

# DELTA: Promoting Young People Participation in Urban Planning

Mikael Reiersølmoen, Francesco Gianni<sup>(✉)</sup>, and Monica Divitini

Department of Computer Science, Norwegian University of Science and Technology,  
Trondheim, Norway  
mikael.reiersolmoen@gmail.com, {francg,divitini}@ntnu.no

**Abstract.** Today urban areas are growing fast, in this process it remains a challenge to include the opinions of the public. This holds especially true for young people. From the 1960's, the rights of the children started to be recognized through the UN Convention on the Rights of the Child. Article 12 of the convention states that children should have the opportunity to express their views in matters that affect them, like urban planning. Our work started analysing the literature and providing an overview of participatory methods used to include children in land-use projects. We then reviewed existing mobile apps targeting participation in public life. Based on the findings from the literature a list of high level requirements was created to guide the design and implementation of the mobile app DELTA. The DELTA app support situated participation encouraging users to explore the urban environment, promoting awareness and critical thinking. Several user evaluations are performed during the development cycles, including expert evaluations, usability and field tests of the final prototype. Based on collected data and lessons learned, results are discussed in relation to participation and learning outcomes for children.

**Keywords:** Mobile technology · Participation · Urban planning

## 1 Introduction

Though public participation in urban planning and design of urban spaces is recognized as important, conventional methods of public participation like public hearings, questionnaires and committee groups have failed to engage the majority of the public (Roberts 2004; Irvin and Stansbury 2004). This resulted in the ongoing multidisciplinary search for more collaborative ways of participation, where opinions and knowledge of citizens and stakeholders are taken into account through authentic dialogs, building social capital and trust (Innes and Booher 2004).

This holds especially true for young people. Since the 1960's, the UN Convention on the Rights of the Child, Article 12 states that children should have the opportunity to express their views in matters that affect them, like urban planning. In Norway, the law regulating planning and building underlines the importance of involving young people and assigns to municipalities the responsibility to ensure their active participation (Norwegian Government 2008).

Involving young people in processes of urban planning is important not only because it is their right (Francis 1988), but also because of their ability to evaluate their environments and come up with ideas of their own (Gleeson and Sipe 2006; Bartlett 2002; Horelli 1997). In addition, the process of participation is also a process of learning, improving their “environmental awareness, knowledge and skills” (Wilks and Rudner 2013) and teaching them how to negotiate and respect other people’s views (Corsi 2002).

Despite the increased recognition of young people as fully legitimated actors, it remains a challenge to sufficiently include them (Lansdown 2010). Attempts to do so can often be described as mostly including them for symbolic purposes and not supporting meaningful participation. To fully engage young people, there should be an effort to create new, innovative methods of participation that suit them, utilizes their knowledge and ideas, and make sure that their contributions are used.

In this paper we present the design and evaluation of DELTA<sup>1</sup>, a mobile app to promote youth participation in urban planning. More specifically, we focus on (i) how situated engagement increases awareness of challenges and opportunities in the local environment and (ii) how game elements can promote the process of participation. Situated engagement means that participation happens at the specific physical location through immersive experiences (Korn 2013). This might lead to a more sustainable form of engagement (Gordon et al. 2011). The rationale for this design choice is connected to the complexity of urban planning, and to the fact that methods of participation should match the capabilities and interests of participants. In addition to facilitating participation, situated engagement might increase participants awareness of challenges and opportunities connected to specific planning projects. Urban planning is not only complex, it is often also perceived as something uninteresting by many young people. It is therefore critical to create a solution that engages them, possibly through game elements.

The paper is organized as following. Next section discusses different approaches to participation of young people in urban planning, followed by related work. Section 4 presents DELTA, with focus on main functionalities, while Sect. 5 describes the three main iterations of its design and evaluation. Section 6 summarizes the results and Sect. 7 concludes the paper and presents future work.

## 2 Participation of Young People

Despite increased awareness, young people are still today insufficiently included in urban planning (Haider 2007; Wilks and Rudner 2013). Conventional methods of public participation fail to engage them, often being characterized by a high threshold to participation. To overcome these challenges, new forms of participation must be developed. Hart (Hart 1992) in the attempt to stimulate a dialog around the topic, proposed a “ladder of participation” to help framing children’s participation, ranging from a mainly symbolic participation to actual participation started by young people themselves. Frank (2006) reviewed several case studies about participation projects where children

---

<sup>1</sup> “delta” is the Norwegian word for “participation”.

assessed their local environment, formulated plans to take action, and took steps to support implementation of their idea. The findings strongly emphasize the positive outcomes of such projects, and thus the importance of working towards inclusion of young people in planning processes. Lessons learned point in the direction of “*giving youth responsibility and voice, building youth capacity, encouraging youthful styles of working, involving adults throughout the process, and adapting the sociopolitical context*” (Frank 2006, 633).

