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Verso un'Ecologia della Mente, 50 anni dopo
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Steps to an Ecology of Mind: foundations of a connective epistemological matrix

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Abstract

The author considers *Steps to an Ecology of Mind (*Bateson G., 1972) a book of extraordinary importance. He attributes the latter to the fact that many of the ideas that helped generate the Ecology of Mind, Bateson's greatest intellectual legacy, can be found in the essays of which the text is composed. He illustrates, by way of example, some of those ideas, which he regards as foundations of the Ecology of Mind: 'stochastic process', 'uncommitted potential for change', 'deutero-learning' and 'economy of flexibility'.

Keywords

Ecology of Mind, stochastic process, uncommitted potential for change, deutero-learning, deuterolearning, economy of flexibility, flexibility economy.

The extraordinary importance of *Steps to an Ecology of Mind*

This year marks the fiftieth anniversary of the publication of *Steps to an Ecology of Mind*, one of the most important texts by the English scientist Gregory Bateson (1904-1980). The book, published in 1972, when the author was sixty-eight years old, is among Bateson's most important works. It is a collection of essays related to four different fields of study: a) anthropology; b) pathology of relationships; c) biology and evolution; d) epistemology and ecology. The essays related to each of these fields of study are arranged chronologically and collected, respectively, within parts II, III, IV and V of the text[1]. Although not an organic text, *Steps to an Ecology of Mind*, due to its extraordinary importance, has been translated into many languages[2].

Bateson presented the Ecology of Mind (his connective epistemological matrix) organically with *Mind and Nature*, a text published in 1979. In 1987, seven years after his father's death, Mary Catherine Bateson, Gregory's first daughter,

[1] The first part of *Steps to an Ecology of Mind* consists of a collection of seven 'metalogues'. The metalogue is a literary form invented by Gregory Bateson and defined by his daughter Mary Catherine as "a conversation that concerns some aspect of the mental process and in which ideally the interaction exemplifies the topic" (Bateson, Bateson, 1987, p. 315).

[2] In Italy, the book was published by the publishing house Adelphi in 1977. A number of essays not included in the previous editions were added to its seventeenth edition of March 2000: "The Conceptual Organisation of Ethnological Material", written in 1940 and published in 1941, "The Minimum Requirements for a Theory of Schizophrenia", written in 1959 and published in 1960, "The Cybernetic Explanation", published in 1967, "Ecology and Flexibility in Urban Civilisation", written in 1970 and revised later, in particular with the addition of the sixth paragraph: "The Transmission of Theory". Also added to the 1977 Italian edition were the Comments to the fourth and fifth parts and the very convenient analytical index.

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published a book based on a manuscript that unfortunately remained unfinished (Bateson G., Bateson M. C., *Angels Fear: Towards An Epistemology Of The Sacred*) that, in terms of Ecology of the Mind, touched on topics that had hitherto been carefully avoided by scientific treatment (beauty, ugliness, love, hate, the sacred...).

The extraordinary importance of *Steps to an Ecology of Mind* has to do with the fact that in the essays that the collection contains - written between the 1930s and the early 1970s - many of the ideas that helped generate the Ecology of Mind, which represents Gregory Bateson's greatest intellectual legacy, can be traced[3]. Of the Batesonian epistemological matrix, those ideas can be considered foundations. I will dwell, below, on just a few of them, by way of example and without claiming to propose an exhaustive discourse[4]. These are the ideas of 'stochastic process', 'uncommitted potential for change', 'deutero-learning' and 'flexibility economy'. I trust it will not be useless.

Some of the most important foundations of the Ecology of Mind proposed in *Steps to an Ecology of Mind*

The 'stochastic process' idea

The essays included in *Steps to an Ecology of Mind* in which Bateson refers to the idea of 'stochastic process' are: "The Minimum Requirements for a Theory of Schizophrenia' (1960, pp. 288-315), 'The Role of Somatic Change in Evolution'

[3] Bateson proposed the Ecology of Mind at the end of his long intellectual journey. It is a science of the living in the broadest sense that, crossing the narrow boundaries of disciplines, has connected and unified what were once the separate territories of the different sciences related to the living: botany, zoology, anthropology, psychology, medicine, sociology... It is the proposal he put forward to overcome what he considered to be a real misfortune for the human species: the habit of thinking in a dichotomous manner and thus separating mind and body, the reasons of the heart and those of the intellect, the self and others, man and nature, nature and culture... The Ecology of Mind is the integration, within a new epistemology, of the whole of phenomena relating to the living, that is, of a very wide range of phenomena apparently very different from each other, but very similar in their organisation and functioning. These phenomena concern life in general: evolution, learning, language and all the other processes, large and small, that innervate the world of living beings. Underlying the Ecology of Mind is the notion that ideas are interdependent and interact with each other. The ensemble of ideas forms a complex, living entanglement, characterised by struggle and collaboration, birth and death. Ideas evolve and their unit of evolution is not the individual idea. It is the whole interconnected system of ideas that evolves, just as in evolution it is not the individual species that evolves, but the interconnected system of species. Ideas are born, live and die. Ideas that are born arise from the combination, via abduction, of other ideas. Ideas that die because they do not harmonise, or because they no longer harmonise, with others. This entanglement is quite similar to that found in a forest or a lake, where plants and animals struggle and cooperate, are born, live, die; an entanglement we are more commonly used to calling 'ecology'. The adoption of Batesonian epistemology implies the adoption of the Batesonian theory of mind, a complex and revolutionary theory. This theory is in fact immanent in the Ecology of Mind, of which it is an integral and inseparable part.

