CAAD conferences
A brief history

Gabriela Celani\textsuperscript{1} and Pedro Veloso\textsuperscript{2}

\textsuperscript{1}University of Campinas
celani@fec.unicamp.br

\textsuperscript{2}Carnegie Mellon University
pveloso@andrew.cmu.edu

\textbf{Abstract.} This paper analyzes the evolution and trends of international conferences addressing Computer-Aided Architectural Design over the past five decades. It starts with the Design Methods Movement conferences, when the possible contributions of computers to Architectural Design started being discussed. It shows how new interests along the history of CAAD development motivated the appearance of conferences on specific topics, and it ends identifying a recent interest towards architectural practice and the software development. With this work we expect to contribute to an “archaeology” of CAAD studies.

\textbf{Keywords:} CAAD conferences, archaeology of CAAD.

\section{Introduction}

Although closely related, the acronyms CAD and CAAD originally refered to completely different things. While the term Computer-Aided Design was related to vector-based graphic software for drafting, as defined by the industry, Computer-Aided Architectural Design has been used to describe a wide area of research, ranging from very abstract computational thinking about architecture to more concrete computer implementations and automated fabrication.

In the late 1980s, Mitchell \cite{1} blamed simplified CAD software, especially created for personal computers in the 1970s, for a deviation in CAAD development. Later on, Burry \cite{2} blamed the similarity between the two acronyms for the marginal place that CAAD has occupied in the architectural curriculum. Still according to him, the emphasis has been on using CAD software for increasing efficiency in architectural firms, over the “quest for design excellence in itself”, which was one of the original objectives of CAAD.

But these two acronyms, as we will see at the end of this paper, are not so distant any more, thanks to a closer collaboration between architects, researchers and software developers nowadays. This is, to a large extent, the result of the...
dissemination of the research in the field, propitiated by the conferences that we will describe in the next sessions.

Since the 1960’s, conferences related to CAAD started being organized in different countries, involving people from universities, the industry and the architectural practice. Some of these conference series formed regional networks and even global networks, through associations, online databases and journals.

Hoping to contribute to the understanding of this merging between CAAD and CAD, and in order to stress the former’s specificities and development, this paper analyzes the evolution and trends of international conferences addressing Computer-Aided Architectural Design over the past five decades. It starts with the Design Methods Movement, when the possible contributions of computers to Architectural Design started being discussed, and ends with robots, one of the latest trends in high tech Architecture.

The motivation for writing this paper was the lack of knowledge that most young attendants have about the origins of these conferences and how they relate to each other. This information can be very useful for helping them engage in this now well-established network of researchers.

This study did not consider conferences on Geographic Information Systems (GIS), because although these systems are very used in the Architectural Design process, these conferences usually focus on city and regional planning, falling outside the scope of the present research. Computer Graphics Conferences, such as SIGGraph, which started as early as 1974, were also not included, because they focus mainly on the technical, not the cognitive aspects of the use of the computer for Architectural Design. Moreover, although we acknowledge the importance of local conferences, we only considered the international ones held in English, due to language constraints and because those probably represent international trends better.

2 The origins

The origins of CAAD development are closely related to the Design Methods Movement of the 1960’s, which begun with the first Conference on Design Methods held in London, in 1962. It consisted of a series of conferences and publications, and its main goals were (1) to design better, by understanding the design process, (2) to externalize the design process, allowing large teams to collaborate from the early stages and reaching a higher level of complexity, and (3) to use the computer to automate repetitive parts of the design process [3].

According to Cross [4], “the 1960s (...) saw the beginnings of computer programs for problem solving” (p.1). One of the first layout optimization programs was developed by Mosley [5]. By the end of the 1960s, and the beginning of the 1970s CAAD was already established. According to Bayazit [6],

“Beginning in the 1970s, computer scientists became interested in systematic design methods and design science. They were trying to program and evaluate building performance to justify scientific design decisions. At the National Bureau of Standards in the U.S., the first International Congress on Performance Concept in
Building was organized in 1972. It brought a new perspective to design research in architecture. Thomas A. Markus and Thomas Maver had been working on building performance at Strathclyde University. Thomas Maver, a computer-aided design programmer, started to work on the programming of environmental building performance evaluation programs. Also, Peter Cowan established the building research center at the University of Sydney in Australia” (p.25).

