An Architecture of the Mind

A Psychological Foundation for the Science of Everyday Life

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Glossary of mathematical symbols

Symbol	Translation
$A \Rightarrow B$	"A" implies "B", or, if "A" then "B"
$A \Leftarrow B$	"A" is implied by "B", or, "A" only if "B"
$A \Leftrightarrow B$	"A" if and only if "B", or "A" implies "B" and "B" implies "A"
$\{A\}$	The set "A"
$A \subset B$	"A" is a subset of "B"
$A \supset B$	"A" is a superset of "B", or, "A" contains "B"
$A \vee B$	"A" or "B"
$A \& B$	"A" and "B"
$A \cup B$	The combination, or union, of the sets "A" and "B"
$A \cap B$	The intersection of the sets "A" and "B"
$A \backslash B$	The set "A" excluding the elements "B"
$a \in A$	"a" is an element of "A"
$\{a_i\}_{i = \alpha \Omega}$	The sequence of elements "a" from "α" to "Ω"
$|\{A\}|$	The number of elements in set "A"
θ	Empty set
2^A	The set of subsets of "A"
$A : B$	"A" such that "B"
$\forall A$	For all "A"
$\exists A$	There exists "A"
$A \circ B$	"A" defined on "B"
$f:$ $A \rightarrow B$	The function, or process "f takes points in set "A" and transforms them into points in "B"
$a = f(b)$	"a" is a function of "b", "b" is transformed by the process "f" into "a"
$A \geqslant B$	"A" is at least as preferable as "B"
$A > B$	"A" is more preferable than "B"
$A \sim B$	"A" is equally as preferable as "B"
$\neg A$	Not "A", the opposite of "A"
$/$	A diagonal strike through any symbol negates it, i.e. inserts "is not" or "does not" before it
$\partial A \partial B$	The change in "A" for a change in "B"

Preface

This is an unusual book. It's in the style of a traditional academic book, but it is not quite in the style of a modern academic book. It is theoretical, but motivated by practicality. It is mathematically logical, but also hopes to speak to the general reader. So to orient you to this work then, it might be worth taking Simon Sinek's advice to start with why. Why was *An Architecture of the Mind: A Psychological Foundation for the Science of Everyday Life* written?

This book was written because I, like many, wanted to understand humans. I wanted to understand how we fit into the world and interact with it. I wanted such an understanding, but also one which was integrated, holistic and systematic. This book was written because I sought, to draw inspiration from Alfred Marshall (1890), a "Science of Everyday Life".

I wrote this book because I needed a theory of how we orient ourselves to, and act, within the world. And I needed one which was at once more simple, more coherent and more comprehensive while also rigorous and general than those which currently exist. I needed that because I needed a theory which I could apply to understand *any* human behaviour, *all* human behaviour. That was the purpose of this book, to propose such a theory. It was motivated deeply by practicality, a desire to develop a foundation upon which a Science of Everyday Life could rest.

The point of this work is therefore to propose a mathematically logical and rigorous theory of our lived experience of the world. The purpose of this book is to offer an integrated, holistic and systematic psychological foundation for the Science of Everyday Life. It seeks to help us understand ourselves, which must surely be the basis for our understanding of our interaction with others. The Science of Everyday Life has its roots in psychology, but it extends into social science, sociology, anthropology, cultural science, political science and economics. The present work therefore proposes a foundation for this science upon which a view of human interaction may be built.

The present work offers a theory of psychology at the level of lived experience, i.e. mental experience. It offers a theory of the mind. It draws on, acknowledges and builds by reference to brain science, although it does not offer a general theory of the brain.

That said, it does offer the hope of a more coherent link between psychological science and brain science. In this sense, the present work is seeking to reach out from the psychological sciences toward the neurobiological view of humanity offered by Sapolsky (2017). This book proposes, in a sense, a focal point for going between neurobiological science and the Science of Everyday Life (what we now call the social and psychological sciences) via the theory of lived experience proposed here.