[4] In fact, there are numerous ideas that Bateson put forward in *Steps to an Ecology of Mind* and that can, in their own right, be considered foundations of his epistemological matrix: 'relation', 'context', 'mind', 'ecology of mind', 'mental process', 'conscious purpose', 'double bind', 'difference', 'information', 'metacommunication' and many more.

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(1963, pp. 393-412), 'The Logical Categories of Learning and Communication' (1964, pp. 324-356) and 'Ecology and Flexibility in Urban Civilisation' (1970, pp. 538-550).

In probability calculus, 'stochastic' is synonymous with *random* and *aleatory*. In the glossary of *Mind and Nature*, Gregory Bateson gives this term a different and more complex meaning: "If a succession of events combines a random component with a selective process in such a way that only certain outcomes of the random can persist, such a succession is called *stochastic*" (1979, p. 303). For Bateson, therefore, stochastic is a kind of process whereby some elements produced by a random flow survive longer than others. The term 'stochastic' comes from the Greek *στοχαζομαι* (stokàzomai), 'to shoot arrows with the bow (or javelins) at the target'. The etymological meaning of stochastic fits in well with Bateson's meaning of stochastic because the situation it refers to represents the productive/aleatory component (the hail of arrows or javelins shot) and the selective/conservative component (the target that distinguishes the 'right' from the 'wrong' arrows or javelins), i.e. the two lower-order processes that combine to give rise to the stochastic process in the Batesonian sense.

The stochastic process is a kind of process of great importance, which completely innervates the world of mental processing - including, of course, all phenomena of psychological relevance, which are also examples of stochastic processes. The difference between the various stochastic processes, which are ubiquitous in nature, lies in the 'individuals' of the population involved (lymphocytes, seagulls, memories...) in the time scale and the environment within which the process takes place. In evolution, which we may consider the stochastic process par excellence, the productive/aleatory component is represented by variation and the selective/conservative component is represented by natural selection that, among the genetic mutations produced by variation, chooses those that are compatible with the characteristics of the environment and the pre-existing characteristics of the mutant organism.

In the world of mental process, *stochastic processes combine with each other* and are not separable. There is no separation between being constraint and being possibility. Constraints and possibilities do not exist as such independently, but become constraints or possibilities in the relation, depending on the part they play in the stochastic process at a certain time and for a certain observer. What from one point of view is higher order of recursiveness (and thus acts as context, gives meaning and selects), from another point of view is lower order of recursiveness (and thus acts as message, receives meaning and is selected). Every internal context is, from another point of view, also part of an external context; what acts as context from a certain point of view acts as message from another point of view; what is selective/conservative part from a certain point of view is productive/aleatory part from another point of view; what, from a certain point of view, is predisposition and establishes the limits of randomness (target), from another point of view is random constructive proposal for the initiation of a process (arrow). And vice versa.

When we simplify by taking a single point of view and consider a stochastic process in isolation, we damage the ecology of mind. This error is not entirely

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avoidable, but it can be partially corrected by cultivating habits of thought that are as broad and ecological as possible. Proposing multiple narratives of a phenomenon is one way to cultivate these habits. When we adopt the double or multiple description method[5] we can grasp broader dances, more conspicuous parts of the 'connecting structure'[6]. We can say, for example, that in combined stochastic processes, the questions/predictions of both *co-select*, that their answers/predictions try to *co-construct*, and that the double stochastic process to which they together give rise is *co-evolution*. The co-evolutionary dynamic determines the outcome of encounters and stories[7]: which encounters will become stories - giving rise to a sufficiently long concatenation of pertinences -, how long the stories will last and how they will unfold. We can then say that *'combined stochastic process' is synonymous with 'ecology' on the one hand and 'history' on the other*. And that the dance of the 'connecting structure' is the overall combinatorial interweaving of stochastic processes or, in other words, the overall interweaving of stories.

The 'uncommitted potential for change' idea

[5] *Double description* or *double or multiple comparison* is a method, proposed by Bateson, that consists in *combining* "information of different kinds or from different sources (...) [in such a way as to obtain] something more than their addition" (1979, pp. 119 ff.). The surplus of information that is obtained in proposing multiple descriptions is *in terms of systemic looking and thinking*.

[6] The total connection between all that lives is referred to by Bateson as a *'Connecting Structure'* (see 1979, pp. 21-27). It is a structure of relationships, hierarchically ordered and fluidly connected, that dynamically evolves over time. "The right way to start thinking about the connecting structure is to think of it in the first place (whatever that means) as a dance of interacting parts" (*ibid.,* p. 27).

