearly, Mary, who swims in the ocean daily, would be at greater risk before treatment than after treatment since then she could recognize the danger and avoid it.

This anecdote indicates how incredibly important awareness of information can be for survival—even a single invariant environmental property can matter. Here the color red does. With enough individuals producing off-spring who can stave off a threat—such as the red tide—long enough to procreate, the doctrine of the survival of the fittest is satisfied and natural selection exploited. The psychological capacity of informed awareness seems as likely a heritable trait as any biological ones.

In addition to its survival value, agents capable of responding to imminent threat quickly have a clear advantage over those who cannot. Both blindness to threats and

inefficiency in response to them can cost a species survival advantage; they both can reduce the number of progeny available to procreate and thus reduce the likelihood that the gene pool is biased in favor of the trait. Response efficiency also endows the agent with an edge in competing for scarce resources. In short, the cost of inefficiency is a relevant variable in calculating the likelihood estimates for an agent thriving or even surviving.

In summary: To survive, organisms must be both biologically fit and psychologically viable. They are biologically fit if they are self-sustaining and psychologically viable if they are competent to care for their needs and tend to their wants. In addition, they must live within a congenial environment—that is, one with appropriate resources, and which poses no insurmountable obstacles to the felicity of actions aimed at obtaining them.

More explicitly, satisfying these conditions, presupposes that agents must be aware of several kinds of information:

- information specifying their vital needs or they would not be motivated to satisfy them;

- information specifying goals that afford fulfilling such needs or they would have no opportunity to choose to act toward them;

- information specifying effective means at their disposal or they could not choose to act appropriately;

- information specifying how well they enact those means or they could not control them;

- information specifying their progress toward the goal or they would not know when to alter their course or stop.

Thus a system without awareness of these sources of information could be neither fit nor viable and would not survive.

One of the most intriguing arguments in favor of the survival value of informed awareness is the following: If consciousness contributed nothing to survival of the fittest, then there would be no reason for its natural selection; but conscious life forms did in fact evolve. Therefore, consciousness must have survival value. Assuming consciousness had no survival value, shouldn't we expect nonconscious humanoid species equivalent in fitness to conscious humans to be equally abundant today. But since no such zombie humanoids have appeared, consciousness must have survival value. This is the 'baby' form of the Anthropic principle which generalizes this argument to the universe being fit as a home for conscious life forms—cosmic consciousness studies if you will—but his is another story.

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