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Preface

This book is dedicated to Manfredo Massironi
who continues to reveal new geometries of the world

The inspiration for this book originated from an intention to show that in the architecture of human cognition the experience of contrariety is widespread and common to many areas of theoretical and experimental research in the Cognitive Sciences. Since the subject is approached with different operational mind-sets, the variety of meanings, applicative contexts and fields of research referring to the word “contrary” raises the question of what is invariant in all these areas and what is the ultimate nature of contrariety. A worthwhile preliminary step (with the objective of facilitating an interdisciplinary view on this issue and opening a table of discussion) is to accept a certain degree of approximation in the use of the terms “contraries and contrariety” and “opposites and opposition”.

This book does not intend to present a set of arguments and experimental data unified by a common theoretical framework. Conversely, we aim to demonstrate the need for broad interdisciplinary research projects to study the role that contrariety/opposition have in contemporary Cognitive Sciences and provide concrete evidence in support of the idea that this is in fact feasible. Differences in definitions and operational approaches to the issue are not only acceptable but are essential to the research project that this book proposes.

Right from the two initial chapters it is revealed how advantageous the acceptance of this criterion is in order to set up a rich frame of reference for psychological research. If it is true that the history of Psychology has been characterized by a progressive separation from Philosophy, essentially due to the need to acquire the status of an experimental discipline, it is however also true that the integration of psychological sciences into the broader field of Cognitive Sciences facilitates a closer dialogue with philosophical investigation and its methodological and theoretical merits. It is not by chance that The MIT Encyclopedia of the Cognitive Sciences¹, which aspires to be recognized as a milestone work in the theoretical establishment of an interdisciplinary area of research opens with an introductory philosophical work by Wilson on the state of the art of studies on the mind and on the philosophy of science. This contribution is part and parcel of the same map which includes Psychology (Keith J. Holyoak), Neurosciences (Thomas D. Albright & Helen J. Neville),

Computational Intelligence (Michael I. Jordan & Stuart Russell), Linguistics and Language (Gennaro Chierchia), Culture, Cognition and Evolution (Dan Sperber & Lawrence Hirschfeld).

The first part of the book is thus devoted to the early roots of contrariety. In chapter 1, *The relation of contrariety in the ancient thought and in the Aristotelian formalization* by Maurizio Migliori, Lucia Paliacelli e Marina Bernardini, we learn that, for the ancient Greeks, contrariety was not only a logical structure but was also founded on the empirical structure of the world or, as we would put it nowadays, a cognitive structure grounded in perception. The chapter also offers various different interpretations of the terms contrary/opposite, already operationalized and ready for experimental development. The authors discuss the surgical abilities – both theoretical and methodological – of the ancient thinkers, and of Plato and Aristotle in particular, to find and show the contents of human experience where contrariety works as a “reagent” in the process of perceptual discrimination between non-identical facts and, at the same time, as a cognitive “binder” in taxonomical organizations.

In the second chapter, *The geometry of opposition and the opposition of logic to it*, Alessio Moretti focuses on one line of research from the matrix of contraries touched upon in classical thinking. This starts from the square of oppositions and goes on to explore the geometrical constraints of further possible solutions whose aim is to organize the variety of logical oppositional relationships. The development of the square into more complicated geometrical models, which are necessarily subject to the constraints of the axiomatic structure of geometry, is considered in comparison to the potential alternatives offered by mathematical formalisms involving pure abstract symbolic calculi. Again in the field of research on contrariety developed by logicians, references to more cognitive perspectives are not lacking. Gärdenfors’ model of conceptual spaces is called into play, possibly with the aim of suggesting that the difficulties concerning the metrical constraints of geometry which have been faced by geometrical logicians in the development of the square of opposition are the same as those that, from a different perspective, Gärdenfors faces with his geometrical model of conceptual spaces. A number of important themes emerge from these first two chapters and pave the way towards a greater understanding of the experimental writings presented in this book.

The chapters forming the second part of the book, *Contrariety in perception*, focus on and experimentally analyze the perception of contraries. In *The spatial path to contrariety* (chapter 3) by Ugo Savardi & Ivana Bianchi, the opening is dedicated to the contrapposto, regarded as the epitome of the thesis put forward in this chapter which states that contrariety has an intimate connection with the human embodied perception of space. Without trying to answer questions regarding the causative priority between the perception of space and the perception of contrariety, a theoretical framework is proposed and empirical evidence is provided in support of the theory that there is a complex architecture of bipolar dimensional structures in direct experiences of space. This evidence implies that metrical and topological models of contrariety (which can be

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analyzed experimentally) may be established to deal directly with the phenomenal experience of space and open a door to a new cognitive theory of contrariety.

