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Do We See Icons or Reality? A Review of Donald Hoffman's *The Case Against Reality*

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Imagine looking at a computer desktop. You see various icons that you can modify, move around, stick into folders and delete. The desktop is a type of reality. If you wanted, you could formulate an ontology and epistemology, or laws explaining the behaviour of icons, images and the like. But the icons are not what is really happening in your computer. For that, you need to enter a different world, composed on microcircuits and tiny movements of electrons. In contrast to microelectronics, the desktop is a convenient way of interacting with your computer. Trying to understand the underlying reality would slow you down dramatically. So you start treating the desktop as reality, yet it's only an interface.

Now imagine that every object that you see—an apple, a phone, your hand—is analogous to an icon on a computer desktop. You see something that makes it possible to operate effectively, but you don't see reality.

This is the argument made by Donald Hoffman in his thought-provoking book *The Case Against Reality: How Evolution Hid the Truth from our Eyes.* Hoffman is a professor of cognitive sciences at the University of California, Irvine, and has studied perception by humans and other animals. He presents a comprehensive argument that we don't see or otherwise sense reality, but only an interface with reality. He calls this perspective the Interface Theory of Perception—ITP. Throughout his book, he uses the computer desktop metaphor.

In support of his perspective, he cites a theorem called Fitness Beats Truth—FBT. Using evolutionary game theory, it's possible to show that a perceptual system designed to recognise what is useful to survival will nearly always beat a perceptual system that sees the truth. Hoffman's argument is that, as the result of evolution, our entire perceptual apparatus, namely the way that our minds interpret sensory inputs, is designed for fitness, not to reveal the truth.

Scientists in various fields have developed models of the world that differ considerably from everyday perception. Physicists tell us that objects are made up of atoms, which are made up of protons, neutrons and electrons, and which in turn are made up of other more fundamental particles. This means that a chair is actually mostly empty space; it only appears solid. Physicists also tell us that light is an oscillating electrical and magnetic field, or alternatively particles called photons, and that the light we can see is only a tiny portion of the electromagnetic spectrum. From a physicist's perspective, we don't see all of reality; special instruments are needed to access much of what is invisible to us. In this context, ITP may not seem so strange.

The driver behind Hoffman's concerns is the problem of consciousness. He canvasses the standard views and finds them wanting. For example, he says that no standard perspective begins to provide the mechanisms in the brain that create the conscious experience of the colour red. Rather than pursue the usual approaches, Hoffman says that to figure out the relationship between consciousness and the brain, there is a fundamental assumption that needs to be jettisoned: the assumption that we see reality the way it really is.

Beauty and Survival

Hoffman presents Interface Theory of Perception (ITP) via a series of themes involving perception, including beauty, illusions and polychromy. Consider beauty: how can a person's judgement of what is attractive be related to activity in their brain? Scientists, Hoffman says, are making progress in understanding the neural mechanisms behind assessments of beauty, but not on the conscious experience of beauty.

Hoffman describes the standard view that perceptions of beauty are the result of a perceptual system that evolved for survival. He cites studies of the role of the limbal ring, a feature of the eye, in influencing assessments of a person's attractiveness. The significance of the limbal ring in beauty can be attributed to evolution: the ring is linked to a person's age and health.

Hoffman says beauty is in the eye of the beholder. Many will go along with this. He then takes the radical step of saying that objects and spacetime are also in the eye of the beholder.

According to Hoffman, most people are "metaphysical realists," believing in the continuity of objects when they are not being observed. "We believe that experience accurately depicts the thing-in-itself" (43). This is where Hoffman brings in the Fitness Beats Truth (FBT) theorem, which says natural selection shapes perception for the purpose of fitness, not replicating objective reality.

Fitness enables an organism to survive and reproduce, but evolutionary theory says nothing about whether the development of perceptual capacities necessarily tailors them to register reality. Hoffman gives many examples suggesting the divergence between fitness-tuned-perceptions and reality. Other species have quite different perceptual systems. The cyanobacterium has 27 types of photoreceptors (compared to 4 for humans); bees can see ultraviolet light; flies find the smell of faeces appealing. It is usual to think that all organisms sense the same reality, just registering different intensities or aspects of the same objects, but Hoffman turns this around, saying that the perceptions of different species can be so radically different that it is more logical to think that perceptions create an organism's personal reality.

