The Application of Karl Popper's Three Worlds Schema to Questions about Information in the Fields of Complexity, Cybernetics, and Informatics

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ABSTRACT

More technically leaning disciplines such as informatics, complexity theory, and cybernetics often make simplifying assumptions about human beings and their causal/informational roles within larger techo-social systems. This paper employs the philosopher Karl Popper's three worlds schema to explore in depth the unique ways in which conscious human subjects process and create knowledge and information. The three worlds represent the physical world, the subjective world of the conscious subject, and the world of language, models, and schemas. The works of major philosophers are invoked to consider what makes conscious human subjects unique in the context of information systems. Context-based understandings, the expressive facet of consciousness, and experience-based valuing emerge as key themes that we believe could strengthen the fields of informatics, complexity theory, and cybernetics.

Keywords: systems engineering, system design, design review, decision-making, philosophy of technology, cybernetics.

1. INTRODUCTION

As highlighted in the conference introduction, Umpleby states that complexity theorists are more focused on objective information flows while cyberneticians expand the sphere of coverage to the observer who interprets information in a general feedback loop [1][2]. In addition the field of informatics is primarily concerned with information flows within and across systems, and while these systems may include the human subject, they usually do not offer this subjectivity any causal or significant role.

What this tells us is that there is a healthy fascination across these disciplines with the notion that, while a great deal of information flows across "objective" technical systems (i.e., networks, computer systems, library shelves, cash registers, etc.), there is something unique and important about the subjective role of the observer in interpreting or creating this information. In other words, if we are to depict the human subject as yet another node in larger information systems, this node has unique properties that need to be examined more closely.

Karl Popper is a philosopher most closely associated with the discipline of Positivism and he wrote a great deal about the role of falsification and the evolution of objective knowledge in scientific inquiry. The "linguistic turn" in philosophy initiated by Ludwig Wittgenstein and Thomas Kuhn's analysis of scientific revolutions have disputed some of Popper's fundamental philosophical bases. Yet he is also associated, from his 1972 book *Objective Knowledge*, with the "three worlds" schema for thinking about qualitatively distinct spheres of knowledge or knowing [3].

To Popper, the "first world" is the physical world possessing physical properties. In contrast, the "second world" is the mental world with mental properties. And the "third world" is the symbolic world of language, ideas, propositions, schemas, models, etc. that exist independent of the first and second worlds. For example the concept of a school system, or the idea that the formula $y = x^2$ represents a parabola in a two dimensional Cartesian system are elements of the third world. According to the philosopher:

> The three worlds are so related that the first two can interact and that the last two can interact. Thus the second world, the world of subjective or personal experiences, interacts with each of the other two worlds. The first world and the third world cannot interact, save through the intervention of the second world, the world of subjective or personal experiences. [3][p. 155]

Furthermore, Popper emphasizes his departure from behaviorists who deny subjective experience:

> By these links the mind establishes an *indirect* link between the first and the third world. This is of utmost

> importance. It cannot seriously be denied that the third world of mathematical and scientific theories exerts an immense influence upon the first world. It does so, for instance, through the intervention of technologists who effect changes in the first world by applying certain consequences of these theories; incidentally, of theories developed originally by other men who may have been unaware of any technological possibilities inherent in their theories. Thus these possibilities were hidden in the theories themselves, in the objective ideas themselves; and they were discovered in them by men who tried to *understand* these ideas.
>
> This argument, if developed with care, seems to me to support the objective reality of all three worlds. Moreover, it seems to me to support not only the thesis that a subjective mental world of personal experiences exists (a thesis denied by the behaviourists), but also the thesis that it is one of the main functions of the second world to grasp the objects of the third world. [3][p. 156]

In this sense, man is confronted with a world and models that world through language and schemas which nurture new third world problems and new understandings of the first world which, in turn, facilitate purposeful modifications to the first world. A simple example would be the child being given the instructions for a model airplane and learning to construct the airplane from the available pieces and the third world model (instructions). In summary, according to Popper:

> It seems to me most important to describe and explain the relationship of the three worlds in this way – that is, with the second world as the mediator between the first and the third. Although rarely stated, this view seems to me clearly involved in the three-world theory. According to this theory, the human mind can see a physical body in the literal sense of 'see' in which the eyes participate in the process. It can also 'see' or 'grasp' an arithmetical or geometrical object; a number, or a geometrical figure. But although in this sense 'see' or 'grasp' is used in a metaphorical way, it nevertheless denotes a real relationship between the mind and its intelligible object, the arithmetical or geometrical object; and the relationship is closely analogous to 'seeing' in the literal sense. Thus the mind may be linked with objects of both the first world and the third world. [3][p. 155]

With this perspective in mind, let us now explore the intersections between each world and the implications these have on complexity, information, and cybernetics.