In Chapter 4, *Investigating contraries by means of change detection*, the authors (Fabrizio Bracco, Ivana Bianchi, Carlo Chiorri, Roberto Burro, Ugo Savardi), approach the subject from the point of view of information theory and test the degree of information potential (Bracco & Chiorri, 2009\(^3\)) present in contrary, similar and different geometrical patterns. For the first time we see contrariety dealt with as a perceptual datum which can be analyzed using the change detection paradigm. This reinforces the results from protocols and experiments using phenomenal tasks, and provides new indications based on detection performance and reaction times. For the very reason that tachistoscopic presentation times are used, the study confirms that contrariety is a direct, immediate component of perception and is identified and processed by the perceptual system in a significantly independent way with respect to other kinds of transformations.

Another chapter on the direct visual experience of contrariety is *Contrariety in plane mirror reflections* by Ivana Bianchi & Ugo Savardi. In reflections, identity and contrariety are face to face. In fact, the surface of a mirror creates a special phenomenal space where the joint experience of identity and contrariety is maximally present, although the optical rules which explain the physics of reflections do not acknowledge this fact. The debate on the mirror question (i.e. why a mirror reverses left and right but not up and down) which apparently highlights the inversion produced, has not taken the perceptual exploration of the phenomenon far enough. This chapter offers an experimental framework for an investigation into the two perceptual experiences of identity and contrariety and recognizes their role as basic components of the phenomenal geometry of mirror images.

Chapters 6 through 10 present a series of experimental works on CONTRARIETY IN LANGUAGE AND THOUGHT. If the works presented in part II focused on the role of perception in the recognition of contrariety, here we see that even though we are dealing more with higher cognitive functions such as language, reasoning and thinking, contrariety still plays a role in both production and recognition processes.

In Chapter 6, *Basic qualities in naïve subjects’ perception of voice. Are they based on contrary properties?*, Federica Biassoni analyzes the qualitative characteristics of the human voice. The main result emerging (with unequivocal clarity) both from the analysis of the literature and from the study conducted by the author, is that the phenomenal structure of the vocal signals which pass from speaker to listener is naïvely understood and “coded” in terms of bipolar dimensions. The importance of the qualitative characteristics corresponding to a given physical vocal signal has already been well exemplified by Kohler’s *takete and maluma*\(^4\); in this case, polarized characteristics (round-angular) are isomorphically displayed in visual shapes and in the corresponding vocal correlates. But Biassoni’s work has the merit of suggesting that qualitatively contrary characteristics are central to the whole set of naïve categories in the analysis of voices.

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The following two chapters are: *Are drag and push contraries?*, by Adriana Schepis, Andrzej Zuczkowski & Ivana Bianchi (Chapter 7), and *Are certain and uncertain epistemic contraries?* by Ramona Bongelli, Andrzej Zuczkowski, Ilaria Riccioni, Carla Canestrari & Roberto Burro (Chapter 8). They are both developments of a Gestalt-psychological approach to the analysis of verbal communication and of the relationships between language and phenomenal reality, initiated some years ago by Andrzej Zuczkowski. The two chapters thus move over common ground. Both aim to investigate the phenomenal experience of contrariety in relation to linguistic structures. In this sense both thus intersect a series of common questions concerning where contrariety lies in language (beyond the familiar case of adjectives), what the degree of evidence of contrariety manifested in different linguistic structures is, whether there is a relationship linking perceptual structures of contrariety and their “traces” in semantic meaning, and what differences in the structures of contrariety emerge when people are asked to recognize if two sentences or words express contrariety or not as opposed to asking them to produce contrary linguistic stimuli. Both studies offer reassuring results in that they show the heuristic value of extending the study of contrariety in language beyond the classic domain of antonymous adjectives or prepositions. And in fact Chapter 7 reveals the importance of perceptual (spatial) structures in verbs with opposite meanings. Chapter 8, focusing on the variety of epistemic states expressed by language, shows that linguistic expressions of certainty and uncertainty in effect presuppose a contrary epistemic bipolar dimension.

In Chapters 9 and 10, *Contraries in productive thinking*, by Erika Branchini, Roberto Burro & Ugo Savardi and *The perception of humor: from script opposition to the phenomenological rules of contrariety*, by Carla Canestrari & Ivana Bianchi, the influence of contrariety is considered with respect to two complex cognitive functions: problem solving and humor. Both chapters, even though in different ways, start by pointing out that contrariety in these areas of research is dealt with more as a topos than a real cognitive structure at the basis of the cognitive process.

In Chapter 9, the authors show that in problem solving, the recognition and manipulation of dimensions of contrariety is an essential component of the process, from the understanding of the initial structure of a problem right through to its solution. In other words, contrariety is a necessary – although not sufficient – condition of creative processes and of any heuristics leading to new solutions.