As part of our work, we reviewed 14 studies addressing the challenge of young people participation (Reiersølmoen 2016). These studies were identified through a systematic mapping of the literature, following the methods described in (Keele 2007). Articles were collected from several online databases and screened in two iterations. Several studies reported inclusion of children that was rather limited and mostly for symbolic purposes, as in (Breitbart 1995; Cunningham et al. 2003; Mallan and Greenaway 2011; Passon et al. 2008). Most of the analysed projects are covering only the lower levels of the ladder of participation proposed by Hart. Other studies focus on the general lack of participation among young people (Laughlin and Johnson 2011; Torres 2012; Dennis 2006; Malone 2013). Several of the analysed studies recognize that the methods used to include adults in planning processes, like public hearings and consultation meetings, are not likely to provide good results when used with young people (Spier 2013; Breitbart 1995; Cunningham et al. 2003; Laughlin and Johnson 2011; Dennis 2006; Mallan and Greenaway 2011). This awareness led to the development of less conventional participation methods, including free drawing, walking tours, photography, specific drawing tasks, and artworks. Horelli (Horelli 1997) conceptualize participation methods into five different groups. Most projects utilized multiple methods, mainly aiming at evaluating an environment or letting participants express their ideas. From the review, it is clear that the most popular participation methods are highly situated, as for example Lawrence Halprin’s concept of walkshop that combines walking tours with specific tasks along the way. Walkshops “*are based on the idea of experience, interaction and communication, not just talking. They become more profound because the approach knocks out the usual seminar or lecturing process that gets in the way of most creativity, because it informs people rather than allow them to discover through personal experience*” (Halprin et al. 1999, 43). In a similar vein, other methods let participants walk free in the physical space, while using drawings or photography as a way to focus and describe the environment. In some cases, participants walk together, sharing thoughts with each other and with facilitators, enabling for negotiation and sharing of ideas. Summarizing our review, there is a need for new forms of- and opportunities for participation to be developed, as most young people have yet to experience being actively involved in planning processes that affect their lives (Lansdown 2010). The reviewed projects show different efforts to promote real inclusion using methods that engage young people. Incorporating situated action in participation methods seems the most promising approach, and is backed by research stating that young people get an understanding of the environment by using their senses (Haider 2007) and when they engage with its features (Chawla and Heft 2002). These methods are, however, costly and time-consuming, generally including only a small number of participants. In the next section we explore how mobile applications have been used to support participation.

### 3 Related Works

Given the situated nature of many of the participation methods identified in the literature review, mobile apps seem to be a promising approach for technological support. The potential of mobile participation also emerged from interviews with city officials and political decision makers in urban planning, who preferred a web-based mobile solution over other approaches such as interactive public screens and design tables for multiple users (Oksman et al. 2014). Participation via smartphones is also expected to be more appealing for young people who normally do not interact with government services (Clark et al. 2013), as they are early to adopt new technologies and shape how they are used (Castells et al. 2009). Example of mobile apps for public participation include solutions that enable citizens to report damages in the city, or provide up-to-date information about it. Most of the efforts to facilitate participation using smartphones fall under the category of informing apps, there is a lack of apps that enable the public to participate in more profound ways (Bohøj et al. 2011). We reviewed the literature for apps that facilitate situated engagement in urban planning. The features and characteristics of the five apps that were analysed are now briefly presented.

**Mobile Democracy** (Bohøj et al. 2011) allows citizens to express agreement/disagreement, comment and upload photos related to particular topics discovered by browsing a map. Augmented reality is also used to position urban elements on top of the smartphone camera view. In **Augmented Reality** (Allen et al. 2011) the focus of the app is to overlay predefined graphic models on existing buildings. The user could therefore only tilt and pan the phone to look at the model, but not move around. It is also possible to rate the different models. **FlashPoll** (Schröder 2014) is an app allowing users to answer location-specific polls, it's designed to overcome the shortcomings of face-to-face participation. Polls are location-based and citizens can participate only when they move in the poll area. **Tienoo** (Kangas et al. 2015) was developed to collect location-specific opinions about forests in Finland. It allows geolocated data collection to happen in real time.

**Community Circles** (Lehner et al. 2014) is based on ideas coming from location-based games, the goal is to enable long-term participation in urban planning. Users create location-specific issues, ideas, opinions or polls that other users can comment, upvote or downvote.

### 4 DELTA: An App for Participation

In this section we present DELTA, the app we designed to promote participation in urban planning. While in this section we focus on the main functionalities, in Sect. 5 we present the design process and how the app developed through three main iterations. DELTA is designed to support situated participation and it is inspired by the idea of workshops (Halprin et al. 1999). DELTA has as target group young people with fully developed writing and reading skills, mainly teenagers.

## 4.1 High level requirements

After reviewing existing apps and participation methods, we identified a list of high-level requirements for our solution.

**HLR1 Location-based:** DELTA should support activities to take place at the location where participation is desired, in terms of ideas or feedback on possible solutions. Participation should be based on participants actual perception of the place.

**HLR2 Engaging:** One of the implicit goals of DELTA is to include the voices of young people in urban planning, and therefore the user must be given an incentive to use the application, it must be engaging. One place to look for inspiration is geocaching. Common motivations for geocaching are: social walking, exploring new places, collecting caches, social status online, competition and challenges (O'Hara 2008).

**HLR3 Collaborative:** DELTA should support collaboration among users. Collaboration helps create better ideas, represents the importance of negotiation in urban planning and creates opportunities to share opinions.

