

PUBLIC SELECTION BASED ON QUALIFICATIONS AND INTERVIEW FOR THE AWARDING OF NO. 7 GRANTS LASTING 24 MONTHS FOR CONDUCTING RESEARCH IN ACCORDANCE WITH ART. 22 OF LAW OF 30.12.2010 NO. 240 AT THE DEPARTMENTS OF THE UNIVERSITY OF BERGAMO WITHIN THE RESEARCH PROGRAMME CALLED "STARS SUPPORTING TALENTED RESEARCHER" – ACTION 1 FOR THE YEAR 2018 – I TRANCHE (CUP: F52F16001350001)

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RESEARCH PROJECTS

"New algorithmic approaches for network decomposition"

Annex code 1

Department of Letters, Philosophy, Communication

Tutor: **Prof. Riccardo Dondi**

A.D. INF/01 - Informatics A.R.F.: 01/B1 - Informatics

The project will deal with the study of network (or graph) decomposition problems. These problems are of fundamental relevance for understanding the behavior of complex systems in various fields of research, like bioinformatics or social network analysis.

One of the most interesting aspects in the study of networks is the identification of subnetworks, or modules, which play a significant role in the behavior of the network. An example considered in literature is the quest for cohesive subnetworks (or subsets of densely connected nodes) within a network.

The literature has focused on the problem of identifying cohesive subnetworks of maximum size, a problem generally intractable from a computational point of view. However, the networks considered to study complex systems usually consist of several modules and a fundamental problem is therefore the decomposition of a network into modules. This problem has only recently been considered in literature and a systematic study of the algorithmic and complexity aspects is still missing. The project will deal with the study of computational complexity and the design of algorithms for problems of network decomposition into modules. The study will consider some aspects that influence the definition of the problem: the overlap or separation of modules, the definition of module, the need to include all the nodes of the network in the decomposition or not.

The algorithmic techniques that will be used in the project are mainly parametrized complexity and approximation algorithms for combinatorial problems.

The project will also consider possible implementations of the designed algorithms and the experimental analysis on synthetic and real data

"The "supermarket revolution" and agricultural production in Italy: Private standards and new representations of food"

Annex code 2

Department of Letters, Philosophy, Communication

Tutor: **Prof. Domenico Claudio Perrotta**

A.D. SPS/08 - Sociology of culture and communication; SPS/09 - Economic sociology and sociology of work and organizations; SPS/10 - Urban and environmental sociology A.R. F.: 14/C2 - Sociology of culture and communication; 14/D1 - Economic sociology, sociology of work, urban and environmental sociology

The present research project aims at studying the "supermarket revolution" and its effects on Italian agri-food supply chains, through a qualitative study and a sociological analysis of the relationships between food retail companies and their suppliers.

To achieve this objective, the research will take into consideration two sectors of agri-food production in which the supermarket revolution had a relevant impact: meat production and the so-called "fourth range" products.

The study will explore the following issues. 1) Strategies and practices through which food retailing companies define production standards concerning quality and quantity of products, food safety, delivery logistics, price. 2) The transformations in the organization of work within the entire supply, due to retailers' standards. 3) The differences in the production and distribution of food products commercialized with either suppliers' brand names or retailers' private labels. 4) Food representations by the actors involved in the supply chain: in particular, the research aims at exploring the tension between, on the one hand, the industrialization and standardization of production and, on the other, the claims of "excellence" of food products, usually linked to "authenticity", "local food", "made in Italy", organic certifications, etc.

The field research will be based upon qualitative methodologies, in particular in-depth interviews. Around sixty interviews will be realized with two kinds of respondents: on the one hand, with buyers, quality managers, food safety managers and other workers of food retailing corporations as well as retail groups specialized in the distribution of organic and fair trade food; on the other hand, with suppliers, such as farmers, processing plants' managers and technicians, officers of consortia, cooperatives, producers' organizations. Then, empirical material will be analysed and the research results will be presented in academic conferences and scientific publications.