This book is therefore very much a beginning, not an end. The present work

focuses on developing a theory of the mind to study the manner in which psychology interacts with the world at large and our behaviour. Further steps, the foundations for which are laid here in this book, will be to extend further the understanding of human behaviour it offers, to extend our understanding of psychopathological states of neurosis and psychosis, and to apply the theory proposed here to understanding systems of human interaction in economy, polity and society. The Science of Everyday Life must be founded upon a theory of our lived experience, of psychology. But it contains much more than that.

An *apologia* is in order here for the style of this book. Clearly, as you will already have seen, it is not quite in the style of modern academic work. This book is the start point for a project which seeks to resist the tendency of academia to fragment into ever more specialised, ever more hair-splitting subdisciplines.

There will be, therefore, many scholars and studies not cited in this book. The purpose of it is not to provide a survey of all the fields it draws on, but instead to draw on existing *ideas* to propose a new one. The purpose of this book is not therefore to seek to unify psychology *per se*, but rather to propose as comprehensive as possible a theory of mind which might form the core of a Science of Everyday Life. It seeks to bring as much of our knowledge to bear as possible on understanding our lived experience, drawing on philosophy, psychology, neuroscience, economics and sociology in an attempt to connect theory with practice and practical matters. It is a deeply interdisciplinary work in that it does not seek merely to cross-fertilise fields, but in fact to merge them. It aims to provide a useful theory to form a useful basis for a useful Science.

This book is thus more in the style of traditional academic books, those writings of old where a thinker would disappear to read and think for a number of years before returning to write down and present to the public at large what they discovered. This is not so common anymore simply because that is not the nature of modern academia, in which one is expected to build up a substantial corpus in specialised technical journals over many years before perhaps publishing a synthesis as a "pop book". I'm very grateful to Routledge and especially Lucinda Knight for affording me this opportunity to write in the old style.

A final word of preface. This work is formal, logical, mathematical and rigorous in its approach to the mind and psychology. However, I have also written it in such a way that were one to simply eliminate the mathematical symbols, one would still find the book coherent and integral. For those not of a mathematical bent, I would suggest that you try to grasp the symbols as a language of expression, but if that becomes overly taxing to simply gloss over them. No equation or symbol is set down which does not have its content explained immediately before or after it in plain English. A glossary of mathematical symbols is provided also to aid the reader.

That's something of my *apologia* for this work. I've found it extremely useful for my understanding of humanity and our interaction. I hope you will too.

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Lucinda Knight I've mentioned above, but she again deserves especial thanks for taking a risk and giving me the opportunity to publish here. She has a difficult job, all the more so for it having been such a big year for her on multiple fronts. But the massive relief she brought me when she offered me my contract I hope can serve as some recompense for her hard work.

Finally, a man cannot go through life without the support of his family. Mine are especially long suffering on my account and there are simply no words to even describe the debt I owe them for standing by me. For their keeping me alive in the dark times, always providing a haven to return to when it all became a bit too much and nurturing the fire within me in the midst of the storm, Mum and Dad can't but have this book dedicated to them alongside its intellectual parents. In keeping with her name, Lucy rolled back the darkness and brought the light. She believed in me and my work, she got me to see its strengths and potential. She read it from beginning to end to make sure it could be understood by someone other than myself. She brings the light to my life, I intend for her to bring it now and forever, and if I can bring but a fraction of that light to hers my life will have been well lived.

1
A fundamental question

What is the mind, how does it function?

There are two questions of philosophy and of science together that are arguably the greatest of all. The first is: what are the fundamental substances of physical reality, and the laws governing them and their interaction? The second question is: what is the mind, and how does it interact with the world? The first inquires about our external reality, and we have been remarkably successful in moving toward answering it. For the second, we look into our internal reality, and the present work aims to contribute toward its answering.