[7] Gregory Bateson defines a story as "a small node or complex of that kind of connection we call *pertinence*" (1979, p. 28). The connection of pertinence asserts the belonging of what comes after to a certain context, to a structure in time that gives it meaning. 'Pertinence [...] is [in fact] the example of one set of metacommunicative messages with respect to another' (*ibid.,* p. 161): a set of messages that declares the belonging of another message to the same class of messages to which they themselves belong. 'What comes before', then, is not simply a part, connected to another part, 'which comes after'. What comes before is the whole of which what comes after is also already a part; a part that is alive and, together with everything else, generative of what will come after. Even what comes later in the present, in the fleeting moment of life's passing, also quickly becomes 'what comes before', along with everything else that was already past: it becomes context in the past and gives meaning, but was already context in the present, a living and inseparable part of it. Pertinence is thus a *contextual connection*, a connection, that is, of a higher order, involving different logical levels: that of the element and that of the context to which the element belongs, which is class with respect to it. In the pertinence connection, the levels of the context and of the element that receives meaning from it are distinct but traversable and not separate. When we consider this kind of relationship over time, we can come closer to understanding what a story is. There is also a 'different' kind of contextual connection, one that asserts that what comes after is part of a different context or rather a different story than what comes before. In my *La psicologia ecologica* (Ecological Psychology) I proposed the name of *impertinence* for this kind of connection. Being 'human' in relation to being 'animal' or 'culture' in relation to 'nature' are examples of relations in which the 'element', mentioned first in each of these dyads, shows such peculiarities that it can be considered - and so it often happens in reference to these relations - different, 'other' than the 'context', mentioned second. These are, in fact, cases of *connection by impertinence*. In each of these cases we can say that the element, with respect to the context, has different characteristics and/or different rules of operation. Impertinence represents the exit of an element from a spatio-temporal context, the fracture of a story, the connection (by difference) by virtue of which a certain element *belongs to another story* (see 2010, p. 144 ff.).

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In *Steps to an Ecology of Mind* Bateson refers to the idea of the 'uncommitted potential for change' in the Commentary to Part 4.

In the world of mental process, uncommitted potentials for change represent the fundamental nodes of information processing and reworking; they represent, *the available flexibility that on the one hand is generated and on the other hand is 'spent' within the flexibility economy* (see below).

An uncommitted potential for change is a *predisposition*, which Bateson calls *'non-structure'* (1972, p. 430). Whether morphogenetic or learning processes, uncommitted potentials for change are generated in the context of relations that 'precede' them ('upstream'); then, once generated, they can become ongoing processes (from potentials that were) in the context of relations that 'follow' them ('downstream'). We can also say that uncommitted potentials for change are, on the one hand, *results of stories* and, on the other hand, *premises of further stories*. Regarding 'non-structure', Bateson states: "We observe that this uncommitted potential is not only always in a finite amount, but must also be conveniently contained in a structural matrix, which in turn must be in a finite amount at each instant" *(ibid.,* p. 430 ff.). When uncommitted potentials for change are committed, they are lost because they become specialised, unchanging parts of structures.

Whether morphogenesis or learning/adaptation, in developmental processes the uncommitted potentials for change represent *instructions as to the relationships to be established with what is encountered, in the contingencies of the present, moment by moment*. They are therefore instructions in terms of relationships and relating to classes of situations, not instructions in terms of things with a name and relating to particular individual situations. It is not a matter, in other words, of instructions on how to build a certain particular finger or how to carry out a certain particular aggressive interaction, but of 'pre-existing descriptions' relating to the process: 'In the growth processes of a human being, there is certainly no word that means finger, nor a word that means five. Instead, there might be a word that means 'branch', a kind of command that identifies the contingencies of branching" (Bateson, 1991[8], p. 459); and there might be, likewise, a representation of the difference between radial and ulnar shape or between palm side and back side.

Bateson also considered the uncommitted potential for change as an interrogative state, a 'question', ready to receive a certain information. When he used 'question' in this sense, Bateson was not thinking of the question that an organism endowed with perception can ask of the world around it: "The question I ask instead is whether, at a deeper level, there might be a kind of *question* expressed in the language of injunctions and similar that underlies genetics, morphogenesis, adaptation and so on. What would the word 'question' mean at this deep biological level?" (Bateson, Bateson, 1987, p. 180).

The example that Bateson repeatedly used to assert the existence of 'questions' at this deep biological level and to explain their meaning and function - an example from the morphogenetic domain - was that of the fertilisation of the frog egg.

[8] Eleven years after Bateson's death, curated by R. E. Donaldson, *A Sacred Unity* was published, a text collecting the writings that, in 1972, Bateson did not include in *Steps to an Ecology of Mind*.