For humans, Hoffman discusses synaesthesia, in which different senses interact. Some synaesthetes see a different colour corresponding to the pitch of every sound they hear. If synaesthesia had been evolutionarily more advantageous, then everyone, rather than a small minority, would be a synaesthete, and the world would be perceived differently. This is an example of how evolutionary analysis points to fitness-shaped perceptions diverging from reality-shaped perceptions.

Some people have specific perceptual deficits, for example prosopagnosia or face blindness. Such people can see faces but have great difficulty distinguishing one from another. They can't recognise friends. It is obvious why this is uncommon: evolutionarily, it is a great advantage to be able to recognise people by glancing at their faces.

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A Quantum Connection

Hoffman draws on results from quantum theory to bolster his arguments. In the Copenhagen interpretation of quantum theory, reality is represented as a wave function that can exist in two or more incompatible states. When a human makes an observation, the wave function collapses into one state or another. The most famous example is Schrödinger's cat, which might be dead or alive, but we don't know which until someone makes an observation that triggers the collapse of a wave function that determines the cat's fate.

In the same manner as some physicists say that observing equipment creates reality, Hoffman's view is that what we perceive is not some permanent object sitting there indifferent to whether or not it is observed, but instead is created by observation. Hoffman provides a tour of views of physicists, concluding that quantum theory does not rule out Interface Theory of Perception (ITP); indeed, they have crucial resonances.

We see the world in the three dimensions of length, width and depth. Hoffman argues that this is not the way the world actually is. He cites physicists who say that spacetime is "doomed" as a theoretical framework. Instead, it is possible to describe reality in two dimensions or without using spacetime dimensions at all. Hoffman reports studies showing that the maximum information contained in a region of space corresponds to the area of the surface surrounding it, not to its volume.

Setting aside what physicists say, in a more everyday sense we only see a two-dimensional surface. Our senses interpret this surface as being in three dimensions, in the same way that we see three dimensions when looking at a hologram. Hoffman says that perceiving the world as having three dimensions is based on a compression algorithm that is valuable for fitness. There is too much information available for us to process it all. In order to survive, it is helpful to package the information in a convenient format that maximises efficiency for operating in the world with a limited sensory and brain capacity. The amount of information about fitness payoffs is huge, and has to be compressed to a manageable size without losing critical information, while minimising errors.

> The picture that emerges is that spacetime and objects are a code used by our senses to report fitness. Like any decent code, it uses redundancy to counter noise. This picture is precisely ITP, with the extra insight that the interface compresses data and resists noise (120).

This is another example of how perception deviates from reality. Instead of seeing and feeling the world as an immensely complex two-dimensional screen, we interpret it as three-dimensional. This is more efficient, just like the way we see three dimensions when watching television. This three-dimensional interpretation is so ingrained that it seems to be reality itself.

> In sum, spacetime is not an ancient theater erected long before any stirrings of life. It is a data structure that we create now to track and capture fitness payoffs. Physical objects such as pears and planets are not antique stage props in place long before consciousness took the stage. They too are data structures of our making. The shape of a pear is a code that describes fitness payoffs and suggests actions I might take to ingest them. Its distance codes my energy costs to reach it and snatch it (135).

ITP does not require that perception entirely results from biological evolution. Seeing, for example, is an acquired skill. People who gain sight after being blind from birth at first have trouble making sense of their visual sensations. Perception is influenced by culture. Anthropologist Colin Turnbull (1962, 252–253) reported that Kenge, a forest-living Pygmy, thought buffalos in faraway grasslands were insects, since without trees he did not automatically adjust for the distance. Some early film viewers feared that trains on the screen might hit them, an illustration that how to interpret images on television and other screens is learned. So is making sense of electron micrographs and CT scans. Learning, including learning how to interpret sensory inputs, is culturally conditioned, and the culture may be that of a national group or a network of scientists. The influence of culture and learning on perception is compatible with perception being an interface. Indeed, this influence makes it even less likely that perception gives direct access to objective reality.

