



*Find innovative solutions  
to help people overcome the  
limits imposed by their  
disabilities. Scientists at work.*

## **WORKSHOP - ABF CHALLENGES**

**JULY 6<sup>TH</sup>, 2012**

AUDITORIUM G. TONIOLO

DELL'OPERA DELLA PRIMAZIALE PISANA.

PIAZZA DEI MIRACOLI, PISA



- 9.00**      **Opening by Andrea Bocelli**
- 9.30**      Welcome speech by Authorities and Rectors
- 10.00**     The MIT Fifth Sense Project: Providing the Functions Of Vision to Blind People  
**S. Teller** MIT Oral presentation and exhibition.
- 11.00**     **Coffee break and exhibitions**
- 11.30**     Music Accessibility for Visual Impaired  
**P. Nesi**, G. Nicotra, Università di Firenze
- 11.45**     Intelligence in the Hand: From Human to Artificial Haptics  
**A. Bicchi**, Università di Pisa
- 12.00**     When your smart phone becomes your guide dog  
**I. Tinnirello**, P. Gallo, Università di Palermo
- 12.15**     Haptic Interfaces: access to digital computing for Visual Impaired  
**C. Avizzano**, A. Frisoli, M. Carrozzino, C. Evangelista S. Anna, Pisa
- 12.30**     Two Research Projects on Computer Vision for Visual Impaired  
C. Guida, M. Fanfani, **C. Colombo**, Università di Firenze
- 12.45**     Social networks: opportunities and challenges for blind people  
M. Buzzi, C. Buzzi, **B. Leporini**, CNR Pisa.
- 13.00**     Seeing with ears, hands and the bionic eyes: from theories of brain organization to visual rehabilitation.  
**A. Amedi**, Hebrew University of Jerusalem
- 13.15**     **Lunch in the Open Gallery**
- 15.00**     Panel discussion: Open problems and Possible solutions  
**Chair: M. Dahleh**, MIT  
**Panelists:** A. Tesi (Rector Università di Firenze), M. Carrozza (Rector SS Sant'Anna Pisa) P. Nesi (Università di Firenze), A. Bicchi (Università di Pisa), L. Emiliani (CNR), S. Teller (MIT).  
With the participation of success stories of visual impaired persons helped by new technologies. Interviews by Giorgio De Martino.
- 17:00**     **Closing by Laura Biancalani, President ABF**

## ABF VISION

I strongly believe that love does justice. And it is for this simple reason that we are all responsible for building a better world. Since love energizes faith, the opposite must also be true. The amazing lives we have been gifted, offers us the privilege, opportunity, and responsibility to give the less fortunate a better future and opportunities.

**Andrea Bocelli**

## ABF MISSION

Our mission is to empower people and communities in situations of poverty, illiteracy, distress due to illness and social exclusion by supporting national and international projects that promote the overcoming of these barriers.



Organizer and chair

## **Laura Giarrè**

Università di Palermo  
(Advisory Board ABF)

### **BIO**

Laura Giarrè is a Control System Professor at University of Palermo, Italy in the EE Department (DIEETCAM). Laura Giarrè received the Laurea degree in Electronic Engineering from the Università di Firenze, Florence, Italy and the Ph.D. degree in System Engineering from the Università di Bologna, Bologna, Italy, in 1986 and 1992, respectively. She has been assistant professor at Politecnico di Torino from 1993 to 1998. She has held visiting positions at the Department of Mechanical Engineering of the University of California at Santa Barbara and at the Laboratory for Information and Decision Systems, MIT, Boston. Her interests are in Identification and Game Theory for Networks. She is author of more than 100 international papers. She has been vicechair of the Sing6 conference, and co-organizer of various workshops and symposium. She is in the Scientific Advisory Board of the Andrea Bocelli Foundation. She is also a poet and a novel writer.