Other centers were the interaction between design science and CAD was occurring were Carnegie Mellon University (with Herbert Simon and Alan Newell), the University of California at Berkeley (with Horst Rittel and Christopher Alexander), the University of California at Los Angeles (with Bill Mitchell and George Stiny), MIT (with Nicholas Negroponte) and others (see [7]).

A new interest in design methods by computer scientists reappeared in the 1980’s, at stated by Cross [8]:

“There was also a broader renewal of interest in design methodology in the late 1980s – especially in AI developments, where hope springs again for design automation and/or intelligent electronic design assistants.” (p.17)

...and by Bayazit [6]:

“Studies on AI researchers affected the development of studies on designers, as experts. “Think-aloud” techniques and “protocol analysis” were adopted by designers”. (p.27)

The relation between computers and design methods was the main focus of a workshop held in 1964 in Atlantic City, USA, titled The First Annual Design Automation Workshop. The Workshop became the Design Automation Conference (DAC) series, which has been held every year since then, for more than 50 years. Although nowadays it is concerned mainly with automated methods for Electrical Engineering Design, in the lack of other conferences, DAC served also as a forum for the early CAAD researchers, especially during the 1970’s, as stated by Joyner [9]:

“Indeed, through the 1970s, papers from architectural, mechanical and other areas of design automation appeared at DAC”. (p.28)

In the 1971 conference, for example, both William Mitchell and Charles Eastman presented papers, titled respectively “The Automated Generation of Architectural Form” and “GSP: A System for Computer Assisted Space Planning”. However, after the 1970s, DAC stopped being a strictly technical conference and started including a large trade show, which eventually became the main focus of the event [9]. Only topics concerned with automated electronic design were included in the conference, but new forums for discussing computer-aided architectural design were created, as we will see in the next sessions.

In the early 1980s, researchers developing CAAD applications felt the need to create their own forums for discussions, where both architectural design and computer
issues could be addressed together. Although independent, these new organizations were closely connected to Universities, to ensure the academic character of the discussions. Koutamanis [10] sees this moment as “the period when CAAD became a recognizable area” and increased its “scientific significance” (p.629). As a result, in the 1990s “CAAD is an established area, with its own conferences, journals and almost exclusive rights (...) to an expensive and promising technology” (p.634).

3 The sister organizations

Since the 1980s, international organizations were created in each continent, to support regional academic discussions about CAAD research and development. The first of such organizations, the Association for CAD in Architecture (ACADIA), was founded in North America in 1981 “by some of the pioneers in the field of design computation, including Bill Mitchell, Chuck Eastman, and Chris Yessios” [11]. Its mission is to “facilitate critical investigations into the role of computation in architecture, planning, and building science, encouraging innovation in design creativity, sustainability, and education” (ibid.). ACADIA has been held in different cities of the United States and Canada.

Education and research in Computer Aided Architectural Design in Europe (eCAADe) was the second organization to appear, founded in Europe in 1983, including a new focus on education. It is described as an

“association of institutions and individuals with a common interest in promoting good practice and sharing information in relation to the use of computers in research and education in architecture and related professions.” [12]

In 1985, CAAD Futures was founded in the Netherlands, “with the purpose of promoting, through international conferences and publications, the advancement of Computer Aided Architectural Design in the service of those concerned with the quality of the built environment” (ibid.). In the Introduction to the Proceedings of the first Conference, Alan Pipes [13] described the founders of CAAD Futures as “veterans of a hundred and one CAD conferences” who were “bemoaning the degree to which big business was taking over the conference scene (...) selling was replacing thinking, products were replacing ideas” ([13], p.18). Differently from the other sister organizations, which are always held in the same continent or region, since its foundation, CAAD Futures has been held in Europe, North America, Asia and, for the first time, will be held in South America in 2015.

Only a decade later similar organizations appeared in the other continents. The Association for CAAD Research in Asia (CAADRIA) was founded in 1996, and the Sociedad Iberoamericana de Gráfica Digital (SIGraDi) was created one year later, in 1997. The Arab Society for CAAD (ASCAAD) was only created in 2001, covering Northern Africa and the Middle East.

The six organizations have annual conferences (except for CAAD Futures, which is biannual, and for ASCAAD, which has had problems due to the political situation
of its region), and share similar goals of supporting CAAD research, teaching and development. SIGraDi is the only one that uses three different languages (Spanish, Portuguese and English), while all the others use only English as their official language. SIGraDi’s conferences also have a broader scope, including areas such as industrial design and media arts, which is probably related to the relative isolation of the South American continent in relation to the main centers where CAAD has traditionally been researched, a situation that is changing quickly in recent years. Figure 1 shows the geographic distribution of the sister organizations’ conferences, and Figure 2 shows their timeline.

