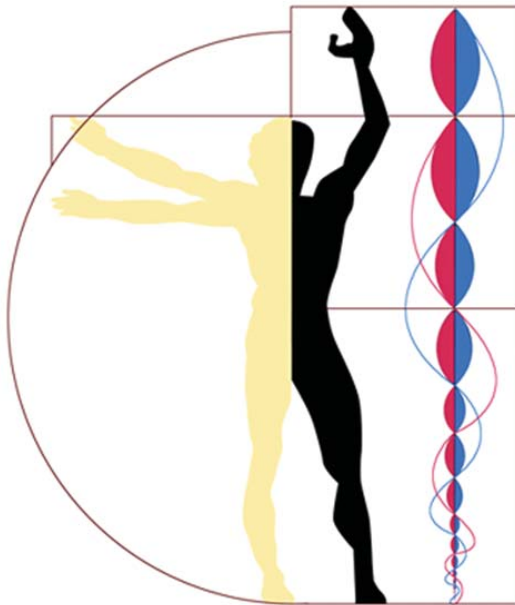


Fabbrica della Conoscenza

XIII Forum Internazionale di Studi

Le Vie dei  
Mercanti

Carmine Gambardella



# HERITAGE and TECHNOLOGY

Mind Knowledge Experience



**Fabbrica della Conoscenza numero 56**  
Collana fondata e diretta da Carmine Gambardella

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Mind Knowledge Experience**

Le Vie dei Mercanti \_ XIII Forum Internazionale di Studi

Carmine Gambardella

## **HERITAGE and TECHNOLOGY**

### **Mind Knowledge Experience**

Le Vie dei Mercanti

XIII Forum Internazionale di Studi

Editing: Manuela Piscitelli

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### **Progetto CAMPUS Pompei**

Il Progetto "Ecoturismo urbano per la fruizione sostenibile dei Beni Culturali in Campania", in attuazione degli Obiettivi Operativi 2.1 e 2.2 del Programma Operativo FESR Campania 2007/2013 per la realizzazione e/o il potenziamento, nel territorio della regione, di forti concentrazioni di competenze scientifico tecnologiche, di alto potenziale innovativo, intende favorire la concentrazione di competenze scientifico-tecnologiche finalizzata a rafforzare la competitività dei sistemi locali e delle filiere produttive regionali non solo nei settori dei servizi associati al turismo e beni culturali ma anche in settori ad altissima tecnologia che possano rappresentare una svolta tecnologica e culturale all'approccio innovativo per lo Sviluppo sostenibile in aree ad altissima vocazione turistica.

*Conference topics:*

**Heritage**  
**Tangible and intangible dimensions**  
**History**  
**Culture**  
**Collective Identity**  
**Memory**  
**Documentation**  
**Management**  
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**Landscape Projects**  
**Environmental Monitoring**  
**Government of the Territory**  
**Sustainable Development**





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**Peer review**

Scholars has been invited to submit researches on theoretical and methodological aspects related to Heritage and Technology, and show real applications and experiences carried out on this themes.

Based on blind peer review, abstracts has been accepted, conditionally accepted, or rejected.

Authors of accepted and conditionally accepted papers has been invited to submit full papers. These has been again peer-reviewed and selected for the oral session and publication, or only for the publication in the conference proceedings.

**Conference report**

357 abstracts received from:

Albania, Argentina, Australia, Benin, Brazil, Bulgaria, Canada, Croatia, Egypt, France, Greece, Iraq, Israel, Italy, Japan, Latvia, Malta, Mexico, Norway, Poland, Portugal, P.R. China, Russia, Slovakia, Spain, Turkey, United Kingdom, USA.

More than 500 authors involved.

291 papers published.

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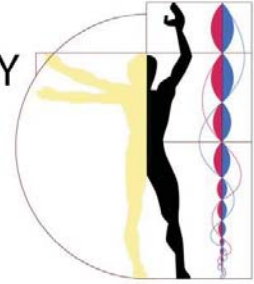
## **Preface**

The theme of the thirteenth Forum “Le Vie dei Mercanti” aims to investigate the complex relationship that develops between technological innovation, knowledge, enjoyment and protection of cultural heritage and the landscape. This leads to the need for an international multidisciplinary comparison in order to explore the questions and issues that are being debated not only in academia, but also among those who govern, manage and control Public Administrations, Institutions and businesses.

The subtitle specifies the macro areas: Mind, intended as both speculative thought as well as the preparation of a methodological process; the subject who investigates, establishes an inescapable destiny with the object analyzed at different scales of analysis, from the architectural structure and design, to the infrastructure and the landscape; Knowledge, as the historicizing of the state of the art reached by the disciplinary skills, integrated with those of material culture, humus generative of innovation for the formation of a human capital that continues to grow; Experience, the representation and sharing of results obtained with good practices, exemplary and paradigmatic, as patrimonial value for humanity to achieve a better quality of life and places created working with Art.

