

# From Maps to Information Systems Along the Routes of the Drawing Navigating in the Archipelago of the Experiences of a Research Group (1974-2019)

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## Abstract

*As we perceive it today, the territory is not always the organic result of natural and anthropic processes of change and transformation linked to the development of environmental, cultural, social, economic and political contexts. The contribution illustrates this assumption by critically reviewing the research experiences conducted in the field of Representation aimed at supporting better and more effective government actions and protection of material and immaterial systems concerned. The results of surveys that have been the methodological foundation and essential cultural heritage for a series of research groups formed since 1974 in the then Institute of Technical Architecture of the Politecnico di Torino are recalled: occasions that required working on representations of different levels of detail, organized in an increasingly integrated system of information, where the vastness of the fields of investigation and approaches has anchored itself to the tradition of the cleverest Italian culture, finding, over time, that unprecedented support offered by information technologies that has allowed us to reach new scientific milestones.*

*Keywords: Information systems, resilience, education and research.*

## Introduction

The territory presents itself to the observer as a dynamic result of actions and transformations produced over time and still alive and it does so not only through its purely visual aspects; their interpretation is allowed by tests, tools and knowledge offered by various sciences and application disciplines. It is necessary to study the analytical tools that, also through the use of the most abstractly objective structures of drawing, can help to clarify the complex process of reading, both by looking at the most innovative thematic expressions, sometimes of exclusive use by professionals, and by considering other elements of figuration and art.

Both with regard to the definition of their typology and with regard to the vastness of the approaches that com-

pete with the experiences conducted, the drafting of the contribution is articulated by comparing two levels of reflection separated by an osmotic membrane that relates the aspects more properly critical and methodological with a more figurative overview, expressed through diagrams and drawings, which is aimed at exposing the application areas and their outcomes.

The representation of a territorial system (including in this environment, landscape and territory) derives from an orderly set of appropriately processed data [Baculo 1992; Centofanti, Brusaporci 2016]. The government of complexity has in this order the founding element, the classification of cognitive elements within homogeneous categories allows to schematize without simplifying, giving

rise to stratified models; each layer corresponds to unique codes of representation that must harmonize with those associated with the other layers, ensuring the permanence of the quality level of information that allows to recompose the cognitive synthesis pursued.

This passage of state, from the data to the information, must be supported by transparent and verifiable procedures at every moment of the processing. The drawing on the paper is based on the final selection of the data according to a given path of study and analysis; the paper is a support for the content, but it does not contain all the data that distilled it, formed in the process of de-icing from the cloud of data to the drawn tract. The nature of the current representation tools goes beyond the static nature of the paper support, becoming liquid. Not only that. Content and container merge in the processing space, the place of analysis is also that of condensation and then distillation, a moment in which the representation supports the analysis by highlighting the substantial elements in an orderly fashion and concealing them on the others.

In the following, after some considerations of merit on the scientific field in which the application experiences have matured, there will follow a review of some experiences of teaching and research significant to highlight methods and tools that support the representations for the governance of territorial systems.

### **Brief notes on the scientific-cultural matrices of reference**

The Institute of Technical Architecture of the Politecnico di Torino, directed by Professor Augusto Cavallari Murat, since the sixties of the past century has addressed issues of research on the historical city and on the fabrics that characterize the urban form and the territory of Turin, from this intense study has derived the need to assess whether and how they could express the forms of representation in relation to the historical contexts and trends of development of the city, designed in its territory and immersed in its environment, with attention to both the phases of knowledge and importance as well as those aimed at the related design actions.

In relation to the objective of defining the codification proposals for conventional representations of building and urban fabrics, one of the results of the work car-

ried out was the definition of a system that, taking into account the functional aspects together with the philological and conjectural hypotheses, was recognized as a standard for urban relief in 1973 (UNI 7310-74).

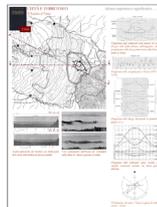
The Department of Engineering of Building and Territorial Systems (DISET) has collected in the eighties of the last century the legacy of the Institute and has deepened, for specific fields of application and through collaborations with researchers from other complementary scientific fields, the results of previous research activities.