Conscious Realism

Hoffman spends considerable time describing various philosophical positions and positioning his perspective among them. He acknowledges predecessors with similar views, such as Immanuel Kant. Philosophers have various objections to Interface Theory of Perception (ITP), and he counters all that he discusses. Here I won't try to adjudicate these disputes but instead to outline Hoffman's view.

He says there is a reality, but that we don't know what it is. Our senses are designed to interpret reality using a code that is advantageous for fitness; our senses, without extra assistance, simply don't have the capacity to get beyond this code in any systematic way, any more than we can grasp the reality in computer electronics by analysing what we see on the desktop. To mistake the interface for reality is like thinking that the letters CAT are the same as the animal.

Hoffman supports a monist philosophical position that he calls "conscious realism." In it, the world is populated by conscious agents that influence each other and perceive each other. He distinguishes conscious realism with panpsychism, in which physical objects can be conscious. In conscious realism, there is no requirement that the physical reality behind our interface is itself conscious. The point is that what we usually call reality, including objects and spacetime, is generated by each conscious agent through a perceptual interface arising from consciousness. Conscious entities only perceive icons, not reality, and do not directly perceive other conscious entities, only their icons.

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The purpose of conscious realism is to deal with the problem of explaining consciousness. As noted earlier, Hoffman says that physicalists have not even begun to explain how the chemical structure of, say, vanilla, can give rise to the taste of vanilla. To address this fundamental and continuing shortcoming of physicalism, he posits consciousness as the foundation of explanation of our world.

I find Hoffman's perspective intriguing and worth exploring even if it turns out to be unsatisfactory. To this end, I next try to relate ITP to a range of other perspectives.

The Social Construction of Reality

The idea that we cannot directly know reality, but instead that it is created by consciousness, seems to have an affinity with the perspective of the sociology of knowledge. In classical formulations, the sociology of knowledge is an extension of the study of society to the study of knowledge systems, which are taken to be the products of society and neither pre-existing sets of ideas waiting to be discovered onr inevitable ways of describing the social world. In other words, knowledge systems are to some extent arbitrary, contingent on social processes.

Looking at the widely cited book *The Social Construction of Reality* by Berger and Luckmann (1966), it is apparent that their concern is with the way that people understand the social world, in particular social institutions. They look at concepts like temporality, society and social roles. Their book might better be titled *The Social Construction of Social Reality*. They are not looking at the reality of spoons, tomatoes and galaxies. In Hoffman's terms, the sociology of knowledge is a sociology of the interface.

Hoffman's picture seems to have an affinity with the philosophical position of pragmatism (e.g., Rorty 1979), which in essence replaces truth with usefulness. Pragmatism is at the level of knowledge, so according to Interface Theory of Perception (ITP) it is at the level of the interface rather than reality. Nevertheless, there are strong parallels. The Fitness Beats Truth (FBT) theorem is the basis for the conclusion that what we perceive is a product of an evolutionary process that selects for fitness. Though there is no equivalent of FBT for philosophical pragmatism, it would be fascinating to explore the implications of applying FBT to knowledge systems.

In contrast to philosophical pragmatism, Hoffman, as a scientist, thinks it is desirable to explore theories of reality. He just thinks that describing objective reality in terms of spacetime, matter or fields is not promising.

Foundations

The Fitness Beats Truth (FBT) theorem is based on evolutionary games, a particular application of the mathematical theory of games. Is there a problem in relying on a mathematical theory, given that it might not be true but rather the result of a process of selecting for fitness? Decades ago, I wrote a critique of game theory, arguing that, for simple games at least, its categories (players, choices, payoffs) were not neutral but instead

"selectively useful" for applications that do not challenge existing social institutions. Going further, biases can even be attributed to the mathematical formalism underlying game theory (Martin 1978).

David Bloor (1976) in *Knowledge and Social Imagery* applied the sociology of knowledge to mathematics. Bloor argued that mathematical concepts, such as the number system, can be understood as chosen for their usefulness rather than their inherent correspondence with the nature of the universe. Mathematics can be considered a system of logic, but given that there are many possible logical systems, the choice of a particular system can be linked to its usefulness for human purposes. Sal Restivo (1983, 2016) has also undertaken a sociological examination of mathematics, emphasising that mathematics is a social product, not a transcendental domain.

