

Is psychology possible?

1. Introduction

In a previous discussion paper I suggested the need for research into whether it was coherent to allow two separately valid languages: the internal language of consciousness and the external language of neuroscience. I also raised the question of whether this necessarily involved a dualistic metaphysics. The present paper is a start on that research. I am not presenting a theory in any sense; simply starting to explore how one can think and talk about the relation between internal and external descriptions.

I use the precision offered by some very simple descriptive mathematics as a way of focusing the ideas. I realise that while this will lend simplicity and precision to those familiar with mathematical language, to the rest it may seem to add complexity. To try to overcome this, I have added in *slanting type* some comments on the mathematics—perhaps at the expense of defeating the object of including the mathematics, namely the achievement of simplicity.

In my title I call the internal language “psychology”, and I am really asking whether it is possible for there to be an internal language which is not derivable from an external language. That is, I am asking whether “psychology” is possible as a field that is essentially independent, not simply pragmatically or methodologically independent. If this were not so, then in a weak sense psychology would be reducible to physiology.

Although the background to these thoughts is the existence of two separate languages, I am not going to examine language per se; but rather some particular implications of having a language. These implications are,

1. that there is a designated collection of *states of affairs* (describable by indicative propositions etc.), and
2. that there are various *explanations* (describable through “if . . . then” or “. . . because . . .” constructions) that constrain the way states of affairs are thought to progress in time.

So I am reformulating my question to ask about the consistency of having two different sets of collections of states-of-affairs and two different collections of explanations.

For example, the utterance (in internal language) “she started singing because she was happy” designates two states of affairs (“being happy” and “singing”) and the implicit theory embodied in the language implies that it is reasonable to deduce the state of affairs “singing” from the prior state of affairs “being happy”.

2. Formalisation

The modern approach to a formal description of the universe—a universe in which there is the uncertainty of quantum theory and chaos—is to formulate precisely the probabilities for getting a later state out of an initial state. In the case I am considering, I shall formalise this by supposing that a language presupposes (or defines) a collection S of states of affairs and a probabilistic dynamics K that enables one, given a state of affairs at a time t_1 , to assign a probability to certain other states of affairs at a later time t_2 . This immediately raises several crucial issues.

1. Is probability the right way to formalise what is going on when one makes non-deterministic psychological statements? Maybe not, but there seems little available as an alternative.
2. What structure does S have? This is mainly the issue of quantum versus classical logic. If we make the assumption that each pair of states of affairs is either consistent or inconsistent, and that one can keep on asking questions about them until one gets down to an absolute final truth, then one has classical logic. Otherwise one has quantum logic (see below). Note that it may be characteristic of psychological statements that they are not necessarily simply compatible or incompatible, but may belong to different ways of looking at things (“The faeries are blessing my garden” versus “I have very nitrogen-rich soil”), which is a quantum logic.

Classical logic is expressed by taking S to be a σ -algebra on a space V of atomic propositions; quantum logic by taking S to be an orthocomplemented lattice. I shall start with the classical case, as being simpler, despite strong indications that quantum logic is in fact more appropriate.

A σ -algebra is a specification of which collections of basic (atomic) propositions are available to give probabilities to—not all collections of propositions can have probabilities. An orthocomplemented lattice is similar, but more general, obeying weaker rules

3. Is the future influenced purely by the state of affairs at one time, or does memory come into it, so that the future is determined by the whole previous history? This second possibility is very likely, particularly because the dynamics of the internal language proceeds through the meaning attached to states of consciousness, and this meaning is not fixed but grows with accumulated experience. We can, however, incorporate memory into the state of affairs at a fixed time by the formal device of simply defining “state of affairs” to include all the past history (giving a snowballing instant that constantly recapitulates, like “the twelve days of Christmas”). I will make this explicit later. The idea of making a whole history part of the dynamics is, of course, very well established in the theory of Feynman path integrals, and I am in part taking this over here.
4. Is “time” to be represented by the usual real line model, when it comes to psychology? And is the time of the internal language the same as the time of the external language? Maybe not, but no alternative comes readily to mind.

Although my primary interest is in consciousness, it makes sense to include unconscious factors in the category of “states of affairs”, and we have also had to expand the concept to allow for histories. I therefore propose to extend the concept of states of affairs from the common-sense notion introduced at the start, to a more abstract notion in which a number of factors that are not directly ascertainable are also incorporated into it.

The simplest situation, assuming classical logic, standard probability theory, and a few technical assumptions about smoothness, is as follows. S is as in 2, and given that the state of affairs at time t_1 is $v \in V$, the probability of the state at time t_2 being in some $A \in S$ is $K(A, v, t_1, t_2)$. A time-dependent probability distribution on V will thus evolve according to

$$\rho_{t_2}(A) = \int_V \rho_{t_1}(dv)K(A, v, t_1, t_2). \quad (1)$$

In the interests of familiarity, we can simplify this by supposing that the situation is sufficiently smooth for derivatives to exist, and that usual semigroup properties of (1) hold as is required for consistency of the probabilistic interpretation. Smoothness requires, for it to make sense, that the set of states V has a manifold structure (or something similar such as a stratified manifold or a differential space). In this case we may suppose that the differential form of (1) holds:

$$\frac{d\rho_t}{dt} = P(t)\rho_t \quad (2)$$

for some linear operator $P(t)$.