In particular, some research sectors focused on Representation and Relief have expanded the areas of investigation pursued so far through:

- studies on the urban form and on the conventions in the urban survey with historical-critical purposes in which the environmental factors have been represented through diagrams, cartograms, graphs, and moreover the fabric of the historical centers has been returned through philological conjectural maps, distributive ideograms of the cellular structure, ideograms of monumentality [Istituto di Architettura Tecnica del Politecnico di Torino 1968; 1975];
  - research related to the system of Cultural and Environmental Heritage of the City of Torino (as preparatory studies for the Municipal General Regulatory Plan) [Politecnico di Torino. Dipartimento Casa Città, 1984];
  - specific studies on the natural and anthropized environment of mountain aggregates [Scarzella 1997];
  - surveys on valuable environmental systems with complementary analyses that integrate the survey of the architectural structure with the context, and with reference to areas undergoing transformation [Novello 1999; Coppo, Osello 2006];
  - relevant experiences aimed at the representation of urban fabrics affected by natural disasters and representations of support for environmental assessment studies;
  - research on drawing and design of rail transport networks and road communications in the Piedmont region;
  - survey of the system of porticoed axes and areas dedicated to open-air trade in the city [Coppo, Davico 2001];
  - critical reviews and analysis of the evolution of representation techniques for the planning and design of underground works [Novello 2007].
- With regard to the forms of processing adopted for the conduct of some specific, more recent research, computer-assisted management systems have been favoured so as to allow flexible access to information and maintain information quality both for archiving and for processing

Fig. 1. Integrated reading of the application experiences [edited by the authors].

**Alcune esperienze applicative**      **Tecniche della Rappresentazione**

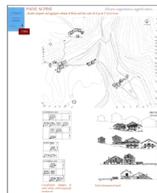


L'analisi di un numero elevato di dati, variabili nel tempo e nello spazio, avviene generalmente attraverso la restituzione di viste sintetiche. Queste viste possono essere elencate attraverso quanto definito dalla norma UNI 2949 Diagrammi e cartogrammi: stereogrammi, diagrammi cartesiani (lineari con diversi tipi di curva, semilogaritmici con punti di tracciatura, logaritmici), diagrammi polari (di fenomeni discontinui, semicontinui e continui), nomogrammi o abacchi, istogrammi con o senza linee di riferimento (a colonne semplici, frazionate, raggruppate, a carne d'organo, a barre semplici, frazionate, raggruppate, accoppiate, alternate, a settori, pittoriali, di flusso), cartogrammi.



Il progetto conoscitivo (per la tutela, per la trasformazione, per la riqualificazione, per la realizzazione, ...) richiede, a valle della raccolta di dati, la restituzione organizzata delle informazioni.

La classificazione degli elementi caratterizzanti, qualificanti e strutturali di specifiche porzioni di territorio è spesso restituita attraverso la schedatura tematica analitica associata agli oggetti reali indagati. La definizione a priori di un glosario delle categorie di dati, aggiornato nel corso delle attività di rilievo, consente la rappresentazione sistematizzata dei dati stessi attraverso la predisposizione di schede sintetiche o estese che possono essere collegate e relazionate a particolari emergenze del territorio o ad elementi architettonici ed edilizi. La scheda può comprendere schemi analitici su tipologie edilizie, schemi distributivi, piante, prospetti.



L'analisi della realtà territoriale e ambientale richiede generalmente anche la realizzazione di modelli a due/tre dimensioni, restituiti attraverso schemi concettuali e idonee tecniche della rappresentazione (proiezioni ortogonali - anche quotate - e oblique e proiezioni centrali). Il modello, a volte ricostruito a partire da rilevamenti diretti o indiretti, consente una serie di valutazioni relative ai valori funzionali, geometrici, formali e strutturali anche a ritroso rispetto all'arco di tempo che deve essere considerato.

**Gestione informatica dei dati**

Il trattamento automatico dei dati, attraverso l'impiego di fogli di calcolo elettronici, riduce notevolmente i tempi di elaborazione e consente, successivamente alla selezione dei dati, la personalizzazione degli elementi di stile utili a facilitare la lettura e la comprensione delle informazioni (tipo di caratteri e posizione di descrizioni e annotazioni, grossezza e tipi di linee, tratteggi, ombreggiature e colori degli elementi, scala), molto spesso fornendo soluzioni - composizioni automatiche - che già contemperano o consentono di mediare queste esigenze. I tempi di calcolo sono notevolmente ridotti a vantaggio di risorse che possono essere applicate per la scelta della più efficace rappresentazione grafica.

Attualmente, i dati che si prevede di collezionare in schede sintetiche dovrebbero essere organizzati per mezzo di sistemi di gestione per basi di dati, anche geometrici, relazionali. La tecnologia informatica consente infatti la distinzione tra struttura e contenuto dei dati e rappresentazione degli stessi dati. A partire da un'unica base conoscitiva, non duplicata e organizzata secondo le tecniche di gestione che verranno analizzate in seguito, è quindi possibile generare delle viste sintetiche e associare queste viste alle entità geometriche frutto della rappresentazione selettiva e simbolica del contesto territoriale.

