form•Z IN FLATWORLD: A CRITICAL CLOSE-READING

by **Mahesh Senagala**

Introduction

The story of **form•Z**'s unique position among dozens of other geometric modelers is well-known. Most of the discussions about **form•Z** have been centered around a narrow focus on the features, technical capabilities, formal results, and comparisons to other software products in the market. In this paper, my intention is to shift the discussion away from a pejorative comparison of "what it can do" and steer it toward a more scholarly and systematic consideration of "what it is." It is indeed surprising, if not shocking, to learn that very little rigorous scholarship is available on understanding, analyzing, and framing the relationship between **form•Z** as a critical construct and the discipline of architecture. Continuing the line of thinking that the author proposed in his article on the critical close reading of AutoCAD (Senagala, 2004), he would like to propose that **form•Z** be viewed not merely as a software product that is a set of digital tools delivered on a CD-ROM. Rather, he proposes that **form•Z** be viewed as a comprehensive enterprise that is an equivalent to such significant buildings as Villa Savoye, or an equivalent to such theoretical frameworks as "Ornament and Crime" by Adolf Loos. Although this is an unusual proposition, the author will try to make a case for considering the critical significance of **form•Z** and the institution of its production to the discipline of architecture. The paper will begin with an examination of the initial argument that gave rise to **form•Z** fifteen years ago, and will conclude by examining the relevance of that argument today.

This paper will examine **form•Z** from two different yet related perspectives. The first perspective will examine how **form•Z** evolved as a "critical argument" as embodied and expressed in its interface design. The second perspective will examine the institution of **form•Z**'s production as an integral part of **form•Z**'s lifecycle and evolution. Further, the author will discuss possible future directions for not only **form•Z** but also CA(A)D in general.

It is not the intent or within the scope of this paper to evaluate **form•Z**'s manifest impact on the profession in terms of whether or not it transformed the design practices and processes as a tool. The author makes no claims either way. Rather, the focus here will be on examining if and how the "intent or argument" of **form•Z**'s designers is translated into the architecture of its interface, and into the modes of production and evolution of the software.

flatWorld: The Exponentially Changing Context

The world to which **form•Z** was introduced more than fifteen years ago, was very different from the world today. The growth and evolution of **form•Z** coincides with one of the most dramatic cultural shifts in the world. In 1991, AutoCAD® Release 11 was in vogue in the profession and in many schools of architecture. Manual drafting and techniques of drawing with traditional media were very much prevalent at that time. Many schools that emphasized design took pride in the mastery of traditional representational media. Also, deconstruction and the tail end of postmodernism were in vogue. The postmodernist obsession with semantics, double-coded communications, and valorization of all things historical eased into the deconstructivist taking-apart of texts and contexts. Computational tools available to architects were either glorifications of manual, two-dimensional media or fairly crude forays into three-dimensional modeling. Such advanced tools as IBM-Dassault CATIA were expensive, ran on expensive platforms and virtually unheard of among architectural circles until Frank Gehry adopted it in the early nineties. For all practical purposes, "fabrication" meant a lie. Except for academic circles, email was an exotic creature and "webs" were still populated by real spiders.

Of the last fifteen years, the last five years have been the most phenomenal in changing the world geography and economics. As outlined in the now well-known book *The World is Flat*, Thomas Friedman draws a world in which information, goods, and people flow with greater connectivity, speed, and entanglement than ever before in human history (Friedman, 2006). Friedman observed that the exponential connectivity and easy access to the Internet coupled with trade innovations have flattened the world into a level playing field. Irrespective of the actual merits of it, the flat world metaphor does capture at least some of the global transformations today. Perhaps our smart homes in, say, the USA, will be monitored or troubleshot or unlocked by customer service centers in India or elsewhere. Perhaps significant amount of architectural production, design, and coordination will be outsourced globally in the near future. Gone were the days when only a few privileged researchers at exclusive places like MIT and Carnegie Mellon University were toying with CA(A)D[a] on million-dollar computers. Today, the world of CA(A)D is a level playing field for anyone anywhere in the world. The context, role, reach, and relevance of CA(A)D has changed significantly since 1991.