The conference is open to multidisciplinary experiences on one or more of the proposed themes. Scholars are invited to present research on either the theoretical and methodological aspects or concrete applications carried out on these issues.

*Carminé Gambardella*



## Wayfinding Accessible Design

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### Abstract

This text is the result of an ongoing research that shows how accessibility take an important role into a wayfinding and landscape design project related to an historic route named 'Via Regina' which is connected with the famous Via Francigena and Via Spluga, all along the frontier between Italy and Switzerland. It puts particular emphasis on accessibility and orientation in the paths and places used by everyone but also and especially by people with different abilities, allowing them to have access and to appreciate the beauties of this historical walk. The project consider the "Design for All principles" as guidelines to develop a wayfinding system as inclusive as possible, with last generation technology supports like the Finger Reader, Ownfone system, dyslexic fonts, Circuit Scribe system, QRCode+Arianna Phone App and other existing tactile and sound devices (sound shower, magnetic field, tactile surfaces and floor, Braille system, 3D sculptures) and panels with the correct readability (distance, fonts size, colors) and perception for the user. Also we want to underline and re-evaluate the concept of "Slow Walk" and the tendency to prefer the slow fruition of the landscape in opposition to the stress-like style of life we conduct every day. We include in this process the valorization of the typical materials, folks and traditions, history of pilgrimage, smuggling, commerce exchanges, architectures and places of worship that are reflected into the project supports.

**Keywords:** Design For All, Wayfinding Design, Landscape Design, Accessible Devices, Arts and History

### 1. Wayfinding Design and Accessibility

The aim of the research project is to reinforce the shared identity of Northern Lombardy (Italy) and Southern Ticino (Switzerland) by preserving and enhancing the shared cultural heritage present in the historical network of footpaths that connect the regions concerned. The research is part of a wider cross-border program, the aim of which is to implement measures to protect, enhance and promote the landscape and the historical and cultural heritage of the area.

In addition to the Politecnico di Milano in the role of leader, the partners in the program are: the Fondazione Politecnico di Milano, Iubilantes Association, Mountain Community Lario Intelvese, University of Applied Sciences of Italian Switzerland, Cultural Heritage Office of Cantone Ticino, Mountain Community Lake Como and Lugano valleys, Museum of Via Spluga, Town of Cernobbio, University of Pavia.

The "Via Regina Lariana", from Como to Sorico, is one of the oldest routes of historic and cultural exchange between Italy and Switzerland. The beautiful Swiss-Italian footpath along the Via Francisca and Via Spluga, with which it forms a continuum, is a fundamental "system" of transalpine soft mobility, the potential of which for European development has so far not been adequately grasped. It possesses all the characteristics required to be identified as part of a Major European Cultural Route: a trail and a territory, therefore, to know and to protect, and to maintain intact for those who travel on foot.

The specific objective of this project, called "I CAMMINI DELLA REGINA", ID 33829732, Misura 3.1, P.O. Cooperazione Transfrontaliera – INTERREG IT-CH 2007-2013", born from the synergy between cultural experts, local museums, government departments, landscape designers, architects, designers and

geomatics engineers, is to create an adequate tool for the full development of this important route and the surrounding area.

In summary, the project has the following specific objectives:

To compare methodologies and experiences in the safeguarding of assets, heritage and cultural landscape, in particular axis of pedestrian crossing, artifacts found along these pathways and building requalification, restoration and maintenance of the sections of footpaths, bridleways, curbs and construction building present on the ancient roads (toll booths, fountains, springs, river bed of the streams, fords, houses, customs, hospitality and reception sites in general) and religious buildings (churches, newsstands, canonical pathways votive , chapels) exploitable as such or, in the case of canonical, reusable as functional structures to the path and / or reception related.

To support collaboration, exchange and mobility between operators and cultural institutions, strengthening ties and exchanges of experience, research and identification of best practices carried out in the specific field by the various partners;

To promote recovery and enhancement of the peculiarities in the local cultures and the use of innovative tools for communication and promotion of cultural heritage and historical memory of the cross-border.

