

PARTICIPATORY PLANNING:

Heritage Conservation through Co-design and Co-decision

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Abstract. Citizen participation in urban planning and architectural design has been long discussed and experimented with since the 1960s. With existing participatory design approaches, two key challenges can be identified. First, the power of citizens to directly affect the decision-making processes is typically quite limited. Second, the use of traditional face-to-face design workshop results in low levels of participation. This paper proposes an innovative participatory design approach with a focus on co-design and co-decision. The co-design stage provides citizens with a tool that empowers them to think critically of their built environment and to initiate design development in their own city. The co-decision stage gives citizens real power in determining the future changes to their city by embedding the participatory design approach into the planning permission system. This participatory design approach is implemented through a web application that allows participants to view design proposals within the existing site context from a birds-eye views and from multiple immersive views, leading to a better understanding of the design proposal's scale and impact. The design proposal viewer has been demonstrated on a heritage site in Singapore, showing its potential to be used as evidence for supporting or rejecting design proposals.

Keywords. Participatory Planning; Co-design and Co-decision; Citizen Power; Visualisation Method; Bird's-eye View; Immersive View; Web Application; SDG 11.

1. Introduction

Heritage conservation is a complex domain that involves multiple stakeholders with varying perspectives and value systems. In Singapore, the three key groups of stakeholders for conservation projects are the government planning departments, the developers, and the citizens. Of these three groups, the planning departments and the developers have disproportionate influence, while the citizens have almost no influence. This has led to many ineffective heritage conservation projects where profit reigns while the historical value and cultural sustainability are neglected. This research

explores Participatory Design (PD) as a way of empowering citizens to have a stronger influence over the future developments of heritage sites in their city.

Citizen participation in urban planning and architectural design has been a topic that is long discussed and experimented with by various scholars (Davidoff, 1965; Arnstein 1969; Sanoff, 2000; Falco, 2019; Tomarchio et. al, 2019). PD typically involves holding various types of workshops that bring together citizens, designers, and other key stakeholders (Sanoff, 2000). Such workshops are complex to organise and labour-intensive. Furthermore, when reviewing design proposals, there is often a high communication barrier between citizens and other design experts, so multiple workshops are usually required. Due to the time commitment that is required, only a small segment of the population can participate, which can lead to biased results. The key problem with workshop-based PD is therefore the lack of scalability.

To overcome the challenge of scalability, practitioners have explored various web-based digital tools to support the PD process. In many cases, these tools focus on the process of collecting feedback from citizens. One example is ArgooMap, a map-based discussion forum that supports place-based comments (Rinner, 2008). The discussion forum allows users to visualize their discussion in relation to the surrounding context. Another example is ChangeExplorer, an application that prompts citizens to provide short feedback on proposed development change as they walk through the city (Wilson et. al, 2019). The application provides a low barrier for participation and only requires a short interaction time.

Another approach is to set up design competitions and to gather feedback from citizens on shortlisted proposals. Some well-known architectural design competitions using this approach include the World Trade Centre Site Memorial Competition and the Sendai Mediatheque Municipal Library Competition. In the context of Singapore, an example is the Singapore Founders' Memorial Design Competition held in 2019. The competition resulted in five designs being developed, which were presented to the citizens of Singapore through an online website and offline through a two-month roving exhibition. Both online and in the exhibition, citizens were given the opportunity to leave feedback and to vote for their preferred design. At the end of the competition, the jury panel evaluated the submissions and selected the winning design.

A key issue with many existing PD approaches is that the level of citizen participation falls under what Arnstein (1969) has described as "tokenism". Under this category of participation, citizens' inputs have little impact on the actual outcomes. The perception by citizens that this might be the case, in turn, results in a low motivation for participation.

This research sets out to explore PD approaches that are both scalable and that allow citizens to have a real impact on outcomes, focusing specifically on heritage sites. A key strategy is to develop more advanced types of web-based tools to allow citizens to be involved in both the design process and the decision-making process.

The research proposes a PD method that includes two stages: a 'co-design' stage and a 'co-decision' stage. In the co-design stage, various groups can make design proposals and citizens can comment and give feedback on those proposals. In the co-decision stage, the planning permission process includes a citizen approval step, in which citizens get to vote for or against finalised design proposals. The proposed approach thereby devolves some of the power currently held by the planning authority

to the citizens. This ensures that citizens have a direct and tangible impact on the evolution of the cities they live in.