The last five years have also seen the emergence of a shift in our view of how computing power could be applied in architecture. Our thinking is beginning to shift from the notion of computing affecting architectural design (as in CAAD and BIM) to computing in the making of architecture (digital fabrication) to the notion of computing integrated into architecture (smart and responsive architecture). Kevin Kelly's prophecy about a networked world are already becoming a reality: "the central act of coming era is to connect everything to everything. All matter, big and small, will be linked into vast webs of networks at many levels. Without grand meshes there is no life, intelligence, and evolution; with networks there are all of these and more" (Kelly, 1994). William Mitchell has put it lucidly when he said that "we become true inhabitants of electronically mediated environments rather than mere users of computational devices" (Mitchell, 1999). Mark Weiser's predictions about ubiquitous computing are becoming a pervasive reality (Weiser, 1991). Architecture that has some amount of global connectivity and real-time intelligent responsiveness is bound to be here and alter the way we approach how we dwell, and thus how we design and build.

Looking at longer term prospects and the continuing flattening of the world, Ray Kurzweil's compelling observations and arguments about what he calls Singularity are pointing toward radical possibilities, convergence and emergence in computational intelligence and biology (Kurzweil, 2005). Even if Kurzweil's observations are only fractionally accurate, we will see exponential (not linear) changes in terms of computing, integration of computational power and intelligence with all things natural and artificial (including architecture). We will see computational intelligence nearing human intelligence. It may be unsettling or even uncomfortable to consider such a longer term vision, but it would be unwise not to dwell upon such a perspective in discussing the future directions of CA(A)D.

As remarked earlier, questions of representation dominated the world of architecture in the seventies, eighties and early nineties. Coincidentally, emphasis on drafting and drawing were prevalent at that time. At present, questions of computability of complex form have come to dominate the architectural discourse. Not surprisingly, three-dimensional modeling and fabrication have been in vogue now. Whereas form is about containment, intelligence is about connectivity, integration, and responsiveness. If we are moving toward connected and intelligent architecture, we have to take into account the questions of computability of intelligent containment (smart form) and systemic performance (smart system) as well as systemic connectivity (smart networks), similar to biological organisms and processes. New times will need new arguments and new responses.

form•Z: Software as "Argument"

The roots of **form•Z** could be traced back to many of the academic and research projects that Chris Yessios undertook in seventies and eighties (Yessios, 1987). Chris Yessios has been quoted as saying that "**form•Z** is an argument against drafting" (Serraino, 2002). In his seminal paper written in 1986 "What has Yet to be CAD," Yessios identified the realities and challenges for computer-aided design tools and how they should differ from mere drafting or visualization tools often mistaken to be CAD. By drafting, Yessios did not mean mere technical drawing. He meant representational means that arrive after the completion of design (problem solving) process. For Yessios, CAD had to actively assist in the conceptualization, generation, and evaluation of design decisions. He wrote:

> *Design includes all activities which occur before a solution, final or preliminary, exists. It includes activities such as problem solving, decision making, value judging, conceptualization, information retrieval, and compositional creativity, where the list is not exhaustive. After a solution, preliminary or final, has been decided upon, it needs to be externalized and communicated either for visualization or construction purposes. The latter is done through drafting. Drafting is not involved with any problem solving oriented decision making, other then possibly deciding what line weights are to be used in what parts of a drawing.* (Yessios, 1986)

Yessios speaks of **form•Z** as a commercial package and downplays the larger academic and critical dimensions of the software (Serraino, 2002). Nevertheless, **form•Z** does stem from an academic argument against drafting when it began in early nineties. Upon close examination, the academic intent **form•Z** and its critical dimensions could be uncovered. The author would liken **form•Z** to Le Corbusier's Villa Savoye in the sense that both are critical constructs within the realm of architecture that challenged the prevailing norms. At first blush this might sound like an incongruent, exaggerated, or far-fetched comparison. But, it isn't.