The research group of the Politecnico di Milano, Department of Design, coordinated by Roberto de Paolis and composed by Massimiliano Mandarini, Silvia Guerini, Maria Rita Ferrara, Umberto Tolino, Francesco Zurlo, Marina Parente, Arianna Vignati, has dealt, among other, to develop together with the Laboratory of Visual Culture of the Department of Environment, construction and design of SUPSI - University of Applied Sciences of Italian Switzerland, coordinated by Andrea De Lucchi, the project of integrated visual communication (brand identity) identifying the identity values expressed by signs of visual and material culture in the area through the design of products, services and communication artifacts (signage, visual identity manual, information points, the drafting of guidelines, promotional gifts and gadgets, computer interfaces, printed and digital publications), to be implemented in four languages (Italian, French, German and English), taking into account the regulations and recommendations on the design of traffic signals for slow and soft mobility.

In the analysis of case studies related to signage was made a choice amongst targeted selection, for both national and international level, where cases were collected with examples of innovative and integrated products and services capable of giving identity, narrative paths and specific orientation to the itinerary.

This identified systems of product and service recurring scenario analysis led to the identification of a list of solutions for a typological signage system in the "I Cammini della Regina" described below.

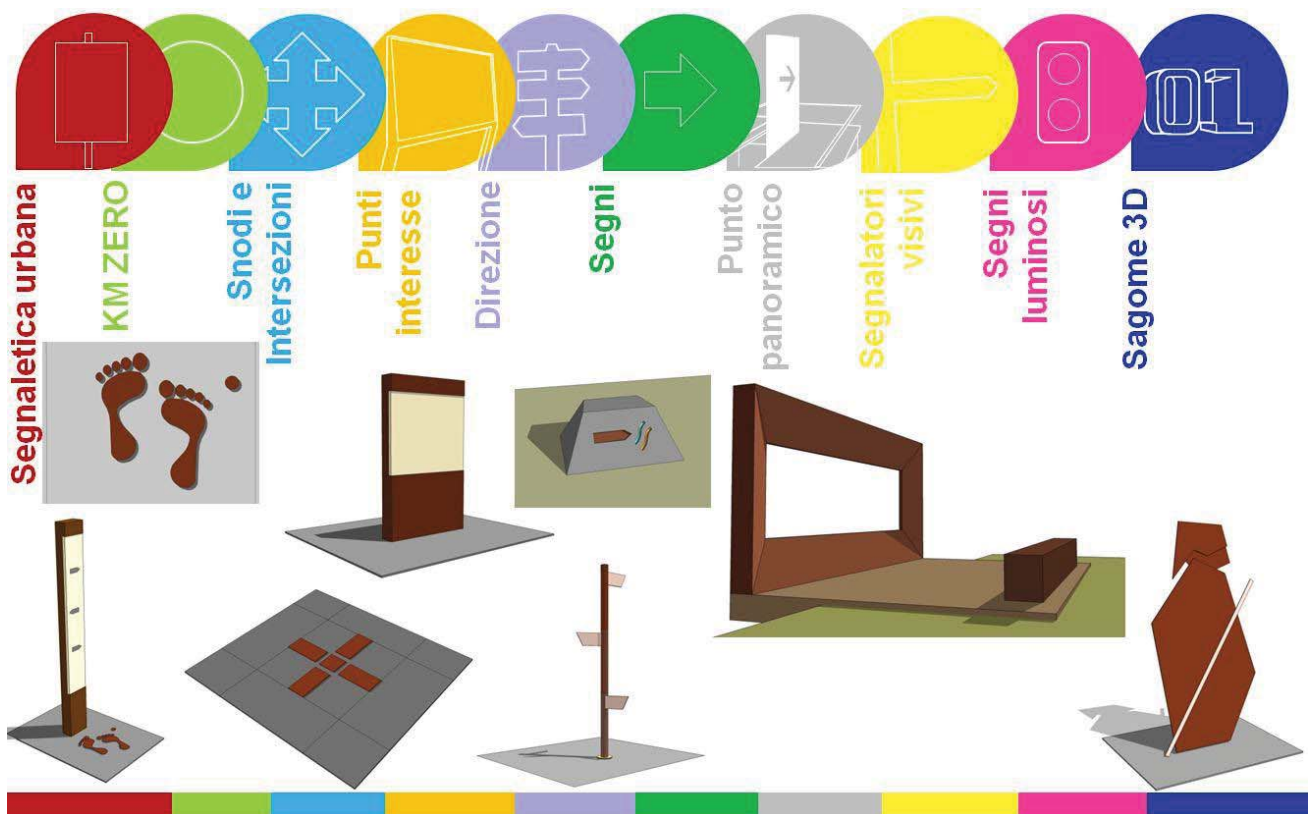


Fig. 1: Abacus for the typological classification of the elements of signage and visual communication.