La redazione di testi avviene attraverso l'impiego di applicativi per la videoscrittura, spesso associati a base di dati centralizzate; l'elaborazione di immagini in formato raster è mediata da applicativi per il trattamento matematico dei valori associati agli elementi puntuali dell'immagine (pixel). La divulgazione delle informazioni in rete è gestita generalmente tramite l'impiego di linguaggi di marcatura del testo che preservano la struttura e le relazioni della base di dati e consentono l'applicazione di fogli di stile per la rappresentazione dei contenuti.

L'elaborazione di modelli concettivi virtuali è ormai completamente assistita dall'elaboratore elettronico. Numerosi sono gli applicativi dedicati, tutti con il denominatore comune della possibilità di gestire separatamente i livelli informativi vector e raster, all'interno del modello o in relazione a questo: una prima grande distinzione potrebbe essere quella relativa alla gestione delle entità geometriche ed alla relazione tra le entità stesse (applicativi parametrici e non); un'altra distinzione è quella relativa al trattamento dei volumi e delle superfici (automatismi per la generazione); ancora, la possibilità di ottenere la rappresentazione a partire dagli attributi associati alle entità e di gestire modelli matematici relativi a particolari fenomeni (fisici, chimici, ambientali, sociali, ...).

Fig. 2. The analysis of the territorial and environmental factors of the Tavoliere di Torino and of the urban plant in Alba [Istituto di Architettura Tecnica del Politecnico di Torino 1975].

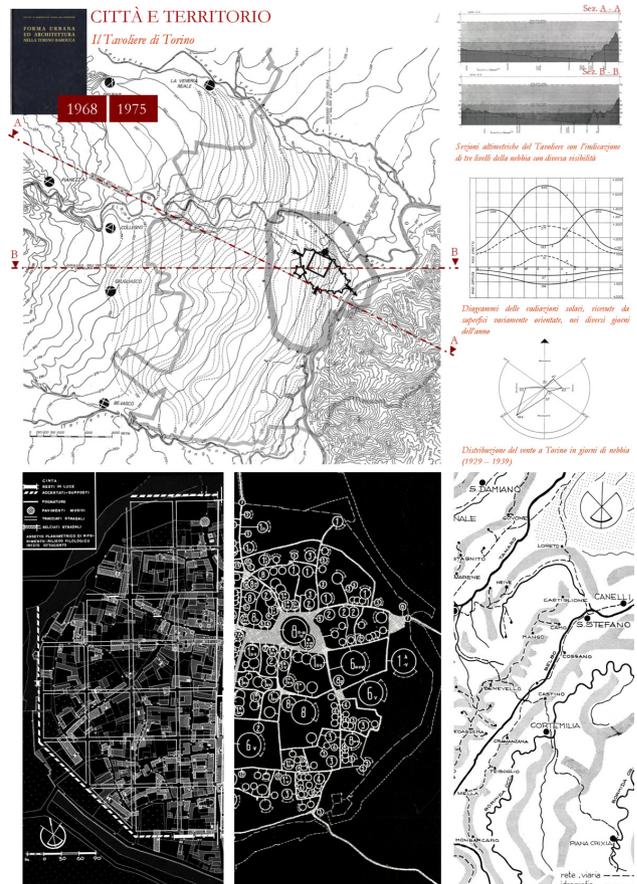
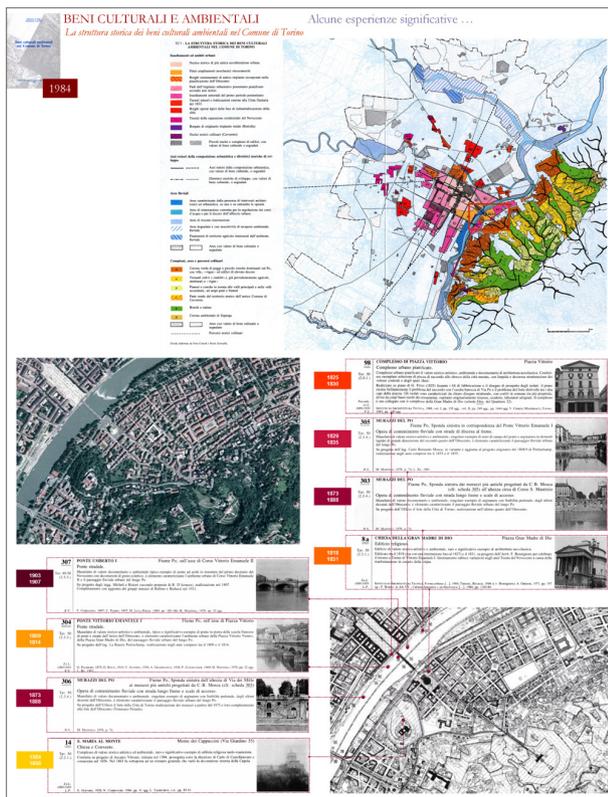