The MIT Fifth Sense Project: Providing the Functions of Vision to Blind People

**S. Teller**

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**ABSTRACT**

We describe a multi-year interdisciplinary effort to develop a wearable device that provides some of the functions of vision to blind and visually impaired people. Key questions include: hat sort of information does the user need or want in order to function more independently? How can the needed information be gathered efficiently from the user’s surround? How can the gathered information be conveyed effectively to the user? Our goal is to support key functions such as independent mobility, information access, work, socialization, and recreation.

Our early focus is on three areas. First, we are developing hand-held and wearable systems to support indoor navigation in unprepared environments. Second, we are developing wearable systems to detect and eventually recognize nearby people. Third, we are developing a MEMS high-resolutio tactile display to rapidly deliver information to the user without interfering with her/his hearing.

(Joint work with Prof. Carol Livermore at Northeastern, Prof. Rob Miller and Dr. Maurice Fallon at MIT, and several others.)

**BIO**

After a PhD in Computer Science at Berkeley, and postdoctoral stints at Hebrew University and Princeton, Seth Teller moine MIT’s Electrical Engineering and Computer Science Department Department (EECS), and its Computer Science and Artificial Intelligence Laboratory (CSAIL), in 1994. There, his group develops machines that work closely alongside people in health-care, military, civilian, and disster-relief settings. His recent projects include: wearable devices that provide task-salient information about nearby terrain, objects, text and people; a self-driving car; an unmanned semi-autonomous forklift; a voice-commandable robotic wheelchair; and a humanoid robot that performs dangerous tasks while people help from a distance.



Music Accessibility for Visual Impaired

**P. Nesi, G. Nicotra**

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## ABSTRACT

Music today is not only the interpretation of music composition, but in a wider sense, it is a multifaceted and multi disciplinary work / research area, ranging from the musicological aspects to the simple coding and distribution of sound. In all these perspectives, aspects regarding accessibility are very relevant, with regard to music composition, play, production and distribution. In the last 10 years, the University of Florence has developed a number of research and development projects in the area of music, music coding and performing arts, putting together different approaches based on information, technology and humanistic aspects. Among the most relevant results be here mentioned: MPEG Symbolic Music Representation, Braille music coding and tools, and recently ECLAP, the European Library of performing arts, and the collaboration with the developers of Braille Music editors, by which many complex tasks performed by sight, are now carried on by the machine, under the guide of the blind user. The presentation will focus on the major results achieved and on the current solutions, providing also an overview about the new challenges and perspectives with major impact on music literacy, development of new job opportunities, new challenges for research in the domain of technology as well as in inclusive education for the visually impaired.

## BIO

Paolo Nesi is a full professor at the University of Florence, Department of Systems and Informatics, chief of the Distributed Systems and Internet Technology lab and research group, and vice-director of the department, referent for the group ICT-Robotics of the University of Florence. His research interests include massive parallel and distributed systems, physical models, semantic computing, computer music, formal methods, cloud and grid. He has been the general Chair of DMS SEKE, IEEE ICSM, IEEE ICECCS, WEDELMUSIC, AXMEDIS international conferences and program chair of several others. He is and has been the coordinator of several multipartner international R&D projects of the European Commission such as ECLAP, AXMEDIS, WEDELMUSIC, MUSICNETWORK, MOODS and he has been involved in many other projects. He has been co-editor of MPEG Symbolic Music Representation of ISO



Intelligence in the Hand: From Human to Artificial Haptics

**A. Bicchi M. Catalano, M. Gabbicini, G. Grioli**

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## ABSTRACT

The human hand is one of the most tremendously complex, yet wonderfully effective parts of the human body. Not only its intricate skeletal and muscular structure, but also its magnificently rich sensory apparatus generate awe, and make one wonder how can the brain tame such complexity making it into the docile and nimble organ we depend so much upon. The question is fundamental not only for the understanding of the sense of touch and manipulation in humans – but also for the possibility of replicating, at least in part, the functions of the hand in artificial devices. I will consider how the embodied characteristics of the human hand affect and determine the learning and control strategies we use for exploring, grasping and manipulating. I will also describe how these studies turn into key ideas for designing better artificial systems for aiding humans, with robotic hands, haptic interfaces, and neuroprosthetic devices.