- Km ZERO: a general philosophy with which to make the products, through the use of products and elements of the territory and from short distribution;
- Recognizability of the signage for urban elements and illustration of the points of interest of the territory;
- Joints and intersections: identification of innovative design to connote the places of intersection and flows;
- Points of interest: elements for the points of interest promotion in physical, digital, traditional and innovative form;
- Directions: design identity for the territory to be used for directional indication systems placed all along the routes;
- Signs: use of signs systems and traces of horizontal and vertical surfaces, replacing the traditional signage to identify a context, a direction, a point of interest or a route and to communicate specific features of the territory, and with simplified and easily actionable modalities, time and travel/run distances;
- Viewpoints: one of the main purposes of the project is to create the terraces, balconies or structures jutting on specific areas that allow users to contemplate the panorama and the environmental landscape in a safe way.
- Visual Indicators: visualization of the inside or outside of a building, an area of interest or even a single item.
- Bright Signs: systems that accompany the visual displays but also the traditional signage and points of interest in order to create a new bright design, even through portable objects dedicated to a specific purpose, representing the character of territorial recognition even in the twilight hours and allow the night fruition of the itinerary.
- 3D Silhouettes: 3D templates communication will replace traditional bulletin boards and will be placed in the main sites, buildings or routes, which may represent the work, crafts or the characters that define the identity of the land and the wealth of material culture.



Fig. 2: Supports abacus. Study for banner design.



In this context, a particular attention has given to signage for all and accessibility and the use of the trail by an enlarged and differently abled target.

## 2. Design for All Principles

The project consider the “Design for All principles” as guidelines to develop a wayfinding system as inclusive as possible. Design For All is an association, a group of members, architects, engineers, lawyers, operators all around the world that share the unique purpose to develop the principles for a better way to use things considering everyone as a user despite of their problems or limits.

### 2.1 Guidelines for an inclusive wayfinding system

Here below you can find the Design for All guidelines written by the founders in 1992 (copyrighted), explaining in simple words what is and for who is conceived the Design for All.

“Equitable Use: The design does not disadvantage or stigmatize any group of users. Flexibility in Use: The design accommodates a wide range of individual preferences and abilities. Simple, Intuitive Use: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level. Perceptible Information: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities. Tolerance for Error: The design minimizes hazards and the adverse consequences of accidental or unintended actions. Low Physical Effort: The design can be used efficiently and comfortably, and with a minimum of fatigue. Size and Space for Approach & Use: Appropriate size and space is provided for approach, reach, manipulation, and use, regardless of the user's body size, posture, or mobility.” Also, a new system of classification (ICF 2001) give a new definition of disability and includes not only the disabilities diagnostically determined but also other kinds of health conditions without distinction between physical and mental. “The new ICF focuses on analyzing the relationship between capacity and performance.

If capacity is greater than performance then that gap should be addressed through both removing barriers and identifying facilitators. The new WHO ICF specifically references Universal Design as a central concept that can serve to identify facilitators that can benefit all people” (humancentereddesign.org)

This clarify in which direction we would move in our project, the wayfinding system should consider everyone who want walk along this historical and attractive path between Italy and Switzerland, and for ‘everyone’ we mean people who can't walk, see or hear or speak, or with mental disease but also people who have other kind of problem - celiacs, heart sufferings, diabetes, short stature, elderly people, families with toddlers and even strangers who don't understand the local language - not considering the diagnosis in itself but the gap between capacity and performance in doing things and identifying facilitators.

