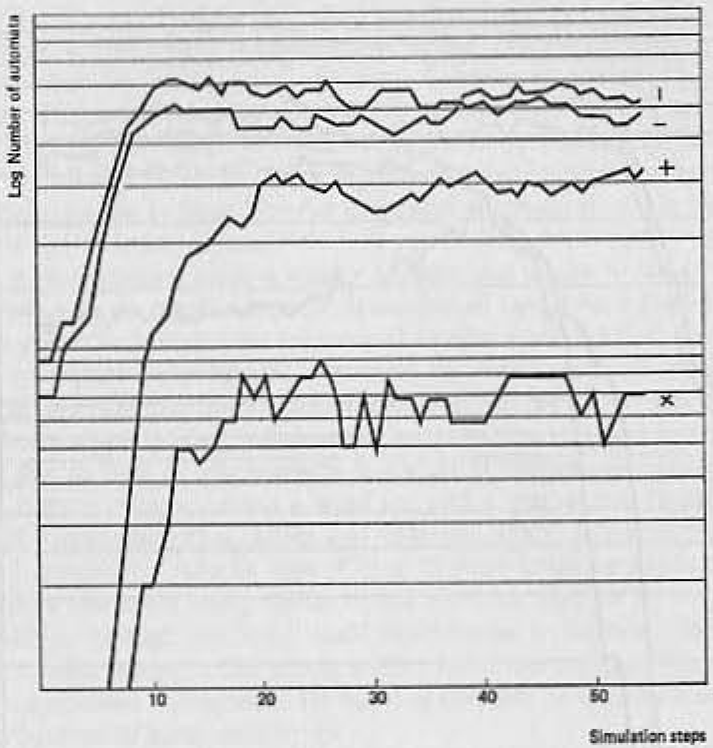


*Figure 29* Control experiment, types |, −, + and ×.

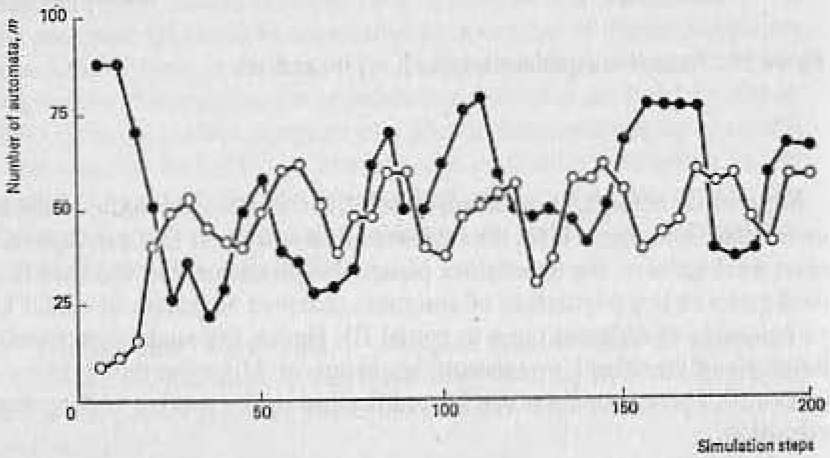


*Figure 30* Oscillatory interaction between complex (+ or ×) and simple (| or −) automata: ○, + or × automata; ●, | or −.



# 4 Relativism

## 1 Observation

Most scientific writing, even in behavioural science, takes it for granted that an observer can, in principle, act as a numinous and unbiassed entity called an external observer. This point of view is embedded in part but not all of system theory.

**1.1** An external observer may make measurements, to determine the state of an observed system for example. Should he partition the system (for instance, into a 'black box' (Ashby, 1964c) called an organism and another 'black box' called its environment) he comes, by dint of observation or auxillary data, to entertain detailed hypotheses. Though of course, he did have some kind of hypothesis to begin with. The organism is worth observing; it has some goal or some characteristic behaviour; it, rather than a myriad other candidate organisms, has been distinguished from the flux of events and chosen apart from its environment.

The detailed hypotheses ultimately arrived at are causal. The organism and the environment are conceived as certain kinds of machine. The observer believes, with certainty or just statistically, that each output was *caused* by some input, or some input/output history. Conversely, he may act upon the organism in a special manner or he may build the environment, as an experimental regulator, in order to do so. In this case, he entertains the predicitive hypothesis that an input will *cause* a certain output or output sequence.

**1.2** Moreover, the external observer is causally related to the system under observation; he necessarily conceives it impersonally and refers to it as *it*. One useful consequence of this fact is that he can consistently entertain the notion that the system has, in principle, a state and that one, and only one, state occurs at once. The state transitions are ordered, and this order is interpreted as temporal ordering and can be determined by an observational clock. *Its* internal clock may be synchronised with this clock in principle at least, in the following sense; any process serially executed or not, is *equivalent* to a serial model within this frame of reference.

**1.3** As part and parcel of the same issue, only the external observer is allowed to make distinctions and to engage in certain other operations which are noted below. The distinction between organism and environment, for example, is of his making; the organism is deemed incapable of such an activity. If an event of this kind occurred it would either remain unobserved or be blamed upon a chance process; this follows from the scheme in which an external observer can preserve his demarcation and impartial stance; it is not a *truth*.

**1.4** Many consequences of choosing to be an external observer are advantageous; most of these have been cited so far. They characterise a theoretical orientation and an experimental method which will be called *classical*. In some ways classical *models* are quite powerful, also. For instance, it is possible, under these conditions, to impute the activities of deductive and inductive inference to the system or its components; sufficiently complex models erected within the classical framework are able to act in this way. Hence, they might, if clever enough, be held to reflect some mental operations of the observer himself were he immersed in the system and observed by another observer impartially.

But other consequences of the classical concept are not as desirable. Consider, for example, the observer's basic mental activity in constructing an hypothesis (section 1.1). It is neither deductive nor inductive but a mix of abduction (as McCulloch (1965), insisted); of distinction, predication, or of cleaving out from a flux of events (the logic of which is due to Spencer-Brown, 1969), and of rule invention to collect the distinguished fragments under the abduced principle. In this connection the reader is also referred to Beer's (1966) commentary on Charles Pierce and 'Fixing Belief'.