This book proposes a theory of the mind which is developed from the proposition that the mind is a network structure within which and upon which the psychological process operates. It utilises the mathematics of graph theory, or more colloquially, the mathematics of networks (Newman, 2003; Chartrand, 1985) to propose the existence of a structure which underlies the otherwise unfathomably complex and individuated phenomena of mental processes. Therefore this work proposes an "architecture" guiding the mental processes of perception, analysis and decision which evolves over time. This architecture reconciles many theories of psychology, indeed, perhaps all of those that currently exist. It also explains and predicts a number of psychological and behavioural phenomena observed by psychologists, neuroscientists, sociologists and economists.

First, we will consider some important philosophical questions concerning the nature of the mind. After taking a stance on these we shall introduce the concept of the mind as a network structure within which and upon which the psychological process operates. We will then use this concept as an architecture within which the psychology of behaviour exists and develop a theory of the process of perception, analysis, decision and the evolution of the mind over time. Naturally, not only a theory of behaviour, a theory of decision, but also a theory of *indecision*, of *inaction*, emerges from this.

The rest of this work will be occupied by efforts to elaborate how this theory explains various phenomena of psychology and behaviour within the context of a single, coherent theory, while reconciling many theories of the same by so doing. First we will consider how the psychological process may be interpreted as a process of reasoning or a process of rule-following, and by this duality arrive at the concept of dual-process psychology. In this chapter of interpretation we will also consider the place of the hypotheses of motivational theory as the basis of decision-making in both psychoanalytic and cognitive theories of psychology. We will also consider the

manner in which social influences enter the psychological process. This in hand, we will turn to consider how various factors affect behaviour. First taking "quasi-fixed" environments, we discover the conditions under which traditional economic theories will be valid to be arbitrated by the existence of a state of substitutability. Then, in the final substantive chapter, we will consider the factors affecting behaviour in a more "wholesale" sense in which environments are free to vary and the whole psychological process affects behaviour in concert. This chapter will propose that there are a few core features of the architecture of mind reconciling the vast array of "heuristics and biases" identified in recent years and revealing them to be in fact the result of fundamental aspects of the human psyche long known to psychology, but hitherto somewhat disconnected.

This will form the core of our psychological foundation for the Science of Everyday Life. The conclusion of this work is not an end; it is a beginning in a long project to come to a new, useful Science of ourselves, our place in the world and our interaction with it. Proofs of theorems within this theory are relegated to the appendix as they are a matter of rigour primarily of interest to those of a technical persuasion, and detract from the development of the theory.

2
Philosophical considerations

The nature of the mind

To begin, we must take a stance on certain philosophical questions, ancient ones in point of fact. What is the mind and in what relation does it stand to the body and the world?

The first systematic treatment of these questions in Western philosophical tradition is given by Descartes (1637 & 1641). In an effort to purge his mind of any notions which might succumb to the sceptical, he found himself arriving at a fundamental truth which he found to be unshakable, related in a famous passage of his *Discourses*:

> But... I observed that, whilst I thus wished to think that all was false, it was absolutely necessary that I, who thus thought, should be somewhat; and as I observed that this truth, *cogito ergo sum*, was so certain of such evidence that no ground of doubt, however extravagant, could be alleged by the skeptics capable of shaking it, I concluded that I might, without scruple, accept it as the first principle of the philosophy of which I was in search.
>
> *Discourse IV*

We often translate *cogito ergo sum* as "I think therefore I am". But this is probably not quite faithful to Descartes' meaning. He probably would have said in the modern day something more like "I have cognition, I am aware, therefore I am". He had some faculty which allowed him to have the experience of existence, which allowed him to be *aware* of his existence. This was the mind.