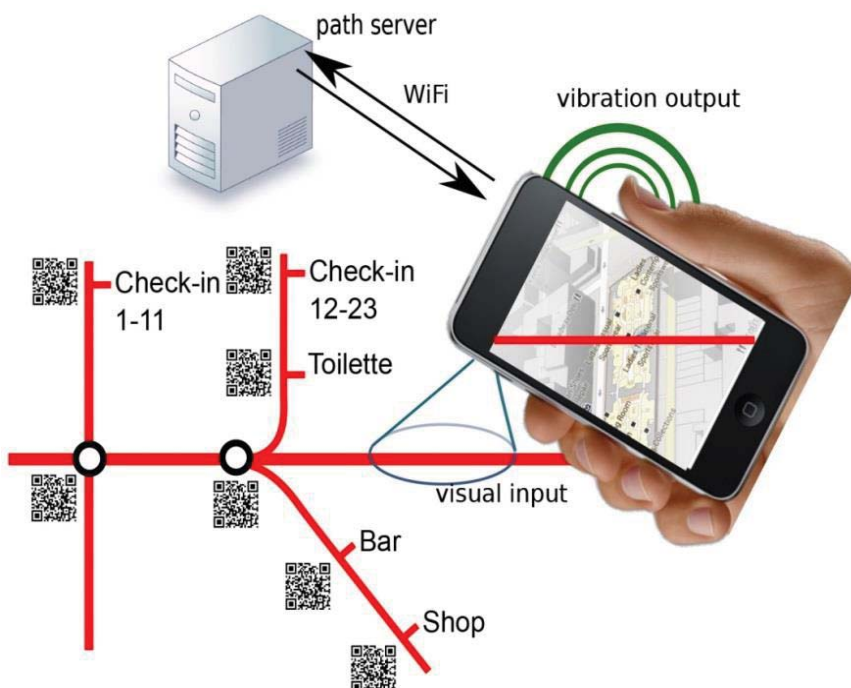


Fig. 3: Arianna App example of functioning. [www.webnews.it/2014/01/09/arianna-il-bastone-virtuale-per-i-non-vedenti/](http://www.webnews.it/2014/01/09/arianna-il-bastone-virtuale-per-i-non-vedenti/)

## 2.2 Main rules in wayfinding project “for all”

Speaking about facilitators, we usually use this term to indicate all the visual, tactile, textural and sensory elements, that represent a support for the user who can't get over an obstacle, someone who wish and want to take benefit of the territory services, but that for different reasons can't reach them in a standard way.

In the case of wayfinding design, it can be a panel set too high, a text written too small, a path which is not feasible, a sound which is not audible in a complex society like ours.

Another aspect to consider is the emergency situation; it is important that the information about how to do and who to contact in case of an accident are very clear and understandable.

Hence the need to take inspiration from good design so that it can carry useful examples of 'human-centered' wayfinding systems in which objects and supports are accessible to everyone, without distinction, to overturn the obstacle into a free-path and the disadvantage into opportunity. “[...] on the one hand we have to think to the supports that help the person overcome the obstacles to a normal communication, on the other hand we must try to reduce the obstacle itself” (P. Cecchini).

In practice, here are some ergonomic aspects to be taken into consideration.

**The roads width should not be less than 1.40 m**; to the readability of the panels it is recommended a **font size that is at least 3% of the reading distance**; it is preferable to use **letters and pictograms of 30 mm and 50 mm size** respectively, for a distance of 1 meter, while 150 and 250 mm for a distance of 5 meters.

The font is preferable in sans **serif version, in one or maximum two styles** (Futura, Century Gothic, Arial, Frutiger, Gill Sans, Helvetica, Univers, ..), at least 18 points with 1.5 line spacing.

**The height of the panels should be 1.50 mt** for the readability even from below.

For orientation signs, **the height of the fonts must not be less than 4.5 mm and 15 mm**.

It's a good practice to provide information panels all along the way, especially in the decision points that indicate **where you are and what you are getting**.

Also, for eye-impaired and blind people, it should be added a reminder signage, in relief on the ground, to pay attention and to announce the near panel.

In the case of visually-impaired people it should be used at least **70% contrasts among different colors** and shapes that is suitable for an optimal understanding of the message.

The same principle should be adopted for the sounds, into the range of **mid-low frequencies** without cadence and with a good pronounce.

**Vertical pillars** all along the way and tactile elements on the ground, help blind people to redirect their walk, at the same way as panels in Braille placed all along the route and in front of the main points of interest.

<http://www.architonic.com/pmpro/marcas-signalétique/3103170/2/2/1>. They can be used also as a limit support all around exposed objects to allow blind people to realize their real size and shape.

A useful support are **small-scale sculptures** that represent particular things that we find on the path: a building, an architectural element, a typical material that the blind user can touch to realize the characteristics (we called it 'haptic approach'). This support can be associated to Tooteko App (see next paragraph).

The tables in Braille or the **multi-sensory plans** (which schematically represent the structure of a path in relief, with big characters and Braille) should have a **space below of about 70 cm** to allow the approach of a wheelchair, and a **height of 80 -130 cm** for the readability.

The **Wire Ariadne** is and remains one of the most adopted systems, it consist in an horizontal embossed line with which the blind is fitted with stick helping him to follow the direction of the street; it is mainly used for indoor spaces but it is increasingly applied in the outside too (the platforms of the train stations or airports).

Finally, for an approach that is as natural as possible even for those who can't easily make the walk due to motor problems, the roads should be maintained in a standard width of 140 cm, some steps can be equipped with special elevated pedestrian facilities that allow the passage without drastically change the natural habitat.

Panoramic points are another important element in a walk, they allow us to see the beauty of a whole natural landscape; for those who want to enjoy the scenery but have difficulties to reach it, it is useful to implement the structure with specific devices, and if possible it should be equipped with all the tools described above (tactile boards, subtitled audio-visual interfaces, ..).

For the displacements it is required an unobstructed area of 150 cm in diameter and an area of vision between 60 and 100 cm.