**Fig. 1.** Geographic distribution of the sister organizations’ conferences. Green is ACADIA, orange is eCAADe, grey is CAAD Futures, red is SIGraDi and blue is ASCAAD. (Source: https://www.google.com/maps/d/edit?mid=zHVl6zCSxA0M.k1d3jUr43TP1).

**Fig. 2.** Timeline of the sister organizations’ conferences.

### 3.1 CuminCAD

In 1998 CuminCAD, the CUMulative INdex of papers on CAD, was established by Bob Martens (TU Vienna) and Ziga Turk (University of Ljubljana), funded by the
European Commission, as a “response to limited, difficult access to scientific information in the field of CAAD” ([15] p.221). It inherited approximately 1000 entries from another CAAD database that had been previously created by Yehuda Kalay, CADLine.

Among all CAAD conferences, CAAD Futures was the only one that had its Proceedings published by a renowned publishing house (at a high purchasing cost), while the other conferences’ books, with a limited number of copies, were in risk of becoming just “gray literature” (ibid., p.221). Therefore, this online database started publishing CAAD conferences papers and became an important resource for doctoral students and young researchers in the field.

At http://cuminCAD.architexturez.net/ one can see the metadata of papers and download most of the full papers or complete proceedings of the sister organizations’ conferences plus those of

- DDSS - Design & Decision Support Systems in Architecture and Urban Planning, a series of conferences organized bi-annually by Eindhoven University of Technology (since 1992);
- AK-AI – a series of conferences organized by Arbeitskreis Architekturinformatik, a German working group on Computer Science applied to Architecture (since 1993);
- EAEAA - European Architectural Envisioning Association (since 1993)

The metadata of all papers published on IJAC, the International Journal of Architectural Computing, are also listed, and full papers from 2003 to 2009 can be downloaded. At http://cuminCAD.scix.net/cgi-bin/works it is possible to perform searches and browse the papers by series.

CuminCAD is presently being supported by the sister organizations, and its access requires subscription, but is free, during one year, to attendants of their conferences. At the end of 2015, the sister organizations plan to make a larger investment in CuminCAD, in order to upgrade its equipment and management system, and turn it into an open access database.

The number of entries presently found at CuminCAD for conference and journal papers is shown on Table 1. Reports and theses are also available. One interesting thing about this comprehensive database is the possibility to perform thorough searches. For example, Figure 3 shows the most frequent keywords found in CuminCAD’s keyword index, not considering common words such as “architecture”, “urban”, “city”, “construction”, “system” and “graphic”.
Table 1. Entries presently found at CuminCAD. (Source: http://cumincad.scix.net)

<table>
<thead>
<tr>
<th>Sister organizations</th>
<th>Other series</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADIA</td>
<td>AK-AI*</td>
</tr>
<tr>
<td>ASCAAD</td>
<td>AVOCAAD</td>
</tr>
<tr>
<td>CAADRIA</td>
<td>DDSS</td>
</tr>
<tr>
<td>ECAADE</td>
<td>EAEA</td>
</tr>
<tr>
<td>CAAD Futures</td>
<td>Journal papers</td>
</tr>
<tr>
<td>SIGRADE</td>
<td>Others ~</td>
</tr>
</tbody>
</table>

*Number of conferences, not papers.

Fig. 3. Most frequent keywords found in CuminCAD’s keyword index. (Source: http://cumincad.scix.net/cgi-bin/works/BrowseAZ?name=titles)

3.2 Architectural Computing

In 2003 the Architectural Computing alliance was created by Andre Brown, from the University of Liverpool. It consisted simply of a website (with links to the regional organizations (http://www.architecturalcomputing.org/) firstly ACADIA, eCAADe, CAADRIA, SIGraDi and CAAD Futures, and later ASCAAD), but it helped strengthening the relations between them. Nowadays, each organization’s website has a link to “related organizations”, expanding the capillarity. Architectural Computing supports the International Journal of Architectural Computing (IJAC), and it can be compared to the International Building Performance Simulation Association
CAAD conferences - A brief history

(http://www.ibpsa.org), which supports its international conferences and a scientific journal in the field.

