SOME EXPERIENCES ABOUT CAAD ON DESIGN AND DOCUMENTATION PROCESSES

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ABSTRACT
The manuscript proposes a qualification of the added value of CAAD according to the scope of application of such platforms, their implications in the own design process and the character of its end items. Each scope as well is defined in different dimensions, which explain and exemplify from a series of experiences developed by the author in the last 10 years, applying CAAD platforms in activities of architectural design, university teaching, investigation and consulting, or urban planning.
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Introduction
In the last ten years, the application of computers on the resolution of design problems has gone evolving from the simple use of database systems, developments on two and three-dimensional modeling, until the generation of photorealistic views and path simulation through telematic networks. On this same way, CAAD systems have come incorporating new capacities that allow not only to obtain better and faster design and planning products, but that has even affected the own nature of the design activity. These factors constitute an important value added to the use of computers, which in opinion of this author affects two scopes of the architecture:

a scope referred to the design process, by which CAAD takes part in determining way in the methods and activities used for projects development; and

a scope referred to the design products, in which the designer activities generate end items of a new nature, as much of the printed as of the magnetic thing.

Next, the way as these scopes are considered in the professional labor is explained and exemplified through projects developed by the author like part of their academic and professional activity: as Projects Manager of RVM Consultores consulting company, as Head of Information Systems in the Faculty of Architecture and Design of the University of Zulia, and as Architect in independent professional labor.

1. Scope of the design process
Considering the factors that affect the definition and accomplishment of a project, the added value of CAAD can be understood in a series of dimensions, which usually affect all design process. According the nature of the project, these dimensions are pronounced with greater or smaller emphasis, of the way that is explained in next the five subtitles.

1.1. Geometric - volumetric dimension.
The vectorial fundamentals of all CAAD systems implies that it does not matter frees it that tries to be an architectonic form, his generation and representation within the system will be always a precise, limitable and, even, three-dimensionable geometric function. It facilitates the best handling of the composition, since it allows establishing axes and vertices for structure the figures that define the components of a project.

The first example of this can be appreciated it in a house building with apparently "free" forms (figure 1). Its general base plant is composed by curve elements, whose attributes of centers and joints can be seen clearly indicated. Its different levels display a game of curved and straight traces that pretend to give an only dominant direction to all the lines of vision from its interior spaces. Figure 2 presents the geometric composition of a de-constructive office building, whose general plant shows a composition of curved elements similar to the previous example; in this case, such freedom has been applied to its
volumetric form, generating plans and vertices clearly quantifiables thanks to the three-dimensional geometric modeling.

The third example (figure 3) shows the volumetric rendered study of two alternatives on the design of a commercial building. The differences in the handling of the planes and covers in facades towards the public route allowed the selection of that project with the accent landmark instead on which it used vaults, since the client considered that this one represents better the institutional image of its car sale company.

1.2. Functional - spatial dimension.
For the harmonic perform of the activities within a building, it is necessary a correspondence between the sequence and interrelation of his spaces, and the uses that their inhabitants give the same ones. In those projects in where the functional complexity is considerable, CAAD offers diverse modalities of support to the programmed design of each area.

The characterization of each one of the jobs in an office, according to its organizacional hierarchy, its relation with the clients and to their own nature of activities, allows establishing a catalogue that facilitate the study of combinations of units. In figure 4, two alternatives of design generated from a same set of functional specifications are appraised with the help of LISP routines, in the search of a minimum area and an operationally "optimal" building.

The following case (figure 5) displays the application of the functional units in low-cost apartment blocks. Each one of them is conformed by space units with a "minimum" size according to governmental regulations and the local market, arranged under typical scheme social-service-private areas. In figure 6, another case of application of such specifications is exhibited, only that in this case and due to economic status profile of the apartments purchasers, the functional scheme is adopted in a less rigid and more expensive formal proposal.

