

Research Facilitation Agreement: *How the human mind makes use of contraries in everyday life.*
(University of Macerata, Verona, Lund, Central Lancashire, Liverpool, Virginia, Pennsylvania)

Research Facilitation Agreement

Relating to the collaboration on a research project in Cognitive Science, entitled: *How the human mind makes use of contraries in everyday life. A new multidimensional approach to contraries in perception, language, reasoning and emotions.*

Participating parties:

UNIVERSITA' DEGLI STUDI DI MACERATA (ITALY),
UNIVERSITA' DEGLI STUDI DI VERONA (ITALY),
LUND UNIVERSITY (SWEDEN),
LIVERPOOL UNIVERSITY (UK),
UNIVERSITY OF CENTRAL LANCASHIRE (UK),
UNIVERSITY OF VIRGINIA (USA),
UNIVERSITY OF PENNSYLVANIA (USA)

The Rectors /Dean of the participating universities, exercising the competences granted to them by the legislation of their respective countries, and mutually acknowledging the legal capacity to sign this Agreement in the name of the institutions they represent

DECLARE:

The universities which participate in this Agreement offer a public service in higher education in their respective countries.

The Parties consider it fundamental to establish a relationship with other Universities.

The research contemplated by this Agreement is of mutual interest and benefit to all Universities involved.

The universities which participate in this Agreement are ready to collaborate in any scientific and cultural matters which can contribute to the established objectives, in accordance with the current legislation of their countries of origin.

THEREFORE, in exchange for each party's contribution of labor and intellectual input towards the educational, technical and scientific research activities set out below, the sufficiency of which is hereby acknowledged, the parties agree as follows:

Articles

Article I: Object of Agreement

The object of the present Agreement is to establish the framework for activities and relations necessary for the joint action of the Parties and for their collaboration on a research project entitled "How the human mind makes use of contraries in everyday life. A new multidimensional approach to contraries in perception, language, reasoning and emotions."

Article II: Description of the research

The research project aims to study in detail the role and behavior of contraries in various cognitive functions in order to extend the body of research on which a proposal for a general cognitive theory of opposition can be based. The project consists of five lines of action: I) CONTRARIES AND PERCEPTUAL PROCESSES; II) CONTRARIES AND PROBLEM SOLVING; III) CONTRARIES AND LANGUAGE; IV) CONTRARIES

AND EMOTIONS and IV) METHODOLOGICAL ASPECTS IN THE FORMALIZATION AND MODELING OF CONTRARIES.

Further details are provided in the scope of work ("SOW") attached hereto as Exhibit A.
Principal investigators are identified for each Party in Article XII.

Article III: Sphere of Action

The Parties agree to conduct scientific cooperation programs; to develop teaching and research projects between the parties; to promote the organization of workshops; to organize international conferences; to publish their joint work in international high quality outlets; to promote exchanges between senior researchers and between postgraduate students (in the case of the master's course, doctoral and postdoctoral students working on the themes of the project).

Article IV: Compliance with Laws

The activities hereunder will be conducted in accordance with, and all Parties will comply with, all federal, state, and local laws and regulations applicable to the activities.

Article V: Participation

In order to implement the activities within the framework of the present Agreement, the Parties can collaborate with other organizations, institutions, entities, and public and private companies.

The relationship between the Parties under this agreement shall be that of independent contractors and not as agents, participants in a joint venture or partners.

Article VI: Termination

This agreement shall become effective on the date when it is signed by all Parties and shall be effective until completion of the research set forth in the SOW or termination of this agreement due to the breach or default of any of the Parties upon written notice to the other Parties. Each party may terminate this agreement upon sixty (60) days written notice for any reason.

Article VII: Confidentiality

Should the data and reports deriving from the present agreement be considered as confidential to the Parties, they shall not be used for other aims without prior expressed authorization. In any case, the ordinances of the current legislation of the Parties' countries shall be met, especially in matters of intellectual property and exploitation of results.