3.3 IJAC

In 2003 the International Journal of Architectural Computing (IJAC) was founded by eCAADe, ACADIA, SIGraDi and CAADRIA, with CAAD Futures’ support. This peer-reviewed journal is published by Multi-Science and has Andre Brown as editor-in-chief. The journal publishes four issues every year, each of which is supervised by an editorial committee from each of the founding organizations. Instructions for authors can be found at http://www.multi-science.co.uk/ijac.htm, and the access to content can be done through http://www.metapress.com/content/121497/.

The organization of these international conferences in every continent, and the creation of an online database and a scientific journal resulted in the consolidation of the field, supporting the introduction of CAAD in Architecture Schools all over the world.

4 John Gero’s conferences

The story of CAAD conferences would be incomplete without a proper reference to John Gero’s conferences. Differently from the sister organizations’ conferences, which had a broader scope, the conference series created by Gero targeted more specific issues, fostering a deeper discussion on special aspects of CAAD. With the purpose of developing a community of researchers, establishing a rigorous scientific style that would give respectability to this new field, Gero created six different series of conferences, following each decade’s main trends.

In the mid 1980s he started two conference series, one on Design Methods for CAD and another one on Artificial Intelligence in Design (AID). The first consisted of only four conferences (1985, 1992, 1995, 1997) because its topic ended up being absorbed by the AID conferences. The AID series targeted the application of Artificial Intelligence techniques in design research:

“The first two conferences used the names of the dominant paradigms of their time [Knowledge Engineering and Expert Systems]. However, I moved to bring all of this work under the umbrella title of “Artificial Intelligence”, and the Artificial Intelligence in Design label was used”[15]

In 2004, the name of this series changed to accommodate new interests. According to Gero [15], in the 1990s the interest in cognitive studies increased and he saw an opportunity to link artificial intelligence and cognitive science simultaneously to design research. For this reason, the AID conference series had its title and scope changed, and became Design Computing and Cognition. But, as Gero puts it, DCC can be considered a “direct outgrowth of the AID series”, and the 7th DCC conference
can be considered the 17th conference of a series that started thirty years ago, with KE’85[15].

From 1999 to 2004 Gero also ran the Visual and Spatial Reasoning in Design conference series, with only three events, in order to "explore this is a separate, specialized topic within design research". However, this separate issue also ended being absorbed by the DCC conferences, and the series was discontinued. Similarly, the workshop on Agents in Design in 2002 “aimed to bring this research area to the attention of design researchers and to bring researchers in this topic together”, but it also ended being merged with the DCC conference (Figure 4).

Gero also hosted, with Mary Lou Maher, the Design Creativity Conference series from 1989 to 2005, and three Studying Designers conferences, plus a number of separate ones.

<table>
<thead>
<tr>
<th>85</th>
<th>90</th>
<th>95</th>
<th>00</th>
<th>05</th>
<th>10</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig.4. Timeline of Gero’s conferences.(Source: http://mason.gmu.edu/~jgero/conferences.htm).

Most of Gero’s conferences were held in Sydney and were linked to his Key Centre for Design Computing. They propitiated the participation of many PhD students from that side of the world, contributing to the formation of a whole generation of scientifically sound CAAD researchers.

5 Other conferences

There are still many other conferences related to CAAD that are worth mentioning, some of which also have papers or abstracts published at Cumincad:

- Building Simulation Conference (since 1985)
- Conference on Design Theory and Methodology (since 1988)
- Design Thinking Research Symposia (since 1992)
- Nexus Architecture and Mathematics Conference (since 1996)
- Mathematics and Design (since 1997)
- Smart Geometry (since 2003)
- Advances in Architectural Geometry (since 2008)
- SimAUD-Symposium on Simulation for Arch. & Urban Design (since 2010)
- Algode-Algorithmic Design for Architecture and Urban Design (since 2011)
- Rob Arch - Robotic Fabrication in Architecture, Art & Design (since 2012)
• BIM Conference (since 2013)

Each of them has been created to bring attention and promote discussion on the most relevant topics that have been introduced to the area in the past years, fostering research and supporting teaching in each field. Their chronology of appearance tells us a lot about which were the hot issues and technical novelties in every decade. Some of the most recently created have introduced innovative formats. For example, instead of presenting papers, Smart Geometry attendants are invited to engage on workshops in which the conference topics are experienced in practice.

