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# From the representation of urban vulnerability to the design of the abacus for the project

## Graphic itineraries for the guide to the reading of the territory and the resilience project

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The concept of resilience applied to the city cannot ignore the specificities of places, a deep knowledge of the urban context, not only in its environmental, microclimatic and structural aspects, but also in its morphological and morphogenetic ones. The places of resilience are those places that in continuous change admit a rethinking. This way of seeing resilience, as one of the dimensions capable of directing transformations, lets us imagine an operational specificity (a character) of resilience that "in this historical moment" needs to be reintegrated into the theoretical and practical aspects of the project culture. The project intended as a cognitive activity that is applied through the techniques of representation and composition. Resilience therefore takes care of the characteristics of that specific place; it allows to shift the attention from its "dysfunctions" orienting the single resources to an image that recomposes and redraws the characters in an adequate functioning. The introduction of urban vulnerability modelling should therefore be understood not only as a cognitive moment, aimed at surveying, assessing the place and quantitatively assessing its resilience, but above all as a real moment of transformation of the place itself, through the introduction of improvement-mitigative and resolving solutions to the problems that emerged during the initial assessment phases. It is therefore necessary to overcome the approach of analysis and monitoring of the vulnerability of places, in order to dialogue with the more operational dimension of resilience through the introduction of responses and proposals for actions aimed at the realization of scenarios and evolutionary phases of the place. The experience conducted shows how the urban survey, in addition to being an opportunity for the representation of levels of analysis and knowledge of the built environment, can become a scientific tool capable of inducing second and deeper level cognitive analysis, i.e. related to the linking of different levels of knowledge, and become an efficient cause of a derivative type of knowledge. Considering the

conditions of resilience and sustainability, which include the problems arising from climate change, we acknowledge the need for dialogue at the different scales of a complexity of actors, competences, disciplines, intermediaries and urban policies. For this reason it is necessary to translate the resilient urban system object of analysis and surveys into "Typologies" of intervention through the construction and representation of solutions, classifications of actions and case studies. The graphic codes investigated within the abacus will therefore aim to relate the systemic evaluation criteria with the project to the urban scale through solutions that from specific analyses encode actions with general characters, defined graphic codes that will facilitate the interpretation and reading of the operations of recomposition of the environments.

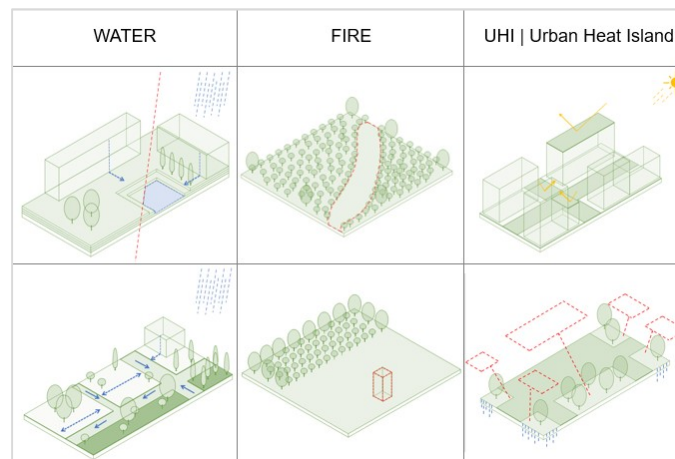


Fig. 1. Abacus stock extract. Water - for Flooding/Water Bombs: top Floodable squares, bottom Channel network. Fire - at the top Fire-belt; at the bottom Watchtower. UHI - Urban Heat Island: top Cool Materials, bottom Depaving.

An abacus of urban regeneration solutions/actions represents a dynamic tool, able to move within those realities that need mitigation/improvement interventions, maintaining a systemic global vision of application. The objective is to create a framework of possible action-solutions-strategies aimed at offering scenarios on an urban scale, oriented to emergency or planning. It thus becomes a tool for consultation and guidance for the development of resilient design, responding in a targeted way to risk through its application in a specific location. A parametric software has been used for the representation, synthesizing and schematization of possible actions in order to realize the models in BIM environment. In this perspective, the use of digital technologies has allowed us to refine and define more and more in detail the knowledge of the urban environment investigated, creating models with an initial level of detail LOD1 and final LOD3, elaborated by successive steps, which have allowed us to perform different analyses and to make quantitative rough calculations within the model itself. From this point of view, the abacus represents the first necessary step in the relationship between the indicators and the city project. Organizing potentially disaggregated data into an abacus of the coded actions is a way of systematizing the investigations carried out, which can be evaluated in their mutual interactions, thus becoming an opportunity for further investigation. As can be easily deduced, the extremely complex structure of the city, requires an investigation developed for multiple areas and thematic sectors, each related to a process of destructuring for parts of the system. This fact can hardly be assumed within a single type of survey, or rather it requires, from time to time and due to the specificity of the analyses to be carried out, precise in-depth studies. It is therefore necessary that all the information collected is

suitably structured and made congruent through the construction of networks of relationships between data that can be interrogated also at a later date. Hence the need to use information systems, where the information collected can be found and related. Most of the time, the availability and the relationability are obtained through the construction of databases connected to computerized cartographies and three-dimensional digital and parametric models able to put the information and the analyses carried out into the system.

The decadence of tools is an inescapable phenomenon that the support of artificial intelligence aim to counteract through the adoption of tools for the communication of the city and for the mapping of redevelopment interventions that can accompany urban regeneration projects. The same tools could be active support for students and experts in urban psychology as well as those involved in the conservation and restoration of cultural and environmental heritage. One of the possible deliverables is to develop an open source video game for smartphone and tablets, a tool for designers and public entities to engage the citizens in the design of the public space, to educate to sustainability and inclusiveness, and to collect data about the citizens' needs, desires and proposals, a flexible tool that can be applied to different neighborhood. Citizens who are not specialists, architects or designers, already have tools today to design and visualize a proposal for the urban space, usually very poorly integrated with tools for capillary detection of individual and group behaviours and attitudes and, most of all, these tools can't prefigure a solution starting from specific urban issues and using *ad hoc* abacus. This features we want to implement allow users to visualise the neighborhood in three dimensions with the support of all the data collection the project will produce; they shall modify it, adding elements, functions and services for the public space, in relation to the topics of ecology, energy, mobility, leisure and culture. Each player can obtain an automatic configuration of urban space, composed by an artificial intelligence engine, make corrections or a new design proposal and visualize its impact, receiving a score about the categories of accessibility, economy, productivity, ecology, social interaction. The player can therefore understand the level of complexity of each decision related to the urban space and the different needs related to different functions. The AI engine learns from corrections and new design solution and propose each time a configuration that takes into account previous modifications. In the light of the above considerations, it is clear that the contribution of the disciplines of representation within the project about the definition of the vulnerability of an urban centre involves aspects that affect the knowledge of the survey, the setting up of multi-relational databases for data processing, as well as the interaction with GIS, BIM and DBMS systems through dedicated web platforms. On the one hand it is necessary to prepare models capable of representing, in synthesis, demanding conceptual elaborations of a deductive logic type, but at the same time it is necessary to make available instantly uninterpreted data and analysis tools capable of allowing the various actors in the field of analysis even if not predictable in the research project as thought in its initial moment.

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