He was also of the utterly unshakable belief that the external world existed, but independently of himself, for he perceived it yet was not consciously aware of creating it. To Descartes' thinking then there were two worlds; a "mental" world of ideas and contemplation where the mind was free to associate and generate ideas, and a physical world determined by the deterministic laws of nature. This is the "dualist" philosophy of mind, held to by many great minds of science and philosophy including (albeit with variations) David Chalmers (Chalmers, 1995, 1996), Sir John Eccles and Sir Karl Popper (Popper and Eccles, 1977) and Sir Roger Penrose (Penrose, 1989).

The present work, however, holds to a monist perspective on reality (that there is one unitary reality) and so Descartes' philosophy must succumb to the critique of Gilbert Ryle. In the *Concept of Mind* (1949) he famously (and a little unfairly) dismissed dualism as a philosophy of the "ghost in the machine". It was founded, to his mind, on a category mistake concerning the concept of "existence". Existence is a

monist concept: there is only one unitary existence (Ryle, 1949, p.24). One reality, not two, for mind and world are clearly deeply connected and interact, even in Descartes' estimation.

Ryle did hold, however, that we have a mind. We do have a consciousness of our existence in the world and experience of it. He even rendered Descartes' description of this into a plainer English: the mind is that faculty by which we may "know what we are about" (Ryle, 1949, p.154). Thomas Nagel developed this notion in a famous paper (1974) titled "What Is it Like to Be a Bat?" Our mind is that in which exists "intentional states" (think *intensio* rather than "intent"), our awareness of our existence within and experience of the world.

But defining the mind we must not exclude the possibility of the subconscious or even the unconscious first explored (in Western tradition) by Sigmund Freud and Carl Jung. We know that we have such experiences as exist in the subconscious/unconscious mind for we feel their impact consciously whenever we have some feeling or emotion for which we cannot identify the cause (Freud, 1917, 1930, 1963; Jung, 1933, 1935, 1964). So we must allow that the mind and consciousness are not necessarily equivalent.

The mind is that element of our being which experiences our place in and relation to the world. We are conscious when we are aware of our place in and relation to the world.

The mind, then, is that in which our lived experience of our existence in the world occurs. By world we are not enforcing a dualist ontology so that the world is only external to ourselves – we are part of the world, the world is internal to us as well as external. It is a part of our being – mind, brain and body united as one whole in a monist world (Bennett and Hacker, 2003; Bennett et al., 2007). We *are* conscious, and are aware of our existence, though not necessarily of its totality.

A new question arises at this point: in what relation does the mind stand to our world?

The extreme solution to this question was proposed by Ryle's student Daniel Dennett (1991, 1996), who equates mind and brain. The mind is in this view totally reducible to the brain. It is thus known as the "strong Artificial Intelligence" view, for a machine which replicated the brain would be held to have an artificial intelligence indistinguishable from the intelligence of a human being.

A potential problem with such a view is that it would appear to deny the existence of consciousness as we experience it. If the mind *is* the brain and consciousness is real there must be some point in the brain where conscious experience is played out as on a screen in a theatre – a "Cartesian theatre" if you will. Given what we know about brains we know this to be absurd, so consciousness as we know it cannot be real.

Searle (1997), drawing on his assessment of the flurry of works published around the time, proposed a weaker form of this hypothesis. It seems absurd to deny the reality of consciousness as we experience it – it *is* the very awareness of such thoughts! Yet it appears that the brain is necessary and sufficient for the mind. If the brain does not function, we die and appear to cease being aware of our existence and place within the world. If the brain functions, we are alive. So the mind must in some

sense be *emergent* from the brain.

Now if the mind is emergent from the brain, we might expect it to function in a similar fashion to the brain. The brain seems to have sufficient regularity for it to be capable of being modelled mathematically (Kandel et al., 2013, Appendices E,F). So we might expect the mind to be similarly amenable to being modelled mathematically. Indeed, we might be able to replicate the function of the mind in the working of a computer and thus create an Artificial Intelligence. Certainly, Turing (1950), von Neumann (1958), Newell et al. (1958, 1962), Simon (1969, 1991) and Samuel (1953, 1959) seem to have some success in that regard. Searle's philosophy thus justifies the basis for this work – we hold the mind under this philosophy to be an entity with regularity sufficient for us to theorise and represent mathematically.