1.3. Typological - stylistic dimension
Typology concept arises from the definition of a set of characteristics that allow identifying different objects under a same general qualification. In architecture, typology encloses formal, space and constructive values, understood under certain concept of "style" often extracted from historical architecture studies to be used with allegorical intentions. In this sense, CAAD has the capacity of the handling of predefined modules that can be used time and time again with some automatizables variants, according to a use of patterns decided by the designer.

In the first example (figure 7), we see the definition and application of stylistic patterns of facades and spatial units, for bank office buildings with high analogical value of Spanish colonial architecture. Each module has a set of formal, functional and volumetric particular characteristics within a CAD template, which allow the application of a certain architectonic language according to the corporate image of the company owner of the building.
This analogical character is also applied to a case of a cultural center showed in figure 8. The building, located in an urban sector characterized by the predominance of indigenous population, has been designed on the basis of determined structural-space modularity from the wood elements that constitute their columns, beams and covers. Such modularity induced to the handling of grids and meshes within CAAD for the distribution of walls and finishes.

The geometric managing of facades and volumes also can be used in allegorical way. In figure 9, the conformation of the facades planes and the space organization of its floors some way reflect allusive intentions to the appearance of an indigenous woman, it as generator principle of the design of an apartment block.

1.4. Normative - urban dimension
Like part of the normative body that regulates the construction of buildings, are the zoning ordinances. They establish the conditions of lot development, and contemplate design parameters in order to generate certain formal homogeneity towards the public routes within each urban sector. They are expressed, on the one hand, in maximum densities and construction areas, those which determine the size of the building, and on the other hand, in maximum occupation areas, number of floors, retreat of the building from the boundaries, minimum areas of arborization and numbers of parking places.

These parametric regulations affect the own form to work under CAAD. After to have calculated the qualitative and quantitative characteristics of the land use allowed in a parcel, the designer decides with the client the amount of space to being built, in meters, in independent units and in number of floors.

By virtue of it, CAAD activities begin with the tracing of the lot measurement according to its astronomical coordinates; after that, designer demarcates the limits of minimum retreat from the boundaries, within is formed the maximum occupation area legally allowed for the building. He studies the location of the number of required parking places, using different kind of parking blocks, as well as of the referential layout of the minimum green area; in function of all this, designer can define the structural modulation and the direction of the facades of the building. Figure 10 shows the base plant of a house building whose design seeks for the greater number of parking places and constructed service area without infringing the norm. The number of floors and the occupation area decided for each one of them on the project, correspond almost exactly to the permissible maximum. The reason of it responds to the interest of the promoter to obtain the greater amount of inhabitable and saleable built area over his lot.

In single houses, is appreciated the same interest by the maximum possible development, confined to the retreat from the boundaries and maximum height of the building (figure 11). The same thing happens with commercial buildings, in which the number of parking places generates the main restriction for the development, due to it is proportional to the commercial premise area to develop. Figure 12 presents a simple commercial building that responds the requirement of maximum built area without great pretensions of design, as well as two preliminary proposals of high-rise buildings generated on the basis of numerical exercises of the urban norms.
1.5. Constructive - decorative dimension

The activity of the decorative design of outer and inner finishes and forms, resides one way or another, in the geometric exercise with axes of formal organization, in the use of repetitible patterns, and in the process of trial and error to evaluate the results. These activities are easily conducibles through CAAD, with the insertion of upgradeable decorative modules in plants and facades projections, and with the three-dimensional visualization of the modeled proposal on hidden lines or rendering views.

Figure 13 shows the final option of facades renewal of an apartment block. Three alternatives were created with a CAAD system, and they were appreciated and evaluated by the proprietors of the building. In base to the selected proposal were elaborated the final construction plans of the new finishes. The next example presents the intervention project of an old house building, to convert it into a bank office (figure 14). The existing outer decorations have been re-interpreted and repeated in new annexed parts of the building, generating a expressive language also used in the inner design as much in columns and walls as ceilings and furniture.