Department of Foreign Languages, Literatures and Cultures

Tutor: **Prof. Angela Locatelli**

A.D. L-LIN/10 – English literature A.R. F.: 10/L1 - English and Anglo-American languages, literatures and cultures

1) Objective:

The objective of this epistemological study on the complexity of literature is to investigate how contemporary literary texts reflect, elaborate and redefine the experiences of societies that are currently dealing with societal challenges posed by ever-growing global interdependencies and newly formed cultural and semiotic contexts.

The project aims to be an entirely original research in several disciplines, focussing on the ethical and epistemic import of literature vis à vis the new challenges of multiple global interconnections. It will offer new methodological tools in English Studies, in the Comparative study of Literature and Culture, and in Socio-Cultural Studies.

2) Theoretical framework:

The cutting edge concept of “contact zone” is the starting point of this study on the epistemological, ethical and social role of literary knowledge in relation to the “societal challenges” outlined in the Horizon 2020 framework. As opposed to traditional and questionable views of language and literature as mere expressions of national/communitarian identities (Anderson 1983), the concept of “contact zone” (Pratt 1991) has recently highlighted the dialogic and conflictual nature of non-homogeneous social spaces. These spaces are often characterized by asymmetrical power relationships (colonialism, migration, discrimination). In this perspective, the research project aims to investigate linguistic and textual “acts of self-placement” (Regard 2002, Deleuze/Guattari 1980) through which hybrid subjectivities come into being, specifically within the literary text, in relation to an ever-changing reality.

3) Research project description:

The project will focus on the analysis of contemporary literary texts (in English or multilingual). Its aim is to investigate how literature not only reflects, but also spawns a variety of processes through which individual and collective subjects relate to a world that is ever more composite, hybrid and transcultural.

This study will also discuss the dynamics through which hybrid subjectivities (migrant, post-colonial) are shaped within the text through the mediations of multiple “others”. The exploration of fluid borders between identity and alterity will be dealt with throughout the research.

The project will develop in the following directions:

1. From a philosophical perspective, it will contribute to a theory of subjectivity which takes into consideration the dynamics of reading and writing of the literary text, while also highlighting the specificity of literary discourse.
2. From a critical-historical point of view, the project will deal with issues of memory, identity and tolerance in order to gain a better understanding of new cultural developments in the European and global context.
3. From a pragmatic-communicative perspective, this project will present the scientific community with a study on the contemporary and latest trends in literary and critical production. It will elaborate methodological tools which could profitably be integrated in innovative didactic practices (both in academic and non-academic contexts).

4) Timing and calendar of activities:

The project will involve the writing of several essays, the participation in international projects and the publication of a book on the chosen theme. It will be organized in three different stages.

A) In the first stage, the bibliography and theoretical/methodological premises of the research project will be defined.

B) In the second stage, some fundamental thematic clusters will be addressed (“Contact zones”, “Societal Challenges”, “Linguistic Acts of Self-Placement”, “Resilience and Literature”, “Hybridization and Contamination”, “integration versus inclusion”, etc.).

C) In the third and last phase the outcomes of the previous phases will be elaborated in the light of a literary theory of subjectivity which takes into consideration the processes of reading and the interpretation of literary texts (Lecerle 1999, 2005)

5) Expected results:

This innovative project is expected to contribute to the discussion on the ethical and social role of literature in relation to contemporary societal challenges and new global interdependencies. It will develop new methodologies of work and research in the field of English literature, Social and cultural studies, as well as in the field of transcultural comparative studies.

It should produce a significant contribution to several disciplines, with possible applications to social practices (in terms of counselling and proposal of inclusion strategies). This will enhance the visibility of our University at a national and international level and it may provide the University with a source of income.