Fig. 3. The identification of the Cultural and Environmental Heritage of the City of Turin [Politecnico di Torino. Dipartimento Casa Città 1984].



the results through the establishment of information systems for environmental and territorial management and analysis.

In the following illustrations (figs. 1-6) – places of stratification and analysis for different purposes – are highlighted some themes and some significant representations related to experiences conducted by the Institute of Technical Architecture and the Department of Engineering of Building and Territorial Systems of the Politecnico di Torino, with particular attention to the techniques of representation used for territorial, urban and environmental analysis.

### Travelling stages between training and research

Representations, images and physical ideas of the territory play a fundamental role in orienting and defining projects and processes of transformation. These images behave like discursive practices, establishing limits and boundaries with respect to what can be expressed, while at the same time providing explicit and even implicit rules, as shared, with respect to the ways in which the contents of representation interact; it is at the same time a study of current and past territorial realities and a foreshadowing of their possible futures.

Images and ideas of territories have played a decisive role in directing and defining practices of conceptualization and reconstruction of the physical city. There are points of passage and rupture, where the new images deconstruct the previous ones, opening the way to new meanings and values, while maintaining a character of continuity.

There are many experiences conducted by the research group of which the authors are part, these are methods and areas of experimentation tested and evaluated on several occasions, we briefly report some, to illustrate the variety of themes and tools in the field of representation have engaged for years activities related to training and research. The first field in which the experimentation of hypertextual languages for the communication of urban relief has been carried out dates back to 1992, with Margherita Ognibene. The Piedmontese floods of 1994 required the organisation of infrastructural assets within a multirelational alphanumeric database [Tarditi 1996] (fig. 7). In 2000, a relational database was drawn up entitled *Computer elaborations and proposals for representation protocols for the management of road infrastructure design*.

Again with Cristina Boido's doctoral thesis [Boido 1998], the documents of the survey of the citadel of Alessandria were organized in a database that can be consulted in the form of a hypertext (fig. 8), a methodology then applied in the training of student architects for the case of the Murazzi along the Po of Turin.

The importance of the representations in the processes of transformation of the urban territory becomes evident for the case of Turin: some components of the local physical landscape (the rivers, the hill, the relationship between the Turin plain and the alpine circle), or certain historical building figures of the city (the orthogonal grid, the nineteenth-century baroque axes, but also the settlement matrices of the industrial city), are denied or strengthened by the projects when the basic images vary. There are undoubtedly important and symbolic moments in the contemporary history of Turin: the nature of the recent transformations of the city, the role of its image, the great urban projects.

The event of the 2006 Winter Olympics in some ways concludes a first phase of the profound metamorphosis that has affected Turin in the last thirty years.

A transformation that is modifying the genetic traits of twentieth-century Turin, and in which the imaginary and the ideas of the city seem to have a central weight.

The pervasive image of the Fordist city – a gigantic infrastructure at the service of production – was, for much of the twentieth century, the totalizing horizon of reference for the physical construction of the city [De Rossi, Durbin 2006].

The diffusion of geographic information systems within the spatial planning tools adopted by public bodies has led to the thesis of Degree (urban analysis of peripheral areas 1999) and Doctorate (strategic environmental assessment of Olympic interventions Turin 2006, 2004) by Maurizio Marco Bocconcinco [Bocconcinco 2004] (fig. 9), then that of Doctorate of Elena Boffa, in particular for urban analysis related to anthropogenic risk.

Changes and permanence characterize the history of the drawing. Technological evolution also offers innovative elements and confirmations of some methods and techniques or the abandonment of others, in favour of more efficient and safe processes.

As mentioned, these studies, which have led people in training to experiment with specific fields of application of drawing through advanced digital tools, have supported part of the research conducted within the then De-

Fig. 4. Integrated Analysis for the Survey [Novello, Coppo 1984].