The use of directive lines, that define the patterns of showcases, ceilings and floors, is appreciable in the interior design projects of a shoe shops chain (figure 15). The contrasts between forms and planes are handled under a three-dimensional conception of the space, determining in sections and construction details the accents in height and shapes that characterize the decoration of these commercial premises.

2. Scope of the design product

Like fruit of any investigation or consulting activity, the items elaborated with a CAAD platform can have an implicit value in itself, as input for the accomplishment of another design or analysis activity, or as final presentation product of the professional service. Next, such implications are explained.

2.1. As input for the analysis, the design and the planning.

All application of CAAD tools generates drawings in magnetic format that can as well be used later for other analysis or planning activities. On urban scale, one of the most important uses of CAAD is to generate vectored urban planimetry for GIS (geographic information systems). Figure 16 presents a continuous set of urban centers, whose road structure has been traced from the manual vectorisation of raster planes using a CAD tool. Later, these base plans were integrated to a GIS to evaluate the location of hospitals and ambulatory centers that constitute the regional health service.

The following example displays the urban structure, the service equipment and the potential attractions for a tourist geographic information system of one regional capital city (figure 17). There, SIG layers with their corresponding attributive data are combined with referential CAD plans and with simple raster plans of the urban center.
From other points of view, the exhaustive graphical documentation of buildings can generate planimetric bases for the architectonic analysis. The first example shows the planes of facade of an historical hotel building on which a morphologic analysis is applied (figure 18). The use of golden rules and harmonic rectangles in facades is revealed when superposing them on the South view of the building. This kind of analysis also can be made three-dimensionally: the house showed in figure 19 was modeled in detail through a CAAD system to evaluate a series of parametric principles of the neopalladian architecture, like proportions of its vestibule and radial symmetry.

2.2. As generator of final products.
One of the elementary uses of all CAAD systems has been the one to facilitate the elaboration of the definitive construction planes of an architecture project. Almost all the examples described in this work concluded in printed plans with measures and details, of a nature similar to the one showed on figure 20. Due to facility in their heliographic reproduction, such plans usually are monochrome, with variants in the line thicknesses to add expression to their contents.

However, it exists other types of final plans that also can be generated by a CAAD, those that allow to the documentation of urban plans and projects. The example of figure 21 presents the detail of a zoning plane of urban intervention actions in a populated center, which by its complexity requires of the color for its better understanding. It is the same case of figure 22, in where a new road proposal on a regional metropolis and their toponymy are established in a illustration ad-hoc included in the urban plan.

It is possible to include another type of final item that is not related to the printed documents: the vectored planimetry developed for the digital spreading of the values of buildings and places with historical or social importance. Figure 23 shows the interface of a telematic information service about buildings, which among its consultation modules, it includes the possibility of access and manipulation of the vectored planes of several buildings through a web browser. The last example (figure 24), expresses a sequence of virtual routes in an important urban place in the regional metropolis, which can be acceded under digital animation (with predetermined routes), or VRML through web browser (with interactive routes) through intranets or Internet.

Conclusions
The different modalities from the added value of CAAD that has been reviewed in this work are supported in a combination of automated and manual processes under a complementary way. It is because the added value is not only inherent to the computation tools used in each case, also to own factors that merge from the nature of the project, such as its theme, their scale, its purposes, their designers and their final users. For that reason, and in spite of the important increase in the capacities of the CAAD systems (such as the development of parametric design tools and "smart" CAAD), the computer aided architectural design will stay like "an eclectic set of applications, independent and unevenly applied in different aspects of the design and the documentation process" (Cuberos, 1998). Such discretionary application of CAAD clings to the inventive capacity of the designer and
planner, only methodologically regulated but inescapably freed under the humanist approach of an architecture as science and art of social service.

References
Figure 1: Lago Cristal Residences (R. Vargas, R. Cuberos, 1995, Maracaibo, 7325 m²). From left to right: base plan, 3D model, current photo.

Figure 2: Punto Fijo Maracaibo Bank office (R. Vargas, R. Cuberos, 1993, Punto Fijo, 980 m²). From up to down: 3D view, base plan and facade photo.