Figure 1: **Villa Savoye (Photo courtesy Brian Pirie, Creative Commons (CC) Attribution 2.0).**

When Villa Savoye was built in 1930, it was an argument against a number of classicist dictums (Figure 1)[b]. Villa Savoye was a critical construct, an argument against the classicist canons of tripartite division, importance of the hearth, primacy of ground, non-inclusion of the automobile, etc. (Figures 2 and 3). Corbusier inverts almost all of the classicist conventions. Villa Savoye reads as an argument against many of the architectural conventions of its time. To use a Foucaldian term "valorization," Villa Savoye not only inverts but valorizes these inversions. It exaggerates, to the point of exclusion, in order to make a point. For instance, Villa Savoye stands on slender pilotis without a solid classicist base or massive columns (Figure 3). It embraces the automobile as an integral part of its program by accommodating its path and parking within the building's boundary. Villa Savoye rejects and inverts the traditional notion of "ground" by forming a garden/terrace on the second and third floors (Figure 4). The conventional notion of rectangular, punched openings as windows was questioned through the use of stretched ribbon openings. Servant quarters, which were usually relegated to the attic were situated on the ground floor in the villa (Figure 3). The fireplace was displaced from its usual central position on the ground floor to a relatively marginal position on the second floor (Figure 5)[c]. However, Villa Savoye is not just a reactive or subversive argument. It is also proactive in formulating a new agenda.

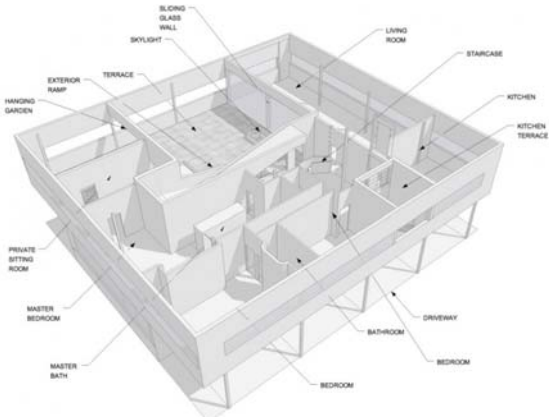

Figure 2: **Villa Savoye First Floor Model (Courtesy, architypes.com, CC Attribution 2.5).**

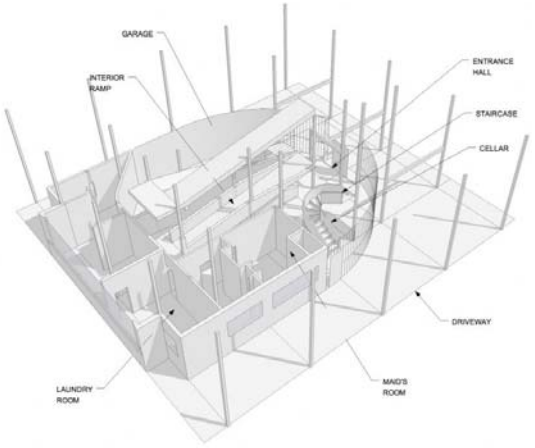

Figure 3: **Villa Savoye, Ground Floor Model (Courtesy, architypes.com, CC Attribution 2.5).**

Many avant-garde architects since Le Corbusier have exploited similar strategies. Peter Eisenman, Daniel Libeskind, Coop Himmelblau, and others have employed such critical strategies to varying degrees of success[d]. Architects have consistently used buildings to make a critical point or two. They have also used their drawings, models, and words to make their point[e]. However, it is not often that we hear programmers making a point through their software packages. Barring some open-source software and pestilent viruses, it is rare to see major software packages being designed as critical or subversive tools. Moreover, it is not common to see programmers making such a point in a systematic, rigorous, focused, and elaborate manner. In this respect, **form•Z** is perhaps one of the first CA(A)D software products to have a critical agenda. It is this agenda that probably endears **form•Z** to its users[f]. It is also this agenda and the consequent inflexibility in its interface design that likely repels others[g].

Architecture of form•Z's Graphical User Interface

Let us now look closely at **form•Z**'s interface to see if it reflects the software maker's initial intent, arguments, and convictions about design processes. Interface is not just that which is in-between. Face is the index of mind. Interface is the index of software's agenda. If we look into **form•Z**'s graphical user interface, we discover that **form•Z**'s critical agenda is not so hidden.