Article VIII: Publication

The Parties shall be free to use the results of the research activities conducted hereunder for their own teaching, research, education, clinical and publication purposes without the payment of royalties or other fees. Each party shall submit to the other parties for review, a copy of any proposed publication resulting from the research at least thirty (30) days prior to the estimated date of publication, and if no response is received within thirty (30) days of the date submitted to the reviewing party it will be conclusively presumed that the publication may proceed without delay. If the reviewing party determines that the proposed publication contains patentable subject matter which requires protection, the reviewing party may require the delay of publication for a period of time not to exceed sixty (60) days for the purpose of filing patent applications.

Article IX: Use of a Party's Name

No Party will, without the prior written consent of the party concerned, use in advertising, publicity, or otherwise, the name, trademark, logo, symbol, or other image of the other Parties.

Article X: Entire Agreement

This Agreement and its attached Exhibits represent the entire understanding between the Parties, and supersedes all other agreements, express or implied, between the Parties as to its subject matter. In the case of any conflict between the terms of the body of this Agreement and an Exhibit, the provisions of the body of the Agreement shall apply.

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Article XI: Modification

Any alteration, modification, or amendment to this Agreement must be in writing and signed by all parties.

Article XII: Legal address of the Parties for notifications and Principal Investigators' names

As far as the present Agreement is concerned, the parties stipulate the following legal addresses for notifications and the following Principal Investigators:

Dipartimento di Studi Umanistici (Sezione Filosofia e Scienze Umane)

Università di Macerata

Corso Cavour, 2

Macerata, 62100

Italy

Principal investigator: Ivana Bianchi

Additional investigator for opposites and doctor-patient communication: Ricardo Pietrobon (Duke University)

Dipartimento di Filosofia, Pedagogia e Psicologia

Università di Verona

Lungadige Porta Vittoria 17,

Verona, 37129

Italy

Principal Investigators: Ugo Savardi, Roberto Burro

Centre for Languages and Literature

Lund University

Lund, SE-221 00

Sweden

Principal investigator: Carita Paradis

Additional investigator for opposites and humour: Rachel Giora (Tel Aviv University)

School of Psychology,

University of Central Lancashire,

Preston, PR1 2HE

Lancashire, UK

Principal investigator: Linden Bail

Department of Psychological Sciences

University of Liverpool

Liverpool L69 7ZA

United Kingdom

Principal investigator: Marco Bertamini

Department of Psychology

University of Virginia,

Charlottesville, VA 22904-4400

Virginia, USA

Principal investigator: Michael Kubovy

Visual Studies

University of Pennsylvania

3405 Woodland Walk

Philadelphia, PA 19104-6125

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Principal Investigator: Ian Verstegen

Article XIII: Duration

The present Agreement shall be valid for 8 years, from the moment of the last signature, and the Specific Agreements deriving from it shall have the validity stipulated individually, in relation to the duration of projects and activities to be executed.

Article XIV: Expenses

The present Agreement does not imply any expenses to be paid by the parties involved. Specific plans of work for the development of the present Agreement will be established between the Universities participating. Any contributions to be carried out by the Parties involved for the development of individual activities will be determined for each individual case. The Parties signing the Agreement thus declare their willingness to carry out any procedures considered necessary to raise funds from both public and private institutions to cover the development of the activities that will be promoted in order to implement the research project specified in the present Agreement.

WHEREFORE, the parties hereto place their hands and seals:

University of Macerata (page 6)

University of Verona (page 7)

University of Lund (page 8)

University of Central Lancashire (page 9)

University of Liverpool (page 10)

University of Virginia (page 11)

University of Pennsylvania (page 12)

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University of Verona

By: (signature)

Printed name:

Title:

Date executed:

EXHIBIT A-SCOPE OF WORK

Title of the project: *How the human mind makes use of contraries in everyday life. A new multidimensional approach to contraries in perception, language, reasoning and emotions.*

ERC: SH4 - The Human Mind and its complexity: cognition, psychology, linguistics, philosophy and education.