Of course, this dogma can be qualified; some hypotheses are deduced from others and some appear as inductive generalisations from previously unfalsified smaller hypotheses. But the initial theme was abduced/distinguished/invented for all that, and even the relatively pedestrian activity of deriving subsidiary hypotheses is necessarily guided by an acumen that stems from this source. Here the inventiveness is manifest as the application of aesthetic or 'know how' criteria used to winnow out 'profitable' lines of development from really or virtually limitless possibilities.

These aspects of mentation, or the corresponding aspects of other than mental processes, cannot be credited to the participants in a classical system because the modelling rules and methods prohibit it.





**1.5** The difficulty is amply supported by the attempts that are made to represent such interesting aspects of cognition within a classical scheme. For example, when Wittgenstein (1953) speaks of a language game, he means a game in which the participants have certain roles and in which question-forms are interpreted *as* questions. When Harrah (1966) speaks, in a similar vein, of communication, of debate or interrogation, he means a process involving question and answer forms that are interpreted by participants with roles. In each case the cogency and existence of a question is asserted; there is no denying that questions exist and are, in fact, properly interpreted (as semantic and pragmatic entities, not just as question forms). But the roles responsible for giving this interpretation are stated extra-theoretically for the simple reason that they cannot be accommodated *within* a classical framework. If someone *really* asks a question it may lead him or whoever the addressee may be, to abduce/distinguish/invent. In any case a questioning transaction is not causal and if the roles and the reasons for adopting these roles were expressed within a theory, then the participants could not be regarded as *it*; rather as personally pronominalised entities.

Though the argument sounds less dramatic, these comments about models for sentient interaction (with the role, psyche or interpretation unformulated in the theory) run closely parallel to similar comments about machine cognition. The acts of abduction/distinction/invention are outside the theoretical specification of the model and only *simulated* within it; this is also true of those heuristics that seek out profitably executable productions and entail abduction/distinction/invention only indirectly.

**1.6** If we are anxious (and I am) to theorise about such matters as abduction/distinction/invention then it is necessary to set the classical concept of modelling and experimentation aside and to resort to a *reflective* theory (like many rather 'sloppy' theories in psychology and sociology). There is nothing counterfactual about doing so, though much convenience is lost. For example, in a reflective theory, the external observer's special position is lost; with minor caveats he becomes a participant. Further, any reflective theory is prone to paradoxical situations engendered by the possibility of self reference. In *general*, such a theory does not tally with a classical theory; though in special but important cases it does so. (The trouble is that there is a basic indeterminancy in specifying the special cases in advance, or picking them at will.) The roots and beginning of this development are stated in the present volume but the main and serious argument is deferred until the next.

**1.7** Is there a true dichotomy, that insists that the theory must be classical or reflective? The distinction is valid; but fortunately there is a continuum of theoretical types and experimental methods that are laid out between the classical and the reflective extreme.

**1.8** One route of approach to a reflective theory, the route to be adopted in the sequel, goes by way of relativistic theories and methods in which the distinction between organism and environment is systematically eliminated (whilst the external observer's posture is retained) until, at last, the external observer's position is undermined.

## 2 Development of Relativism[1]

The gap between the classical concept of a theory and a reflective theory, and the experimental methods that also go along with them, can be bridged by a series of intermediary cases of theories, models and methods shown graphically in Figures 31 to 35.

The figures employ the following symbolism or shorthand. In each figure there is a modelling universe for an observer. The models may be abstract and intellectual, for example, mathematical constructs of one sort or another, or artifacts, for example, physical devices and computer programs like the learning models described in Chapters 5 and 6. Readers who prefer tangible instances to begin with should scan Chapters 5 and 6 before starting the (next) section 2.1. The basic requirement is that a model shall be communicable to other observers using an observational language (usually scientific English together with formal schemes like algebra to augment it locally). It is a metalanguage for talking about models as a class and also for talking about real structures and laboratory experiments. In each figure there is a real or experimental universe. It contains an experiment, meaning any constructible or coherently observable situation. For brevity, the discussion is confined to experiments involving an organism or subject. The experiment comprises a subject/organism and a regulator which in Fig. 31 is a programmed environment and in Figs. 32 to 35 is one of the null-point/steady-state mechanisms described in Chapter 7 or an adaptive regulator (Chapter 8). I suggest a scan of Chapters 7 and 8 before starting the (next) section 2.1, and readers who prefer tangible instances will find it essential. The modelling universe and the experimental universe are shown as dotted outline boxes.

In all cases it is assumed that an observer has a description of his model and a possibly imperfect description of the experiment. Though the form and scope of the description could be detailed, this refinement is avoided

1. Relativism is not without exponents. For example, Helson's *adaptation* level theory is explicitly relativistic and Helson (1964) discusses the philosophical implications in the introduction to his book on the subject. However, in that case, the relativistic frame of reference is an adaptation level for the organism or subject, rather than an observer or an experimental situation.





and the description is indicated by a specific symbol . Further, the external observer can operate in various ways upon the models and/or experiments under scrutiny. An operation that is unrestricted, apart from the rules of the observational language, is represented by a filled-in parametric arrow penetrating whatever is operated upon. To limit the scope of an operation, the arrow never penetrates an entire dotted box but only some part of it, a subsystem demarcated by a plain line box. An operation, of whatever scope, that *is* restricted; namely, an operation which would jeopardise the systemic structures, asserted by a figure or its text description if they were carried out in an untrammelled fashion, is symbolised by a blank parametric arrow ; generically the restricted operations are called 'tuning' operations. This is a commonly used jargon in the field of large population modelling and indicates adjusting parameters so that the model fits the facts or adjusting an experimental design so that it satisfies a model.

Finally '→' is a unidirectional (information flow) coupling and the double arrow notations '↔' and '↔' stand for bidirectional flows.