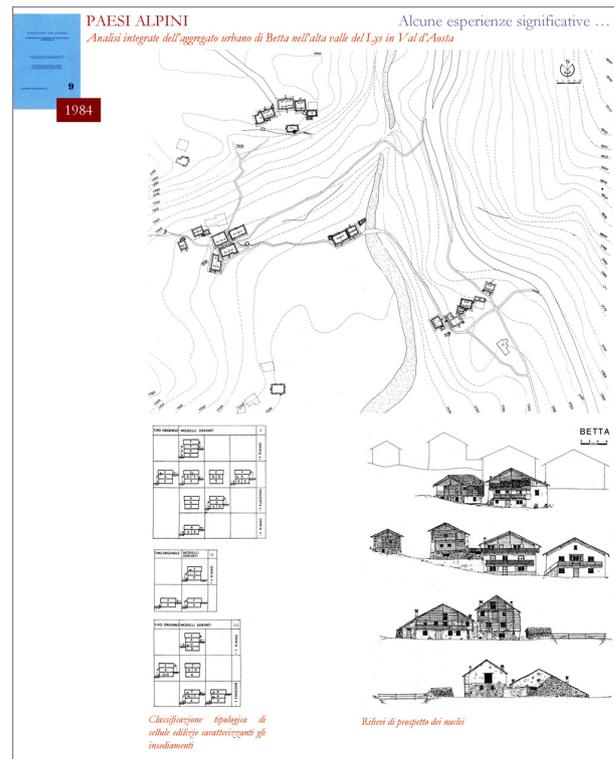
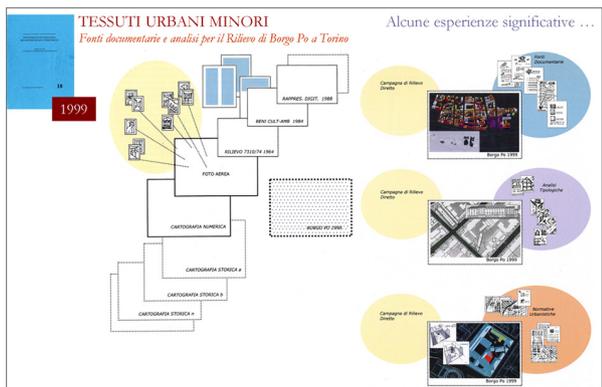
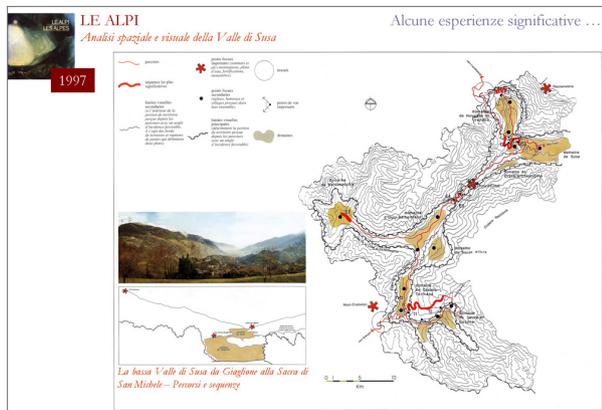


Fig. 5. Spatial and visual analysis of the Susa Valley [Comoli, Vercy, Fasoli 1997].

Fig. 6. Documentary sources for the Survey [Novello 1999].



partment of Engineering of Building and Territorial Systems. The research contract with the Province of Turin [Novello et al. 2007], for the analysis of the most suitable graphic codes and representation techniques for the visualization of the information relative to the municipal level acoustic restoration plans (PRAC) (fig. 10), is also worth mentioning.

The next paragraph focuses on a significant experience, compendium of the previous ones and very articulated application for the quality and number of experiences involved; it is an experience of applied research, carried out for the Piedmont Region and for the Tourist Observatory [Novello et al. 2009], relating to the census of sports facilities in the region (CISP), in this case setting up methods of monitoring and reporting in real time of the progress of the survey.

### An applied research experience: the census of sports facilities in Piedmont

The Piedmontese territory is characterized by the presence of a plurality of constraints of landscape-environmental protection that identify areas that, for their aesthetic, environmental, naturalistic and anthropic peculiarities, characterize the landscape. The actions of protection and the interventions of modification of the state of the places in zones of particular interest are subordinated therefore to the verification of the procedural fulfillments for the safeguard, the management and the planning of the interventions in relation to the landscape values.

Consistently with the nature of a system in continuous movement, the reading and writing of the transformations of environmental and territorial level, including the related methods of management, processing and analysis of information, must be appropriately adapted to correspond to representations that, only if conducted in dynamic processing environments, become useful media to improve the governance of the systems under investigation.

