MODRULE

Using Gamification for Collaborative Mass-Housing Design Process

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Abstract. “ModRule” is a platform that facilitates easy collaboration between architects and end-users in the design process of mass-housing buildings. Hereby, architects set the overall framework and parameters of the building, while future occupants set their design-targets and budgets to arrive at a solution that satisfies both architectural and occupants’ needs and desires. Akin to games, rule-based design requires a specific logic and order that has to be followed to achieve the design outcome. Our research employs gamification techniques in the design process to aid designers and users to engage in a rule-based and logic design process to achieve a meaningful solution. We report on the outcomes of a design process with an architect and a group of end-users. The paper concludes with a discussion of how collaborative mass-housing design processes can contribute to both inclusive design and bespoke living through the advantages that participatory design and buildings bring to architecture and society.

Keywords. Mass housing; Collaborative design; Collaborative design system.

1. Introduction

“It [Ville Spatiale, Paris] has no floor plan, because it can be anything. So the importance is how people who live there manipulate the chairs or the enclosures and so on.” states Yona Friedman in an interview {www.iaac.net}. Even though Friedman’s theoretical position does not necessarily motivate this research, the statement above is in agreement with the objectives of this work.
In conventional design of high-rise mass housing, developers will plan based on their past experience and market analysis, which architects will then visualise and realise in a profitable and cost-effective manner. As the design product might become obsolete during the process of construction, many developers target completing and selling the building as quickly as possible. This motivation encourages both developers and architects to adopt modular unit systems to achieve the most efficient time-frame and cost. In addition, they develop standards to ensure further efficiency and fitness of the housing products. However, these processes have exerted a profoundly negative effect on creativity and opportunities for innovative building construction (Gao et al., 2012).

Mass-housing, as the name suggests, is for the masses. However, the industry is currently in such a top-down operating state that occupants usually cannot have any input in the design process; they can only choose from pre-defined options and select the one that is most suitable for them. Although every family is different with diverse needs, the houses are usually categorised quite generally into studio apartments, and 3-room to 5-room apartments. Instead of design responding to family needs, the exact opposite situation is present: the family must adapt itself to the units’ design. By adopting an open-source system and open-collaborative design strategies, this research examines the need to develop a platform for a bottom-up design approach that allows mass-customization in the housing industry, while maintaining efficiency and cost-effectiveness. A design environment that employs such a platform, called “ModRule”, is presented in the following on the basis of strategies acquired from the “Open Building” [http://open-building.org/ob/concepts.html].

The name of ModRule is a synthesis of ‘modular designs’ and ‘rule based design processes’, while the interaction within ModRule derives from the idea of gamification, which is creating enhanced user-participation in a non-game context, i.e., mass-housing architecture in this case. The relationship between games and architecture is elaborated in this respect. The initial test of ModRule is conducted within the curriculum of the Master’s course at the School of Architecture, the Chinese University of Hong Kong. An elective course (Arch5231) in computational design, which was elected by 5 female and 10 male students of the first and second year.

2. Open Building Concept

Introduced by Habraken (1961), Open Building is a bottom-up approach to building design (Valena et al., 2011). Having constituted a new paradigm in the architectural field during the 1960s, the idea was proposed via two main
domains of actions that bring together a sense of community with the best interests of individual inhabitants. Ignoring a balance between these aspects frequently results in major problematic issues, such as uniformity, brutality, chaos and disturbance in architecture, a situation which many inhabitants face currently. Achieving a coherent balance between individual participation and top-down design manipulation is challenging, as it involves all parties involved during the building process, which is ideally led by the building masters, i.e., the architects. A design studio is therefore setup to test the practicality of the idea with the help of the ModRule platform that is developed at the DARA (Digital Architecture Research Alliance) that where gamified interfaces are prototyped to test the idea of stakeholder engagement in architectural design via digital means {http://www.daralab.net}.

Two housing projects to which the Open Building approach is applied are worth mentioning here before discussing gamification. Firstly, the Ökohaus project, conducted by Frei Otto and Herman Kendell in 1981 for the Internationale Bau Ausstellung (IBA) exhibition, is conceived via user participation and open design strategies. Secondly, Next 21 (Kim et al., 1993) experiments with a participative/collaborative design method and a flexible building system, in particular. In both works, the architects incentivise prospective inhabitants to contribute willingly to the construction, as well as the architectural design. Since these two works were performed, issues related to mass-housing architecture, such as design tools, production lines and, perhaps more importantly, the interests of inhabitants, have transformed at great scales.