Section 2 will describe the proposed PD process for heritage projects. Section 3 presents a prototype web platform for viewing design proposals, for supporting both the co-design and co-decision stages. Section 4 gives summarises the results of a set of demonstrations. Finally, section 5 draws conclusions and discusses future research directions.

2. PD Method

This research proposes a novel and scalable participatory co-design and co-decision method applicable to key heritage sites, specifically focusing on heritage conservation practice in terms of adaptive reuse and new-build around heritage sites. The method will focus on design aspects that have an impact on the public, including the proposed building programme, proposed massing of new buildings, proposed demolitions, and architecture detail including materials, colours, patterns, and so forth.

The co-design and co-decision processes focus on citizens with differing levels of involvement in the PD process. The co-design process will require a high level of participation. This is envisaged as being driven by both developer organisations and by committed citizen groups, often in conflict with one another. We refer to these collectively as ‘proposal makers’. They participate directly in a combative process by creating design proposals and counter-proposals.

The co-decision process will require a low level of participation. This is envisaged as involving a much larger group of citizens who participate purely by exercising their right to vote for or against a design proposal. The level of involvement is not to be confused with the level of power. The co-decision citizens may not be participating so intensively as the co-design citizens, but their act of voting holds significant power.

In the building design process, the typical stages are conceptual design, schematic design, detailed design, and finally tender documentation. Application for planning permission will typically start during or at the end of the schematic design stage.

In the proposed process, the new co-design and co-decision stages will occur during the conceptual design phase, prior to application for planning permission. Citizen approval needs to be obtained before any application for planning permission can be made. The process, therefore, reverses the power structure. In the proposed method, the citizens are in charge of making the primary planning decisions. The government-planning department can then come in later to ensure that other secondary requirements are met. Once a design proposal has received citizen approval, the planning authority has no right to overrule the decision unless compelling technical reasoning is provided.

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2.1. CO-DESIGN AND CO-DECISION

In the proposed process, the new co-design and co-decision stages will replace the conceptual design phase, prior to application for planning permission. Citizen approval needs to be obtained before any application for planning permission can be made. The process, therefore, reverses the power structure. In the proposed method, the citizens are in charge of making the primary planning decisions. The government-planning department can then come in later to ensure that other secondary requirements are met. Once a design proposal has received citizen approval, the planning authority has no right to overrule the decision unless compelling technical reasoning is provided.

The co-design process is initiated whenever a proposal for a heritage site is submitted by proposal makers. A process with a fixed time window is then initiated, during which various proposal makers can submit counter-proposals and or create new proposals by modifying or merging some other proposals. During this process, citizens can give feedback on proposals. However, no voting can occur. The key steps in the co-design process are shown in Figure 1.

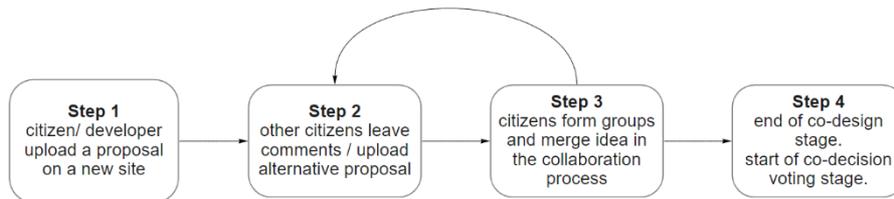


Figure 1. Co-design process.

Once the co-design time window has run its course, a new time window will then start for co-decision, during which citizens can vote on proposals. The co-design process may result in multiple proposals being put forward for voting. Proposal makers are likely to seek support for their proposals from the broader public through various social media platforms. Citizens can vote for multiple proposals, and for each proposal, they can vote either in for or against. The total number of votes for each proposal are then added up, with votes against being counted negatively. Proposals that reach a certain minimum total number of votes are then automatically approved. The key steps of the co-decision process are shown in Figure 2.

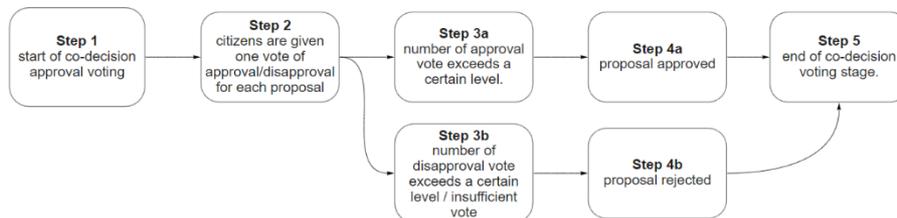


Figure 2. Co-decision process.