## 3. Technological devices for an accessible fruition accessibility

### 3.1. Arianna App and associated QRcode

A recent application (2014) allows you to read your position and direction through a special scotch tape fixed on the floor and provide an auditory guidance (when the line on the floor is under your finger, your

smartphone intercepts it via webcam and emits a vibration). This system can be associated to QRcodes all along the way, when you are in front of a sculpture, a typical object, a panoramic view, etc. and make you a detailed audio description. The QR-Code and the dedicated app allow you to access information (mainly sound but also video with subtitles) that enrich your knowledge about the path you're walking on, it is friendly-user with an easy approach for an individual use, to allow a more complete experience of walking .

<http://www.webnews.it/2014/01/09/arianna-il-bastone-virtuale-per-i-non-vedenti/>

For the hearing-impaired and deaf people is important to point out, when available, the presence of **magnetic field** to listen **using telecoil hearing aid**. Usually the presence of magnetic field is signalled by a specific icon (an ear strikeout and T). This allows hearing-aid wearers to exclude background sounds and focus the listening to the speaker; subtitles are welcome especially when the speaker is over.

It's useful to provide the route with multimedia information points, all along the route.

Another useful device is the 'sound shower', which delivers sound from a specific point where the user is located in, under it, so that he can receive information without disturbing people around.

<http://www.euphonia.fr/douche-sonore.html>

### 3.2. OwnFone

This phone has been created using 3D printer and customized for everyone even in Braille; if the blind user doesn't know Braille code, he can have a raised text on the keypad. This system allow special users to have a Braille interface and buttons to contact particular people in case of need creating a constant connection between the blind users and their friends or family. An Haptic touchscreen help to recognize the contacts he fixed on, with a credit-card size and customizable screen with two or four programmable buttons pre-programmed to call friends or family members or emergency service. Alternatively Apple's VoiceOver is another app that read the screen allowing users to navigate their phone using gesture-based controls.

### 3.3. Dyslexie Font

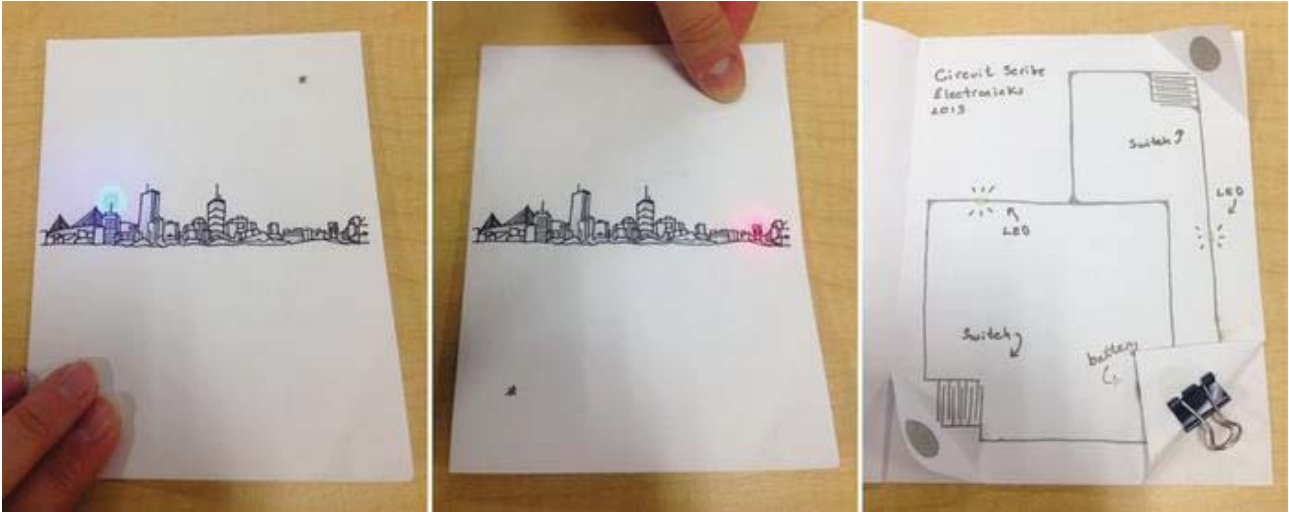
In 2008 the dyslexic designer Christian Boer, has invented a font that facilitate people suffering dyslexia to read and produce text using a particular font which is especially conceived to reduce dyslexic troubles like leisure confusion and bad legibility. This font is a classic "Sans Serif" but with some modifications on the bottom/top/side of the letters, in orientation and dimension. Every letter distinguish from all the others by their shape so that everyone of them is unique. The designer create a website to present and diffuse this font.