Bloor's and Restivo's analyses raise the question of whether the FBT theorem might be undermined by its dependence on a socially shaped system of mathematics. In other words, if our perceptions are the product of evolution and don't register the truth, and our logical systems are similarly shaped by evolution, maybe they do not register the truth either, with the consequence that the FBT theorem might not be true. While superficially this might seem to be a problem, on reflection it seems unlikely that a different logical system—different from the mathematical system underpinning game theory—would lead to a contrary theorem, Truth-Beats-Fitness, being true. In other words, even if evolutionary games are biased in some systematic way, it seems exceedingly unlikely that this bias would lead to a different conclusion.

Addressing these concerns, Hoffman says the FBT theorem applies only to perceptions of the world (90-91). Cognitive capacities need to be studied separately to see how they are shaped by evolution. Not all evolutionarily derived capacities are necessarily unreliable. Indeed, there can be selection pressures for ability with logic. For example, the value of reciprocity for humans can contribute to selection for logical ability. Hoffman says skills in mathematics and logic can exist compatibly with the FBT theorem and with Interface Theory of Perception (ITP), but whether concepts in mathematics and logic enable understanding of objective reality remains to be seen.

Another foundation issue concerns quantum theory, which Hoffman uses to support his perspective. Conscious realism is built, at least by analogy, on the idea that wave functions, which describe reality, remain in a state of indeterminacy when not observed. As noted, this is often dramatised by Schrödinger's cat which, before it is observed, is probabilistically both dead and alive, with one of these states realised only when a human looks at it. Hoffman extends this idea to all observations by sentients.

The idea of the collapse of the wave function on observation is an interpretation of the mathematical formalism of quantum theory: the mathematics itself does not require this way of understanding it. There are other interpretations of the mathematics of quantum theory. David Bohm (1952) famously developed a hidden-variable formulation, rewriting key

equations so they can be interpreted deterministically. Landé (1965) developed a classical basis for deriving quantum fundamentals, and there are many other non-standard treatments.

If the mathematical apparatus of quantum theory were not interpreted using the Copenhagen framework, what would that imply about ITP? This isn't clear to me. In any case, quantum theory is not required to prove FBT. Furthermore, conscious realism doesn't depend on quantum theory, though the Copenhagen interpretation gives it more plausibility.

Connections

Hoffman's picture has some intriguing connections with various perspectives in science and technology studies and beyond. Here I mention a few to indicate areas for exploration.

Actor-network theory (ANT) is a way of conceptualising the social, organic and technological world. It treats humans, scallops, door-closers and other such things as actors or "actants" that relate to each other through networks. The actants seek to "enrol" each other to serve their purposes (Latour 1987).

ANT seems have similarities with Interface Theory of Perception (ITP). On the closer look, though, these are only on the surface. ANT operates entirely at the level of the interface, so it is not addressing any deeper reality. Conscious realism says conscious agents are fundamental, but objects are not conscious. The objects or actants are fundamental in the ANT framework, but this doesn't say a lot because the framework concerns the interface. Alternative frameworks for social analysis, such as structural concepts of the state, markets and patriarchy, are also at the level of the interface, or at least are abstractions about interface dynamics. Arguably, ANT is no more connected to reality than structural analysis.

Hoffman says science has evolved in a way that draws on features of human nature: people argue best for what they believe or against contrary ideas that others believe (196). Reasoning evolved for the purposes of persuasion, and science arose from these inadequate foundations via groups and individuals mustering logic and evidence against opponents. This perspective on science is contrary to the common view, at least among scientists, that scientists should be objective. Hoffman's evolutionary picture is more compatible with the analysis of Ian Mitroff (1974), who found that elite scientists fiercely stuck by their preferred views and attempted to undermine contrary views (and denigrated scientists holding those contrary views). According to Mitroff, scientific norms such as organised scepticism exist alongside "counternorms" such as organised dogmatism, and the counternorms can be functional for scientific progress. Mitroff's picture might be a starting point for an evolutionary model of science.