All through its evolution, **form•Z**'s interface design and configuration has not changed much in concept and layout (Figures 6 and 7). This gives us an opportunity to take a close look at the interface defaults in any version of **form•Z** to understand some of its essential critical agenda that has persisted until today.

a) **Visual versus Textual**: By default, command input in **form•Z** is only allowed mainly through menus and icons. This goes counter to the interface of a typical CA(A)D software where the user could type commands, macros, and scripts. The taking away of textual command input takes away some of the speed from the modeling process, but presumably forces the user to work primarily through visual means[h]. By taking away speed, the interface also demands and imposes more deliberation and thinking, which could frustrate users used to typing textual commands. This kind of valorization is akin to Le Corbusier's architectural strategies at Villa Savoye. Valorization (as opposed to moderation) is a mark of all critical work.

b) **Space of Interface**: There is only one place in **form•Z**, the Modeling Toolbar to the left, where object creation

Figure 4: **Villa Savoye Terrace Gardens (Photo Courtesy, Brian Pirie, CC Attribution 2.5).**

Figure 5: **Villa Savoye Living Room Showing Fireplace (Photo Courtesy, Brian Pirie, CC Attribution 2.5).**

and modification is commanded. Drop-down menus at the top offer options and ways of viewing and rendering the model. The palettes on the right side offer tool options and model data organization. The palettes at the bottom offer alphanumerical input. Various helper tools are placed at the bottom-left corner of the model window. There are no exceptions to these rules when the default settings are used. Such a clear-cut, zoned spatial configuration of the graphical user interface is a rarity in the CA(A)D world, and evokes some of Le Corbusier's modernist dictums of functional zoning.

c) **Artists' Interface versus Engineers' Interface**: Cyan, Magenta, Red, and Gray are the dominant colors in the interface. And these colors have specific meaning. Cyan icons are "tool-modifiers" that are used in object creation. Magenta icons are "void" operations used in space creation. Gray buttons interact with cyan or magenta icons to produce a desired modeling result. This notion of "mixing colors" is akin to an artist's way of working through a color mixing palette. Also, the cyan icons act as markers that vertically demarcate different sets of tools. The spatial conception and delineation of the interface does provide the user with a decidedly creative environment. Further, it is probably intended to make the user feel as though he or she is in front of an easel or a drawing board as opposed to being inside an aircraft flight deck. This aspect of the interface design can surely be read as being a big part of the "argument against drafting" and promoting spatial (void) modeling.

d) **Three-dimensional Interface**: By this the author does not mean visual three-dimensionality. Each icon in the modeling tool bar expands in X-Y axis. Double-clicking the icon reveals the "Z-axis" of the icon options that are "hidden beneath (or above)" (Figure 8). This three-dimensional organization allows for packing and folding more commands and command variations within a relatively small amount of interface real estate. Once again, the argument for three-dimensional thinking and processes is directly evident in the interface design itself.

e) **Cartesian Space versus Tabula Rasa**: In many-a-CA(A)D software, the modeling window is either a blank, black empty space, or occupied by a generic grid. **form•Z** shows its

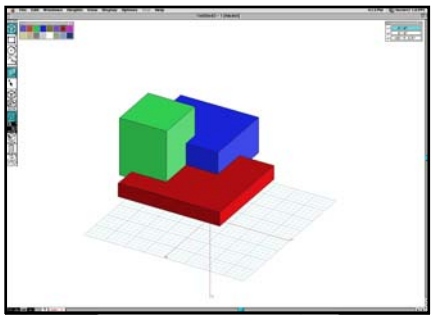

Figure 6: **form•Z 1.0 Interface (Courtesy AutoDesSys).**

architectural origins through the use of Cartesian grid with X, Y, and Z axes in axonometric view that greets the users upon entering the software by default. This view is reinforced by making the three-dimensional modeling and helper tools readily available to the users. These decisions are significant and go against many other comparable software products. Here, the interface designer is conveying a specific 3D spatial paradigm as opposed to a blank slate or a generic grid, both of which are fundamentally two-dimensional in concept.

All of the observations above clearly show the latent critical agenda and the way **form•Z** imposes certain rigors and software designers' preferences on the users. It is also clear that the "argument" has helped define the software's identity to a great extent. There are many well-known buildings, including those by Peter Eisenman, that critically impose specific ideas of habitation on its users, which have proven to be more than frustrating to some. The question of the merits of imposition of author's critical will of one kind or the other will continue to be debated ad infinitum. Are software packages allowed to enjoy similar prerogatives and privileges? The answer should be 'yes'! Do software packages (or buildings) with critical agenda have to be "popular" (as in large market share), easy to use, obedient, and have a sweeping impact on the discipline in order to be significant? Not necessarily.