This states that the probability of a given state at the later time is got by adding up, for all possible previous states v , the probability of that previous state occurring, multiplied by the probability of getting the considered final state from that previous state.

Functions—that is, numbers that depend on some variable such as position or state—are called smooth if their rate of change as the variable is changed is finite and varies continuously. There are no sudden jumps or jerks. Studies of time evolution are often expressed in terms of semigroups in which there is an evolution operation that take one state into a later state in such a way that the result of applying two operations in succession is the same as applying an appropriate single operation. A manifold is a mathematical space which in a neighbourhood of each point is similar to our familiar physical space (except that it will not necessarily be three dimensional), but which may differ radically from common-sense space on a large scale.

The rate of change of the probability density is given by an operator on the probability density at a given time. The operator is linear in the sense that it takes sums and multiples of probability distributions into sums and multiples of the result of operating on the individual distributions.

All that has been said so far about the psychological language holds also for the physical language (the

external language) used for the brain. It has a collection of states of affairs W , a σ -algebra T and a dynamics such that a probability σ evolves according to

$$\frac{d\sigma_t}{dt} = Q(t)\rho_t. \quad (3)$$

3. Relating the languages

We now need to formulate a relation between the two languages. At this stage we can start to discriminate between the extent of dualistic ingredients.

Case a. One possibility—the least dualistic—is that every external state of affairs (brain-state) corresponds to a well-defined subjective, internal state. In that case there is a map f from W to V .

If we exclude out of the body experiences then there are no subjective experiences that do not have an associated brain state and so this map is surjective. There are presumably a great many brain states that are subjectively indistinguishable and so f is certainly not injective.

A surjective map is one that maps onto the whole of V . An injective map is one in which different elements are carried into different results.

Case b. It may be, on the other hand, that there are aspects of the subjective state that are not uniquely specified by the brain state, in the sense that for each brain state b there is a whole set v_b of subjective states of affairs that might correspond to the brain state. There is an internal “degree of freedom” over and above the brain state. While less purely monistic than case a, this is not necessarily dualistic in that there need not be any entity that could be defined as mind which can be singled out as separate from the brain state. We can now distinguish two sub-cases:

b1. In this subcase we assume that the sets v_b for various b are either identical or disjoint (i.e. if one subjective state can arise from two brain states b_1 and b_2 , then every other state that can arise from b_1 can also arise from b_2 , and every other state that can arise from b_2 can also arise from b_1). In that case there is a projection $\pi : V \rightarrow B$ where B is the collection of all the sets v_b , and a map $f : W \rightarrow B$ which, as before, is surjective. This will be the case if we have incorporated past histories into the specification of V , but the brain state only specifies the present moment (including the present memories). In that case, π is projection onto the end-point of the history and B is the collection of momentary subjective states, shorn of their history.

b2. “Otherwise”—everything else. In this case there is a looser relation between brain states and subjective states, more akin to c below.

Case c. There may be no fixed relation between brain states and subjective states of affairs, but only a loose influence of the former on the latter. In this case the subjective realm starts to take on an entirely independent existence as a separate mind.

4. The compatibility problem

The basic problem I find with dualism is that it either over-specifies the world or else it collapses into monism. Suppose that my physical actions, moving my limbs and so on, are the result both of the action of my soul and of my brain and physiology. How do the two causal influences fit together? If the soul demands one action and physiology demands another (a situation reported with anguish by St Paul) then either the limb in question takes the average (in which case the soul becomes simply another physical cause and we have collapse into monism), or we require a third factor to adjudicate between them, which seems unsatisfactory. Maybe this situation never happens because the soul only acts within the “gaps” left by the fact that the dynamics of physiology is indeterminate (a possibility canvassed by Polkinghorne). This is logically possible, but seems an inadequate account of what decision making is really like.

The possibility in which I am interested here is that of there being a single system, the human person, describable by two languages, the internal and the external, which though distinct are compatible in that no prediction of one will ever be refuted by the other. The question then is, can any of the models described in the previous section exhibit this sort of compatibility, while having the subjective dynamics still independent of (i.e. not determined by) the physical dynamics? (The condition for independence is the condition that the internal description is really saying something in addition to the external language).

To formulate this, it is convenient to assume that the two dynamical systems V and W are each autonomous: that is, all the factors relevant to the dynamics have been included in the specification of the states of affairs. For W this will involve including all the inputs from the outside world into the specification of the brain state; for V it could involve including, for example, the collective unconscious in the subjective state. In this case, the operators P and Q are independent of time. When the systems are autonomous it makes sense to regard the dynamics as something that is in principle empirically verifiable: one carries out large numbers of observations in order to determine K and hence P (although in practice it is very implausible that one could proceed in such a quantitative manner). Thus compatibility involves the requirement that the two dynamics make the same statistical predictions.