## BIO

Antonio Bicchi is Professor of Automatic Control and Robotics at the University of Pisa. He graduated at the University of Bologna in 1988 and was a postdoc scholar at M.I.T.A.I. Lab. in 1988-1990. His research interests are in Dynamics, kinematics and control of complex mechanical systems, including robots, autonomous vehicles, and automotive systems; Haptics and dextrous manipulation; Theory and control of nonlinear systems, in particular hybrid systems. He has published more than 300 papers on international journals, books, and refereed conferences. He currently serves as the Director of the Interdepartmental Research Center “E. Piaggio”, and President of the Italian Association of Researchers in Automatic Control. He has served as Editor in Chief of the Conference Editorial Board for the IEEE Robotics and Automation Society (RAS), and as Vice President of IEEE RAS, Distinguished Lecturer, and Editor for the book series Springer Briefs on Control, Automation and Robotics, and for several scientific journals, including the Int. J. Robotics Research, the IEEE Trans. On Robotics and Automation, and IEEE RAS Magazine. He has organized and co-chaired the first WorldHaptics Conference (2005), and Hybrid Systems: Computation and Control (2007). He is the recipient of several best paper awards, and of an Advanced Grant from the European Research Council. Antonio Bicchi is an IEEE Fellow since 2005.



When your smart phone becomes your guide dog

**I. Tinnirello, P. Gallo**

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## ABSTRACT

Recent data on market penetration show that smartphones are likely to be fastestspreading technology in the human history. This impressive spreading of all the technologies included in a smartphone (GPS, touch-screen, multimedia players, storage and obviously wireless access technologies including near-field communications) also correspond to the spreading of interacting smart devices in the environments in which smartphones are likely to concentrate. Apart from the cellular base stations which are becoming more and more capillary, examples of these devices are WiFi Access Points, RFID tags, smart TV, game stations, etc., which populate our apartments, offices, stations, malls, and so on. We argue that this technology spreading at both the user and environment sides can be an important opportunity for developing user-assisting applications exploiting what is already available in our hands and in our environments. Specifically, we propose an application for indoor navigation in which WiFi Access Points provide reference signals for localization (acting equivalently to GPS satellites) and touch-screens are used as simple tactile interfaces producing vibrating signals. We focus on the proof-of-concept of both the low-cost ranging and interface solutions, showing that current programmable APs allow to have a good tracking accuracy without any preliminary calibration, while vibrating signals generated as a function of a given screen location can help in reading simple display messages.

## BIO

Ilenia Tinnirello has been Assistant Professor at the University of Palermo since January 2005. She received the Laurea degree in Electric Engineering and the Ph.D. on Communications, respectively in April 2000 and February 2004. She has also been Visiting Researcher at the Seoul National University, Korea, in 2004, and at the Nanyang Technological University of Singapore in 2006. Her research activity has been mainly focused on wireless networks and in particular on: multiple access algorithms with quality of service provisioning; cross-layer interactions between access solutions and physical layer; mobility management and load balancing in wireless packet networks. She has been involved in several international and national research projects, among which the bilateral Italian-Korean research project INFINITY and the national research project PRIN MIMOSA, as scientific coordinator for the research unit of Palermo, and the European project FP7 FLAVIA, as technical coordinator.



Haptic Interfaces: access to digital computing for Visual Impaired

**C. Avizzano, M. Carrozzino, A. Frsoli, C. Evangelista**

S. Anna, Pisa [c.avizzano@sssup.it](mailto:c.avizzano@sssup.it)

## **ABSTRACT**

The talk will present two type of devices that enable visual impaired people to access and interact with digital resources. The GRAB (GRaphical Access for Blind users) device, is a dual point haptic device that support libraries for map exploration, data analysis and spreadsheet interaction; the DOC (Dispositivo Orientamento Ciechi) device is a wearable device that interacts with indoor and outdoor localization services to assist visual impaired navigating large and unknown areas such as open spaces and airports.