3. PD Web Platform

To support both the co-design and co-decision processes, a web platform is proposed.

This web platform aims to achieve greater citizen involvement in the PD process. The platform will support all aspects of the PD method, including uploading design proposals, giving design feedback, and voting on design proposals.

Two key issues are the process of generating design proposals, and the process of visualizing design proposals. For citizens with little design experience or training, these are both challenging aspects of the PD method.

3.1. GENERATING DESIGN PROPOSAL

For the co-design process, proposal makers need to be able to create their own design proposals. Proposal makers are assumed to be more committed and have more time than most citizens. Nevertheless, the process should still be made as easy as possible.

For creating designs, various web-based tools were studied that allow citizens to model their own designs. Two examples are the “Ideas for Tanjong Pagar” study (Tomarchio et. al, 2019) using the Qua-Kit tool and the “NIMBY” web game (Yenardi et.al, 2021). These examples are interesting since they allow citizens to create their own design proposals as a way of gathering feedback. However, to make the 3D modelling process simple and easy to use, these tools are constrained to produce only simplified geometric models. The approach would not work well for this use case, since design proposals for heritage sites cannot be easily constrained in this way.

For this reason, the decision was made to allow proposal makers to use existing 3D modelling tools to create 3D models of their proposals. To keep the modelling process as simple as possible, BIM modelling formats and tools would not be required. Instead, since the design proposals focus mainly on the exterior, geometric modelling tools such as Sketchup can be used. Models can then be uploaded in geometric forms such as Obj or GLTF.

3.2. VISUALISING DESIGN PROPOSAL

For both the co-design and co-decision processes, citizens need to be able to easily view and understand the impact of proposed designs from a variety of different vantage points in the city. For proposal makers, the level of expertise may be assumed to be a little higher. But for citizens that are giving feedback or participating only in co-decision, the assumption must be that they have little time and little experience in evaluating design proposals. The process of viewing design proposals, therefore, has to be fast and easy.

Relying on traditional representations such as architectural drawings will be too complex. To properly understand the impact of design proposals, it is critical to view proposed designs in 3D, within the urban context. The 3D models that are uploaded therefore need to be geo-located and viewable in ways that show the surrounding streets and buildings. Through tools such as Google Maps, citizens are mostly already familiar with two modes of viewing 3D models: birds-eye view and immersive view. We proposed to integrate these two modes into the proposed web app.

3.3. PROTOTYPE DESIGN PROPOSAL VIEWER

To test the feasibility of the proposed PD method, a prototype web application has been

developed for citizens to evaluate design proposals (Figure 3). This prototype focuses on the contextual viewing of 3D models within the urban context, as this is a critical requirement to make the whole approach viable.

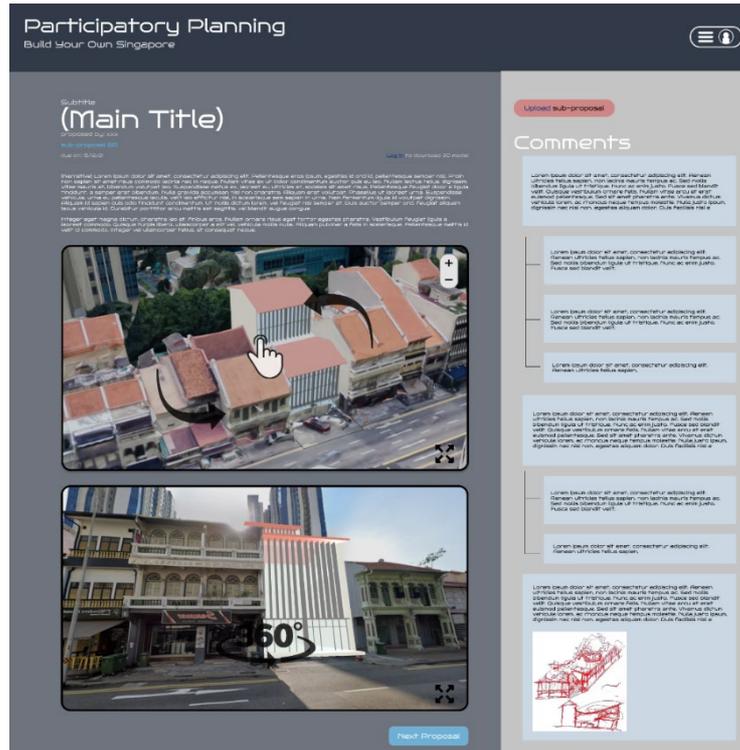


Figure 3. User-interface for reviewing individual proposal during the co-design stage.