Abstract

Contraries are pervasive in our perceptual experience of the world, our emotions, our systems of classification, our reasoning processes and our language. What lies behind this fact? Are we dealing here with a really basic cognitive structure?

By means of experimentation, this project will study the invariant structures of opposition as they emerge from various different cognitive functions and will consider the consequences of these results in terms of theory, methodology and application to specific contexts.

Origins and general aims of this Agreement.

This research Agreement is the second step in a process of collaboration on the theme of "contrariness/opposition" that started in 2001 involving some of the principal investigators in the present research agreement. Over the years, there have been contacts with other researchers, giving rise to various scientific exchange experiences, visits, workshops and meetings in the university locations involving the Parties in this Agreement (funded by National Research Grants, the European Science Foundation; Stiftelsen Lundborgska Idofonden). This has led also to some joint publications in international journals.

The aim of the present Agreement is to start a new phase in this collaboration, further interlacing the scientific work of the researchers involved and prompting systematic collaboration initiatives. The Agreement will facilitate this ambitious project concerning the development of a mature, multidisciplinary, comprehensive approach to "contraries/opposites" which goes beyond disciplinary boundaries (i.e. constructions in language, reasoning, emotion, perception, etc.) that up to now have limited research on this issue. This will hopefully allow cognitive scientists to discover something new about the cognitive roots of this relationship which since time immemorial has been recognized as being so central to human cognition.

Project aims

1) To gain knowledge about human behavior with respect to contrariness which we assume is a very fundamental perceptual relationship, an important structuring principle for people's thinking, reasoning, communicating, emotional responses, sensory experiences, decision making, aesthetic thinking, hedonism. We want answers to questions such as:

- a) what are the characteristics of objects, events, actions, and properties that humans perceive as "opposites"? Is this structure invariant across domains and across sense modalities? To what extent everyday perceptual experience is perception of polarized properties and to what extent is it perception of intermediate (neither hot nor cold, neither good nor bad) experiences?
- b) what is the relationship between our perceptual experience of opposites and the ways in which we express it in natural languages?
- c) what is the role of opposites in human's ability to face and solve problems? Is "thinking opposite" related to creativity? Can we improve individuals' ability to produce divergent/creative responses by means of a simple strategy based on manipulation of opposites? Does this help to overcome cognitive fixedness and make representational changes of an initial mental model easier?
- d) What is the relation between emotional contrast and cognitive contrast? How is stress and displeasure, and also pleasure, appreciation, amusement and relief, related to experiencing or becoming aware of contrasts?
- e) How does this new comprehensive perspective on opposition/contrariness change the traditional way of dealing with opposition/contrariness in cognitive sciences? (Theoretical aspect). And how does all this impact on tools which make use of opposites like bipolar scales or reverse items? (Methodological aspect).

To answer these questions we will extend the analysis of the role and structures of opposites in various different cognitive functions. The project consists of five lines of action:

- I) CONTRARIES AND PERCEPTUAL PROCESSES;
- II) CONTRARIES AND LANGUAGE;
- III) CONTRARIES AND PROBLEM SOLVING;
- IV) CONTRARIES AND EMOTIONAL ASPECTS;
- V) METHODOLOGICAL ASPECTS IN THE FORMALIZATION AND MODELING OF CONTRARIES.

2) To develop applications using the results of the research in the following areas: the construction of psychological methodologies based on bipolar scales/binary spaces; strategies for creative thinking (effective problem solving strategies and the use and understanding of irony); improvements in mutual understanding in doctor-patient communication; the correction of common mistaken behaviors related to the over or underestimation of the oppositional components in the visual information conveyed by mirror reflections.