In addition, we can extend autonomy to require the time independence of the map f . For, if f were to be time dependent, its changes would have to be determined ultimately by the states of the brain and of the subjective realm, and so one could always reformulate the map as a time independent one.

For case a the situation is almost exactly as we would expect: namely that since there are no extra degrees of freedom in V , the two languages are saying the same things in different ways.

With one qualification, probability distributions are pushed forward by functions, and so in case a the distribution σ is pushed to a well defined distribution $f^*\sigma$ on V . Compatibility is the requirement that this distribution obeys the correct dynamics on V , namely that

A structure on a mathematical space is said to be pushed onto another space by a map between the spaces when the structure moves in the same direction as the map. When it moves in the reverse direction it is said to be pulled

$$f^*Q = Pf^*.$$

Since σ determines ρ , and hence its dynamics, uniquely, there is no extra information contained in V .

The only qualification in the above concerns the σ -algebras involved, which are also pushed forward by f . If S is finer than f^*T , then σ determines not ρ but $\rho|f^*T$. There is thus the possibility of extra information being contained in the fine-grained structure of K that is hidden from the classical dynamics on W . It must be admitted that this is a long shot. One would be hard pressed to believe in a subjective dynamics that singled out subjective states that corresponded precisely to non-measurable sets in physical phase-space!

Case b1 offers—again, unsurprisingly—clear scope for the internal language saying more than the external one, because of the greater freedom in V : now σ constrains ρ through the requirement that $f^*\sigma = \pi^*\rho$, but the dynamics on W no longer determine the dynamics on V . The compatibility condition is more difficult to specify in this case, unless the projection π splits: that is, if one can define a space M (for ‘mind’!) such that $V = B \times M$ and π is projection on the first factor. One can then introduce, rather speculatively, a prior probability distribution λ on M to enable one to map a distribution α on B to the distribution $\pi_\lambda\alpha = \alpha \times \lambda$ on V , so that the compatibility condition becomes

$$\pi_\lambda \circ f^*Q = P\pi_\lambda \circ f^*.$$

The case of b1 that seems particularly interesting is the one where the space V consists of histories and π is projection on the endpoint. Here the projection will in general not split naturally, unless, of course, the space of histories has a natural linear structure (which seems an artificial assumption). Neither does there seem very much hope of establishing a prior distribution on the space of histories even if it does split. On the other hand, it would seem unreasonable to say that there was no consistency condition at all, since it should be possible to point to some circumstances that would be highly implausible on any (non-natural) assignment of splitting and

prior distribution. So in this case it may be appropriate to recognise that precise numerical compatibility is an idealisation in what is most probably a non-quantitative situation, requiring instead an approximate condition that the previous compatibility condition be approximately satisfied for all reasonable splittings of the projection.

5. Quantum logic

While I do not propose analysing here the possibilities opened up by quantum logic, a few remarks will help to move the investigation in that direction.

First, it seems likely to me that the subjective realm will be more in need of quantum logic than the neurological one. The shifting world of open-ended meanings and simultaneously entertained possibilities that characterises our thought processes seems much better suited to a quantum logic than to a classical one; while at the neurological level it could still be worth looking at models involving only the macroscopic classical behaviour of neurons and ignoring their inner quantum workings (though more on this later).

If one is to represent the subjective realm by a quantum logic then it is not immediately obvious what to put in the role of dynamics.

The quantum state (a bounded linear functional of the operator algebra that is derived from the quantum logic) corresponds in general to the description of an ensemble. If our aim is to recover for science the reality of the interior life, then it will be of no avail to introduce an abstraction such as a state related to an ensemble: rather, the state must correspond to an individual experience. This takes us into the problems of wider ways of formulating quantum theory.

Probably the correct approach is to recognise that consciousness has a certain fuzziness in time, so that we are dealing with what is literally a fuzzy space comprising a succession of local states defined through the process of self-observation that is the essence of human reflective consciousness.

This would be to break radically new ground, however, and as a first investigation it would be simpler to approximate the evolution through a non-linear process combining “collapse” with Hamiltonian evolution. The distinguished Boolean lattice that governs the collapse would itself be a function of the subjective state, introducing a further dimension of non-linearity.

One possibility that we have thus reached, is that one could discuss the quantum case simply by taking V to be a space of (mixed) quantum states with the dynamics just indicated, with W a space of classical states, and proceed as before. No essential difference would thereby be introduced as a result of introducing quantum logic, except at the level of interpretation.

An alternative approach, however, would be to use a quantum logic formalism for both objective and subjective world. This could be done even if the objective system were classical, by restricting it to a Boolean logic. In this case compatibility will be expressible, after taking a vector representation of the algebras, through the usual unitary mapping between spaces. This could well produce quite new possibilities.

6. Summary

I have described a way of thinking about the relation between internal and external languages in which each has its own dynamics; there is a clear sense of compatibility between the two; the internal language is not reducible to the external even in the weak sense that each internal language statement is derivable uniquely from an external one; yet where there is no identifiable “mind” in the usual dualistic sense. I would argue that such

a situation becomes entirely natural as soon as one tries to formulate the idea that there is an internal, conscious dimension to the world, in addition to the external one treated by conventional physics.

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