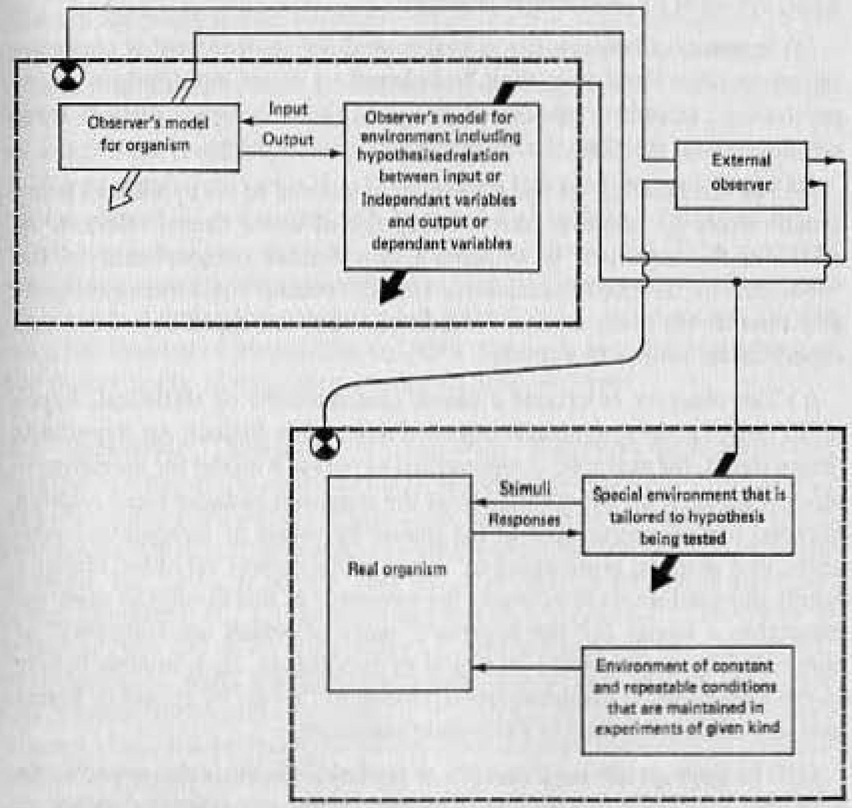


*Figure 31* Classical method.

**2.1** Figure 31 depicts the classical experimental method.

(a) The observer is an *external* observer in so far as he can view the experiment and any participant (here dubbed the 'organism') impersonally as an *it* which is studied.

(b) Because he is in this position he can use a clock or his sense of time to order events. In particular, time (mapped onto the integers) imposes a successor-ordering upon universes (both modelling and experimental) so that either universe is constant and there is equivalence between temporally distinct universes. $U(t) = U(t + 1)$.

(c) It is always possible, on that account, to distinguish between the *organism* and its *environment* in the following very definitive sense: the grounds for making the distinction in the experimental universe are the same as the grounds for making it in the universe of a model for the experiment. Hence the distinction appears in the model as well and it represents the same thing; for example, the boundary of the organism with the environment, drawn at its sensors and effectors.

(d) Interaction between the organism and the environment is also conceived as causal and may thus be referred to as an input/output or, in psychology, stimulus/response exchange. This exchange is distinct from any interaction entailing the observational metalanguage.

(e) The box labelled 'special environment tailored to the hypothesis being tested' refers to whatever surrounding the observer deems relevant. In addition, the organism is embedded in a further compartment of the 'environment' designed to exclude or annul or swamp out extraneous inputs and thus to maintain constant conditions that are repeatable from one experimental session to another.

(f) The observer entertains a *causal* (deterministic or statistical) hypothesis only, i.e. the organism is regarded as *it* and is distinct. An hypothesis (being tested, for example) is represented as part of a model for the environment. Typically, an hypothesis about the organism includes some relation between inputs, represented in the model by values of independent variables, and outputs, represented by values of dependent variables. Under a family of hypotheses (or acting as the generator of this family) an observer entertains a model for the organism, parts of which are supported or eliminated by confirmation or denial of hypotheses. Such models belong to the class of serial machines (recall comment (b)) or, by appeal to Bremmerman's limit, the class of finite-state machines.

(g) The appropriate macroscopic or probabilistic variables are *selective* uncertainty/information indices (Chapter 1) and are estimated either as statistical indices or indices of selective work. In particular, the universe is constant so that $U(t) = U(t + 1)$.

A theory, within which an external observer can make inferences, is a metaphor and is expressed in the observational metalanguage, which asserts a strict analogy, that is to say, it is either an isomorphism (one-to-one correspondence) or a homomorphism (many-to-one relation—preserving correspondence) between a *relation* coupling 'observer's model for organism' with 'observer's model for environment' and a further *relation* coupling 'real organism' and 'special environment'. Tenure of the analogy is contingent upon the existence of its domain of interpretation which (as below) is an identification between the 'model' universe and the 'experimental' universe, i.e. it holds if a metalinguistic proposition 'there is an identification', is true.

An identification, usually obtained by specifying measurements and the like, is a stable condition in which the boxes or subsystem boundaries enclosed in 'model' and 'experiment' retain their integrity and in which those in 'model' are in register with some or all of those in 'experiment'. The crucial point is that variations which do not explicitly appear in the model are 'constant conditions' in the experiment (i.e. the constant condition 'Box' has a unidirectional coupling directed towards the organism). In other words, the material analogy underlying the theory has a universe in which these conditions *are* held constant as its domain of interpretation.

The external observer in Fig. 31 carries out two kinds of operation: (1) by means of unrestricted operations, he poses and tests hypotheses which, if valid, permit him to make inferences within the *theory* and (2) by means of the 'tuning' operations, he adjusts his model for the organism so that it can be identified under the measurement procedures at his disposal. In this way, the contingent proposition becomes true, and the material analogy of the theory holds, in its proper domain of interpretation.

**2.2 Relativistic Theories** A *relativistic* theory/model/experimental method is necessary in so far as the organism (more plausibly, the subject) engages in activities such as exploration, attention direction or non-trivial learning in which he exerts control over his environment and consequently changes the universe (either real or modelled) in which he operates. Thus, in general, $U_\alpha \neq U$ (a constant) but $U_\alpha \to U_\beta$ and $U(t) \to U(t + 1)$ where $U(t) \neq U(t + 1)$. If the subject is *designed* to act in this manner and it is desired to study the phenomena (learning or exploration) that cause the trouble, then a classical model is inapplicable. In order to achieve closure at all, the subject's excursions must be compensated and founded within a (larger) universe ($\mathscr{U}$ say) such that $U_\alpha \subset \mathscr{U}$ and $U_\beta \subset \mathscr{U}$ (or $U(t) \subset \mathscr{U}$ and $U(t + 1) \subset \mathscr{U}$). Under these circumstances, the constancy required for any kind of external observation is maintained by a compensating regulator and the 'constant condition' is a dynamic but stable *interaction* between the subject and the regulator.