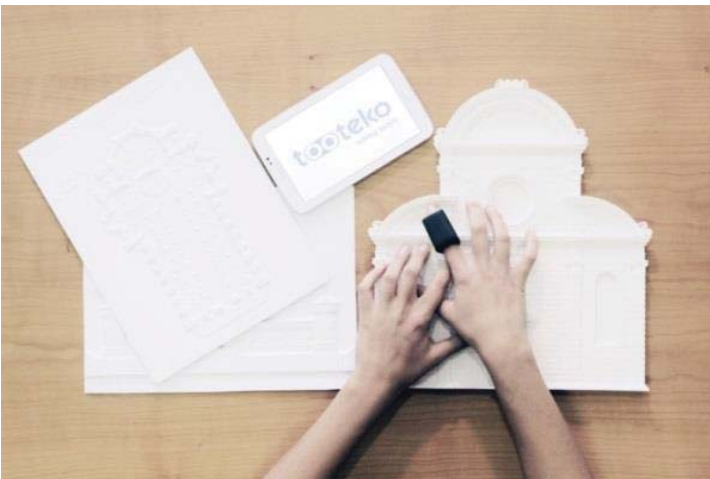
Fig. 4: OwnFone prototypes. Now in production, you personalize the haptic display with the contacts you want



Fig. 5: An example of Dyslexie Font (blue) in comparison with a classic Sans Serif font (red). [www.dyslexiefont.com](http://www.dyslexiefont.com)



**Fig. 6:** An example of the Circuit Scribe process [www.kickstarter.com/projects/electroninks/circuit-scribe-draw-circuits-instantly](http://www.kickstarter.com/projects/electroninks/circuit-scribe-draw-circuits-instantly)



**Fig. 7:** The Tooteko components: the 3D model with hotspots on, the ring that read hotspots, the app on the tablet with wi-fi connection

### 3.4. Circuit Scribe

Circuit Scribe is an application to make light with a liquid conductor circuit and a little battery and it activate with a simple gesture. You can draw smooth lines with conductive silver ink to create functioning circuits instantly with a coin battery, a paper clip and LED and associate them with other components. You can apply it on a lot of supports so it become an instrument that help in the creation of other objects. Besides you can draw what you want in the form and shape you have in mind. It is possible to use it with Arduino another open source application that allow people to create a lot of electronic stuffs. It can be used into a map where each stop light up when you reach it, like in the Via Regina's route.

### 3.5. Finger Reader

Finger Reader is a device that enable blind users to read books or other written supports, line by line in a sequential manner scanning the text the finger is following, providing real time speech and tactile feedback. The ring on the finger has a camera that focus words at a fixed distance using the sense of touch when scanning the surface; also the device does not have many buttons to facilitate the use by an eye impaired user. Two vibration motors are fixed on the top and bottom of the ring to provide haptic feedback and indicate to the user how to move the finger. Here is the hardware process "[...] we look for text lines by fitting lines to triplets of pruned contours; we then prune for lines with feasible slopes. We look for supporting contours to the candidate lines based on distance from the line and then eliminate duplicates using a 2D histogram of slope and intercept. Lastly, we refine line equations based on their supporting contours. We extract words from characters along the selected text line and send them to the OCR engine. Words with high confidence are retained and tracked as the user scans the line. We record the motion of the user to

predict where the word patches might appear next in order to use a smaller search region.” (<http://fluid.media.mit.edu/sites/default/files/paper317.pdf>)

### 3.6. Tooteko

Tooteko is a system that allow blind and partially sighted users to learn informations about art and monuments in scale (tactile models), by touching them.

Many museums are equipped with scale models that represents big architectures or monuments and art works. Tooteko enables the blind users that touch models to receive real-time auditory informations about what they are touching with their fingers.

The auditory data is activated by the contact of the hand on different parts of the model and in case of multiples touches in sequence, this sequence is respected in the audio too. This is innovating in comparison to classic audio-guide which gives informations but doesn't follow the tactile perception.

Tooteko is composed of: an hi-tech ring; a tactile surface tagged with NFC sensors; an app for smartphone and tablet.

How does it work? The ring read the NFC (Near Field Communication) tags positioned on the model (with hotspots) and via the app send them to the smartphone or tablet that activate the audio track referred to each NFC touched tag. Everything happen in wireless mode. The hotspot-NCS tags are recognizable via braille keys on the surface.

This system can be applied on any 3D surface (statues, architecture models, sculptures, 3D plans, etc).

## 4. Conclusions

We have seen how it is important to include accessibility in a project and especially in a wayfinding project, where you must orientate people all along a great path into nature. Everyone has the right to access to the beauties and panoramas that this route can offers. It is essential to develop supports and visual symbols that everyone can understand without distinction and give information in the most efficiently way considering different parameters like speech, volume, length, distance, space around the user, color contrasts, support dimensions and materials, relief elements.