Such shrewdness favours responsible changes, also with regard to the critical aspects of vulnerability due to endemic or induced risks, and lends itself to suggesting prudent actions to trigger sustainable developments capable of respecting territorial vocations, increasing the resilience of the various systems involved: the new drawings and representations, if conveniently renewed, can be

confirmed in their traditional role of active and integrated support to face the different scales of intervention resulting from increasingly complex challenges. The opportunity to consolidate the census activities conducted by DASET – which, as a practical result, had precisely the definition of a cognitive framework of sports facilities, in particular public property, updated to June 29, 2007 – as an inheritance for future updates or future census activities of infrastructures, including those not related to sport, was seized in the direction of making general and exportable the elements of approach and organization of the different phases of work, the primary objective of each research experience. The complexity of a system that is constituted by the stratification of its components, both in time and space, by the different relationships that connect them and by the specificity of the different qualifications has required, during the survey of the plant engineering – from the training of the work team to the analysis of the consolidated data in November 2007 – many activities and resources that have been dedicated to the collection, storage, processing and choice of representation techni-

ques for the exchange of updated reports on progress and for the drafting of documentation relating to the final results (fig. 11). The preparation of a special Information System for the collection of data from the sports facilities (SIRIS), supported by computer tools, was interpreted, from the outset, as an essential and functional component for the preparation of regional planning and monitoring tools, an absolutely fundamental and necessary element, wanting to provide that the knowledge levels gained could be shared, available and disseminated on the network, anchored in the present, but necessarily projected into the future, in order to be fully usable. These issues of updating and disseminating information, which have become increasingly important and in use in the academic and research fields, exported to the institutional activities of the public administration and to the fields of application of professional practice, make it appropriate to disseminate information in a way that is oriented towards heterogeneous audiences, not necessarily technically prepared but rather made aware of accessible information methods and with an intrinsic high quality of communication.

Fig. 7. The structure of the database set up for the management of data relating to crossings on the river Tanaro [Tarditi 1996].

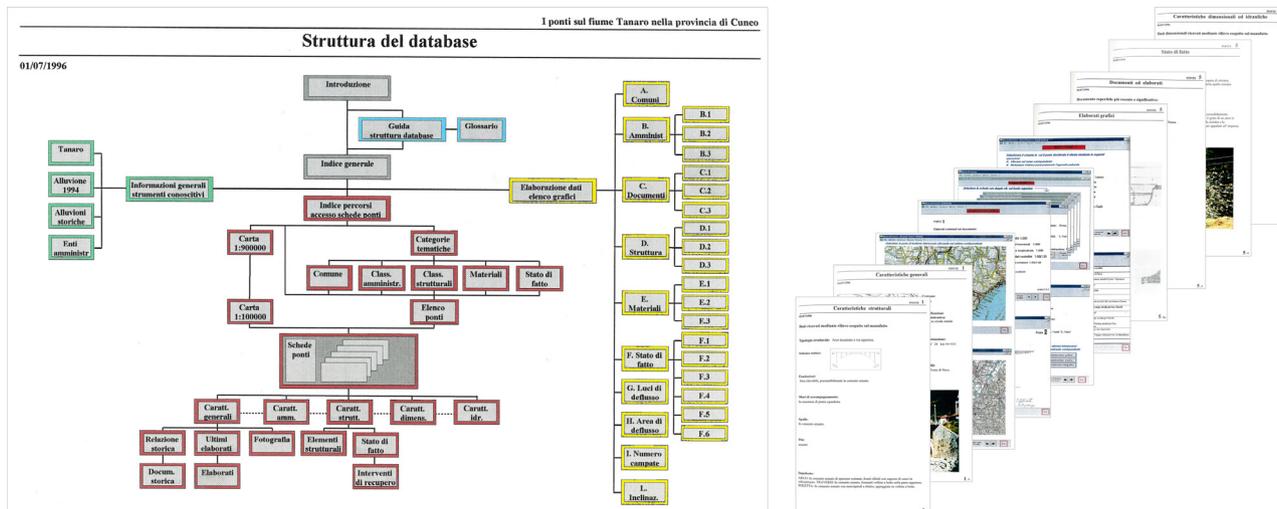
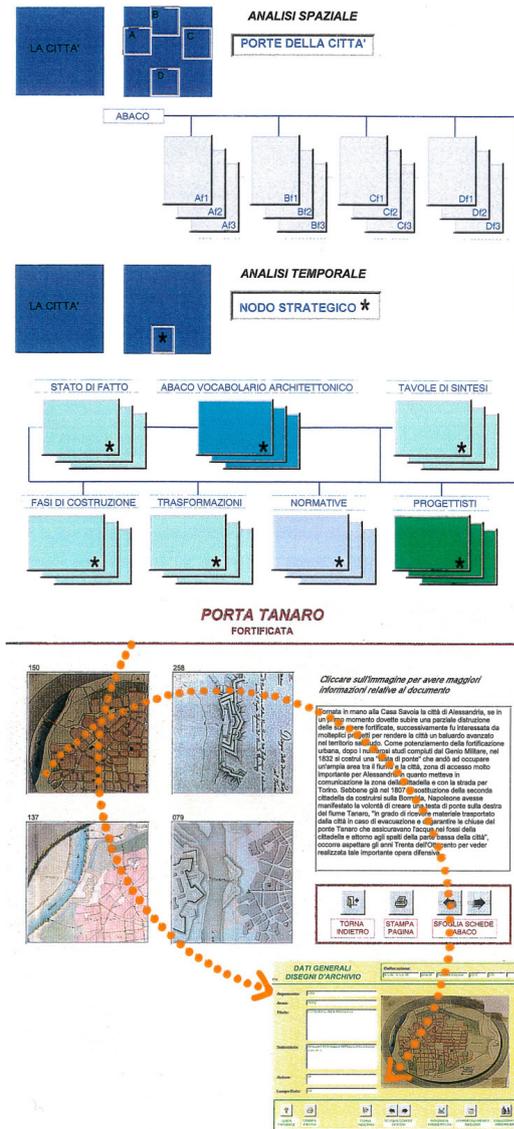