Searle's philosophy, however, is one of "weak Artificial Intelligence". A machine constructed to replicate the function of a human mind is not necessarily the same as a human being in the particular of consciousness. Unless the machine is aware of its place in and relation to the world it is not equivalent with a human being. Searle puts it neatly when he makes a distinction between the "syntax" of mental processes and the "semantics" endowed them by consciousness. A machine may faithfully enough replicate the "syntax" of observing van Gogh's *Starry Night*, indeed one might argue that a camera does this. But not until it is *aware* of that experience and can *feel* the ecstatic beauty and chaotic glory of the cosmos swirling above us can we say that machine equals mind (cf. Jefferson, 1949, p.1110).

There is some consonance between the "weak Artificial Intelligence" philosophy and what we might (riskily) call "mystic" philosophies of the mind which draw heavily on Eastern traditions. No less an authority than Erwin Schrödinger (1944) turned to the great religious mystics surveyed by Huxley (1945) when faced by the gap between "life", "mind" and his famous "aperiodic crystal" (later known as DNA). These hold that there exists a field of consciousness pervading all of reality from whence ours arises at birth and to which it returns at death. They call this field the "Godhead".

We might hypothesise that such a field does exist, and that it is "concentrated" by the human brain into such a quanta as is sufficient for the human mind to exist. Such a process would make the brain both necessary and sufficient for the mind as in the weak Artificial Intelligence philosophy. It is also an idea not inconsistent with the thought of Thomas Nagel (2012) who has hypothesised there must be some as-yet undiscovered field pervading reality from which our consciousness derives. Daniel Siegel (2016) reaches a similar conclusion, hypothesising that the mind is an emergent, self-organising complex system regulating the flow of energy (the dual of information) across its field in reality – a theory which we will see is also consistent with our specific theory of the psychological process.

We hold to, or rather draw upon the philosophy of weak Artificial Intelligence and the mystic philosophy as regards the relation of mind (thus consciousness) to the brain, body and world. The mind is held to be emergent from the brain which is necessary and sufficient for it to exist, and mind, brain and body together constitute an individual's being in a monist world.

2.1 The form of mental processes: thought, language, the *gestalt* architecture of mind

What then, is the logico-mathematical form which can represent the function of the mind? Let us discover this by considering the most basic mental process: a thought. What is the nature of a thought?

We can find an unusual degree of agreement between philosophers and psychologists that the basic nature of thought is to form a *connection*. David Hume (1777) and Immanuel Kant (1781) both speak of thought as "connection" between objects and events in the world. Both Freud (1917, 1930, 1963) and Jung (1933, 1935, 1964) spoke of them as "association" of objects and events in the world – especially within ourselves. John Dewey (1910) spoke of thought as "inferring the unseen relations" between objects and events in our environment. George Kelly (1963) spoke of thoughts as "channelised" by the way in which we "construe events" in our personal constructs of the world. Herbert Simon (1947, 1956, 1959, 1967, 1969, 1976, 1978a,b) saw thought as a process of implementing various steps in behavioural rules, or algorithms, connecting each step to the next in the sequence. Friedrich Hayek (1952) saw thought as successive "classifications" of objects and events relative to higher and higher order conceptualisations of them. Kenneth Boulding (1961) spoke of thought as "filtered" through our "image" of the world. And we know that our brains, from which we hold the mind to emerge, are network structures consisting of synaptic connections between neural cells (Kandel et al., 2013; Sapolsky, 2017).

A mathematical formalism which permits us to represent the form of thoughts thus conceived as relational, connective, objects is graph theory, or more colloquially, the mathematics of networks. The basic mental process, a thought, is to express in language a relation $R_{hh'}$, or a connection, between two elements h, h'.