2.1. GAMING IN MASS-HOUSING CONTEXT

Designing games and buildings share similar aspects at conceptual, as well, as technical levels. With the introduction of digital design tools in architecture, pedagogy and practice have had to adopt new workflow systems based on heavy computational processing. However, to the best of our knowledge, no one has yet realised how games successfully combine these two arguably different fields. On the one hand, games always bring together different people with diverse backgrounds by giving them the freedom to negotiate their interests. On the other hand, architecture, mass-housing in particular, provides prospective users with only two options, i.e., “buy” or “not buy”.

When important design decisions are made in mass-housing architecture, participation is mostly ignored. The paradigm is primarily based upon concerns about return on investment and defining and acquiring “ideal user” types. Therefore, by being almost universally excluded from participation,
communities frequently experience detached and removed from the process that has great influence to their lives (Cansever, 2011).

In March 2014, venturebeat.com reported that computer and online games have become a part of everyday life, reaching $13 billion USD in revenue in China alone. Being aware of this rapidly evolving condition, we are predominantly interested in the role of game design elements in increasing the engagement of inhabitants. Game design can unleash new creative ways of producing engaging and enjoyable activities to engage in problem solving. The computer games SimCity and Prison Architect are, for example, created with an underlying logic of parametric relationships between content and gameplay. In other words, the player easily becomes an integral part of the game (Ruiz-Tagle, 2007). ModRule is developed by utilizing a similar logic. In the next chapter, game elements in general are introduced in order to elucidate the differences between making games and employing the gamification tactics sought by this project.

3. Gaming or game elements

By definition, the term “gamification” is different from “game”. Gamification constitutes designing a system in a non-game context by using game design elements (Deterding et al., 2011; Werbach & Hunter, 2012). Despite apparent similarity, gamification is not based alone on game theory, in which decision-making strategies are characterized by pure math terms and formulas. Equally distinguishable in terms of implementation is the difference between gamification theory and serious games that are used to test skill sets in visually game-like virtual environments that are similar to real conditions.

Dissimilarity to serious games and game theory shows that one does not become a game designer or mathematician by using gamification techniques. Rather one must start thinking like a game designer in order to generate a narrative sequence of links that will possibly define the level and quality of user participation once his or her system is implemented. Thus, gamification does not transform its elements into a game of “Points, Badges and Leaderboards” (PBLs). Nevertheless, it is increasingly common to break down games into design elements to acquire more participation based on a “fun feeling” (Aydin et al., 2014; Schnabel et al., 2014).

3.1. GAME ELEMENTS

It may be asserted that gamification has always existed, and that even the Egyptian pyramids were built in this way, in which labour was grouped into teams from respective hometowns to compete against each other. Because of this ambiguity, it can be further argued that there are hundreds of game ele-
ments that game designers harness to attract players into the “Magic Circle”, which is a concept that defines the boundaries of engagement in play and play environments (Huizinga, 1955). The Mechanics, Dynamics and Aesthetics (MDA) framework developed by Hunicke et al. (2004) is a classification system of current concepts and definitions of gamification, shown in Fig. 1. First, mechanics is concerned with the technical component of game design, based on algorithms, codes, and logic. Secondly, dynamics define the interaction between the player and the system via a set of process descriptions. Last, but not least, a game designer uses elements of aesthetics to increase the “fun factor” that prompts emotional responses, such as fantasy or a narrative.

Applying gamification to a non-game context does not require using all of these elements, as even game designers choose to include only certain elements. Instead, the aim is to achieve an effective linkage of used elements so that the intended level of fun is experienced by the player. This could even be accomplished by employing a quite simple element, such as a completeness bar, which many social platforms currently exploit (Fig. 2).