Something similar happens with humor where contrariety plays a key role. In Chapter 10, the authors show that references to contrariety are recurrent in linguistic and cognitive literature on humor, in particular in the constructs of script opposition or local antonymy. However they also demonstrate that these constructs are still somehow vague. A new way of operationalizing contrariety is put forward, taking into account the conditions which have emerged from the literature in another domain of psychological research (i.e. the experimental phenomenology of perception) and manifesting the prerequisites which are required for two facts to be perceived as opposite to each other. Three rules in particular are applied to the definition of the degree to which contrariety can be directly perceived between two humorous texts: the condition of invariance and maximum opposition, the non-additive behavior of contraries, and the definition of intermediate states. By integrating these three aspects with current theories on humor
processing and the implications of results from an initial experimental study, the chapter provides promising indications that this can in fact contribute towards the clarification and enrichment of the operational definition of “script opposition”.

One of the central aspects of a cognitive approach to contrariety concerns the definition of the inherent nature of contrariety. In most of cases, when referring to contrariety, psychologists also refer to dimensions, implying the existence of a latent trait which connects one pole to the other and which is characterized by a bipolar nature. In other cases the term “dimension” is used to refer to qualitative or quantitative gradations of a single property and in this sense their unidimensional nature is assumed. Some of the studies presented in the previous section have in some way dealt with the question of unidimensionality, either assuming it or testing it.

The three chapters forming the last part of this book directly address the issue of the UNIDIMENSIONALITY OF CONTRARIES.

In Chapter 11, *Measuring in experimental phenomenology and carrying out phenomenological psychophysics: the case of contrary properties*, Roberto Burro supports and reinforces the proposal put forward by Kubovy & Gepstein (2003)⁵ that in the theoretical and methodological framework of the experimental phenomenology of perception, equal attention needs to be paid to the nature of phenomenal facts and to the instruments used to measure it. In this chapter, the author suggests an experimental simulation to test the assumption of unidimensionality when estimates of perceptual properties are involved, and presents epistemic arguments together with arguments based on the mathematical theory of measurement in order to prove the feasibility of a quantitative study of contrariety in perceptual variables.

In Chapter 12, *From opposites to dimensions: filling in the gaps*, by Ugo Savardi, Ivana Bianchi & Roberto Burro, the authors start by pointing out that, in the literature which in one way or another has referred to the phenomenal-perceptual and conceptual correlates of antonymy, the question of the nature of dimensions and how they relate to the experience of contrary properties has never been addressed in a proper experimental research project. Focusing on perceptual and, in particular, spatial variables, the authors demonstrate that a series of considerations resulting from the application of set theory to descriptions of phenomenal experiences of contraries are enough to make one doubt that the idea of dimensions as continua comprising all the instances of two poles as well as those in between (intermediates) can be derived in a straightforward way from the perceptual experience of these three components. This is demonstrated with respect to various types of spatial contraries on the basis of some experimental data collected in psychophysical studies investigating their perceptual nature.

In Chapter 13, *Reverse items are NOT opposites of straightforward items*, Carlo Chiorri, Pasquale Anselmi & Egidio Robusto show that the assumption of unidimensionality has been long questioned in the field of psychological test development. The anisotropies embedded in the structure of questionnaires which are positively worded, negatively worded, or use mixed worded items, has been thoroughly studied and the indications resulting from most of these studies reveal a certain degree

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of independence between the supposed “reversed” poles. The authors investigate whether and how the rating scale categories of the Rosenberg’s Self Esteem Scale (1965) function differently for straightforward and reverse items, using a wide sample of participants. Since results prove that agreeing with given items does not perfectly correspond to disagreeing with the corresponding reverse items, the authors conclude that the two kinds of items cannot be considered to be the exact opposite of each other.

We started this preface with the premise that in order to encourage the development of a new common interdisciplinary table of discussion on “contrariety” in the context of contemporary Cognitive Sciences, the researchers involved would need initially to be reciprocally indulgent about the use of the term, and avoid establishing precise – which in this case would also necessarily mean strict – definitions. This has not, however, led to a lack of communication between the contributors to this book. Even though a common theoretical and methodological framework was lacking, it seems to us that this book encourages a richer research project on this cognitive structure. Moreover, despite the differences in the perspectives and theoretical contexts of each contribution, there seems to be a common aspect emerging at every level of analysis. This regards the recognition of direct phenomenal evidence of what the term contrariety really means. Independently of how far researchers lean in one direction or another when analyzing cognitive processes using different methodological and conceptual tools, the importance of genuine cognitive experiences of contrariety is never negated and is even taken for granted.

Beyond the many questions which this book raises, we might consider how many more questions we might need to ask in order to fully understand how contrariety works in our cognitive system. This is something that cannot be resolved with things as they are now, but the aim of this book is also to stimulate people into asking further questions.

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Ugo Savardi