It is also noteworthy that some of the conferences created more recently, namely Smart Geometry and Architectural Geometry, have strong connections to the architectural practice in their origins and aim at impacting the CAAD software industry, instead of influencing only researchers. Smart Geometry, for example, was founded in 2001 as a discussion group by architects Hugh Whitehead, Lars Hesselgren and J. Parrish, with collaborators Robert Aish, Robert Woodbury, Axel Kilian, Mark Burry and Chris Williams, “as a way to recapture parametric and computational design to architecture” ([16] p.8). The first conferences had a focus on “software development, new tools for architects and engaging with ideas outside the boundaries of ‘architecture’” ([16] p.8), and resulted in the development of Generative Components. The idea was to create an environment for explorations, away from both the architectural office and the university.

Architectural Geometry describes itself as a conference for “connecting researchers from architectural and engineering practices, academia and industry (…) supported by the direct participation of the most renowned architectural design and engineering offices along with academic laboratories”. [17]

In other words, if the first CAAD conferences were looking at academia as a fertile ground for innovation, now the opposite seems to occur. Advanced practices bring in their daily problems and the CAAD software and hardware industries see this as an opportunity to develop new products, from parametric modeling and BIM packages to 3D printers and manufacturing robots, which, in turn, end up influencing education.

6 Discussion

This paper presented an overview of the main international CAAD conferences created since the 1980s, stressing their importance in establishing CAAD as a scientific field of research. It is also important to acknowledge the existence of many local conference series on similar topics, most of them held in local languages, which had also a great impact in the field. For example, in the 1990s, a series of National Seminars on the Teaching of Applied Informatics were held in Brazil, in Portuguese, which had an important influence in the introduction of CAAD subjects in the architectural curriculum.

The diversity of interests and contexts that characterize current conferences makes it difficult to select predominant topics. However, in comparison to the background in
which the CAAD conferences emerged, it is possible to detect some structural changes.

In the 1960s most of the researches in the domain of the DMM were interested in developing a science of design, focusing on rational methods that allowed to externalize and even compute the design process – what J. C. Jones [18] called glass-box methods in opposition to designer-centered black-box methods. CAAD researches distinguished themselves from the drafting interest in which CAD industry orbited around for a long time. Instead of dealing with automating conventional tools or accelerating current practices, CAAD research assumed that computation implied a rupture in the modus operandi of architectural design. Therefore, they investigated computational techniques to solve general design problems or even to deal with design automation.

In the last three decades, globalization process and the end of ideological polarization gave way to a leap towards a pragmatism in architectural design and theory [19]. This general leap in architecture accompanied not only radical changes in CAD industry but also in CAAD research.

In the late 1980s and 1990s, there was a wide interest in experimental architecture to challenge the conventional geometry. Animation and 3d-modelling software became a gateway for different types of computational geometries and algorithms in design practice. Simulation, digital fabrication and - more recently - robots made these new formal experiments feasible. In the 2000s, Scripting and parametric-modelling became a platform to explicitly orchestrate design flow of information, while BIM expanded the framework of representation of the buildings beyond geometry to incorporate AEC data.

This series of changes reinforces the idea that “the focal point for advanced technologies in architectural design has shifted from the outer edges of the virtual to a position of hybridity of the actual” [20], which, in the case CAAD, seems to characterize a pragmatic turn. Topics that were part of CAAD research for decades, such as an information models or generative design, came to the forefront of the industry. Knowledge from other fields and technical novelties from different industries are often and quickly incorporated in CAAD as conference topics. Practitioners and researchers related to CAAD develop specific algorithms to fulfill their own design needs and sometimes they even change the industry – in other words: they build their own tools (Aish in [16]). This means that the words CAD and CAAD, as described at the beginning of this paper, are becoming less different, as a feedback between practice, industry and academia is becoming more frequent.

As we stated above, CAAD was a research area inquiring primarily into computational solutions for general design problems or even to contribute to a general science of design. While the operative optimism of the pioneers remains, an intense feedback between research, practice and the industry seems to predate any generalizable model or method developed only in one of these fields. In this context, CAAD conferences become an experimental territory to contribute to on-going architectural design changes. So, in order to better understand tendencies and predict future developments, a constant work needs to be done in this archeology of CAAD Conferences.
Acknowledgements. We would like to acknowledge FAPESP (Proc.# 2012/10498-3) for its constant support. We would also like to thank Professors John Gero and Bob Martens for kindly answering our messages and providing important information for this paper.

References

17. http://www.architecturalgeometry.org/