Details of the five lines of action:

I) CONTRARIES AND PERCEPTUAL PROCESSES

1a) Perception and prediction of contrary behaviors in reflections

In the field of naive optics, we aim to further develop and extend the collaboration which up to now has involved professors Bianchi, Savardi and Bertamini (Universities of Macerata, Verona and Liverpool, respectively). This has so far led to a satisfactory number of international publications (Bianchi & Bertamini, 2012; Bianchi & Savardi, 2008, 2012; Savardi, Bianchi & Bertamini, 2010) and their research has resulted in new hypotheses in addition to those previously put forward. These regard how the relationship between an object (or person) in front of a mirror and its reflection takes shape mentally: i.e. how people think of reflections on the basis of geometry involving identity or contrariety with reference to allocentric coordinates (based on the environment) rather than intrinsic spatial coordinates.

Planned developments: Experiments will test the capacity of this model to explain orientation and localization errors made by adults when making predictions based on a real object or its reflection.

Expected results: We foresee a difference (depending on the nature of the prediction) both in terms of the frequency of errors (more frequent for predictions based on reflections) and the type of error (geometrical translations are more frequent when starting from reflections). This may result in interesting theoretical developments concerning the understanding of the relationship that cognitively links reflections and real objects but may also suggest interesting applications regarding activities (e.g. driving) which largely involve estimates based on reflections (i.e. rearview mirrors or parabolic reflectors positioned at crossroads).

1b) Recognition of contrariety between perceptual stimuli. We aim to extend the exploration of how the perception of opposition works in visual perception (Savardi, Bianchi, 2005; Bianchi, Burro, Torquati, Savardi, 2013; Bianchi, Savardi, Burro, Martelli, 2014), auditory perception, taste, smell and touch.

Planned developments The perceptual structure of a number of bipolar dimensions identified as primal in each sense area will be analysed using phenomenological psychophysics – as defined by Bianchi, Savardi and Kubovy, 2011; Burro, 2009; Kubovy and Gepstein, 2002. We will also test whether and how this structure changes when the same dimensions are applied intermodally (e.g. rounded-angular applied to visual shape, sound, taste, smell, and touch).

Expected results Some changes in the structure of the poles and their intermediates might be expected when the same dimension is cross-modally applied (how severe these changes are is to be defined); it might also be discovered that often the whole dimension changes when crossing sense boundaries. That is, the natural opposite of given a property A, might be B in sight, but C in sound, D in smell and H in taste. In this case, it is however to be expected that A, B, C, D and H will not be totally independent properties but rather define a multidimensionally related set.

II) CONTRARIES AND LANGUAGE

1a) "Neither lethargic nor lively". A number of studies in psycholinguistics, cognitive semantics and cognitive linguistics have demonstrated the existence of an antonymic structure common to all natural languages (e.g. Croft & Cruse, 2004; Jones, Murphy, Paradis & Willners, 2012; Murphy, 2003; van de Weijer, Paradis, Lindgren & Willners 2012). However, very little research has been done on experiences described as *neither one pole nor the other* – that is, "intermediates" (Bianchi, Savardi & Kubovy, 2011; Paradis 1997, Paradis & Willners 2006, 2013).

Planned developments We intend to use corpora and experimental studies to determine: 1) whether lexicalization of intermediates (e.g. "tepid" for hot-cold, or "level" for ascending-descending) somehow correlates to the perceptual structure of "neither...nor.." experiences (e.g. topologically a point vs. a range); 2) whether the neutrality of Intermediates is a real datum (i.e. they are equidistant from the poles as suggested by "neither...nor...") and if so, whether asking people the opposite of an intermediate state would not lead to a significant preference for one or the other pole; conversely, if people do tend to prefer one pole (e.g. if "ascending" is more frequently identified as the opposite of "level" than "descending") then this suggests that intermediates are not neutral/equidistant. Tests will be carried out with both adults and children (using both perceptual and linguistic tasks) since we wish to understand whether this anisotropy of intermediates (which we expect for many dimensions) exists at an early phase in cognitive development.