Figure 3: Autojapon car sale (R. Vargas, R. Cuberos, 1992, Maracaibo, 830 m²). Up: Alternative 1. Down: Selected alternative.

Figure 4: Ciudad Ojeda Principal Bank office (R. Vargas, R. Cuberos, 1992, Ciudad Ojeda, 320 m²). From up to down: small and large office alternatives, 3D view, photo on 1995.

Figure 5: Las Palmeras Residential Park (R. Vargas, R. Cuberos, 1994, Maracaibo, 4176 m²). Up: general base plan (detail). Down: artistic sketch based on 3D model.
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Figure 6: Residence Tower (R. Vargas, R. Cuberos, 1993, Maracaibo, 3000 m²). From left to right: apartments floor, artistic sketch, and current photo.

Figure 7: Latino Bank office design catalog (R. Cuberos, R. Vargas, Punto Fijo, 1993, alternative with 315 m²). Up: facades template. Down: final drawing of a proposal.

Figure 8: Indio Miguel Cultural Center (R. Cuberos, G. Bravo, 1995, Santa Rosa de Agua, 690 m²). Up: general base plan of the little island. Down: artistic sketch based on 3D model.

Figure 9: Miguel Angel Residences (R. Vargas, R. Cuberos, 1994, Maracaibo, 3350 m²). From left to right: apartment floor, current photo, Wayuu native woman dancing "yonna" with folklore dress on Paraguaipoa, near Maracaibo.
Figure 10: Da Vinci Residences (R. Vargas, R. Cuberos, 1994, Maracaibo, 3010 m²). From left to right: General base plan with normative limit shape, apartments floor, and current photo.

Figure 11: Milva House (R. Vargas, R. Cuberos, 1993, Maracaibo, 540 m²). Up: photo on construction work. Down: second floor, with main rooms.

Figure 12: Commercial and residential buildings (R. Vargas, R. Cuberos, 1993, Maracaibo). Upper left: Ciclobarca commercial center, 110 m². Right and down: preliminary studies for new housing projects in base to urban normative.


Figure 14: Indio Mara Maracaibo Bank office (R. Vargas, R. Cuberos, 1994, Maracaibo, 760 m²). Up: artistic sketch based on 3D model. Down: facade detail.
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Figure 15: Deportivos 2000 shoe shops (R. Cuberos & associates, 1994-98, Maracaibo) Up: ceiling plan of a 180 m² shop. Down: photo without furniture of a 512 m² shop.

Figure 16: Cities urban structure on the eastern coast of Maracaibo Lake, for the Regional Health Geo-referenced Information System (FAD-LUZ - Zulia State Governm 1998, Regional population: 2500000 inhabit.)

Figure 17: Maracaibo urban structure for a Tourism Geographic Information System SIGTUR (FAD-LUZ, 1998, Maracaibo urban area: 22000 has.)

Figure 18: Morphologic studies from an hist hotel building (FAD-LUZ, 1990, Maracaibo). F up to down: main facade, geometric study, current photo.


Figure 20: El Vigia Occidental Bank office Vargas, R. Cuberos, 1992, El Vigia, 1213 m²). 3D model. Down: construction details.
Figure 21: Altagracia Urban Plan (FAD-LUZ, 1997, Altagracia, Population: 32000 inhabit.). Land uses zoning plan.

Figure 22: Maracaibo Urban Plan (FAD-LUZ, 1998, Maracaibo). Road structure plan on AutoCAD interface.

Figure 23: AGORA - Telematic information System about architecture and cities (FAD-LUZ, 1998, Maracaibo). Graphic face with DWF file. http://www.arq.luz.ve/agora

Figure 24: Virtual paths on a Baralt Square 3D model (FAD-LUZ, 1998, Maracaibo). From upper left to right down: Lia Bermudez Art Center, Beco-Blohm Building, Tito Abbo Building, Saint Francis Church with Rafael Baralt statue.