Some last generation technological devices can be adapted to the project, here are some examples:

- blind people could “see” a church on the Via Regina route touching the scale tactile model positioned in the interior and hearing the description of each part they are touching in sequence using tooteko;
- the stops in the Via Regina Plan could become luminous when you visit them in order to evidence how many stops remain to visit. This would be possible using Circuit Scribe; the same system can be adopted in a Via Regina Map and card leading to a personalization, a souvenir and a record about our own tour;
- the content of the panels all along the route can be written using dyslexic font, this would be readable by everyone but especially by whom are suffering from dyslexia at differents stages and have difficulties to distinguish letters;
- Arianna App is an useful application that can be adopted for blind people when they are in limited spaces all along the Via Regina route like panoramic points or crosspoints, so users can choose where they want to go and what they want to see in the area near around: watch the panorama, go to the toilet, go to read the information panel or go to visit the church just near to them.



**Fig. 8:** Supports abacus. Study for Via Regina wayfinding system. Other samples from the guidelines for the different types of panels.

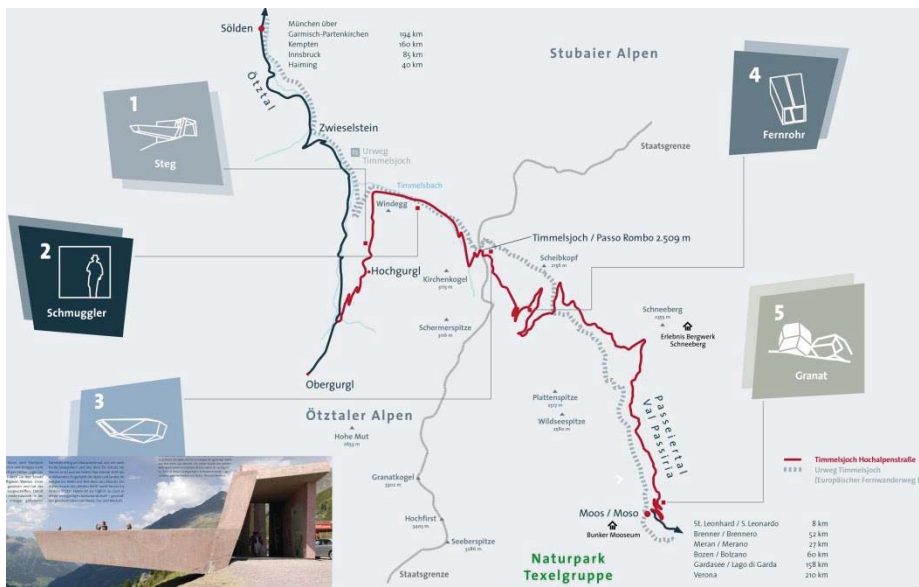


Fig. 2 Esempio schematico di un punto d'informazione TL (punto info)

Fig. 9-16: Some of the case studies we considered during the research phase of the project.

9-10. F1rst Design Studio (DE) – Touristisches Leitsystem Stadt Solothurn – [www.basig.net/portfolio](http://www.basig.net/portfolio) - 3D horizontal signage that exploits the structure of the street and its surface

11. PearsonLloyd (UK) – City of Bath Wayfinding System – [www.pearsonlloyd.com](http://www.pearsonlloyd.com) – an example of use of material in harmony with a strong presence of historic and architectural elements typical of the city of Bath in Great Britain

12. BuroNorth (AU) – Fall Creek Alpine Resort – [www.buronorth.com/projects](http://www.buronorth.com/projects) – an example of integration of a peculiar signage structure into the natural environment. As in the Via Regina route, the nature presence is very strong.

13. NTK Studio (DE) – Notenspur Leipzig – [www.n-t-k.de/orientierungssysteme](http://www.n-t-k.de/orientierungssysteme) - this system exploits the horizontal orientation signage integrated with vertical totems and multifunctional stand

14. Adler & Schmidt Studio Leitsystem Rheinhalb Pfalz - [www.adler-schmidt.de/de/komdesign/orientierung/rheinland-pfalz.html](http://www.adler-schmidt.de/de/komdesign/orientierung/rheinland-pfalz.html) - It show how powerful is a 3D sample of a place, for touch and sight

15. Timmelsjoch - [www.timmelsjoch.com](http://www.timmelsjoch.com) – a project with strong similarity with the Via Regina one in particular for the panoramic point structure

16. Swiss standard pedestrian signage system. Example of an information panel along a Swiss route. The Swiss pedestrian signage is standardized for all the country regions in format, color and typography rules.

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