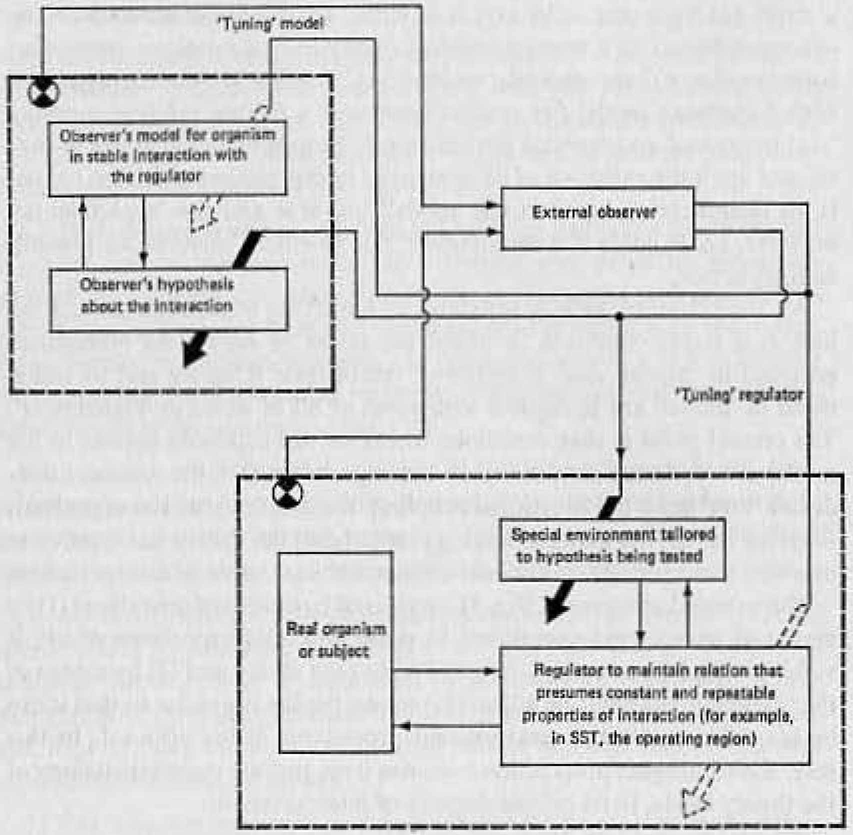


*Figure 32* The relativistic method using a null-point or steady-state technique. 'Tuning' connection may also be interpreted as a design process for the regulator in which a computer programmed model (for instance of the type in Chapter 6) is run predictively in order to obtain effective regulator design.

Figure 32 depicts a simple *relativistic* method, detailed in Chapter 7. The constant condition is maintained by a regulator, a device that holds the organism in an 'operating region' where he is able to perform a task and to persist in its performance. The appropriate form of model represents the *steady-state system* of subject and regulator in interaction, and is instanced in Chapter 7. 'Tuning' operations increase the size of $\mathscr{U}$ and may be refined by executing the *joint system* model as a predictive device (under various





parameter values or hypotheses) and by using the parametric adjustments that stabilise the steady-state model to improve the design of the *real* regulator in the experiment.

The salient features of this relativistic theory/method/model are listed in the following previously established order.

1.(a) The observer is an external observer.

(b) He can order events, as before, *except* those within the joint system.

(c) If he is to maintain the fundamental constancy, the external observer can no longer make a clear demarcation between that compartment of the environment responsible for constancy of conditions and the subject (unlike Fig. 31 the coupling is bidirectional; it is only possible to observe a stable regulator/subject interaction).

(d) The events *within* the joint system are not *observed* as causal but *are* distinct from any transactions in the observational metalanguage.

(e) The environment that embodies the observer's experimental hypothesis *can* be distinguished from the real regulator/subject system, but *not* from the subject in isolation.

(f) The observer entertains causal hypotheses *about stable modes of interaction* in the joint system and his model is a model for this entity taken as a whole, as in Chapter 5. It belongs to the class of finite function machines.

(g) The appropriate macroscopic or probabilistic variables are indices of self-organisation, derived from selective uncertainty/information indices, but which are *not* constrained by the requirement that $U(t) = U(t+1)$; in fact, this condition is rarely satisfied.

2. A theory, *within* which the external observer can make inferences, is a metaphor expressed in the observational metalanguage that asserts a strict analogy between a relation coupling 'observers model for interaction' to 'observers hypothesis about interaction' and a further relation coupling 'real interaction (both components)' to 'special environment'. Tenure of the analogy depends upon the existence of its domain of interpretation, which is an identification between the 'model' universe and the 'experiment' universe.

3. Identification is secured by the stable operation of the regulator.

4. The external observer carries out two kinds of operation. (a) By means of unrestricted operations he poses and tests hypotheses about a stable interaction. (b) By means of 'tuning' operations he adjusts the real regulator so that it secures stable interaction and brings his model for the interaction into register with the reality.

5. The arrangement shown in Fig. 33 is a special case of some practical importance. All 'tuning' operations are built mechanically into an adaptive