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The frog egg is a radially symmetrical system and there is nothing in it that differentiates from other possible planes what after fertilisation will constitute the tadpole's bilateral symmetry plane. The egg 'does not know' where its segmentation should begin and epigenesis cannot therefore begin until the encounter with the spermatozoon provides this crucial information. The encounter between this information and the predisposition - the 'non-structure' that the uncommitted potential for change is - generates other structure. Usually the spermatozoon enters the egg a little below the equator, and the meridian that passes through its entry point and the two poles of the egg defines the plane of bilateral symmetry of the future frog. The hemisphere from which the spermatozoon enters will be the ventral part of the frog. However, we know that, like the egg, the spermatozoon does not contain the necessary information inside it. That this information is not contained in its DNA is shown by the fact that, if the frog egg is bitten by a camel hair instead of a spermatozoon, a tadpole will nevertheless develop from it, which will then become a frog. This frog will be in every way similar to a frog born of the fertilisation of a spermatozoon except that it will be haploid - that is, it will have only half the chromosomes - and sterile. The information as to what the beginning plan of segmentation should be is not contained in the egg or even in the spermatozoon: it arises from the encounter, hence the relationship, between egg and spermatozoon. The egg embodies a kind of implicit, immanent question, an 'interrogative state' ready to receive an answer or a certain information, which is then provided by the entrance of the spermatozoon (see Bateson, 1972, pp. 429 ff.; Bateson, 1979, pp. 216 ff.; Bateson, Bateson, 1987, pp. 180 ff.; Bateson, 1991, pp. 283 ff.). The egg, which represents a proposal of potentiality, acts as a context and gives meaning to the spermatozoon's entry: it gives it the meaning of an answer to the implicit question that it is; more precisely, the egg gives the spermatozoon the meaning of an indicator of where (and when) its segmentation will begin. In the frog egg, without the structural conditions, i.e. the predisposition (to self-segmentation) prior to the reception of the message (sperm or camel hair puncture), the message itself would have no meaning and would not initiate processes. Not all messages arriving from outside, on the other hand, take on meaning. For example, for the potentially fertile frog egg, 'puncture' messages (from a spermatozoon, a camel's hair, a pin...) may be significant and initiate cellular segmentation processes, but not diffuse pressure messages (from a fingertip, a breath of air...) or others. On the one hand, therefore, not all messages meet a certain implicit demand (not all 'arrows' hit the 'target'); on the other hand, not all messages that meet a certain implicit demand are accepted, take on the right meaning and are considered adequate responses to initiate processes from the immanent demand (not all arrows that hit a certain target stick there). This is a stochastic process that selects the 'right' and 'wrong' messages from the point of view of the *internal context* (in this case, the egg). On the one hand, the latter acts as an uncommitted potential for change, as an implicit question that establishes the - tautological - boundaries of randomness (positive choice or possibility); on the other hand, it acts as a selective/conservative part of the process (negative choice or constraint) when it establishes, for example, that the pressure of a fingertip or a breath of air cannot

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initiate a process of cell segmentation[9]. This selective/conservative function performed by the structural predispositions is, from the point of view of the internal context, more stable than the productive/aleatory function and, in the transcontextual dynamics, represents the side of the interface that expresses the higher order of recursiveness, which acts as context and gives meaning, and is therefore 'meta' with respect to the message.

The fact that the spermatozoon can be replaced by a camel's hair suggests an *external context*, from which the message comes, that is rather undefined and random. The internal context into which the message enters, on the other hand, is very definite and predictable. This way of describing the situation, whereby the organism represents the question to which the answer comes from outside, overturns the traditional one according to which the external context of learning would be a 'question' to which the organism's behaviour provides an answer, which can be selected as right or wrong. In the case of the frog-egg discourse, Bateson adopts the viewpoint of the internal context with the awareness that it is a partial viewpoint, complementary to the traditional one. From an ecological perspective (and, as ecological, not simply 'evolutionary', but 'co-evolutionary') we must try to have the same awareness as Bateson of the partiality of taking only one of these two points of view; and we must work on getting used to taking both the internal and the external context point of view.

Taking both points of view allows us to discover the unsuspected. What happens, in fact, if we change our point of view and assume the point of view of the external context? What happens is that the case of the frog egg becomes the case of the spermatozoon, which is now our new internal context, defined and predictable, whereas before it was a message from the external context, undefined and random. Before, when our internal context was the egg, the structural

[9] I refer to my *La psicologia ecologica* (2010, pp. 161-65) for those who would like to explore the topic of positive and negative choice in relation to different kinds of explanation). In that text I recalled that what is commonly referred to as 'explanation', i.e. *causal explanation*, is usually *positive*. On the basis of this kind of explanation, one directly identifies the cause of a certain event, claiming that it occurred because a certain other event - which preceded it - occurred. I then recall that another kind of explanation, the *cybernetic explanation*, is, on the contrary, always *negative*. On the basis of this second kind of explanation, 'one considers the conceivable alternative possibilities that could have arisen and then wonders why many of these alternatives were not realised, so that the particular event was one of the few that could actually have occurred' (Bateson, 1972, p. 435). I recall, again, that the evolutionary process, interpersonal processes, thought processes, learning processes and all processes of psychological interest are also characterised by positive choice. Positive choice, by proposing a certain range - more or less wide but in any case not infinite - of possibilities, establishes, in a certain order of recursiveness, the boundaries of the unpredictability of ecological dynamics and is therefore self-preservative. In this sense all creaturely processes are also *tautological*, as well as *ecological,* just as Bateson stated of the Creatura as a whole (see Bateson, 1979, p. 272; see also footnote 10). Finally, I propose - in order to adequately account also for the positive choices that, together with the negative ones, constitute ecological dynamics - that it is necessary to conceive of a different and more complex model of explanation, the *ecological explanation*: an explanation capable of accounting for events that are, on the one hand, subject to constraints and, on the other, characterised by *inequality of probability* (not all changes are possible and possible changes are not all equally probable). It must then be an explanation that can contemplate *both constraints and possibilities* and therefore *be both negative and positive*; and that, in relation to the operation of constraints and possibilities, can contemplate the crossing, over time, of orders of recursiveness.