The prototype allows users to view the uploaded 3D models in both bird's eye view and the immersive view, as shown in Figure 3. Both views include the surrounding context, allowing for a better understanding of the design proposal's scale and impact.

3.4. BIRD'S EYE VIEW

The bird's eye view mode allows citizens to understand the scale of the design in relation to the rest of the cityscape. Citizens can zoom in and rotate around the viewport to have a better understanding of the spatial relation between the design proposal and its neighbouring buildings.

One limitation of the Google Maps model is that it does not support modification and removal of existing geometry. For design proposals that include demolition of existing buildings, it is therefore not possible to remove these parts of the model. The research, therefore, envisages that, for the final implementation, a locally developed 3D city model would need to be used, with APIs that allow removal as well as the addition of geometry. In Singapore, the government has already developed such a

model, referred to as the Virtual Singapore model. Unfortunately, at the current time, the model is not yet made publicly available. As a result, the prototype will use static models extracted from Google Maps through RenderDoc as an interim solution for testing purposes. The existing Google Map base allows for easy navigation.

The prototype uses the JavaScript library three.js to display the uploaded .glTF 3D model file in the web application. This 3D model is overlaid onto the extracted 3D Google Map model and integrated with the different viewers.

3.5. IMMERSIVE VIEW

The 360° immersive view mode allows citizens to have immersive views of the proposed design from specific vantage points. In this viewing mode, the camera can be rotated, but the camera position cannot be moved. Similar to Google Street View, citizens can still navigate from one immersive view to another, which can still give a semblance of walking around.

The immersive view embeds the 3D model within a 360° equirectangular image of the urban context. This image wraps around the model, giving the impression that the model is placed inside a 3D context of surrounding buildings. In cases where the image includes objects that are both in-front of the design proposals as well as behind it, two equirectangular images can be created. In the example in Figure 3, we can see that various objects such as trees, signs, and lampposts appear in front of the design proposal, while everything else appears behind.

The key advantage of the immersive view mode is that is a highly efficient way of obtaining a realistic representation of the surrounding context. Citizens can easily create their own equirectangular images using a simple smart-phone app and upload the images to the web application, thereby creating new street-view locations. We can imagine that proposal makers will initially create a set of immersive-view locations that show their design proposal from the best point of view. Citizens can then create their own immersive-views, possibly highlighting some negative aspects of the proposed design. The immersive views can include images at different times of the day, images from surrounding buildings, or images from distant vantage points.

All design proposals can be viewed using the same set of immersive views. The prototype web app allows design proposals to be switched while in an immersive view, without changing the camera angle. This allows design proposals to be easily compared and contrasted.

4. PD Web Platform

To test the proposed method, a demonstration has been created for one of the heritages sites in Singapore, the Jalan Besar Secondary Settlement Conservation Area. The heritage site consists of a series of pre-war and post-war shophouses that were preserved mainly along the main streets. Certain plots of land along the strip were not under conservation status due to the original buildings being demolished prior to the site being gazetted as a conservation area (Figure 4 - left). Even though the allowable gross plot ratio on-site is 3.0 and the construction of rear extensions is permissible by law, plenty of buildings on-site have not maximized their development rights (Figure 4 - right). In the demonstration, the participatory design web platform is used to

simulate potential development changes on-site with two main purposes: i) to ensure careful insertion and modification of conserved buildings; ii) to monitor new developments on sites next to existing conserved buildings.



Figure 4. Jalan Besar Conservation Area analysis.

For the demonstration, two different design proposals have been created and a set of immersive views have been added. Both design proposals showcase how a new building can be built next to existing heritage buildings.

In the first set of views (figure 5 - left), the proposal shows a design intervention that responds to the gable roof form of neighbouring historical buildings by continuing the design language. However, looking at the 360-degree view on street level, we notice that the louvers façade design is too overwhelming compared to the bay-window design of the neighbouring architecture. In the second set of views (figure 5 - right), the design proposal shows a flat roof building with a roof garden on the building block in front. Even though the second proposal does not use the same gable-roof language, it still blends in well with the surrounding building due it having similar height and levels with neighbouring buildings. The 360-degree view on street level also shows that the second design proposal with three-bay windows blends in well with other historical buildings on site which also utilises the same three-bay windows language.