Albert-László Barabási is a complex networks researcher who applied his approach to success, meaning acquiring money or fame. In his 2018 book *The Formula: The Universal Laws of Success,* he distinguishes between the intrinsic value of an entity and its success. A song, for example, might be judged by unbiased listeners as average but be highly successful in the charts, or languish unrecognised. Barabási calls the intrinsic value "fitness," and spells out

the conditions under which fitness leads to success. In many situations, preferential attachment—for example, people's liking of songs that other people like—shapes their judgement. The result is confirmation of the maxim "success breeds success."

Barabási's picture has some parallels with Hoffman's. The processes by which some individuals become successful is a combination of individual attributes and the collective agreement about those attributes: success is in the eye of beholders and requires collective action. In a vaguely analogous process, objects that humans observe are in the eye of the beholder (an eye and perceptual process shaped by evolution), and there is a collective process of agreeing about the objects and their characteristics. Whether there is more to this than an analogy would be worth exploring.

Steven James Bartlett (2005) analysed the psychology of human evil, "evil" here used in a non-religious sense referring to violence, cruelty and destruction of the environment. As part of his analysis, Bartlett examined inherent and persistent flaws in human thinking. The relevance here is that Bartlett argues that dysfunctions in human behaviour can in part be traced to fundamental shortcomings in thinking resulting from evolution. This is analogous to Hoffman's view that perceptual illusions are due to the failure of evolution to provide perceptions that are useful for survival. Bartlett's view is worth quoting at length because of its close connection to ITP:

> The human belief in transcendence is a disorder of thought: It involves a projective misconstruction beyond whatever reference frame is in use, plus the predication of independent existence to what is projected. This belief is common among people in all societies. It takes many forms: the child's belief that a tree must make a crashing sound when there is no one there to hear it; belief in deities who live in a heavenly dimension to which living human beings have no access; belief that a nation possesses a supervening identity and reality for which it makes sense to sacrifice life; the belief that is typical of so many ideologies—that they define an autonomous reality in which the sole, exclusionary, and unique Truth is to be found; and of course the metaphysician's belief in the reality of objects "in themselves." When these beliefs are carefully analyzed, none is found to have meaning, for the meaning they are thought to have—and the meaning they can be thought to have—is dependent upon the reference frames that are used to think and articulate those beliefs (Bartlett 2005, 303).

Semiotics

Semiotics is the study of signs, including systems of signs. The most familiar semiotic system is language. Words have meanings but only in relation to the overall system of meanings. The assignment of meanings to words is arbitrary, in that—aside from a few instances of onomatopoeia—the sounds or symbols have no particular connection to the things they represent. Sign systems also exist outside of formal language, for example in gestures.

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Signs are composed of the signifier and the signified, for example the word "table" and the object or category that "table" refers to. Most words have a dominant meaning, the denotation, and other associated meanings or connotations.

Signs may be arbitrary, but sign systems serve purposes, including communication, influence and deception. To the degree that sign systems are functional, it makes sense to understand them as having evolved and to serve the purposes of survival. In different cultures and environments, there may be different words and concepts, suited for the situation. Stamp collectors use a rich set of words to refer to colours; chemists have specialised words for chemicals.

There is a strong parallel between language as a sign system and Interface Theory of Perception (ITP). Indeed, language might be considered an interface between humans and their perceptions: an interface of meanings. Alternatively, ITP might be thought of as a system of signs created by our sensory apparatuses: the signs are the objects we perceive, and collectively these signs create systems of meaning. ITP thus might be the basis for a semiotics of perception.

Implications

Does Hoffman's picture have any implications for social issues, such as the problems of racism and war? If so, these are not obvious. If our perceptions have been shaped by evolution for the purposes of fitness rather than truth, and we see icons on an interface rather than reality, this doesn't seem to change things in a practical way. If you are in pain, it is not much consolation to think that this experience does not necessarily correspond to ultimate reality. If you see a bomb heading your way, it doesn't help to know that the bomb is only created when you observe it.