Fig. 8. The urban design of Alessandria between survey and project, structure of the database and analytical cards [Boido 1998].



## Conclusions and developments

Currently, the most recent and significant investigations are directed towards further complex work aimed at defining processing equipment to manage information assets of various kinds, designed to make more effective and efficient multidisciplinary research, in order to exploit the information potential of the graphical representation for those environmental and territorial systems of which you want to know and improve the degree of resilience, or the measurement of the ability to absorb and mitigate the effects of critical anthropogenic and natural events related to different levels and scales of influence. The path has therefore been enriched by making new supports for the path of Drawing.

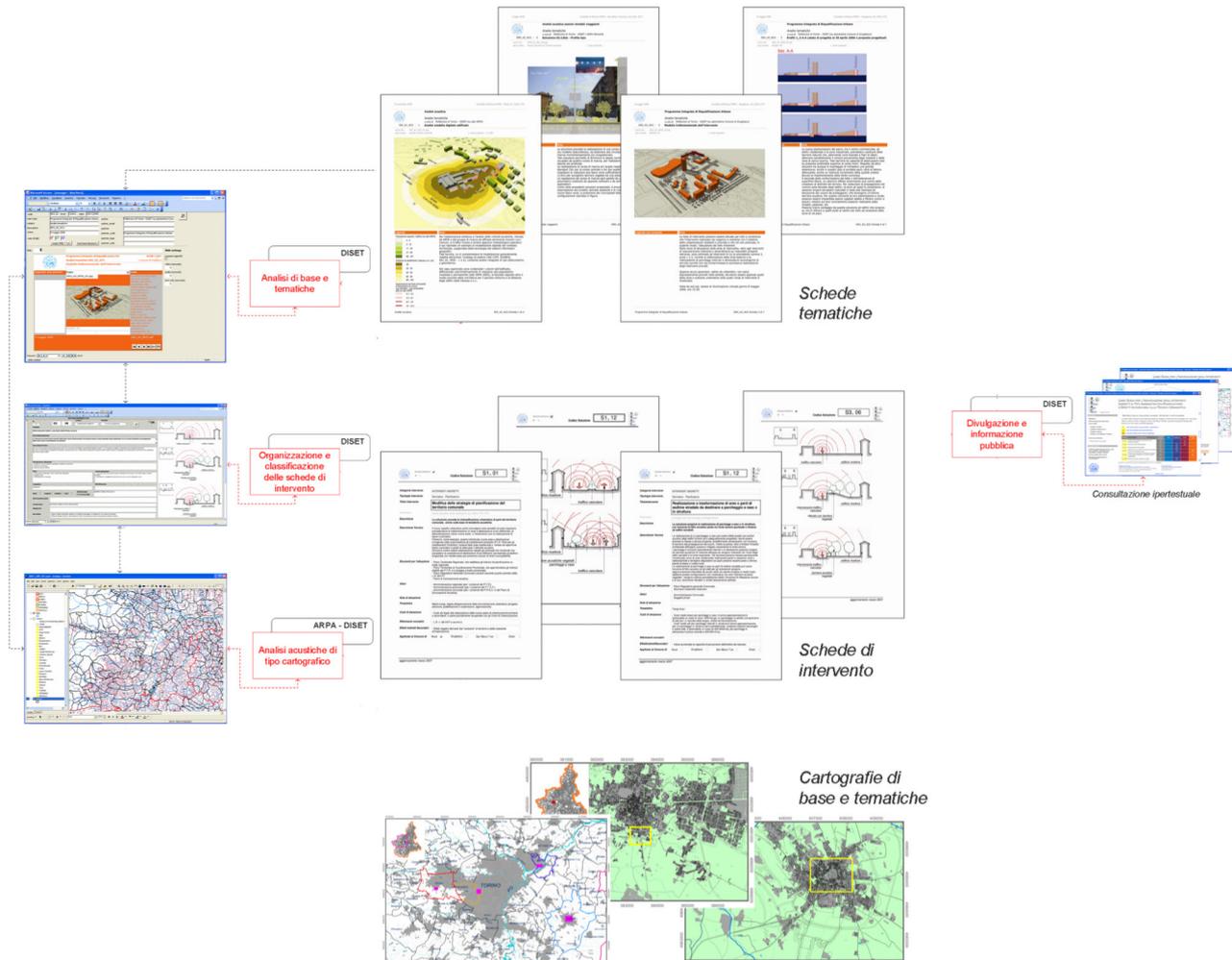
This highly collaborative field of work has found institutional expression at the Politecnico di Torino through the recent establishment of an Interdepartmental Research Centre specifically dedicated to in-depth studies on the theme of resilience, responsibility for interventions and risk (R3C), to which many researchers from different scientific sectors, including our Drawing area, have adhered.