The Architecture of Product Lifecycle and Production System

Criticism of software often stops at the review of a product. When examining a product, its performance, value, meaning, impact, and sustainability, it is important to consider the institution of its production, the production process, and indeed the whole life cycle of the product. As much as we would like to think that it is individuals who produce things, Gregory Bateson, Henri Lefebvre and Deleuze and Guattari would remind us that it is the institutions which strategically and systematically produce the space of possibilities through products. A product is but an expression of the systemic functioning of an institution and its subculture. It behooves of us to examine the institution of production when

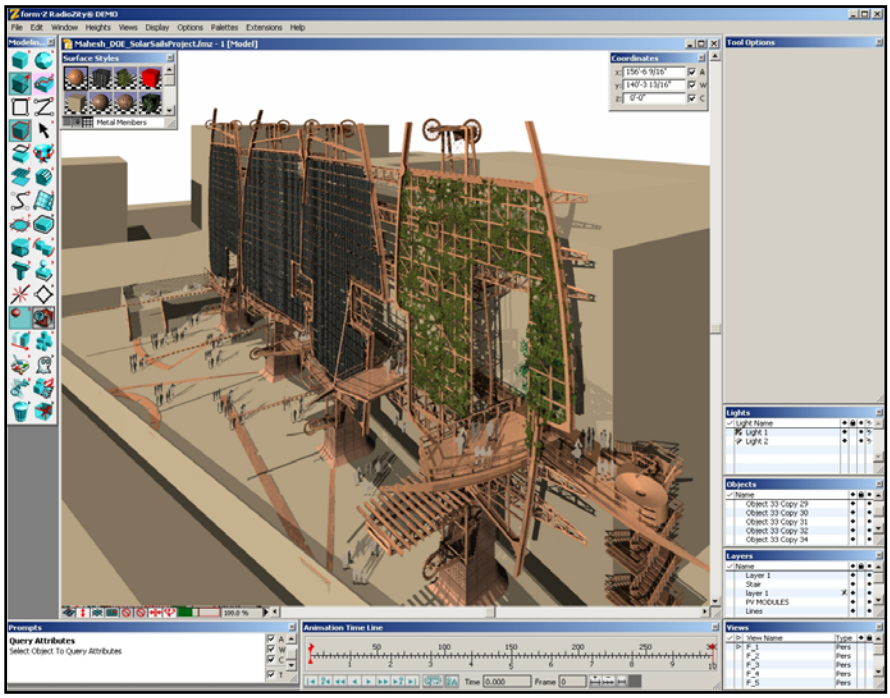

Figure 7: **form•Z 6.0 interface showing "Solar Sails," the 2nd Place Winning Entry by Mahesh Senagala, US D.O.E. and AIA National Competition, 2000).**

we wish to comprehensively examine a product. For instance, Honda as a company makes reliable automobiles. The reason for the excellence of the products made by Honda is the institution of its production, the company, its work culture, and its value system[i]. Another instance, this time a negative one, is the tobacco products and the institutions (corporations) that produce those products. It is by now common knowledge that the tobacco companies have a questionable record when it comes to ethical values in making and marketing their products. The overall significance, value, and sustainability of a product is directly dependent on the (corporate) culture of the institution of its production.

form•Z can be better understood if we carefully look into its entire lifecycle as orchestrated by AutoDesSys. The academic roots, the architectural roots, and the research roots of **form•Z** need no introduction. The software, although solely a product of AutoDesSys, began in principle in the spirited academic and professional environment of the Ohio State University. The product, although promoted as a commercial software, is undeniably academic in its bent. Moreover, **form•Z** is itself a record of Yessios' fruitful collaborations with Peter Eisenman in the late eighties (Yessios, 1987).