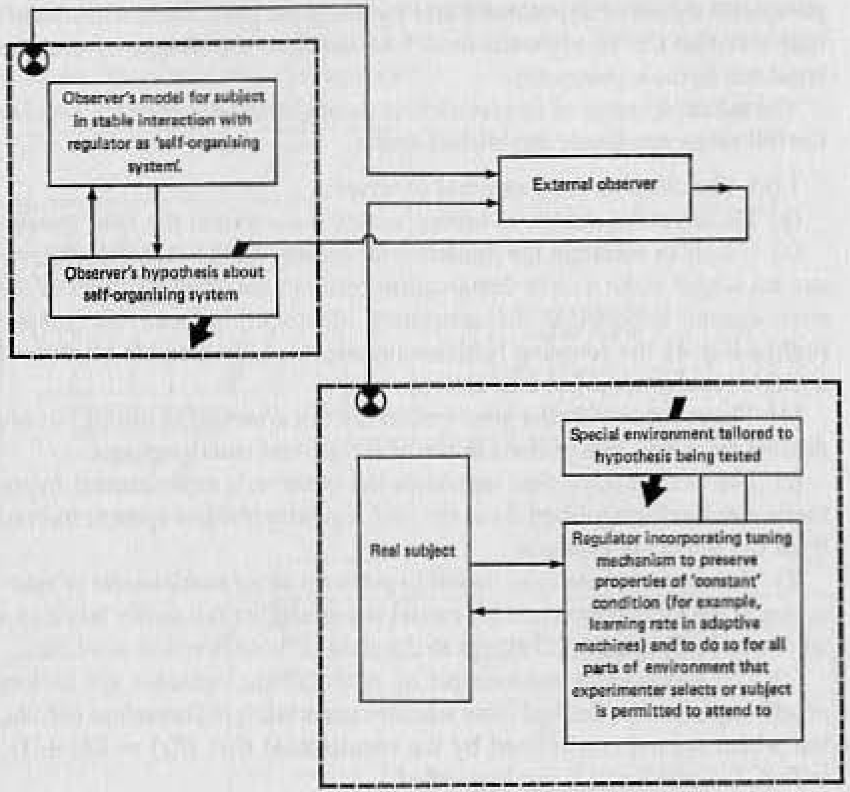


*Figure 33* A special case of Figure 32 in which the 'tuning' mechanism is specified as a part of a regulator and its model. This is the adaptive system of Chapter 8.

component of the regulator (as in Chapter 8) and are represented, isomorphically, in the model (as in Chapter 6). The construction also indicates the restrictions imposed upon 'tuning' in general; namely, it must be open to instrumentation and representation within the calculus of finite-function machines. In turn, this limitation imposes restrictions upon the size and structure of the (large) universe $\mathscr{U}$ in which the phenomena of interest can be observed.

6. The point can be usefully rephrased, using a distinction due to Hesse (1963) discussed in Pask (1963, 1971a). The distinction demarcates analogies *with* and *without* 'neutral' analogical properties; that is, properties of undetermined relevance, at some instant.

A standard analogy is a relation, in the simplest case, of the form '$A$ is to $B$ as $C$ is to $D$' where $A$ and $B$ belong to one universe ($U_X$ say) but $C$ and





$D$ belong to another universe $U_Y$. There is a function, or in general a relation, $F$, carrying elements (such as $A$) in its domain, into elements $B$ in its co-domain; likewise a relation, $G$, carrying elements $C$ in its domain, into elements $D$ in its co-domain. The analogy exists in so far as there is a relation between $F$ (in the universe $U_X$) and the relation $G$ (in the universe $U_Y$). The analogy is *strict* if this relation is an *isomorphism* or a homomorphism. The *analogical* universe is specified by choosing an indefinite sequence of properties $P_X$ of $U_X$ and $P_Y$ of $U_Y$; the analogy has no *neutral* properties and is *closed* if for all $P_X$ or $P_Y$ that are chosen, each one either is or is not relevant to the analogy. In the former case a particular pair $P_{X_0}, P_{Y_0}$ is characteristic of the analogical universe. If this is not possible at a given instant (though it may become possible to effect the discrimination later) $F$ and $G$ holds only in part of the analogical universe (there are regions of fuzzy specification); the analogy is only *locally* strict and not always so.

Let $U_X$ and $U_Y$ represent the 'model' universe and the 'experimental' universe so that $\mathscr{U}$ is the pair $\langle U_X, U_Y \rangle$ related by the analogy underlying the theory. The limitation upon 'tuning' is that this analogy remains always strict, or 'tuning' is carried out to secure this result.

**2.3 The Hinterland between Relativistic and Reflective Theories** The difficulties caused (from the classical standpoint) by activities like attention directing and learning can be ascribed to a misbegotten choice of the unit for observation. Instead of regarding the subject as a system (such as a system in classical physics), with input and output it would be possible to regard *him* (now *him* quite seriously though) as a unit of interpretation; a symbolic structure which is usually executed in a non-localised processor. Really, it is a matter of approach. For, in either case, the sentient character of a human being (and other systems as well) must be acknowledged. Either his integrity as a symbolic (interpretive, innovative, strategy constructing) entity can be taken as *fundamental* and the processor responsible recognised after that; or else, using the approach so far adopted, the processor can be regarded as the fundamental unit and the symbolic processes it executes can be ladened onto it.

All the relativistic expedients may be viewed quite legitimately, as means to isolate an *observable* core of mentation within a capsule of processor. In each case, the processor has expanded (to keep symbolic events observable, the processor is distributed across the components of an interactive system bounded by $\mathscr{U}$). But the limits imposed upon $\mathscr{U}$ in section 2.2(5) are, for many purposes, crippling. They disallow the investigation of lengthy or educationally interesting stretches of learning, for example, or any kind of non-trivial creativity. So, on balance, it is provident to accept the obvious (that is, the obvious to someone primarily concerned with these psychological events rather than someone concerned with human neurophysiology) and to recognise that man is first and foremost a symbolic entity.

Something is gained by doing so. Under this interpretation it is clear that the constant conditions of an experiment rest upon certain norms which the subject accepts if he engages in an experimental contract (to take part in the experimental situation at all and to obey its rules). Moreover, in such a situation he adopts a role and this role (student, respondent in an interview, decision-maker or whatever) *may* be taken as the fundamental unit under scrutiny. On the last point it is possible, at this stage, to remain uncommitted. But if the investigation is to proceed beyond the limits shown under number 5 of section 2.2, then the following characterisations are essential.

(a) The subject speaks a language: either he is formally given a language, the object language of the experiment, or he uses the symbol system actually provided *as though it is a language*, a fact that is empirically manifest, for example, as the 'participant interaction' of Chapter 7. The object language has a genuine interpretation and it is a command and question language, not just a formal language.

(b) The special environment is symbolic and constitutes a description, in terms of this experimental object language, of relations or topics that are knowable. It may be extremely complex (Chapter 11).

(c) The experimental constancy is maintained by a normative scheme, the experimental contract. As one party to this contract the subject accepts and interprets a *role* which the regulator must also interpret. For its part, the regulator cooperates with the subject (through the experimental language) and makes it *possible* for him to keep the contract he has agreed to keep. The notion of 'experimental construct' is exemplified in Chapter 7, section 7 (notably in subsection (e) on p. 190 and p. 191).