Increasingly, the evolution of information systems is conforming tools and applications towards structures that are easily portable and interconnected at all times. The storage and management of data for their graphic representation follow consolidated criteria and forms of knowledge, but in a more efficient way and towards a wealth of increasingly numerous and heterogeneous information. Technological evolution also offers innovative elements and confirmations of some methods and techniques or the abandonment of others, in favour of more efficient and secure processes. The path that the contribution has taken through a number of fundamental stages, critically analyzed precisely because it highlights elements that have remained compared to those that have been abandoned, has been enriched by making new areas of research and renewed ideas.

Changes and permanences characterize the history of drawing; we wanted to give personal testimony of the aspects of method contained in experiences that we can consider distant, in the face of technical progress that proceeds at high speed, and how these aspects remain in the current developments, thus being able to consider them, reasonably, immutable even with respect to the frontiers that are expected.



Fig. 10. Elaborations and results of the PRAC research, the information and computer system [Novello et al. 2007].



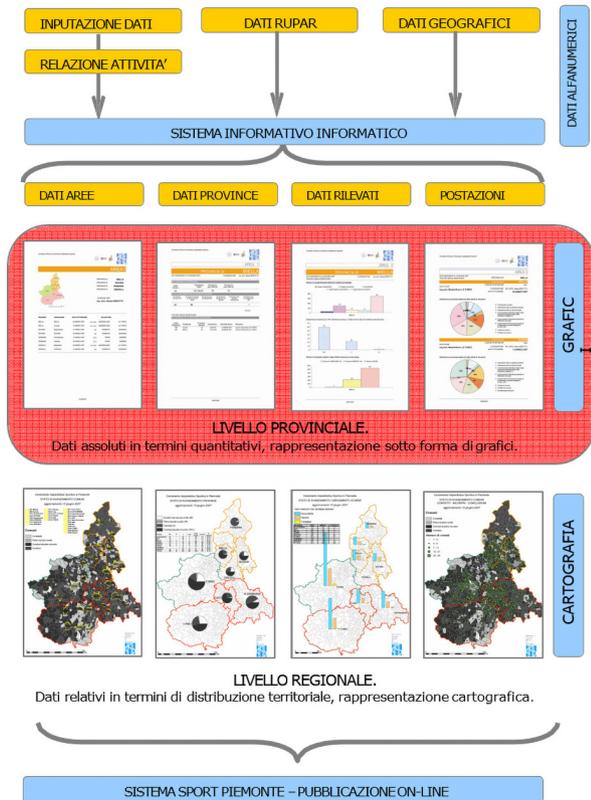


Fig. 11. Elaborations and results of the CISP research, the information and computer system [Novello et al. 2009].

Fig. 12. A keyboard “under the blanket of the territory” is the suggestion of the painter and draughtsman Tullio Pericoli.



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