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Constructing Reality

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Preface

I came across Gregory Bateson's ideas many years ago, reading his excellent books (Bateson 2000, 2002) while studying and formalizing the Theory of Control Systems (Mella 2012, 2014). The "conjecture" that our cognition "constructs the world" by operating on "differences," which the "mind" distinguishes and elaborates, though not entirely new (Ceccato 1969, 1974), caught my attention. I immediately sensed that Bateson's hypothesis could be operationalized by applying the Theory of Control Systems, specifically, the *identification* systems (to *identify* the differences and order them) and the *recognition* systems (to construct the *descriptions* and *definitions* of "objects" and "concepts"). However, this development required a precise definition of the "cognitive process" that Bateson spelled out and exemplified, though never formalized. From this concatenation of facts came the idea of attempting an "operationalization" of "Bateson's Conjecture on Cognition."

In short, Bateson adopts the Constructivist Perspective to propose an epistemological theory of knowledge based on the capacity of a "cognitive system" to *construct* a representation (map) of the world (territory) through the perception and ordering of differences, even at successive levels. Bateson views the "mind" as the "processor" of knowledge that acts as a "machine," a "cybernetic apparatus" – with multiple inputs – capable of calculating differences, memorizing and comparing these, and finding analogies. *Analogy* is not simply the lack of differences but a judgment on the level of differences. Two objects, though different, are *analogous* if their differences are considered "too small" to reveal a *difference of differences*. Only through *analogies* can we conceptualize classes, concepts, and thus knowledge.

By adopting a simple metaphor, Bateson distinguishes between knowledge and what is known, comparing knowledge to a map and what is known to a territory: "*The map is not the territory, and the name is not the thing named*." The map – that is, knowledge – is formed by taking account of the differences the observer perceives in the territory represented; these differences and their transforms are "*elementary ideas … and these differences are themselves to be differentiated*" (Bateson 2000: 463). "*Information can be defined as a difference that makes a difference*" (Bateson 2002: 91).

As a "processor" of knowledge, our "mind" carries out a continual process of discovering relationships in the patterns of differences, and this process leads to the emergence of a hierarchy of differences based on which all knowledge is constructed (Bateson 2000: 454–471; 2002: 106).

Strictly following the direction outlined by Bateson, this study (which expands and completes some ideas presented, although in another context, in Mella 2014) seeks to operationalize Bateson's Conjecture on Cognition, proposing three objectives: (1) above all, to make Bateson's definition of "mind" operative; by introducing simple symbols, I show how it is possible for any "mind" – not necessarily only the human one – to construct *descriptions* of objects and *definitions* of concepts by simply making use of "primitive" operations involving comparison, the identification of differences, and analogy; the symbols introduced give a meaning to the observation, identification, and comparison of "objects" and "concepts," which will allow me to formalize several models or moments that operationalize the concept of "cognition"; (2) to apply the same conceptual framework to define the process of *denomination* through which the "mind" manages to represent objects (descriptions) and concepts (definitions) through "signs" (descriptions of signs) and "signifiers" (definitions of signs), thereby forming *semes*; (3) to apply the symbols and the concepts of *description, definition*, and *denomination* to operationally deal with the problem of "truth" as correspondence, making use of a reliable *process of determination*. To achieve these objectives, a simple formal symbology is proposed to represent the basic elements of cognition and communication to demonstrate how the cognitive process can be linked to a succession of acts entailing distinction, description, definition, and recognition.

More specifically, based on the notion of Observative Dimension, the Observative Universe is defined as a vector of dimensions through which the "mind" filters reality and constructs a Technical Description (not yet adopting specific language) as a vector of the states of those dimensions determined for a specific object "O." Thanks to the innate process of *analogy* and *analogical generalization*, the "mind" starts from descriptions repeated for a set of objects – held to be analogous, though different – to arrive at the Technical Definition of a "general object O∗," which, in fact, represents the concept (idea) of O∗ as well as the meaning (signified) of the signs that denote it. Knowing the world means carrying out descriptions of "O" and constructing definitions of "O∗" as the class of all "Os" recognized as elements (examples) of "O∗." The same symbology is applied to define the basic elements of the process of "linguistic denomination" and the formation of languages through a "signification process" that couples a technical definition of "O∗," which represents the signified of the "general sign S∗," to the technical definition of "S∗," which represents the signifier of "O∗." Communication is the basis for the arguments made in the final part of the book, which demonstrates that even the Tarskian correspondence-truth "'the snow is white' is true if and only if the snow is white" requires processes of definition and description which are at the basis of knowledge. Therefore, operationalizing Bateson's hypothesis means proposing a formalized and coherent *structure of propositions* that form an *interpretative theory* of the modus operandi of the (human) "mind." This structure of propositions will be useful

not only in shedding light on our cognitive processes but also in laying the formal groundwork for artificial intelligence.

To make the operationalization process efficient, I used some typical models (Rings) of control systems (mentioned in a short APPENDIX) that make knowledge and learning possible, even if we are almost never aware of their activity because they operate at very high speed and in such a routine manner as to escape our attention.

I conclude by highlighting several areas of research suggested by Bateson's conjecture and based on my proposed operationalization process.

Note: the text is rich in quotations because I preferred to directly refer to the thoughts of the many authors cited without filtering these through my interpretations or synthesis.

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About This Brief

This brief presents an overview of Gregory Bateson's Constructivist method of Cognition. Bateson proposes a theory of cognition that is based on the abstract notion of difference that the mind distinguishes and perceives and represents information that constitutes and separates how different states are ordered, grouped, and classified. Bateson, however, does not clearly indicate how a cognitive system can develop a knowledge of reality from the perception of these differences. This book seeks to offer a scientific approach to Constructivism. Using Bateson's hypothesis, chapters discuss how our mind distinguishes and elaborates differences, allowing us to form perceptions of objects, and how these objects can be described and compared. Chapters also discuss how from differences it is possible to construct concepts or ideas of how these can be defined and how to derive from these differences the meanings of the signs used for the structuring of languages. The brief offers a coherent structure of propositions that form an interpretative theory of the modus operandi of the human mind, which will be useful not only in shedding light on our cognitive processes but also in laying the formal groundwork for artificial intelligence.

Constructing Reality is a must-have resource for researchers and students of the cognitive sciences, as well as education sciences, and researchers and scholars of artificial intelligence, learning theory, and intelligent automata programming.

Piero Mella

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