It follows, of course, that an observer's hypotheses are no longer necessarily causal and that though the observer may refer to the subject/regulator system as *it* he must recognise, with increasing cogency as more interesting hypotheses are tested, that he is looking at a conversation in which the subject and the regulator regard one another as 'you' and 'I' (not, as before, in which the subject regards the regulator as *it*). In the most restrictive forms of theory, these points are not too obtrusive. One restricted form is shown in Fig. 34; the features of which are listed below.

1. (a) The observer is an external observer.

(b) He can *only* order events at the cost of restricting his enquiry and he is not in a position to order all events taking place in the joint system.

(c) The special environment is symbolic and is interpretable both in the object language of the experiment and the observational metalanguage.

(d) Events (transactions) in the system are only distinct from transactions





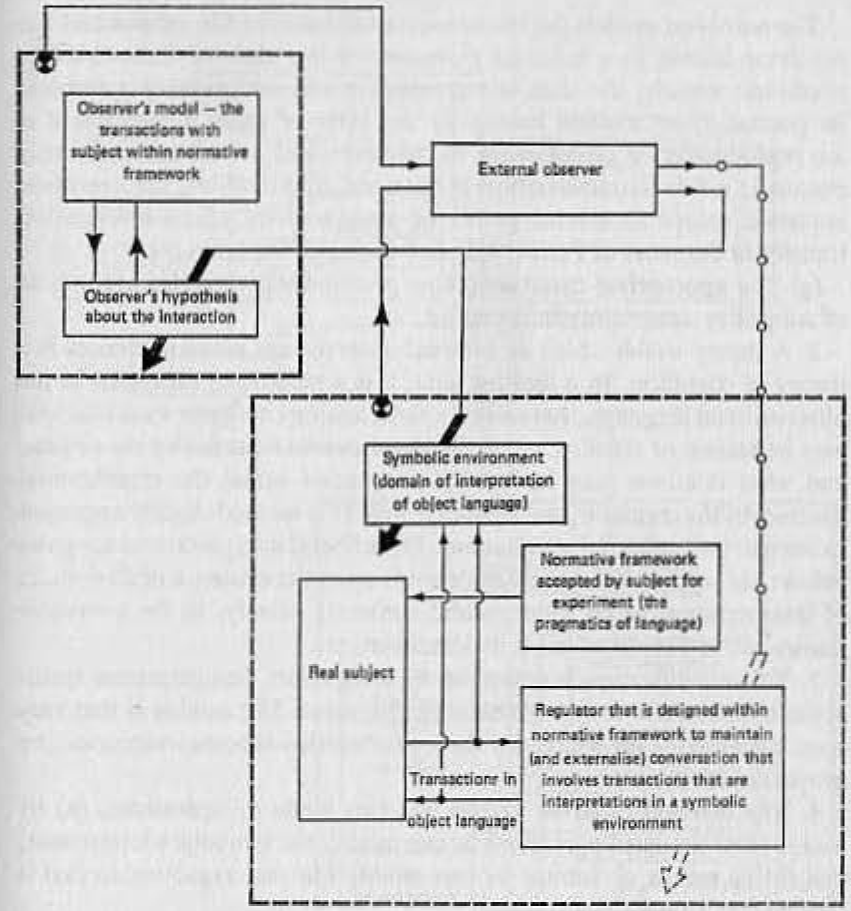


*Figure 34* Model identified in a normative framework. Only very limited 'tuning' operations are permissible if the observer is to retain his external status.

in the observational metalanguage in so far as usage of the object language is restricted for this purpose.

(e) The special (symbolic) environment that embodies the observer's experimental hypothesis is distinguished as the topic of a conversation which the regulator and the subject discuss.

(f) The observer entertains hypotheses about relations that may be brought about by the execution of procedures and the topics that may be known by dint of executing other procedures. Some hypotheses concern knowable relations and others concern how relations are known, reconstructed, and satisfied.

The *narrowest* models for the conversation between the subject and the regulator belong to a minimal extension of the class of finite-function machines; namely, the class of reproductive and evolutionary automata. In *general*, these models belong to the class of fuzzy algorithms that are reproductive or evolutionary in character and are also concurrently executed; a full characterisation is obtained by fuzzifying the execution sequence except at special points of synchronicity where information transfer in the sense of Petri (1965) and Pask (1973b) takes place.

(g) The appropriate macroscopic or probabilistic variables are indices of subjective uncertainty/information.

2. A theory *within* which an external observer can make inferences is a theory of cognition. In a limiting case, it is a metaphor, expressed in the observational language, that asserts a strict analogy between what relations *may* be known or satisfied *within* the experimental contract by the subject, and what relations may be known or satisfied *within* the experimental contract by the regulator, and similarly, any of the methods legally employed to learn or bring about these relations. More liberal interpretations are given below; but tenure of *this* analogy depends upon the existence of its domain of interpretation as an experimental contract; namely, as the *normative framework* in Fig. 34 which is its identification.

3. This identification is preserved by a regulator that maintains transactions which refer to the symbolic environment. The trouble is that very soon the analogy on which the theory is founded becomes vaccuous; no properties are relevant.

4. The external observer carries out two kinds of operations, (a) by means of unrestricted operations he can modify the symbolic environment, and (b) by means of 'tuning' he can modify the real regulator so that it secures stable interaction.

The 'tuning' operations are very restricted if the conditions of section 2 above are to be preserved. A special case is shown in Fig. 35 in which the model with components $E(n)$ and $I(n)$ are those discussed in Chapter 6; similarly, the real regulator is characterised by an 'internal model' $E(n)$. If used as a process for designing effective regulators (for example, to maximise learning rate or some other property of the interaction) and if confined to the trivial symbolic environments of Chapter 6 (one coding relation $\mathscr{R}$ or two alternating relations $\mathscr{R}_1$ and $\mathscr{R}_2$) the arrangement in Fig. 35 degenerates into Fig. 34 even though the system is given a symbolic interpretation. However, if the learning model is equipped, as shown, with a list of learning strategies employed by subjects when exploring a larger symbolic environment (the *data table* in Fig. 35) the system, though still highly restricted, is not positively degenerate.