The mind is the totality of the manner in which an individual thinks about the world and infers the relation of the objects and events contained therein together. It is, to use an old nomenclature, a *gestalt*, a whole of organised (i.e. related) parts, a structure, an architecture of thought, the syntax, the linguistic expression of which we can represent using a graph, or more colloquially, a network.

Definition 1 (The mind). The mind of the individual is a network system, or *gestalt*

$$\mu = HgH \tag{2.1}$$

consisting of elements $h \in H$ representing the *objects and events of reality* related to one another by relations $R_{hh'} \in g(H)$ between the objects and events of reality $h, h' \in H$ within a graph, or network.

The Germans would call this mental network our *Weltanschauung*, our "worldview". Karl Polanyi (1958) would have said it expresses our "personal knowledge" of how the objects and events in our world relate to one another. Hayek (1952) would have called it our "map" of reality and Boulding (1961) our "image" of the world. Kelly (1963) would have called it our system of personal constructions of

reality, our personality.

However we interpret it, the mental network μ expresses the individual's understanding of the objects and events in their world and expresses it in a *language*. This language is not necessarily equivalent to any spoken language, it may be "pictoral" or "symbolic" *a la* the philosophy of Ludwig Wittgenstein (Wittgenstein, 1914–1916, 1921; Wittgenstein et al., 1930–1932; Wittgenstein, 1953). It might even be inexpressible but as symbols (Jung, 1964) or even extant within the "tacit dimension" of which we cannot actually speak (Polanyi, 1967). Nevertheless, the elements of that language H are the equivalents of nouns, adjectives, subjects, objects. The connectives of that language are the equivalents of verbs, adverbs, propositions, conjunctions. It provides the manner of expression for the "syntax" of thought which the consciousness endows semantics (meaning) to (Searle, 1997).

2.2 The evolution of the mind: consciousness, creativity, psychological indeterminacy

If consciousness is accepted as real, it seems reasonable that one would allow for an *active* consciousness, for us to be aware of the experience of thinking *and* to engage in that experience. If we didn't allow for engaged and active thought in consciousness, then consciousness would seem to be a passive "ghost in the machine" sort of consciousness. Siegel (2016) would appear to be in agreement with this notion insofar as he sees the mind as a conscious regulator of energy and information flow. But if we allow consciousness to be real in this manner, we allow the possibility of thoughts which exist for no reason other than "we" (the phenomenological "I" (Luijpen, 1969)) think them consciously and actively. The existence of such a thought does not itself break the principle of sufficient reason (Melamed and Lin, 2015), but the "I" thinking them might. That the "I" brings into being a conscious thought might be the terminus of a particular chain of causation.

We call such thoughts to exist "genuinely creative thought", they are thoughts which exist for no reason other than they are created by the phenomenological "I". The capability to imagine new things is endowed by the conscious mind. This poses a difficulty for mathematical models which by their nature (consisting always of statements $A \Rightarrow B$) require the principle of sufficient reason to hold. Active conscious thought, insofar as it may be genuinely creative is indeterminate until it exists. However, that we might not be able to determine the existence of such thoughts before they are extant does not preclude us from representing them once their existence is determined. Koestler (1964) taught that all acts of creation are ultimately acts of "bisociation", that is, of linking two things together in a manner hitherto not the case. Acts of creation, bisociations made by the conscious mind, are indeterminate before they exist, but once they exist they can be represented as relations $R_{hh'}$ between two objects of reality h,h'. We may think of such acts of creation as akin to the *a priori* synthetic statements of which Kant (1781) spoke.

This is no matter of mere assertion. Roger Penrose (1989) holds, and it is difficult

to dismiss him, that the famous theorems of Kurt Godel imply something unique exists in the human consciousness. The human mind can "do" something no machine can. Godel demonstrated that within certain logical systems there would be true statements which could not be so verified within the confines of the logical system but would require verification by the human consciousness. The consciousness realises connections – in this case truth-values – which cannot be realised by the machinations of mathematical logic alone. It *creates*. The human mind can therefore (since we have seen those connections made) create connections in the creation of mathematical systems irreducible to machination alone. There are certain connections which consciousness alone can make.