2. The Intersection between the First and Second Worlds

Philosophers of consciousness have closely examined the role of information in phenomenal consciousness [4][5]. In Chalmers' analysis, subjective (phenomenal) information is qualitatively distinct from objective (measurable) knowledge even though they may be very closely coupled. In his contemplation of this intersection between what we are calling the first and second worlds, Chalmers states:

> Phenomenal properties have an intrinsic nature, one that is not exhausted by their location in an information space, and it seems that a purely informational view of the world leaves no room for these intrinsic qualities. [4][p. 155]

Therefore, in this paper, we will explore what Popper here identifies as intrinsic qualities that do not square with a "purely informational" way of framing worlds.

To deepen our appreciation of this intersection, consider the first world property of (potential) information contained in a physical object's emission of light of a particular electromagnetic frequency. When this kind of information is received by a human subject (second world) and perceived as *green*, this information is *not* the same. Green information belongs to the second world and is not part of the first world. Technical instruments can measure the frequency of the electromagnetic emissions but, as far as we know, there is nothing inside of the instrument witnessing greenness.

The intersection between the first and second worlds has been a source of mystery and fascination for philosophers and scientists. Reinvigorated by Thomas Nagel's essay *What is it like to be a bat?* [5], the question of subjectivity or "phenomenal consciousness" successfully challenged consciousness scholars who claimed to have "explained consciousness" by identifying its various fundamental functions [6]. Nagel's main point was that (consistent with Popper) there is something intrinsically different about phenomenal consciousness that external observers can never access or directly analyze.

Various thought experiments help to sharpen this claim. In one thought experiment a hypothetical brain physiologist named Mary knows all that could possibly be known about brain dynamics including all of the chemical, electrical, and nerve processes involved in a subject's visual perception. That is, if a subject that she was studying was perceiving a red rose, Mary would understand everything about how the wavelengths of light are received by the retina, transferred to optic nerve signals, received by various lobes of the brain resulting in color recognition. However if Mary had been brought up in a purely black-and-white world devoid of color, and she had never directly observed the red rose that her subject is experiencing, could Mary have an a priori understanding of what redness would look like? If one of her students brought her a red rose would she be *surprised* by redness or would she already have had an understanding of what it would look like based on her exhaustive knowledge of the brain? While we may not know for certain if she could, we certainly cannot conceive at this time of a scientific theory that could provide Mary with this kind of subjective insight. Rather, thought experiments like these clarify the challenge to science and philosophy regarding the intersections of the three worlds. There is something about the third world that does not have direct access to the second world. The second world draws upon the third world models and schemas to organize and make sense of what is perceived, privately, in the second world, but it cannot introduce it if it is not already there. One cannot know what pain, color, or tones are until they are actually experienced.

Chalmers coined the phrase "the hard problem" to reinforce how difficult this problem is [4]. In his rhetoric, third-person (third world) data may be highly correlated with first person (second world) data, but they are qualitatively different. One captures an

external reality and the other an internal reality. Chalmers goes on to conclude:

> Physics requires information states but cares only about their relations, not their intrinsic nature; phenomenology requires information states, but cares only about the intrinsic nature. This view postulates a single basic set of information states unifying the two. We might say that internal aspects of these states are phenomenal, and external aspects are physical. Or as a slogan: Experience is information from the inside; physics is information from the outside. [4][p. 305]

When it comes to a human being's interpretation of color, tone, taste, smell, etc., from a complexity-cybernetics-informatics points of view, as long as there is close coupling between first world and second world "states," this informational asymmetry rarely presents a *practical* problem. Two humans would agree that the rose is red even if they perceive that color sensation in very different ways.

The informatics/complexity/cybernetics implications of this information context exist, but are relatively narrow. The human subject (second world) receives information from the first world and is able to make meaningful *differentiations* about the objects in the first world. Whether temperatures, pressures, tones, voices, colors, shadings, tastes, or smells, the human subject is able to build information from the available stimuli in a manner that makes a difference – is able to distinguish things in meaningful and practical ways. As Chalmers observes: "…information is a *difference that makes a difference*." [4][p. 281].

From a complexity perspective, the second world confronts the first world in a way that seeks to reduce complexity by ferreting out the "differences that make a difference" and constructing meaningful distinctions from these various thresholds of what are otherwise continuous variables.

Cybernetics is a science of messaging and, in particular, the use of messaging within a system to achieve control or some other end. Therefore in addition to the reduction of complexity as we have just discussed, the human subject (second world) is confronting the first world with actions, aims, purposes, and questions (as represented in the third world) and is therefore picking up on particular cues, messages, and signs from the first world that have a place in these schemas and models. This compels us to look more closely at the relationship between the second world and the third world, as this is where informatics, complexity, and cybernetics become more salient.