5. If more liberal 'tuning' operations are permitted in Fig. 34 (and if,





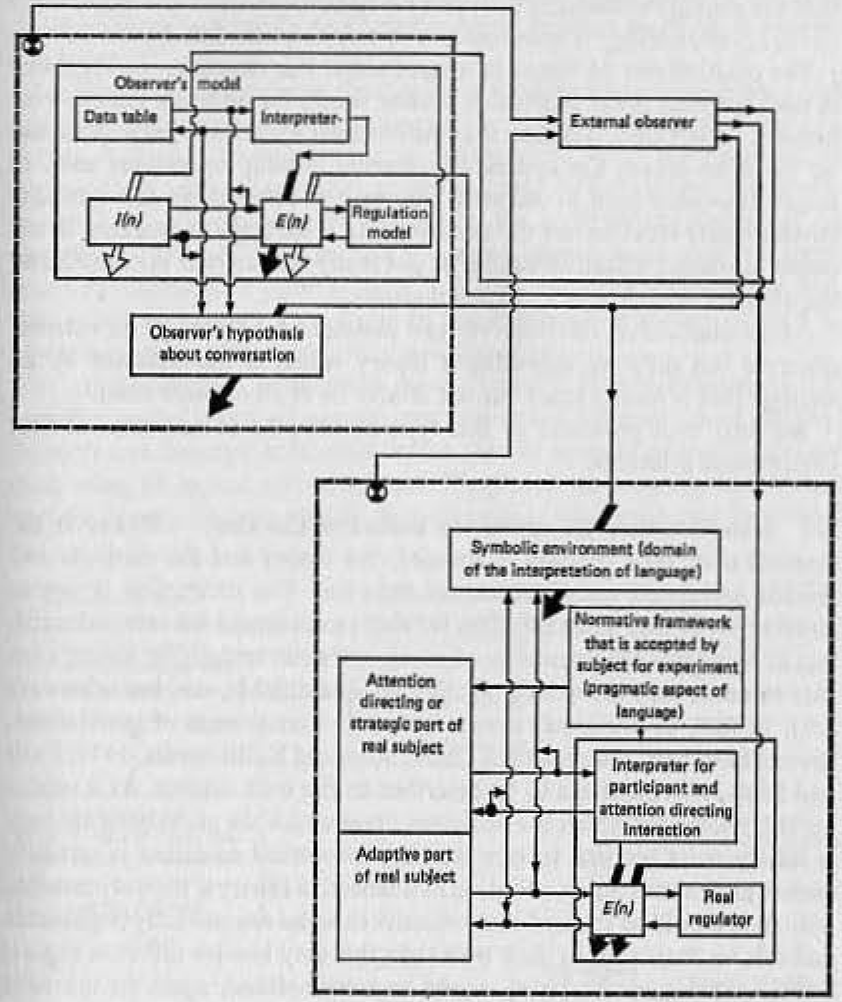


*Figure 35* A special case of Figure 34 detailing one legitimate 'tuning' operation, the adjustment of $E(n)$ so that learning rate is maximised. A computer program model for $I(n)$ (of the type described in Chapter 6) is run predictively to find an effective design for $E(n)$, which is then introduced into the real regulator. The data table is a list of observed strategies.

correspondingly, the *data table* is replaced by a competent strategy producer) then either the normative framework is disrupted (the experimental contract is broken) or the transactions extend into the symbolic environment, which must be defined so that it accommodates them, in such a way that the analogy underlying the theory is not *always* strict but only *locally* strict, i.e. the analogy is *open* and not closed, as under 6 in section 2.2.

The position can be stated in several ways. For example, the regulator in such a system could be another human being; for instance, the observer himself. In that case, it is clear that the observer would be a *participant*. But by the same token, the apparently external 'tuning' operations used to secure constancy (and to maintain transactions focused on the symbolic environment) also convert the observer into a participant speaking in the object language. Effective 'tuning' is not really an *external* operation and the observer is no longer an *external* observer.

As an alternative, the observer can maintain his status as an *external* observer but only by tolerating a theory which is underpinned by an analogy that is *locally* strict but not *always* or at all instants strict.

We deal with problems of this type in Chapter 11 and offer several compromise solutions.

**2.4 Transition from Relativistic to Reflective Theories** Whenever the external observer's position is abraded, the theory and the methods and models associated with it, becomes *reflective*. The distinction is not as clearcut in the case when the observer elects to maintain his external status but to relinquish the possibility of an always strict underlying analogy (so that certain events are strictly measurable, quantifiable, etc., but others are not). In fact, as previously asserted, there is a continuum of possibilities. Several have been instrumented (Pask, Scott and Kallikourdis, 1973; Pask and Scott, 1973) and are to be described in the next volume. As a rule, a point is reached at which the occasions upon which the underlying analogy is locally strict become so rare that the theoretical construct is virtually useless and, at this point, adoption of a reflective theory is the only sensible option. It should be stressed that reflective theories are perfectly respectable and can be dealt with in their own right but they involve different experimental techniques (to be discussed and exemplified, again in the next volume) and have little resemblance to classical theories.

For future reference, it is worth noting here that a significant transition takes place at the point when the structure of the symbolic environment (Fig. 34) comes under the control of transactions in the joint system, i.e. when the dialogue is no longer confined to a topic (however broad) but the topic evolves, under the influence of the dialogue.

**2.5 Other Examples** The following examples are culled from Pask (1973a) where they are much more thoroughly discussed. They serve a dual purpose; to give some impression of the effects of the 'significant transition' mentioned in the last section upon models of repeatable real life events and





to dispel the impression (which may easily have been given) that these considerations only apply to human subjects, human learning, cognition and so on.

In psychology, the bias is shifting from behaviouristic to symbolic and cognitive interpretations; for example, the trend exhibited in Scandura (1970). A similar transformation is taking place in ethology and social anthropology. One manifestation of the trend is that events previously regarded as epiphenomena thrown up by the complex gurgitation of an underlying particulate process are conceived nowadays as symbolic regulatory mechanisms; a point of view that goes from the whole to the part (like *relativism*) rather than going in the traditional direction of part to whole (one salient feature of the classical theory).