A user-test was carried out with laypersons with no architectural training, to test the efficacy of the web platform for obtaining feedback on potential future developments. Interviews were carried out in which participants were asked to evaluate and discuss the two designs created for the demonstration. The result indicated that the birds-eye and immersive views were easy to understand and were able to support design proposals discussion among laypersons.

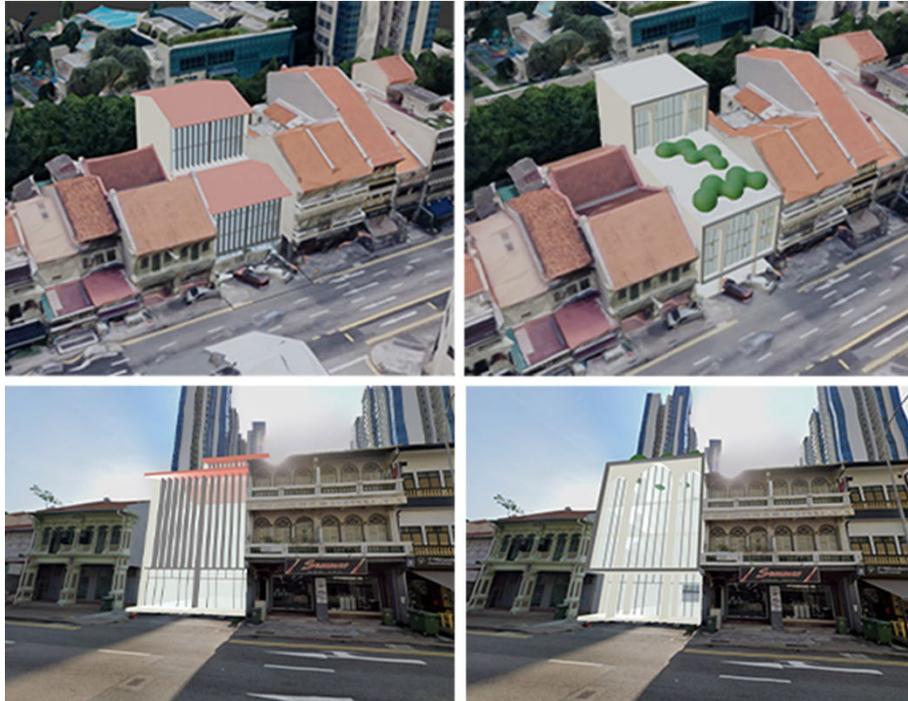


Figure 5. Demonstration showing different design proposals

5. Discussion

A proposed PD method devolves significant power to citizens. The method gives citizens direct control over the evolution of urban neighbourhoods in and around heritage sites in their cities. In the proposed method, citizens are able to participate in both a co-design process and a co-decision process. In the co-design process, they can gather to form committed citizen groups that make proposals and counter-proposals. Through this process, they have complete freedom to develop their own designs or to adapt other existing designs. In the co-decision process, the citizens get to vote on proposed designs. Design proposals are then approved or rejected solely based on the results from this voting process, without interference from external parties. The co-decision process gives citizens real power in determining the future changes to their city.

To support the proposed PD method, a web platform is proposed that supports all aspects of the PD method, including uploading design proposals, giving design feedback, and voting on design proposals. One of the key parts of this web platform is the process of viewing design proposals within the urban context.

To test the feasibility of the proposed PD method, a prototype of the web application has been developed for citizens to evaluate design proposals. The prototype allows design proposals to be viewed within the urban context from a birds-eye view and from multiple immersive views, submitted by citizens themselves.

The design proposal viewer has been demonstrated on a heritage site in Singapore, highlighting how different views can be used as evidence for supporting or rejecting design proposals. The web application contributed towards SDG Goal 11, 'sustainable cities and communities', by proposing a heritage conservation approach that values the contribution of the communities in both the design and decision-making processes.

In future research, the prototype web application will be further developed to include additional features. In particular, a more intuitive 3D modelling method is being explored that allows citizens to make changes to design proposals submitted by others. This will allow a more fluid conversation to emerge between citizens, all modifying each other's designs, with gradual convergence on a number of preferred options. Further research can also be conducted on the communication between the citizens and the architects to ensure that the citizens' choice of design in the conceptual stage can be accurately represented during the final detailed design stage.

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