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conditions and predisposition - i.e. the implicit demand, the uncommitted potential for change - were related to self-segmentation; now that our internal context is the spermatozoon, the structural conditions and predisposition - i.e. the implicit demand, the uncommitted potential for change - are related to the puncture. The spermatozoon now represents an implicit question, an interrogative state relating to whom (or where) to sting, and is ready to receive an answer, i.e. a message bearing information. The latter is provided by the encounter with the egg. And that egg, 'out there', is now part of the randomness of life, that is, it is placed in the productive/aleatory part of the stochastic process, it is an answer for the internal context that is the spermatozoon, which acts as the selective/conservative part of the process. What was previously the implicit question, the egg's uncommitted potential for change, now becomes an external message, a proposal of potentiality that, from the spermatozoon's point of view, is a response that can be right or wrong: in this case 'right'; 'wrong' would perhaps be for the spermatozoon, as a response, the proposal to be stung that a lily pad leaf or a stone or the slime of the pond might put forward.

Gregory Bateson tended to prefer structure-based explanations to quantity-based ones. His reflections on the nature of 'demand/question' understood in a deep biological sense led him, however, to realise that the two kinds of explanation can harmonise and that, therefore, the question can be considered quantitative and the answer can be considered qualitative: “I reflected that perhaps the state of the egg at the moment of fertilisation could be described by reference to a certain amount of 'tension', which in a certain sense is resolved by the essentially digital or qualitative answer given by the spermatozoon. The question 'where?' is a distributed quantity. The answer 'there' is a precise digital answer, a structured digital resolution (...) it seemed to me that (...) the digital answer, in each individual case, is random, whereas the question has quantitative origins, represented by an increasing tension” (Bateson, Bateson, 1987 p. 181 ff.). These reflections, it seems to me, take on the sense of an important exploration of the interface that distinguishes and connects the *Pleroma* and the *Creatura*[10].

The ‘deutero-learning’ idea[11]

[10] Bateson, inspired by Jung and the ancient Gnostics, called the *Pleroma* the world of the non-living and the *Creatura* the world of the living. The Pleroma is the physical world, the world in which forces and shocks constitute a sufficient explanatory basis for events; the Creatura is the world in which *distinctions* are drawn, and in which *difference* can be a cause (see Bateson, 1972, p. 496; 1979, p. 20). It is important to emphasise that Pleroma and Creatura are not separate or separable except as levels of description: "On the one hand, the Creatura exists within and because of the Pleroma; the use of the term Creatura indicates the presence of certain organisational and communicative characteristics that are in themselves non-material. On the other hand, knowledge of the Pleroma exists only in the Creatura. These two entities can only be encountered in combination, never separate' (Bateson, Bateson, 1987, p. 36). Throughout his life, Bateson dedicated his studies to the second of these two worlds: to the world of mental processes and thus to the Creatura. The exploration of the interface between Pleroma and Creatura was, however, one of the main aims of *Angels Fear*, Gregory Bateson's last book, written together with his daughter Mary Catherine: "This book deals mainly with certain features of the separating surface or *interface* between Pleroma and Creatura and also with the interfaces between different kinds of mental subsystems, including relations between people and between human communities and ecosystems" (1987, p. 38). Regarding the interface between Pleroma and Creatura, Bateson asks: 'Where do the mental and the material meet? In the tinkling of silver or in the pangs of disease? And how does one construct a science capable of speaking, in a single, rigorous framework, of reincarnation and at the same time of protein deficiency?" (Bateson, Bateson, 1987, p. 278).

[11] Gregory Bateson unified several phrases under the term “learning 2” (or 'deutero-learning'): "'learning to learn', 'learning to cope with and expect a certain kind of context for adaptive action' and 'change of character due to experience' are three

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There are several essays - almost all of them included in *Steps to an Ecology of Mind* - that Bateson dedicated to learning or in which he made important contributions with regard to learning: 'Social Planning and the Concept of Deutero-Learning' (1942, in Bateson, 1972, pp. 199-217), 'The Minimum Requirements for a Theory of Schizophrenia' (1960, in Bateson, 1972, pp. 288-315), 'The Logical Categories of Learning and Communication' (1964, in Bateson, 1972, pp. 324-356) and 'The Reinforcement Message' (1966, in Bateson, 1991, pp. 220-239). With the 1964 essay, Bateson proposed learning as a hierarchically organised phenomenon (learning 0, learning 1, learning 2 - or deuterolearning - and learning 3[12]) in which each order of learning, except the first, consists of a change in the immediately preceding order of learning.