## **BIO**

Carlo Alberto Avizzano (Eng., PhD) is the Coordinator of PERCRO Laboratory. He is also external Professor with University of Pisa for the course of Mechatronics. Avizzano's research activities deal with intelligent robot controllers including autonomous robot as well as human interfaces. Relevant application fields include: reactive robots, portable haptic controllers, mobile robotics, simulators, multimodal systems, telelearning, design of virtual behaviours. During his research activities, he has collaborated/coordinated several EU and National projects. Avizzano has been author of more than 130 papers published on International Journals and peer reviewed International conferences. Avizzano holds 3 different patents and 2 software copyrights on haptic interfaces and control software. He is associated editor of several international boards and journals, such as: IROS, ICRA, IJRR, ISPR, Presence, ToH. Avizzano is member of the steering boards of international Societies on Robotics and Virtual Environments such as: EIES and MIMOS.



Two Research Projects on Computer Vision for the Visually Impaired

**C. Colombo, C. Guida**

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## ABSTRACT

Computer vision is an emerging technology quite popular as a tool for improving the autonomy of blind and low-sighted people both in outdoor and indoor scenarios. Cameras are used as additional eyes, whose images are automatically analyzed by the software so as to support the visually impaired in their everyday tasks. Most of the current research is focused on the development of computational methodologies for scene analysis/enhancement that can be implemented in real time on mobile devices such as smartphones and tablets. The talk will describe two projects currently under study at the Computational Vision Group of the University of Florence. The group also includes a visually impaired person with strong interests in computer vision research. The first project, called "BusAlert", now at the last stages of development, addresses the design of an innovative method for localizing and recognizing automatically with a smartphone the line number of an incoming bus. This application is potentially useful for all the visually impaired people living in urban contexts, such as Florence, where the bus line number is still provided only in a visual way to the people at the bus stop. The second project, called "Visitor", is currently at an early stage of development. The project addresses the design of an hardware/software infrastructure based on computer vision and wireless devices, that can support visually impaired people to move in an autonomous way (e.g., without the need of an accompanying person) in unknown environments such as supermarkets and other public spaces. The main idea is to exploit the basic computing facilities of modern mobile devices so as to localize continuously the users with respect to pre-computed 3D maps of the environment, and help them with selforientation, obstacle avoidance and path planning.

## BIO

Carlo Colombo is Associate Professor of Computer Vision at the University of Florence. He is the founder and coordinator of the Computational Vision Group (CVG) (<http://cvg.dsi.unifi.it>). His current research focuses on image and video analysis and its applications in robotics, biomedicine and aids for disabled people, 3D television and computer graphics, cultural heritage preservation, advanced human machine interaction, multimedia. On these topics he has published over 100 papers on refereed international journals, book chapters, and conference proceedings. He is the general co-chair of the 12th European Conference on Computer Vision ECCV 2012. He also serves in the Program Committee of several international computer vision conferences, and as Area Editor of the Elsevier journals Robotics and Autonomous Systems and Computer Vision and Image Understanding.



Social networks: opportunities and challenges for blind people  
 M.C. Buzzi, M. Buzzi, B. Leporini

**CNR-Pisa**

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## ABSTRACT

Social interaction is important for everyone, including the differently-abled. Social network applications are reshaping ways of communicating, interacting, studying, working, sharing information, and keeping in touch. Social networks as well as Web 2.0 applications have been changing people's relationships and communication. Unfortunately, these applications are usually visually oriented, designed for people who can see, and generally use graphical elements to convey information. Furthermore, the User Interfaces (UIs) are increasingly rich in information, functions and data which are updated frequently. These dynamic and complex UIs can lead to difficulties and issues in terms of accessibility and usability for people who must interact via assistive technologies. In this talk we discuss how blind persons, using screen readers and voice synthesizers, are able to interact with social networks (such as Facebook) and micro-blogging platforms (such as Twitter). In particular, we discuss some electronic barriers we should be aware of and suggest solutions for designers, in order to remove them and facilitate the use of social networks.