The problem of conscious thought goes a little further though. New relations may be presented to the consciousness either by genuinely creative thought or otherwise, but they must be actually incorporated into the mind, $R_{hh'} \in g(H) \subset \mu$ and take their place alongside others in the totality of thought $g(H) \subset \mu$. Being a matter of conscious thought by the phenomenological "I", the acceptance or rejection of such relations is something we cannot determine until the "I" has determined the matter. As Cardinal Newman demonstrated in his *Grammar of Assent* (1870), connections may be presented to the phenomenological "I", but they are merely presented to the "I" and therefore inert until the "I" *assents* to them – accepts and incorporates them into that individual's worldview. The question of assent to various connections presented to the "I" is an either/or question Newman recognises is ultimately free of the delimitations of reason and a matter for resolution by the "I" alone.

There are thus two indeterminacies introduced to any psychological theory by the existence of consciousness:

1. Indeterminacy born of the possibility of imagining new relations $R_{hh'}$ in genuinely creative thought.
2. Indeterminacy born of the acceptance or rejection by conscious thought of any new relation $R_{hh'}$ and their incorporation or not into the mind $\mu \supset g(H)$.

The reality of consciousness thus places a natural limit on the degree to which we can determine the processes of the mind, determine those thoughts which will exist prior to their existence. For psychology, this indeterminacy of future thought until its passage and observance is the (rough) equivalent of the indeterminacy introduced to the physical world by Heisenberg's principle, the principle underlying the concept of the "wave function" upon which an indeterminate quantum mechanics operates (under certain interpretations (Kent, 2012; Popper, 1934, Ch.9)).

2.3 Philosophical conclusions

We hold to the following philosophical notions in this work. The mind is that element of our being which experiences our place in the world and relation to it. We are conscious when we are aware of our place in and relation to the world. We hold to a mix of the "weak Artificial Intelligence" and mystic philosophies that mind is

emergent from the brain and that mind, brain and body constitute the individual existing in a monist reality. The mind is a network structure $\mu = \{H \quad g(H)\}$ expressing the connections $g(H)$ the individual construes between the objects and events in the world H, an architecture within which and upon which the psychological process operates. The reality of consciousness introduces an indeterminacy into that architecture which imposes a limit on our ability to determine the psychological process.

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3
The psychology of behaviour

Operating within and upon the architecture of mind

An individual exists within the world. They are influenced by and interact with that system. The world-system may be conceived of as containing information which we may represent as subsets of an arbitrary semiotic space. By information we mean pre-sensory information in the information-theoretic sense (Shannon, 1948a,b) employed in physical science.

Definition 2 (The world as information). The world contains a particular realisation, $v \subset V$, of all possible information contained within the world, V.

This is a formalism of the initial proposition of Wittgenstein (1921) that the world, all that is the case, is the totality of facts. Here facts, what is the case, are represented by information v. The whole information of the world however is not available to the individual, for the individual exists at a particular location within the world system.

Definition 3 (The individual's neighbourhood). The individual occupies a particular neighbourhood N within the world system.

We shall leave the notion of "neighbourhood" within the world-system formally undefined but for the usual connotations attached to the notion of "neighbourhood" and that it must account for the orientation of the sensory organs in physical space, not being merely a mathematical "ball" in physical space. For instance, when placing the individual within the context of a network, their neighbourhood N includes a set of other individuals the individual is directly connected to. We can now define the information contained within the neighbourhood of the individual within the world-system.

Definition 4 (The individual's environment). The individual's environment contains the information $v_N \subset v$ associated with their neighbourhood N within the world, which is a subset $v_N \subset V_N$ of all possible information which may be contained within their neighbourhood $V_N \subset V$.