*Deutero-learning is the case of change in the process of learning 1, for example a corrective change in the set of alternatives within which the choice is made or a change in the segmentation of the sequence of experience*s. To say that deutero-learning is 'a corrective change in the set of alternatives within which choice is made' and to say that it is a 'change in the segmentation of the sequence of experiences' is not to make contradictory statements, nor is it to make substantially different statements. It simply means highlighting different, but not separable, aspects of the same order of change[13]. When we talk about a corrective change in the set of alternatives within which the choice is made we propose a description of the phenomenon in terms that are prevalently, but not exclusively, cognitive; when we talk about a change in the segmentation of the sequence of events we propose a description of it in terms that are prevalently, but not exclusively, perceptive. In fact, a change in the set of alternatives within which the choice is made is in any case a way of changing the segmentation of the sequence of experiences, by making a certain 'excerpt', rather than another, from the overall matrix of events. And a change in the segmentation of the sequence of experiences - albeit apparently minimal as moving, for example, in relation to a story, from considering events from L to P to considering events from M to Q - nevertheless represents a way of changing the set of alternatives within which the choice is made. It represents a shift from considering the set of events from L to P to considering the set of events from M to Q, which may mean, for example, considering a conflictual interaction, shifting from the perception of a set of aggression behaviours to the perception of a set of defence behaviours. The adoption of a different segmentation may in fact also radically change the meaning attributed to the sequence of events.

Whether one privileges the cognitive or the perceptive aspect of deutero-learning, it is in any case a change that does not concern a single situation, but a

synonyms for a single kind of phenomena, which I gathered [...] under the term *deutero-learning*" (Bateson, Bateson, 1987, pp. 28 ff. 28 ff.); see also Madonna, 2010 pp. 233-37).

[12] The paragraph on learning 3 was added to this essay in 1971.

[13] The transfer of learning that deutero-learning represents and that relates to cognitive and perceptual habits concerns the non-verbal understanding typical of the primary process, based on abduction and similarity.

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class of situations. In other words, it is a change that relates to *contextual learning*: "proto-learning is about the particular fact or action, and deutero-learning is about contexts and classes of contexts" (Bateson, 1979, p. 208), more precisely, it is about the recipient's acquisition of the ability to create contexts. Creating a context means learning - within a relation - *rules for putting together information about events, places, living beings, one's own actions or those of others.* This structure of informations, created by the receiver, gives meaning to what happens within it. Without context, words and actions have no meaning and "the meaning of a given action or sound changes as the *context* changes, and especially as the state of the relationship between A and B changes" (*ibid.,* p. 156). The learning of the ability to create contexts is a *learning of relations that takes place through relations*: "it arises from a kind of dual description that goes with relation and interaction" *(ibid.,* p. 181).

If after repeatedly going through *a Pavlovian-type context* a dog behaves in some subsequent context as if it too were characterised by the same configuration of contingencies ('if you have a stimulus and a certain time interval then you have reinforcement') we might say that the dog has achieved deutero-learning. Similarly, if after repeatedly going through *an instrumental context* a dog behaves in some subsequent context as if it too were characterised by the same configuration of contingencies ('if you have a stimulus and a certain element of behaviour then you have reinforcement') we might say that the dog has achieved deutero-learning[14]. Deutero-learning, in fact, means precisely learning to expect a certain configuration of contingencies.

Expecting a certain configuration of contingencies can be adaptive (if one is right in expecting it) or maladaptive (if one is wrong in expecting it). In the first case learning 1 will be facilitated and/or accelerated by the deutero-learning, in the second case it will be hindered and/or delayed. In both cases deutero-learning will represent a very tenacious learning order because the propositions governing segmentation have the general characteristic of self-validation: "The sorcerer's apprentice does not give up his magical view of events when the spell does not work. What we call 'context' includes, in addition to external events, also the subject's behaviour; but this behaviour is regulated by previous learning 2, and will therefore be such as to shape the overall context to the extent that it adapts to the desired segmentation. In other words, this self-validating characteristic of the content of learning 2 has the effect of making it almost ineradicable" (Bateson, 1972, pp. 347 ff.; see also Ruesch, Bateson, 1951, pp. 239-56; Bateson, 1991, pp. 226 ff.; 1979, p. 181; Madonna, 2010, pp. 235 ff.) and thus most likely to make an attempt to eliminate or modify it fail. This is a kind of learning of enormous importance in the context of educational relationships, in the context of caring

[14] The learning 1 contexts that, repeatedly crossed, can produce deutero-learning are naturally not only those related to the various kinds of learning studied in psychology laboratories: Pavlovian, instrumental, mechanical etc. (see *ibid.*, p. 333). In many other situations, in fact, the presence of a certain deutero-learning can easily be 'explained' by considering or hypothesising *the types and modes of reinforcement* of a certain learning 1 context.

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relationships and in any circumstances in which the most complex, necessary and vital aspects of human and animal behaviour are relevant.

The 'economy of flexibility' idea

From the above reflections we can infer that the function of deutero-learning is not to make us fit for a certain kind of situation, but to enable us to realise a valuable economy: "An essential and necessary function of habit formation and learning 2 is an *economy* in the thought processes (or neuronal channels) that are used to solve problems, or learning 1" (Bateson, 1972, p. 350; see also *ibid.*, pp. 181 ff.). Through the realisation of a deeper and more lasting change, replacing a more superficial and reversible one, this economy allows the organism to free up flexibility for further learning/changes of a lower order (see *ibid.*, p. 399; see also Madonna, 2010, p. 235).