3. The Relationships between the Second World and the Third World

It is in the intersection between the second and the third worlds that we encounter more interesting questions about information and knowledge. That is, what roles do subjectivity, phenomenology, or the existence of mental states play in *affecting* the interpretation, creation, and distribution of information across systems? Popper himself, spends a great deal of his analysis of the three worlds to precisely grapple with the role of *understanding*. He discusses how the third world is, paradoxically, wholly man-made yet has its own autonomy. In concert with this, he claims that understanding is a third world property:

> Here I will start from the assumption that it is the understanding of objects belonging to the third world which constitutes the central problem of the humanities. This, it appears, is a radical departure from the fundamental dogma accepted by almost all students of the humanities (as the term indicates), and especially by those who are interested in the problem of understanding. I mean of course the dogma that the objects of our understanding belong mainly to the second world, or that they are at any rate to be explained in psychological terms. [3][p. 162]

He goes on to posit that any interpretation that results in a model or theory, or any creation of something like a model or theory, may be accompanied by second world (mental) processes, but actually belong in the third world because they represent understandings of objective (Platonic) relationships. This raises the central question of the paper, can we challenge Popper's conclusion here by asking is there anything about mental states of understanding in the second world that is not simply a direct application of third world knowledge? That is, is there something in the second world that goes above and beyond first world sense perceptions or third world "objective" knowledge that is meaningful in the contexts of informatics, complexity, and cybernetics?

To answer this question, we introduce theoretical positions from the linguistic turn in philosophy (e.g, Ludwig Wittgenstein and Jacques Derrida) [7][8]. For example, Wittgenstein's notion of family resemblances and language games and Derrida's examination of *phenome* and *phoneme* offer interesting descriptions of the things that the mind can do that involve, but are not fully constituted by, objective third world knowledge. Furthermore, Thomas Nagel's *Mind and Cosmos* is a direct attempt to consider the place of mind in the universe the unique role of *valuing* [9].

4. Language Games

In Wittgenstein's earlier works he attempted to establish an objective foundation for all knowledge based up on "primitives" or propositional building blocks. His work was lauded and accepted by the philosophical community, especially the Positivists, but yet years later he began to question his own basic assumptions about fundamental objective building blocks of meaning. In *Philosophical Investigations* he offers an entirely different stance in which context and use are central to the construction of meaning [7]. In other words, there is no objective meaning that is not context-dependent. For example, the word "game" has many meanings to us and we can only understand what it means in the context of its usage. There is no way to objectively and unambiguously define through propositions what a "game" is and what a game is not. As he state:

> For a *large* class of cases – though not for all – in which we employ the world "meaning" it can be defined thus: the meaning of a word is its use in the language. And the *meaning* of a name is sometimes explained by pointing to its *bearer*. [7][pp. 20, 21]

Furthermore he asserts that there is no such thing as a private language. As long as one is using language to assign meaning in one's thinking, one must be using a language that is interpretable by others – has meaning to others. Therefore Wittgenstein ushered in to the sciences and the social sciences a new conceptual stance in which, although language must forever be a public currency, the assignment of meaning is grounded in its context of use and there is no systemic bottom-up construction of meaning.

Popper was aware of this movement and even admitted its legitimacy in humanities-driven disciplines, but maintained that through falsification and theory construction, science would nonetheless converge on, although never perfectly reach, what is assumed to be a single objective *truth*.

If we are to accept Wittgenstein's assumptions over Poppers, this has implications for informatics, complexity, and cybernetics. In particular, in any of these disciplines if we are to consider the human being to be a node within larger techno-social systems, the context-based meaning construction that occurs within the second world becomes more relevant. Information is not objective and singular in its meaning, but requires a human subject to consider a myriad of overlapping and potentially conflicting contexts for even the simplest of everyday communications. Complexity is created out of and reduced through this second world capability of the mind. And from a cybernetics point of view, any "signaling" that is to occur to/from the agent is implied or inferred through these context-based language games.

5. DERRIDA'S *PHONEME* AND *PHENOME*

The father of phenomenology, Edmund Husserl, sought to ground science from a second world perspective where any knowledge, if it is to be purely scientific, must be built from the fundamental information coming to the human subject's consciousness [10]. In this sense, he was trying to erase all third world knowledge and start over again so that all third world (scientific) knowledge would correspond to the information realities occurring at the intersection of the first and second worlds. Otherwise, he claimed, the third world knowledge is ungrounded and subject to non-scientific attributions and projections.

Jacques Derrida is a philosopher who, among other endeavors, challenged the objective and scientific premises of Husserl's phenomenology. Consistent with Wittgenstein, Derrida rejected the idea that there are singular Platonic truths that inhere in logical relationships. In other words, while Husserl saw mathematics as a pure example of a logical basis for objective meaning (in the second world), Derrida argued that any logical construction cannot be context-independent [8]. In general, this means that logic does not have an independent existence of its own but always has a rhetorical foundation. In his view, rhetoric *precedes* logic.