## BIO

Barbara Leporini graduated from high school in programming with full marks in 1992, and in 1997 she got her Master Degree in Computer Science with full marks and honours. In 2003 she obtained her PhD with a dissertation on the following subject: "Criteria to improve web site usability and accessibility when interacting through screen readers: definition, application, and evaluation". Barbara has done her research at the CNR of Pisa in the laboratory of "Human Interfaces in Information Systems" of the Institute for Information Science and Technology (ISTI). Currently she is a researcher of the same Institute. In general, her research activity concerns the problems that disabled people, and particularly blind people, encounter when they try to access information. Her investigation, aims at promoting a better and stronger integration of disabled people in the society. Through the years, this issue has become more and more important both for research (e.g., see the European research project proposals) and applications). Barbara works on usability and accessibility, for disabled people, of Web interfaces, search engines, mobile engines, and identification systems for the electronic signature. Beyond research, Barbara has been teaching classes of computer sciences. She has also provided technical support for the accessibility and usability at various levels. In particular, she participated to boards and groups working on different problems concerning visual impaired people.



Seeing with ears, hands and the bionic eyes: from theories of brain organization to visual rehabilitation.

## **A. Amedi**

Hebrew Univ. of Jerusalem

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### **ABSTRACT**

The exciting view of our brain as meta-modal or as a highly flexible task-based and not sensory-based raises the chances for visual rehabilitation, long considered unachievable, given adequate training in teaching the brain how to see. Recent advances in rehabilitation approaches, both noninvasive, like sensory substitution devices (SSDs) which present visual information using sound or touch, and invasive, like visual prosthesis, may potentially be used to achieve this goal, each alone, and most preferably together. Visual impairments and said solutions are being used as a model for answering fundamental questions ranging from basic cognitive neuroscience, showing that several key visual brain areas are actually highly flexible, modality-independent and, as was recently shown, even visual experience-independent task machines, to technological and behavioral developments, allowing blind persons to 'see' using SSDs and other approaches. I will present evidence that SSDs can be potentially used as a research tool for assessing the brain's functional organization; as an aid for the blind in daily visual tasks; to visually train the brain prior to invasive procedures, by taking advantage of the 'visual' cortex's flexibility and task specialization even in the absence of vision; and to augment post-

### **BIO**

Amir Amedi, Israel: Assistant Professor, Medical Neurobiology, Institute for Medical Research Israel-Canada; Member, The Edmond and Lily Safra Center for Brain Sciences, The Hebrew University of Jerusalem (since 2007). Recipient: Wolf Foundation Krill Prize for Excellence in Scientific Research, James S. McDonnell Foundation Scholar Award in Understanding Human Cognition. Education: PhD in computational Neuroscience, Hebrew University of Jerusalem (2005). Post doc and Instructor of Neurology, Harvard Medical School (2007). He is Head, Multi-sensory Integration and Brain Plasticity Research Group; Artificial Vision and Sensory Substitution Research Group.

Lab website: <http://brain.huji.ac.il/>

## **EXHIBITIONS:**

**Università di Pisa**

**Istituto Italiano di Tecnologia** di Genova

**Scuola Superiore Sant' Anna** di Pisa

**Università di Siena**

**Istituto Cavazza** di Bologna

**Gruppo Sinapsi** - Università di Napoli

**Associazione Lettura Agevolata Venezia**

**Centro per l'Autonomia Ausilioteca Campana**

**Associazione Culturale Archibaille Verona**

## PANEL DISCUSSION

**Chair: M. Dahleh MIT (US)**



**Panelists:**

L. Emiliani, S. Teller, M. Carrozza, A. Tesi, P. Nesi, A. Bicchi

## Success stories:

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THANKS to:



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