Bateson called this process the 'economy of flexibility'. The Batesonian idea of the 'economy of flexibility' has not received as much attention from scholars as the importance it has in the English scientist's epistemological proposal, an importance - in my opinion - equal to that of the idea of 'deutero-learning'. Bateson left us reflections on the theme of the economy of flexibility in many places in his work, but he discussed it more organically in two essays, "The Role of Somatic Change in Evolution" (1963, in Bateson, 1972, pp. 393-412) and "Ecology and Flexibility in Urban Civilisation" (1970, in Bateson, 1972, pp. 538-550), both included in *Steps to an Ecology of Mind* (1972).

The economy of flexibility constitutes a fundamental aspect of the ecology of mind: it is a *mode of operation of adaptation*, i.e. of change/learning, in the world of mental process. In the world of mental process, adaptation - whether of an individual, a species, or an idea - occurs through the stochastic process (see above), i.e. through the combination of the process of random production of the new and the process of selection of what of the randomly produced new will survive. This combination of randomness and selection of randomness occurs on an economic principle.

Indeed, the changes brought about by the stochastic process impose a price, which is paid in terms of flexibility. Consider, for example, an organism that, in the course of its evolutionary process, has to cope with an internal (genetic) change or an external change, i.e. produced by the environment in which it lives, and is thus subjected to stresses that require somatic modifications. The implementation of somatic modifications consumes entropy, i.e. "uncommitted possibilities for change in many different physiological and neural parameters and variables" (Bateson, 1991, p. 330). When uncommitted possibilities for change are committed, they are lost because they become *specialised and unchanging* parts of structures, i.e. negative entropy. We can detect a similar relationship between flexibility and specialisation as between entropy and negative entropy and consider flexibility as *uncommitted potential for change* (see Bateson, 1972, pp. 541 ff.; see also above).

Adaptive changes limit the possibilities of other adaptive changes, possibly required by further and different stresses. A sick man, for example, in order to adapt to the stress represented by the disease, pushes certain physiological

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variables to values far from the midpoint or even to extremes. Man becomes vulnerable and stays indoors in the heat. With those 'stressed' variables, he could not, in fact, respond adequately to further stress. He is undergoing adaptive change and his possibility of further change is reduced (see Bateson, 1991, p. 330). The price an organism pays in the various circumstances of adaptation relates not only to the change it faces, but also to the degree of somatic flexibility it has at its disposal at that time. The degree of flexibility at its disposal depends "on how much somatic flexibility the organism is already employing in adapting to other mutations or environmental changes. We are faced with an *economy* of flexibility" (Bateson, 1972, p. 397).

Even in the field of behaviour, the change entails a price in terms of flexibility. For example, when we first encounter a problem, we may solve it by trial and error or sometimes intuitively. When we are faced with the same or similar problems, we tend instead to deal with them in a progressively more economical way, taking them away from the stochastic process and entrusting them to the deeper, less flexible workings of habit. We implement an immediate response, without wasting time and energy in the internal and/or external processes that we instead use, of necessity, in new situations. When this happens, "it seems that stochastic or exploratory mechanisms are freed up to solve other problems, and it is quite conceivable that a similar advantage is gained by transferring the task of determining a somatic characteristic to the genetic code" (*ibid.*, p. 303). In general, we can state, that habits enable savings to be achieved. We can also state that *the savings achieved and the transcontextual reorganisation required to achieve it represent the economy of flexibility*.

This kind of economy does not work in the same way as other, better known, kinds of economy. Take, for example, the case of the money economy: here, each expenditure is added to the others and the economy becomes constraining when the sum of expenditure reaches the limits imposed by the budget. The energy economy works in a similar way: it becomes constrictive when the sum of expenditures reaches the limits imposed by the energy budget. These are functions that Bateson calls 'summative' (see 1972, p. 397) or 'subtractive' (see ibid., p. 542). In the case of the economy of flexibility, things are different. Consider, for example, an organism that has to deal with several genetic changes through somatic modifications. A first mutation may reduce the set of its possible life states to a certain subset (for example, to the subset that includes individuals that develop neck muscles beyond a certain limit). A second mutation may reduce the set of its possible life states to a certain other subset (for example, to the subset that includes individuals whose total body weight falls below a certain limit). The simultaneous presence of the two mutations will reduce the possible viable states of the organism to the subset represented by the states common to the two subsets related to the two mutations (i.e., to the subset that includes those individuals manifesting both the first characteristic and the second). The economy of flexibility is thus characterised by a functioning that Bateson calls 'multiplicative' (see *ibid.,* p. 397) or 'fractional' (see *ibid.,* p. 542).

When certain variables in the functioning of an organism are stressed because it is undergoing adaptive change and a further stress on change occurs, a

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contradictory demand on some variable manifests itself somewhere in its physiology: "This contradiction - the demand that the variable increase to cope with stress A and simultaneously decrease to cope with stress B - constitutes a double bind at a deep level. These double binds are usually met by responses whose logical type is at a higher level" (Bateson, 1991, pp. 330 ff).