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"3d4amb: use of 3d stereoscopy for amblyopia"

Annex code 4

Department of Management, Information and Production Engineering

Tutor: Prof. Angelo Michele Gargantini

A.D. ING-INF/05 - Information processing systems A.R. F.: 09/H1 - Information processing systems

The project aims to design and experiment a system based on 3D vision for the diagnosis and treatment of some visual problems, primarily the visual disease of amblyopia in children. A goal of this project is to develop a software system that is effective for the treatment of amblyopia and can replace the classic bandage therapy. It should be more effective than patching in solving problems related to compliance and adoption of treatment. Although there are already attempts in this direction, the project has as its originality the use of low-cost tools (like Google cardboard) suitable for home use (PC or smartphone), and integrated into a service that allows monitoring from remote from the doctors. The project will focus on proposing activities (such as simple videogames) that can attract small patients and make the therapy easier to follow. The project's specific expected result is to collect experimental data on the use of the system that can confirm its medical validity.

Department of Engineering and Applied Sciences

Tutor: Prof. Fulvio Adobati

A.D. ICAR/21 - Urban design and landscape A.R. F.: 08/F1 - Urban and territorial planning and design

Description of the research project

The growth of settlements which in the twentieth century has affected the European territory has led to a reduction of the green soils and permeable and the weakening of the capacity of the city to manage natural events. Especially in the territories of the great rivers, nowadays it is possible to recognize the presence of buildings and spaces waterproofed whose presence represents a problem for the hydrogeological, ecological and landscape aspects.

We are faced with the need to increase the safety of urban systems ensuring a more efficient management of rainwater, rises the need to promote a policy of "subtraction controlled" and reduction of these surfaces waterproofed.

The de-waterproofing and actions for the de-sealing are part of the "Guidelines on good practices to limit, mitigate and compensate for the waterproofing of the soil" envisaged by the European Commission to promote the recovery of built spaces. Some German cities (e.g. Dresden) have planned compensatory measures for projects of transformation of soils not built in the form of speeches of de-sealing or greening on urban areas. Some Italian regions have introduced in their legislation the de-waterproofing for a general landscape recovery (Veneto and Emilia-Romagna) or with specific reference to the fluvial areas (Lombardia and Liguria). At the local level the project Sos4Life, promoted by the municipalities of the province of Forlì-Cesena with the Emilia-Romagna Region, has introduced a mechanism for an exchange of credits builders that allows to transform a medium free only in the case of recovery, to agricultural use or natural seeds, of land already sealed. Finally, an innovative instrument promoted by Regione Lombardia for the management of the environment as the contract of river Olona-Bozzente-Lura, has planned actions of elimination of building volumes for redeveloping the fluvial landscape and mitigate the risk hydraulic.

The development consists in devising a synoptic inside which the emergence of technical devices present today and get the definition of operational scenarios:

- a) case study analysis for the definition of an "atlas of experiences". For the selected cases should be recognized some characteristics, for example: reference framework, promoters, the purpose of the initiative, the typology of the proposed device, forms of incentive, objectives achieved criticality encountered, etc.;
- b) interaction with professionals and other stakeholders;
- c) Construction of a synoptic verb-visual, which, through the definition of a taxonomy of actions, the reprocessing of analyzed cases, the intersection with the considerations that emerged in interviews and consultation of the available literature, provides a clear explanation of the different tactics;
- d) identification of certain geographical contexts present in Lombardy, in particular urban areas affected by the passage of large rivers, which evaluate the activation of measures to increase resilience;
- e) formulation of strategic scenarios for the application of devices for de-waterproofing.

Times and temporal phases of research:

First year:

- 1) Construction of the atlas and survey of the literature: 8 months
- 2) Interaction with experts: 6 weeks
- 3) Processing of the synoptic panel: 2 months
- 4) Organization of the workshop intermediate of sharing of first results (Table restricted with teachers, officials P.A. and operators): 2 sep.