However, the idea that evolution has shaped perceptions may be helpful in imagining alternatives. Universal evolution, used by Hoffman, is responsible for human tendencies such as in-group allegiance and confirmation bias. Knowing that these are the results of evolution suggests it is possible they can be changed. Indeed, if perceptual systems are the result of selection for fitness, then perhaps they can be changed to serve a new environment. Altered states of consciousness are known to be possible (Wittmann 2018), and may give a different perspective on reality, as mystics have claimed for millennia.

Pim van Lommel (2010), a cardiologist, investigated reports by patients of near-death experiences (NDEs), and started exploring the nature of consciousness. He argues that consciousness is not solely a product of the brain because brain function doesn't reveal the nature of thoughts and feelings, the mind can change the function and anatomy of the brain (neuroplasticity), and consciousness can be experienced independently of the brain, as in some NDEs. Van Lommel suggests a picture built around nonlocal consciousness: the brain is an interface during normal waking consciousness, picking up a small bit of "endless nonlocal consciousness." Sometimes, as in NDEs, direct experience of nonlocal consciousness is possible. The interface is linked to quantum spin coherence.

Like Hoffman, van Lommel argues that consciousness cannot be derived from neurons, and to address this shortcoming it is worth postulating that consciousness is fundamental in some way. Van Lommel's and Hoffman's pictures are somewhat different. Lommel—like a number of other writers and spiritual traditions—postulates a universal consciousness, to which individuals have only limited access. Individual consciousness is like an interface with universal consciousness, the body serving as a sort of download mechanism. NDEs provide a temporary access to the consciousness beyond the self. Hoffman does not propose a universal consciousness, but instead a community of conscious entities that can only perceive representations of each other.

If scientific knowledge is knowledge about the interface, not about reality, there is no reason to assume scientific knowledge can ever be complete or fully coherent. If perceptions are about fitness, it is plausible that there can be aspects of perception (and knowledge) that appear contradictory or impossible. This offers a new perspective on anomalous phenomena of all sorts, including psychic phenomena. It might be that conventional scientific principles deal satisfactorily with most of what is seen at the perceptual interface, but that the reality that underlies and motivates the interface is not so simple. This opens the door to precognition and other phenomena studied by parapsychologists: just because observations seem impossible according to scientific laws doesn't mean they don't occur.

Scientific knowledge, and its cousin technology, may be useful for understanding the interface, but there is no guarantee that they always serve fitness. Hoffman says that illusions are shortcomings in the interface, shortcomings in the sense that they do not aid fitness. At the level of society, there are a number of beliefs that arguably are hindrances to survival, for example that economic growth is always a good thing or that ever more powerful weapons are needed for defence. This brings up Steven Bartlett's claim that some patterns of human thought, and related activity, are fundamentally misguided. The capacity to use tools was valuable to the human species for most of its existence, but constructing nuclear weapons arguably created more danger than benefit. In this sense, scientific knowledge, which should be supporting survival, has gone astray.

Conclusion

The interface theory of perception can seem exceedingly strange, but perhaps that is only because it is unfamiliar. Interface Theory of Perception (ITP) does not affect everyday behaviour, just as the physics understanding of objects as made up of atoms that are mostly empty does not affect the way we think about or interact with objects.

Some scientists treat entities they study but cannot directly observe, such as quarks, neutrinos and black holes, as useful concepts, without assuming they really exist. ITP expands this instrumentalist view to the macroscopic world: it is useful for individual and species survival to see objects in three dimensions, but we should not assume they really exist.

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ITP is definitely a challenge to usual understandings of perception, and of what we perceive. It is also, potentially at least, a challenge to scientists who say scientific knowledge is about reality, or about truth. ITP instead says scientific knowledge, indeed knowledge more generally, is about fitness, in other words usefulness for survival, by humans or other conscious entities. In this, it seems closest to the philosophy of pragmatism and to semiotics.

Hoffman's book is filled with fascinating information and provocative ideas. It is well worth reading even if you remain convinced that you directly observe some part of reality. It may be safer to take the blue pill and remain at the interface. Or you can risk taking Hoffman's red pill and upending your intuitions.

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