Image: A Support for Architectural Cooperative Design

Gilles Halin, Sylvain Kubicki
CRAI, UMR-MAP, Nancy-University, France.
halin@map.crai.archi.fr;  kubicki@crai.archi.fr; http://www.crai.archi.fr

Cooperative design is an activity where actors share and exchange ideas, propositions, requirements, and constraints about the definition of an object. In architectural design, image plays an important role. It is the support of creation activity, object representation or references. Considering this important role of image, we suggest studying how the digital image is used as a support of collective activities in assistance tools dedicated to architectural design.

Keywords: Digital Image; Cooperative Design; Cooperative Assistance Tool

Introduction

Cooperative design is an activity where actors share and exchange ideas, propositions, requirements, and constraints about the definition of an object. The object under design evolves from an initial idea to a final state that will be realized. At the beginning, the object is mental. Then, following the evolution of reasoning, creation or choices made and alternatives taken, the object takes form in sketches, schemes, 2D or 3D representations or texts. It becomes the support of confrontations with future users, of designer’s means, of co-designers’ exchanges etc. We say that the object is conceived when the solution to the problem described in the specification conditions is largely accepted by the actors involved in the project (including final users).

After a general analysis of cooperative design activity, followed by its application in the architectural field, we will focus on the forms taken by digital image in this activity and how they are used as a mediator for cooperation activity.

Cooperative design activity

Every cooperative design activity could be characterised by:

- An objective to be reached, generally represented by an object to be designed,
- A progressive transformation of this object during design process,
- A set of activities realized in this process: creative activities, idea brainstorming, information search, modeling, representation, selection, simulation, calculation, validation, coordination and communication,
- A set of representations of the object, tracing and describing its design,
- A set of actors from various disciplines, with specific culture and skill.

This is a rich and complex context, its representation in software and its exploitation by the different actors involved in a project are a real challenge.

Cooperative Architectural Design

In the field of cooperative architectural design this
context is increased by some characteristics of the AEC sector.

- The place of image in architectural design:
  - Image (sketch, photography, 2D or 3D representation, etc) has a particular place in architectural design. It is a stimulating factor for creation and imagination,
  - Image is also a support for solution representation or simulation,
  - Image has a patrimony function in architectural references,
  - The visual culture characterizes architects and numerous reasoning mechanisms are built using image.
- Architects often use image references taken from reviews, specialized books or personal photography databases.
- A “designed and built” architectural object is situated and unique:
  - A building project is a situated activity. Many parameters are linked with its localization. The project is a “unique prototype”,
  - Information about localization is generally graphic (i.e. plans, maps) or photographic.
- Design teams are weakly hierarchical, heterogeneous, ephemeral and evolving.

Through this brief analysis of architectural design characteristics we underline the importance of image (graphic or photographic). It is a support for creation, representation, reasoning, patrimonial and technical reference or communication between actors. This omnipresence of image in architectural activity is due to its media properties: transmission of a global message, proof effect, instant perception, global perception dominated by image, information encoding capacity, human aptitude to memorize a lot of images. The cooperative architectural design has evolved through the development of new dedicated tools (Achten 2002). In order to explain how the image is integrated in cooperative activity, it seems important to understand what is the role of these cooperative assistance tools in architectural design.

**Cooperative Design Assistance Tool**

Computer models and tools developed over many years to assist cooperative design have often shown their limits when they have tried to assist architectural design. Particularities of the architectural object and of its design context engender some difficulties that are the subjects of numerous research fields. Regarding this reality, the place of an assistance tool in cooperation is not obvious. It should help every designer/actor to search, produce, memorize, share, communicate and sometimes reconsider his choices. These activities are essential and they need different kinds of tools that can be localized in the three functional spaces which characterize the cooperative assistance tools (Halin et al. 2003); production space (CAD), coordination (regulation) space, communication space (exchange) and conversation space.

The Cooperative Design Assistance Tool (CDAT) then becomes the “coordinator” tool inside the cooperative activity. It has to propose to each actor an adapted vision of the exchanges, the evolution of the design object, the shared knowledge, the design team composition and more globally of the cooperative activity context. Taking into account the importance of image in architectural design it appears important to keep this privileged place when activity becomes cooperative. We now suggest studying the place of this media in Cooperative Architectural Design Assistance Tools (CADAT).

**Place of digital image in CADAT**

We suggest identifying the place of image in CADAT through its localization in functional spaces of collaborative tools: production, communication (exchange) conversation (synchronous) and coordination (Figure 1).

**Production space**

In this space digital image is present in three forms:

- Representation of the object (2D or 3D) under design projected on a screen or on an interactive
digital desktop (Safin et al. 2005). When many designers use this desktop to work together this image becomes a cooperation support,
- Imaged reference (image.idée) about other design types or representations stimulating creation (Kacher et al., 2005). These references could be shared, annotated or exchanged and become a cooperation support between designers.
- Simulation of a physical phenomenon e.g. to help architects and engineers to work together.

**Conversation space**
Conversation space allows designers to dialog. Digital image is used as a support to this dialog between actors:
- Immersed in a room (same location) where designers present the project situated (augmented virtual reality) using for example a 3D representation projected on a screen (Cruz-Neira et al., 1992)
- Used on a whiteboard (distributed) through a 2D representation (Telepict) or 3D (Redliner) (Jung et al. 1999) where the actors could annotate the objects,
- Immersed in a virtual world where dialog between actors is established through avatars associated with the image of the person participating in the discussion (Rosenman et al., 2005).

**Communication space**
This space memorizes information exchanged between design actors. Digital image is used as a sup-
port for visualization of an informational space and as a navigation tool. In this case image is graphical and interactive. We cite two examples:

- **Bat’Map**: A graph-based visualization of cooperation context allowing the user to navigate in this context (Halin et al., 2003).
- **Math’Graph**: A tool using matricial and graph-based visualization to represent exchanges between actors (Otjacques et al., 2005).

### Coordination space

Coordination space allows the actors to regulate collective activity by planning the activities or taking a coordination meeting. Image is used as a support for:

- Planning visualization (Pert or Gantt graph) which could be interactive and shared,
- Shared agenda visualization allowing the users to fix collective events,
- Participants and project information visualization during a synchronous meeting (Webconference).

### Conclusion

The role played by image in architectural design is primordial. We have tried to show in this article that when activity becomes collective and mediated by a CADAT tool, this role has to be preserved. In the different spaces of cooperation (production, communication, conversation and coordination) image could be - and has to be – present and used. Numerous tools exist and demonstrate that image use as a cooperation support is possible and real. Meanwhile the CADAT integrating every use of image does not yet exist: it has yet to be designed.

### References


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