Expected results: We expect Intermediates to be much more extensively present in perception than in lexicalization. Anisotropy is expected to often characterize Intermediates at a perceptual level; we expect to find a correlated effect in language, but probably this will emerge at a semantic and pragmatic level rather than at a purely lexical level.

IIb) Contraries in Irony. Various linguistic and cognitive theories have acknowledged that incongruence mechanisms are implied in humour and irony (for an overview, see Forabosco, 2008; Dynel 2009; Giora 2001).

Planned developments We will focus on the phenomenon of anisotropy which has emerged from perceptual research, i.e. the fact that changing a property from one pole to its opposite (e.g. from small to large or vice versa) does not necessarily lead to the same result: it may lead to the perception of similarity in one case and of opposition in another. We also wonder whether this is mirrored in Irony. Irony can also contrast a given situation bi-directionally (e.g. It is 0° degrees outside: "It's so hot!"; or It is 40° degrees outside: "I'm freezing"). We will study whether perceptually grounded rules, in addition to the linguistic and pragmatic rules already identified in existing literature (e.g. Giora and Ofer, 1999; Giora, 2003) may account for these asymmetries. This part of the project will benefit from the collaboration with Rachel Giora (Tel Aviv University)

Expected results We expect the contamination between two apparently different domains to help researchers to identify new perspectives which may lead to a more fruitful inspection of this question. On the subject of this multidisciplinary view, see Canestrari and Bianchi (2012, 2013).

III) CONTRARIES AND PROBLEM SOLVING

IIIa) Contraries can help in the search for a solution to a geometrical problem: Problem solving (conceived as a kind of reasoning process leading to the solution of a problem) has been widely investigated in contemporary studies. A relatively recent issue is whether using contrasts can facilitate the process (Gale and Ball, 2006, 2009, 2012; Branchini, Savardi & Burro, 2009).

Planned developments The project intends to study the effects of this heuristic in geometrical problem solving involving the manipulation of mental images (carried out by both adults and children). We will investigate whether and, if so, how an explicitly or implicitly suggested mental manipulation of a problem in terms of opposites might stimulate people to overcome fixedness, facilitating a reorganization of the mental representation of the problem thus helping them to find a solution.

Expected results: We expect the application of an explicit strategy based on "creating the opposite" of the properties of a problem to lead to: an increase in the number of people coming up with a correct solution; a change in the type of information which they focus on during their search for a solution and finally a trend towards a decrease in the time taken to reach a solution. The relevance of these positive effects, if confirmed, is based on the consideration that elaborating the structure of a problem in terms of contraries is an easily accessible and generalizable strategy and it does not require expert competence since opposites are primal in human cognition, in general, and in spatial cognition, in particular.

IIIb) Contraries can help us to understand the "divergent thinking" underlying artworks: The contribution of the psychology of perception (as developed within the framework of what today is known as "neo-Gestalt Psychology" or "the Experimental Phenomenology of Perception") towards understanding the creative processes involved in art has a long tradition (e.g. Arnheim, 1954; Versteegen 2008, 2014; Kubovy 2003).

Planned developments: The project will integrate the expertise of researchers in the psychology of perception, the psychology of art, the psychology of reasoning and art history. The aim is to develop a new scientific and at the same time educational approach to modern and contemporary art for both children and adults. Starting from the idea that people's interest in and appreciation of contemporary and modern art can be improved by helping them to discover how to look at an artwork, the project will test the specific hypothesis that prompting people to discover that artworks often manipulate the usual structure of objects by using contraries is an effective way a) to improve their understanding of contemporary and modern art b) to increase their appreciation of it and c) to stimulate not only recognition but also the production of divergent thinking. This hypothesis will be tested by means of proper methods applied to educational curricula and exhibition itineraries developed in schools, art academies and museums.

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Expected results: Various proposals will be developed (inspired by the research topics which are the object of this Agreement) involving research into art and corresponding educational and exhibition itineraries. For example, one topic will concern reflections and artworks which make use of mirrors. We will work on the idea that creative manipulations in art often involve strengthening (accentuating or adding) or weakening (attenuating or denying) the perceptual contraries exhibited in mirror reflections. The scientific work developed based on this idea will also inspire the creation of corresponding materials for art exhibitions and educational itineraries, addressed to both adults and children.