One of the shrewdest moves by AutoDesSys was to focus strongly on "grassroots" strategy of engaging the academic institutions through the Joint Study Program, which is one of the largest academic partnerships among software companies that features the following:

1. A rigorous feedback system that is contractually established
2. Recognition of quality results through its annual juried awards, and
3. The dissemination of the above two objectives through the production of an annual report

Although, for AutoDesSys, the bottom line is in the commercial sales of **form•Z**, undoubtedly their heart is in the Joint Study Program. A close reading of the terminology used in the program reveals this point. The representatives of the academic institutions who participate in the Joint Study Program are called "Principal Investigators," a term from the research world. The expectation from the PIs is to actually pedagogically and technically investigate the software so as to help evolve it. According to AutoDesSys, the goals of the Joint Study Programs are: "(1) to promote education in 3D modeling and computer enhanced design, and (2) to contribute to the evolution of computer driven design tools" (formz.com, January 2007). To the best of my knowledge, there is no other computer-aided design software maker who has an equally rigorous academic program with all the seriousness of joint academic and research investigation[j].

It is an aggregate of these instituted programs that endears **form•Z** to many of its academic users. It is this system of participation, feedback, and recognition that empowers and engages most of its budding professionals. The other software makers who make their academic licenses freely available to students probably do so mostly to improve their bottom line and to gain more market share, and not necessarily with the intent of joint academic investigation as a partnership. When examined in this larger context, **form•Z**'s critical agenda makes greater sense as an expression of the values and practices of the institution of its making.

Conclusions

In summary, the first conclusion the author would like to draw from this multi-pronged examination is that software products undoubtedly merit a more systematic and scholarly discussion about their role in the discipline of architecture with respect to what they are in addition to what they do. After all, a software is a body of knowledge, assumptions, habits, propositions, and arguments in a critical relationship to the issues of concern to the discipline. Just as buildings and texts play a critical role in challenging the norms of the discipline, so could software products. A close reading of **form•Z**'s graphical user interface reveals and reinforces the claims of the software maker that it is in part "an argument against drafting."

The second conclusion is that a software cannot be seen as a mere product in isolation from its lifecycle and production systems. A product should be seen as an expression of the deeper structures, values, practices, and beliefs of the institution of its production. Such a holistic consideration reveals the true value, meaning, and potential of a product.

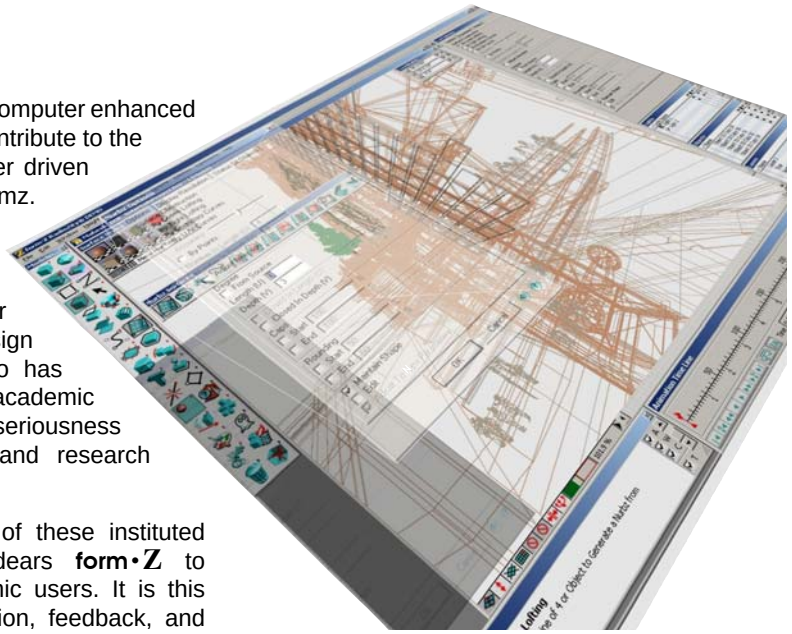

Figure 8: **X, Y, and Z Axes of Icon Organization in form•Z 6.0.**

form•Z is a significant contribution to the discipline of architecture, on par with Le Corbusier's Villa Savoye.