Regarding 'logical types' or, as I think it is preferable to say, the *hierarchically organised orders of recursiveness* in which adaptive changes occur, consider the case of acclimation, often cited by Gregory Bateson (see 1972, pp. 398 ff.; 1991, p. 331; 1979, pp. 207 ff.). This case is an excellent example of how the economy of flexibility 'governs' the trans-contextual transitions that occur when adaptive change occurs. A man living at sea level who moves to a high mountain will involuntarily, automatically begin to pant and quicken his heartbeat to adapt to the climate, atmospheric pressure and other characteristics of the mountain environment. These changes are superficial and rapidly reversible: if he descends to sea level that same day, they will disappear. In fact, these changes represent *a first order commitment of available flexibility*.

However, it would be a waste, in terms of flexibility, to use breathlessness and tachycardia to adapt stably - and not occasionally - to the mountain environment. To do so would also be risky. Man might, in fact, suddenly have to duck for the arrival of a car dangerously hurtling down the road, or need to flee to avoid an avalanche or escape the clutches of a bear. In other words, man might have to respond, in the absence of available flexibility, to a new stress. He could not cope with the new emergency by speeding up his respiratory and cardiac rhythms, those variables being already stressed. He would then find himself in a particularly vulnerable condition, which could pose serious risks to his own survival.

If man's stay in the high mountains is prolonged, the new environmental conditions become durable for him, and the fact that more superficial variables cannot change favours the change of deeper variables. In order to avoid remaining in a vulnerable condition for too long, it becomes necessary for him to *make a sacrifice in terms of reversibility* in order to be able to realise *an economy in terms of flexibility* and make his breathlessness and tachycardia superfluous - and thus available for possible new stresses. Physiological changes will then occur - relating, for example, to the heart, the rib cage, the amount of haemoglobin in the blood and breathing habits - which will gradually allow man to acclimatise. These physiological changes represent *a second order of commitment of available flexibility*. With this second order of commitment of flexibility, a new, more 'abstract' kind of adaptation occurs - related to a different order of recursiveness - involving more profound and less reversible changes.

The second order of commitment of available flexibility, whether it is somatic change as in the case of acclimation, or the formation of habits in dealing with problems, on the one hand diminishes and on the other increases the uncommitted potential for change. More precisely, when this order of commitment occurs, *flexibility a) decreases in relation to a certain, higher (deeper) order of recursiveness of phenomena and b) increases in relation to another, less high (shallower) order of recursiveness of phenomena.*

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This 'movement' of flexibility can be understood more clearly by considering that 'sacrificed' reversibility is not completely 'other' than flexibility and vice versa. Indeed, *reversibility can be considered as a kind of diachronic flexibility,* of a higher order: a kind of flexibility of flexibility; on the other hand*, flexibility can be considered as a kind of synchronic reversibility*, of a lower order: a kind of reversibility of non-reversibility. We can also say that, in different temporal orders, one corresponds to the other *being both uncommitted potentials for change*. The relationship that exists between flexibility and reversibility embodies, in effect, the transcontextual character of the phenomena of the mental process world. It involves the crossing of the boundary that distinguishes one phenomenal order from another.

In an ecology of ideas, the evolutionary process characterised by the economy of flexibility determines which ideas are to be rigidly programmed and how they are to be managed.

An important aspect of the rigid programming of adaptations in mental systems is that of *frequency* of use. If a certain type of response repeatedly leads to a positive outcome in a certain kind of context, that kind of response will become habitual, i.e. the response will be rigidly programmed. That a response is frequently confirmed in a certain time frame does not, however, mean that it is 'true' nor that it is necessarily useful in the long term: the context may change and the response may become maladaptive. "Natural selection reaffirms [simply] in a 'tautological' way that ideas that survive will survive longer than those that do not" (Bateson, 1972, p. 546). Of the fact that frequent responses, which are rigidly programmed to be frequent, are not necessarily 'true', we can find numerous examples in the world of mental processing. In the evolutionary process of a language, for example, it often happens that, just because it is frequent, a word that initially represents nothing more than an error or a deformation of another word is stabilised and established as new.

The survival of a frequently used idea (or word) is further facilitated by the fact that, as it is rigidly programmed, it undergoes *a removal from the field of critical scrutiny*: 'Ideas that survive repeated use are, in fact, handled in a special way, which is different from the way the mind handles new ideas. The phenomenon of *habit formation* selects the ideas that survive repeated use and places them in a more or less separate category. These trusted ideas are then available for immediate use *without close scrutiny*, while the more flexible parts of the mind can be reserved for handling new problems' (*ibid.*).

Finally, with respect to the survival of ideas and thus with respect to their rigid programming, *the relationship of one or more ideas with other ideas* is relevant. Ideas may in fact support or contradict each other, and may be more or less easily combined with other ideas. Ideas that harmonise best with other ideas - in particular with the most important and 'load-bearing' ideas of a certain ecology - are more likely to be rigidly programmed: being harmonious in relation to premises, they become parts, in their turn themselves rigidly programmed, of ecological constellations or subsystems and share their fate (cf. Bateson, 1972, pp. 546 ff.; 1991, pp. 227 ff.).

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