Again, although put somewhat differently, this parallels Wittgenstein's later philosophy, but Derrida goes further by examining the rhetorical mechanisms (e.g., the voice) that are found in and unique to the second world. Although Derrida's language is famously difficult to decipher, in this passage he explains how the voice plays a central role not just in the meaning of things (phenomena), but in consciousness itself:

> …no consciousness is possible without the voice. The voice is the being which is present to itself in the forms of universality, as con-sciousness; the voice *is* consciousness. In colloquy, the propagation of signs does not *seem* to meet any obstacles because it brings together two *phenomenological* origins of auto-affection. To speak to someone is doubtless to hear oneself speak, to be heard by oneself; but, at the same time, if one is heard by another, to speak is to make him repeat immediately in himself the hearing-oneself-speak in the very form in which I effectuated it. [8][p. 80]

He uses this perspective as the foundation for any kind of subjectivity at all. To be a subject is to have a voice (*phoneme*) and to have an awareness of that voice being enacted and received. As a second world property, we are thus able to extend Wittgenstein's analysis by including the speaking (voice) components of the human mind. Although this has some relevance to informatics and to complexity because it homes in on consciousness as a rhetorical *producer* of meaning from which logic follows, this has stronger implications for the signaling aspects of cybernetics.

In the context of cybernetics, the second world capacity to signal and to be aware of signaling at the same time creates a feedback loop in itself. That is, the potential meanings of the signal being produced (as a function of imagined other (second world) minds is considered in its production. Therefore prior to any actual cybernetic interaction with the external world, an internal cybernetic conversation, of sorts, occurs and is central to the constitution of the eventual signal (output). While non-human (technical) systems are able to perform context-dependent operations, it could be argued that the second world feature of hearing one's own voice enables the more general Wittgensteinian language games.

6. VALUING

Earlier we spoke of the philosopher Thomas Nagel's analysis of subjectivity and the impossibility of one subject understanding another's subject's internal experience. More recently, in his book *Mind & Cosmos*, Nagel laments the historical exclusion of the conscious mind in scientific and philosophical traditions [9]. This exclusion is in error because, consistent with our analysis of Wittgenstein and Derrida, there are things that occur in Popper's second world that fall outside of a Newtonian/Cartesian cause-and-effect world. Yet in addition to Wittgenstein's meaning construction and Derrida's voice (*phoneme*), Nagel argues that *valuing* is also a second world property of mind that is irreducible to pure objectivity or logic. In a nutshell, he states that to realists who believe in a single objective reality "something other than value must make value judgments true or false." [9][p. 101] So, in a very real way Nagel is echoing Derrida's notion that rhetoric precedes logic, but with rhetoric being replaced by valuing. Valuing, according to Nagel, is a feature of the subject that is influenced by experience as well as by psychological factors. Popper's second world, in this context, is then a play space within which the human subject's experiences and accumulated knowledge can come to bear upon the voice and upon interpretations of meaning at the most fundamental levels.

To informatics and complexity theories this implies a situation in which, to the extent that a human subject is embedded in larger system, that subject represents a private store of experience that is

not directly visible to others and yet which has developed in response to highly complex past experiences. To cybernetics this compels us to take more seriously the sociological concepts of *adverse selection* and *moral hazard* that result from the inherent unobservability of values within human actors [11][12]. In other words, the values upon which an individuals intentions and actions are built cannot be directly observed and must be inferred from their actions. Practices such as background checks and job interviews can be viewed as cybernetic responses to the adverse selection and moral hazard potentials created by the hiddenness of actual values.

7. Conclusion

As we have presented above, Karl Popper's three worlds schema is useful in thinking about human beings and their interactions in complex information systems. Unlike non-human nodes in systems, human consciousness (or the second world) is a space in which a physical world is perceived and a world of meaning is interpreted and expressed. Through the works of Wittgenstein, Derrida, and Nagel we see a common theme in which, paradoxically, Popper's assumptions about a singular underlying basis for objective truth is systematically questioned. Therefore, in some sense, they use Popper's demarcation of the three worlds (especially the role of consciousness in the second world) against him. Aside from this philosophical interplay, this exercise has revealed that the human subject is able to perform informational and cybernetic functions that need to be accounted for when thinking about "objective" system dynamics more broadly. Most central is the notion that within second world (human subjectivity) is a space in which linguistic interpretations are negotiated, potential expressions ("outputs") are formulated, and the values undergirding these interpretations and expressions are privately managed. To the extent that the systems that informatics, complexity theory, and cybernetics analyzes include human subjects, this paper provides some theoretical bases for ways to both appreciate and account for the unique capacities they bring to bear within the system.

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