IV) CONTRARIES AND EMOTIONAL ASPECTS

Emotional experiences (joy, anger; disgust, pleasure; pride, shame etc), aesthetic judgments (beautiful, ugly; pleasant, unpleasant; interesting, boring etc) and valence in general (positive/negative) are modulated by opposites. In the arts emotionally negative objects can sometimes be positively judged.

Planned developments Starting from studies which have shown that art can elicit a broad range of both positive and negative emotional experiences (Blood & Zatorre, 2001; Blood, Zatorre, Bermudez, & Evans, 1999; Juslin, 2013; Scherer, 2005; Silva, 2005, 2009, 2013), and within the general framework of a "pleasure of the mind" theory (Kubovy, 1999), the project will investigate which bipolar dimensions are primal in two apparently different kinds of art experience: A) when the appreciation of art is mediated by reasoning processes (such as for example in programmed and kinetic art or in conceptual art) and B) when the emotional reaction is more immediate and rational-reasoning aspects are less involved or not involved at all (as in expressive art).

Expected results: 1) The identification of different core-sets of bipolar emotional dimensions which specifically characterize the two types of art experience (A; B) in addition to an obvious overlapping set of common dimensions. 2) A demonstration that the appraisals of emotional responses fostered in A is no less intense than in B.

V) METHODOLOGICAL ASPECTS IN THE FORMALIZATION AND MODELING OF CONTRARIES

Bipolar scales are frequently used in psychology in order to model cognitive, personality and emotional traits or to express judgments. These scales (e.g. positive-negative; good-bad; calm-agitated etc.) presuppose assumptions of unidimensionality and symmetry that recent works have however called into question (Bianchi, Savardi & Burro, 2010; Bianchi, Savardi & Kubovy, 2011).

Planned developments:

Va) An assessment of the structure of bipolar scales. The aim is to extend checking for unidimensionality in the most common bipolar scales, taking advantage of the collaboration with M. Kubovy (University of Virginia), a highly competent experimental psychologist with a great deal of experience in the field of methodology, C. Paradis (University of Lund), a professor of English linguistics specializing in cognitive linguistics and an expert in the study of opposition in language and Alessio Moretti (PhD), philosopher, logician and oppositional geometer.

Expected results The establishment of sets of bipolar scales defined by similar metric and topological characteristics in terms of the extension of intermediates, the asymmetry of the two extremes, unidimensionality or non-unidimensionality.

Vb) Bipolarity-unipolarity in doctor-patient communication. We will test the effects (in terms of between-subject variability and decision making outcomes) of the application of uni- or bi-polar scales in doctor-patient communications. This part of the project will benefit from the collaboration with R. Pietrobon (Duke University) and various health care institutions.

Expected results: If people hearing information provided by a doctor spontaneously recode it in bipolar terms (healthy-ill; high-low risk; high-low commitment of the treatment), we expect to find less between-subject variability in the understanding of information when a bipolar method (e.g. a *small* nodule) as compared to uni-polar method (a nodule of *x cm*) is used - although the latter is more precise quantitatively speaking. This might also help in terms of improving informed consent forms. Among the expected results for this part of the project is the development of a user friendly, customized application based on touch tablet technology for research with oncology patients.

Vc) Impact of opposites in absolute and differential thresholds. A procedure to be used in psychophysics will be developed in order to quantify the amount of variation in absolute and differential thresholds due to estimates of pairs of contrary properties versus single properties.

Expected results: Despite a satisfactory stabilization in measurements, traditional psychophysical methods do not allow the processes underlying the relationship between sensation and judgment to be evaluated. Using Signal Detection we expect to be able to test how the use of opposite properties modifies judgments in terms of determining the presence/absence of a given target.