In his discussion of population density control, Wynne Edwards (1963) puts forward a convincing argument that many phenomena of display, mimicry and directive behaviour have a specific signalling function, rather than being biological epiphenomena. They mediate communication in a specific density control system. For example, the singing and territorial

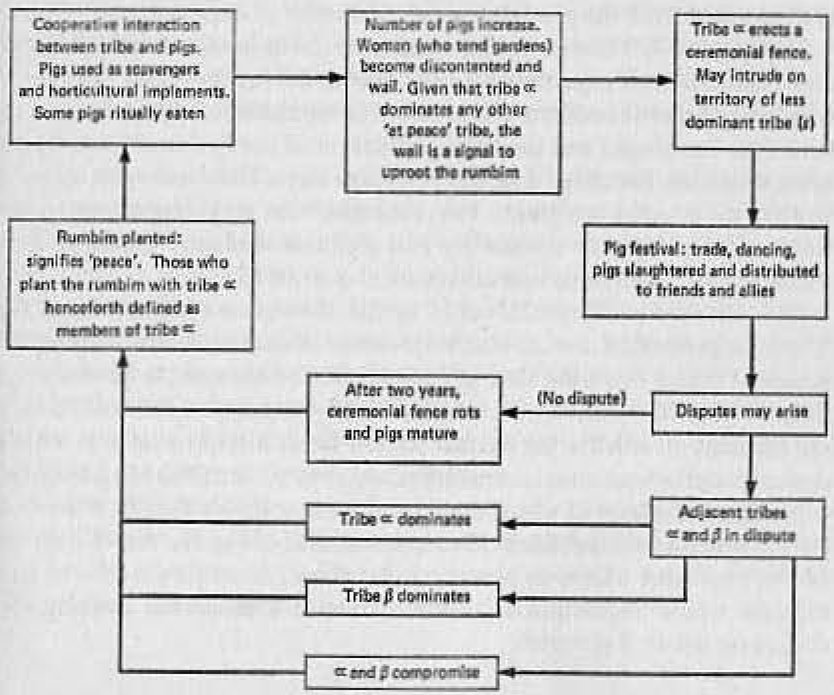


*Figure 36* The ritual cycle of interaction between the Tsembega tribe and the local population of partly domesticated pigs.

excursion of male birds prior to mating, serves (a) to indicate male density to other male birds, and (b) to provide information about the resources available in a given habitat. From (a) and (b), an individual male is provided with a difference-signal relevant to density control. Notably, this difference-signal is a property of the local group of animals and is sometimes generated by a ritual colligation or 'epideictic' display.

Within a group, there is an established dominance hierarchy, wherein any male individual has a level. The hierarchy is established by convention in some cases, and by stress-mediated hormonal mechanisms in others. The lowly individuals, 'excluded males', are not allowed to mate and breed (for the hierarchy sets up a prescriptive norm in this respect). According to Wynne Edwards' hypothesis, the relative number of 'excluded males' in the local group is determined by the intensity of the difference-signal which thereby serves as a feedback to establish the group goal of securing a reproduction rate (hence, a subsequent population number) that fits the resources of the environment. The group goal is, in many cases, contrary to the innate goals of the individuals; for example, reduction of various sex drives. Thus, the model involves a logical hierarchy of goals to be sharply distinguished from the partial-ordering hierarchy of dominance.

Rapaport (1967) makes similar comments about human density control and exemplifies his argument by a specific model for the ritual regulation which maintains a condition of mutualism between the local population of a tribe (the Tsembega) and the local population of partly domesticated pigs upon which the Tsembega depend, in various ways. The ritual cycle is easily written as a serial program. For example, one very elegant program was written as a term exercise by two graduate students, Cartledge and Rezac (1970).[2] The basic operations are shown in Fig. 36.

As in the case of Wynne Edwards' model, it involves a logical hierarchy. There is a perceptual level at which conditions of the environment are interpreted as acting upon the state of individuals (for example, to produce the signal of female dissatisfaction which is chiefly responsible for determining the moment at which a pig festival starts). Next, there is a level at which conventional or traditional norms are established in the milieu of a particular tribe (this is the level at which the flow chart is written). Finally, there is a level at which a tribe is defined. The terse comment of Fig. 36, 'A man belongs to the tribe with whom he plants the Rumbim', conceals the crucial fact that the whole 'regulation algorithm' contains a clause for defining the domain in which it operates.

2. Robinson (1973) is responsible for a more elaborate program which simulates the ritual regulation process responsible for maintaining a deviant group in urban society.





Bateson (1956, 1972) represents the cultural 'double bind' (a trapping state induced by misperception and misinterpretation at a higher or meta level in a conversation) as the mechanism whereby the conventionally encoded organisation of a culture is modified. It is argued that the maintenance of homeostasis in a social group depends upon the existence of a suitably encoded organisation, such as the Tsembega ritual, in which conflicting tendencies trigger off compensatory reactions. This organisation personifies the culture and is essential for its physical integrity. If a pair of cultures having incompatible organisations are juxtaposed, a 'double bind' situation occurs, as a result of which the cultural organisation pattern is necessarily modified. Bateson has also considered an analogous process operating in the genesis of familial schizophrenia. Once again, the model is accommodated in an hierarchical structure and this structure is mandatory.

These organisations are studied in an essentially relativistic manner by ethologists, anthropologists and psychiatrists; all of whom act (overtly or not) as regulators compensating for their intrusion. The observers in question use sociological variates, locally tenable political or conventional structures, or themselves, pure and simple, to secure this end. In pursuit of regulation, liberal use is made of models; either intellectual, or mathematical, or computer programmed. To a large extent it is possible for a professional observer to maintain the posture of an external observer; that is, to segregate a mental function of external observer from the mental function of regulator.

This orientation becomes impracticable at the moment when the ritual structure is modified, autonomously; for example, in the case of density control, by genetic or mass aggregation effects; in the ritual cycle, by resolving which tribe a human being belongs to, and in a double bind situation, throughout. The concommitant event of this transition in the abstract, is an instruction from within the model, to rewrite the model or to change its domain. In other words, execution of this instruction, in a stable manner, places the model fairly and squarely in the category of reproductive automata (section 2.3(f)) and usually in the class of evolutionary automata executed concurrently rather than serially.

Attempts to match the evolution to reality (or vice versa, to prescribe the mode of evolution at the outset), entail participation, without which the process looks merely random. By virtue of participation, however, the theory entertained by the observer becomes reflective.