The focus of game elements is placed on the user in order to keep him or her playing. Through thinking like a game designer, our purpose is to make ModRule as engaging and understandable as popular and enjoyable games. The following chapter explains our participatory and collaborative design platform, ModRule.
4. ModRule

By integrating the concept of open architecture and the essence of gamification, we developed a collaborative platform, ModRule. This is a system that allows the architect to work on the building design closely with the potential inhabitants. The setup, however, is quite different from a normal design process. In ModRule, housing design is broken down into four parts: i) the overall form; ii) the spatial layout of units; iii) structure; and iv) architectural components. The architect does not design the building all of the way to a final product. Instead, he or she uses ModRule to plan a framework, the types of factors that he or she wants the users to set as targets, and the possibilities or constrains that will accompany the factors (Fig. 3).

![Figure 3. Workflow of system](image)

The architect opens up the model to future users who subsequently “design” their desired home according to the parameters and constrains set by the architect.

4.1. ADMIN INTERFACE

The platform is divided into two main categories, i.e., the Admin Interface and the Public Interface. The admin interface (Fig. 4) is where the architect prepares his or her framework of the design. With reference to most games, “gridding” the plans helps to simplify the collaboration process. The architect can grid the plans with respect to his or her plan geometry, i.e., it needs not be a square grid if the architect is designing a unique housing plan.
Next, the architect sets the parameters of each grid, giving each grid a value for any factors desired by the inhabitants. For example, the most apparent parameter will be the cost of each grid. The architect can also set the daylight factor, sky-view factor, privacy, views, etc., to provide the users with information about each grid so that they can make a better decision. In addition, some grids can be set as “fixed”, where users will not be able to select them. These are mainly spaces, such as the core of the building, the circulatory systems, utilities, and even public spaces where sole control would belong to the architect.

4.2. PUBLIC INTERFACE

After the architect has established every detail, he or she releases the model for users to look at. Since our platform is currently still a prototype, the overall detailed form and renderings of elevation and spaces are not available; the users only see the plans of the buildings. Certain information, such as orientation, available view types, and amount of sunlight is indicated in the diagram as part of the model.

Through the interface (Fig. 5) the users first set their targets or factors that contribute to their desired home design. Gamification plays a critical role in this process, i.e., instead of the designers setting targets for the players to achieve, the “players” in this case set their own targets within the parameters and frameworks set by the architects. During the “playing” process, the users try to fulfil their targets as completely as possible.
In any collaboration process, it can be assumed that conflicts will exist. To address this, an interface in the ModRule system appears for any conflict that a participant has with other users. Negotiations are then necessary. A resolution of the conflict can be negotiated by referring to the pre-established target values of the participants. The architect acts as “judge” in this case and facilitates a successful solution of the conflict.

4.3. ADMIN-WATCH INTERFACE

In the administrator interface, there is an additional feature, in which the architect can oversee the entire “playing” process (Fig. 6). The interface is quite similar to the public interface, in that it makes the process easier. Every conflict is visible, and the architect will have to consider the targets of each user to provide the best win-win situation for everyone involved. For example, the user with “view” as the first target will have a higher priority to choose units with a high view value compared to another user with “view” as the second target. However, if the former user has already achieved 80% or more of his or her target, the latter will then be given priority to achieve his or her target.
After all of the prospective inhabitants have fulfilled their targets as much as possible and are satisfied with the outcome, the architect will move on to the next phase in which every individual user will plan his or her interior spatial layout. The process is simplified such that users with no knowledge of design will still be able to utilize it fully. The users will only need to drag the room types, make the connections, and the plan will appear immediately (Fig. 7).

This process however, is still in the development process. The aim is to allow the user to have a clear view of what he or she is designing and how it might affect his or her neighbours.
5. Conclusion

In this paper, a platform is introduced to demonstrate how potential inhabitants can be included in the design process. Especially in mass housing, where the inhabitants are the main users, they should play a central role in achieving their desired living spaces.

Compared to a fully computation-generated outcome, this process engages users much more, allowing a stronger emotional engagement. All conflicts can be addressed and solved through the parametric framework that allows for interactive change and amendments.

Having progressed beyond a massing study and engages all stakeholders with each other and the design, this process is, however, still under development. There are still many issues remaining for the architect to address and solve, such as building codes, good praxis, and professionalism. Yet, at this stage, our tool still offers a platform for collaboration and user participation. In the future, we plan to integrate Building Information Modelling (BIM) Libraries for users to choose and apply in the design of their homes.

Other possible enhancements include an integration of algorithms that automatically suggest the best fit for the various target values that are set by future residents to reduce conflicts that can currently occur during the initial design stage.
References