Second year:

- 5) Integration and consolidation of the synoptic panel: 1 Month
- 6) Analysis of geographical contexts: 3 months
- 7) Construction of strategic scenarios: 4 months
- 8) Production of a dossier of synthesis with the product results in research: 3 months
- 9) Organization of final seminar for the presentation of the results of research: 2 weeks

Description of the expected results: originality and relapse on the advancement of knowledge

The line of research fits into the strategies of international reference: Agenda UN transforming our world: the 2030 agenda for sustainable development_Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable; A HABITAT Trends in Urban Resilience 2017; 7 th framework program of action of the European Union in the field of the environment, Horizon 2020- sustainable management of natural resources and ecosystems and the goal of a society and economy resilient to climate change.

The evidences of the phenomena and the attention to the different levels to the theme of the hydrogeological set-ups in the safety of urban contexts still has the need to establish a clear instrumentation (species under the procedural profile and of the effectiveness of implementation). In particular the use of the device for the transferable development rights, as possible device technical-administrative, imposes a renewed reflection on the institute of urban and territorial equalization that, at a distance of many years from the first experiments, still offers wide margins for its effective implementation (in addition to the aspects of fairness and distributive justice). The theme is connected for the efficient management of the ecosystem services is then in the center of the National Strategy for Sustainable Development - October 2017 (III.1 prevent natural hazards and related to the human action and to strengthen the capacities of the resilience of communities and territories).

Within the frame of the regulatory resources available, the experimentation of models of implementation of devices of transferable development rights within an evaluation system which combines the effects with the measurement of the universe of ecosystem services, represents a horizon of research complex and promising for efficient regeneration of the river corridors and difficult urban contexts involved.

Department of Engineering and Applied Sciences

Tutor: **Prof. Fontana Francesca**

A.D CHIM/07 - Principles of chemistry for applied technologies A.R. F.: 03/B2 - Principles of chemistry for applied technologies

Objective:

The project is based on the preparation and characterization of organic molecules (azahelicenes) endowed with an extended aromatic conjugation, which absorb light in the range of the visible-near UV radiation and show marked fluorescence and phosphorescence properties, as well as intrinsic chirality due to their helical shape. The aim is to enhance the study towards applications of these molecules in the fields, already object of some preliminary work, of sensors and of spectroscopic analysis. It is also desired to apply optically stable azahelicenes also in the field of chirality induction in ionic liquids for electrochemical applications.

The work performed to date was mostly limited to the class of aza[5]helicenes, which are not optically stable. Due to the extremely marked optical activity of this class of compounds, it would be desirable to widen investigations to more extended and optically stable systems (aza[6]helicenes), whose utilization may open application fields of paramount interest. It will be therefore necessary to develop effective synthetic strategies for new mono- and diaza[6]helicenes, to be then separated into their enantiomers and subsequently modified for specific applications. They can be endowed with hydrocarbon chains bearing appropriate functional groups, in order to bind them to carbon nanotubes or to nanostructured noble metal surfaces, to obtain highly enantioselective materials. They can also be quaternarized onto the nitrogen atom, with the purpose of obtaining ionic compounds utilizable in electrochemistry for chiral catalysis.

The project is structured in the following phases:

- 1) preparation and characterization of aza[6]helicenes, either known or as yet undescribed, and separation of the pure enantiomers by means of chiral chromatographic techniques
- 2) modification of the molecules prepared in phase 1) by a) addition of hydrocarbon chains bearing appropriate functional groups or b) quaternarization of the nitrogen atom
- 3) modification of carbon nanotubes or nanostructured noble metal surfaces, by using the molecules prepared in phase 2) through the development of methods for the formation of stable bonds between the reactive functional groups and the surfaces to be modified; modification of the properties of ionic liquids by means of the chiral molecules obtained in phase 2b).
- 4) characterization of the materials obtained in phase 3) by different techniques, such as spectroscopic or electrochemical analysis, in order to assess the effectiveness and reproducibility of the preparative methods, so as to optimize the procedures, and also to evaluate the stability of these materials.
- 6) verification of the effectiveness of the realized materials for the specific applications which represent the object of the research, namely:

d. nanostructured gold surfaces modified with optically stable chiral azahelicenes for applications in Raman-SERS and SEF (Surface-Enhanced Fluorescence) spectroscopies

e. carbon nanotubes functionalized with azahelicenes for applications in electrochemical sensors

f. ionic liquids modified by addition of chiral quaternary salts for applications in electrochemical stereoselective processes