The final conclusion is that the nature, role, and relevance of CA(A)D software products are changing radically as we begin to experience more of the exponential evolutionary transformations that Ray Kurzweil, Mark Weiser, Kevin Kelly, and many others have observed. The challenges facing the discipline of architecture and the domain of CA(A)D fifteen years ago are not the same as the ones today. The concerns are going to be exponentially more different in the next fifteen years. It is ironic that the fifteen years of **form•Z** are parenthetical between one type of flatness (of drafting) and another type of flatness (of the world). As **form•Z** enters the flatWorld, it faces new challenges to which it could critically respond. If, fifteen years ago, **form•Z** began as an argument against drafting, what would be the argument against now and in the next fifteen years? That is a million-dollar question.

The author hopes that this critique has not only shed light on the critical aspects of **form•Z** but also opened the doors to new methodologies of scholarly examination of software products in response to the radically and rapidly changing context of the architecture of emerging flatWorld.

Disclaimer

The author would like to declare that this article was not commissioned by AutoDesSys.

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Notes

a The use of the abbreviation CA(A)D is intended to embrace the ambiguities that lie between the broader field of computer-aided design and its subset, computer-aided architectural design.

b. For Creative Commons License information, please see: http://creativecommons.org/licenses/by/2.5

c Le Corbusier's work is characterized by polemical inversions of classicist and prevailing architectural conventions of his times. These avant-garde strategies could be seen all through his oeuvre. See Jencks, Charles, Le Corbusier and the Tragic View of Architecture, Harvard University Press, Cambridge, Mass. 1974, for a detailed discussion of Corbusier's design strategies that challenged the norms of his day.

d Much has been written about the problems created by many avant-garde works of architecture to their users. Peter Eisenman and Daniel Libeskind seem to be the critics' favorites for scathing reviews of their built works and other creative work. See the following articles for a sampling of some of the critiques of critical buildings. Mark Lamster, "The Wexner Center: plagued by a bad layout and shoddy construction, Ohio State University seeks a retrofit of its Peter Eisenman building" in Metropolis 2001 July, v.20, n.11, p.54; Philip Nobel, "Peter's tantrum: after its multimillion-dollar rescue, the newly reopened Wexner Center remains as vexing as ever," in Metropolis 2006 Mar., v.25, n.7, pp.62-66; Robert Ivy, "Challenging Norms: Eisenman's obsession" in Architectural Record 191.10 (2003): 82-88; and Mark Kingwell, "Monumental / conceptual architecture: The art of being too clever by half," in Harvard design magazine 2003-2004 Fall-Winter, n.19.

e Interestingly enough, it is a commonly accepted notion that the discipline of architecture encompasses not only buildings but theoretical and critical texts, drawings, models, and a variety of other bodies of knowledge. It is not as common to see software constructs (in distinction to buildings designed using specific software constructs) being accorded that same status as buildings, drawings, and texts.

f Many of the leading architects today are known to use **form•Z** extensively in their design and visualization process. The list includes Peter Eisenman, Douglas Garofalo, Steven Holl, Morphosis, Antoine Predock, Michael Rotondi, and Bernard Tschumi. This maybe an indirect measure of **form•Z**'s critical impact on the discipline.

g A recurring criticism by many users of **form•Z** has been about what they term as its rational yet difficult to use interface compared to AutoDesk Maya® or Google's SketchUp®.

h **form•Z** does allow for many keyboard shortcuts by default that could be greatly customized.

i To quote Richard Bayfield, et al, "Honda's philosophy is summed up by 'Through [sic] challenge, fresh ideas, a young attitude, teamwork and a friendly working environment, we will achieve all we set out to accomplish'… The philosophy creates a culture in which it is appropriate to challenge the status quo; indeed the company encourages creative dissatisfaction. This means that every assumption or application within the automotive sector of the business is challenged regularly. It is the drivers (philosophy and culture) of the business which are the key" (Bayfield and Roberts, 2004). Further discussion of specific corporate culture examples could be found elsewhere. See Lightle, Susan, Kenneth Rosenweig, et al. (2003), "Why Toyota and Honda Topped the 2002 J.D. Power Quality Study," in Cost Engineering, Dec 2003, Vol. 45, No. 12.

j The Joint Study Program is perhaps the best example, in the commercial realm, of involving and integrating users' feedback into the evaluation and evolution of the software. In pubic domain or open source software, examples such as Linux abound where users collectively and directly author, alter, and evolve the software.

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