A sufficient quantity of 5-aza[6]helicene will be preliminarily produced, by already known methods, in order to separate its enantiomers and/or modify its structure for the various applications. Subsequently the phase of preparation and characterization of nanostructured surfaces and of modified ionic liquids should take place, and the optimal reaction conditions for their preparation defined. At the same time, the materials obtained as described would be tested to assess their effectiveness and durability in the specific application. Based on the observed results, it will be possible to devise structural modification of the helicene itself or of the added side chain in order to modulate the performance of the material.

The diverse synthetic methods to be perfected should converge towards the preparation of a wide range of molecular materials, viable for the obtainment of different specific goals, some of which already preliminarily explored and others not yet essayed. The approach is synergistic, in that it optimizes the efforts by developing general synthetic procedures utilizable, with appropriate variations, in different fields.

The practical objectives that are pursued are, among others:

- realization of sensors for biomolecules based on the modification of carbon nanotubes; a study was already performed to prepare a selective epinephrine sensor for biological fluids, and the results encourage the prosecution of the investigation, trying to clarify the structural requirements for the molecules to modulate their properties on the basis of the desired applications.
- realization of nanostructured noble metal surfaces modified by optically active azahelicenes for applications in Raman-SERS spectroscopy, particularly to the aim of realizing a portable biomolecule sensor for the continuous monitoring of ematic levels of antiepileptic drugs.
- realization of nanostructured noble metal surfaces modified by optically active azahelicenes for applications in SEF spectroscopy, to exploit the intense fluorescence of azahelicenes for analytic purposes
- preparation of modified ionic liquids as catalyzers for the realization of enantioselective electrochemical reactions by the electrodic surface.

“Design of microelectronic systems for antimatter detectors in cosmic ray astrophysics applications”

Annex code 7

Department of Engineering and Applied Sciences

Tutor: Prof. Massimo Manghisoni

A.D. ING-INF/01 - Electronic engineering - German A.R. F.: 09/E3 - Electronics

The research project involves the design of a new microelectronic system for the read out of strip sensors used in the detection of anti-deuterium particles from cosmic rays.

The identification and the discovery of the nature of Dark Matter is today one of the most relevant scientific problems for the understanding of the universe. The General AntiParticle Spectrometer (GAPS) is a balloon-born experiment with a novel approach for indirect dark matter searches that exploits cosmic antideuterons. The experiment involves the use of a stratospheric balloon with a lithium-drifted silicon, Si(Li), tracker system. The signal generated by each detector in response to the incident radiation must be suitably amplified and filtered in order to optimize the signal-to-noise ratio before being processed by the digital section.

In a prototype of the experiment, which was flown in 2012 from the Taiki balloon base of the Japanese Space Agency (JAXA), the amplification of the signal coming from the sensors was carried out using electronic circuits made with discrete components and housed on printed circuit boards.

The proposed research project aims to adopt an extremely innovative solution for the design of the electronic instrumentation to be used in the scientific experiment. The proposed solution involves the use of integrated microelectronic technologies for the design of the entire readout channel for the processing of the signal coming from the detectors. Thanks to their extremely small size and limited power consumption, integrated circuits can guarantee performances that cannot be obtained with commercial devices.

The project, which will last 2 years, envisages the realization of a multi-channel chip in a high-density CMOS technology. The ASIC will have to be ready in time for the balloon launch which is currently scheduled for the second half of 2020 by the McMurdo station in Antarctica.

The research activity will be carried out at the Microelectronics laboratory of the University of Bergamo, in Dalmine.