**HLR4 Project support:** DELTA should inform the user about ongoing or planned projects in the city.

These requirements focus on the perspective of the citizens, without considering urban planners. Indeed, the app is complemented by a back-end solution for urban planners to add and manage projects, but this is outside the scope of the paper and it will not be explained further.

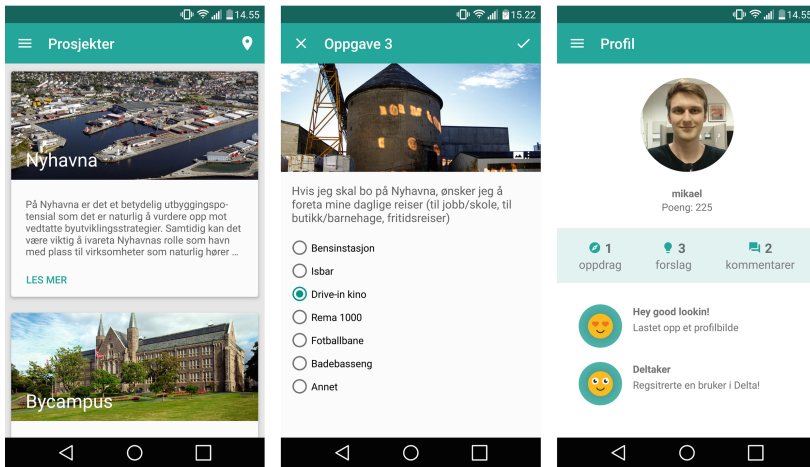
## 4.2 App description

DELTA is designed to enable and motivate young people to participate in urban planning. From the app, users can get an overview of active urban planning projects in their area and they are allowed to contribute in several ways: (i) they can complete surveys, (ii) post suggestions, and (iii) discuss suggestions. These functionalities are paired with game elements such as personal points (score) and achievements. The decision to structure the app around projects is related to HLR4. The inclusion of surveys is inspired by FlashPoll and Tienoo apps, described in chapter 3, while how the surveys are designed is largely inspired by the concept of workshops, which relates to HLR1 and HLR2. The ability to post and discuss suggestions satisfies HLR3, while game elements relate to HLR2, which is connected to make the participation engaging.

The main screen of the app is a map showing the current location of the user. Locations of planning projects that are under development are marked on the map, with colors indicating one of three different states: no active survey, completed active survey, and uncompleted active survey. Users can select a project to read more about it and start the connected survey.

**Projects** - Projects should be added by planners, every survey is connected to and resolves around one specific project. Suggestions posted by users must likewise be posted within one of the active projects (Fig. 1, left). Exceptions are scores and

achievements, explained more in detail later in the chapter, which are not project-specific. The app shows the location of the planning projects on a map so users get an overview of what planning projects are currently under development in the area.



**Fig. 1.** List of active projects, task answering interface and personal profile.

**Survey** - A survey is designed like a treasure hunt, where each task of the survey (Fig. 1, center) is connected to locations that the user has to find. To complete a task the user must be in close proximity of its location. The user will not see the coordinates marked on the map, but will see approximately how far away the location is. After a task is completed the user will have to navigate to the next with the help of a textual description which references the map and elements of the surrounding environment. The idea behind the surveys is inspired by Lawrence Halprin's concept of city walks. Participants receive a set of instructions that guide them to certain locations, where they are asked to contribute with ideas and thoughts about the place (Halprin et al. 1999). The walk is designed to bring awareness of problems and opportunities in the city (Hirsch 2011). The intention is not simply getting from one place to another as quickly as possible, but to see the connection between places (Hirsch 2011). Participants are forced to look up from the smartphone, increasing awareness of the surrounding environment. Game elements are used to create a more challenging and engaging participation process, without reaching a difficulty that can interfere with the experience. Participants are encouraged to cooperate, since the treasure hunt is likely an activity that people will enjoy doing together. Planners design the route they want the participants to follow, which allow to craft an experience that pays particular attention to specific places along the way. There are four different types of tasks, which consists of one or more questions. The difference in the task types is how the questions can be answered: it can be through a linear scale, multiple choice, check-boxes or free text.

**Suggestions** - A suggestion consists of an image, a title and some describing text. Other users can agree or disagree, and they can comment on it. Creation and interaction with suggestions can happen later in time, regardless of the physical position of the user.

The opportunity for users to comment and express agreement or disagreement on other user's suggestions is the fundamental way in which the app supports collaboration among users, as it encourages dialog between citizens.

**Profile page** - Each user has a profile page (Fig. 1, right) which shows an overview of the activities in the app: suggestions, comments, agreements and disagreements, and number of surveys answered. The profile page also shows the user's score and list of achievements.

**Game elements** - Certain activities are rewarded with points and achievements. As an example users get points for completing a survey, post suggestions or receiving agreement on posted suggestions. Achievements are rewarded when reaching predefined milestones, for example taking two surveys or after the fifth suggestion posted. A public leaderboard reports the ranking of the users. The game elements are intended to increase engagement using rewards and competition. This encourages high quality contributions since the best way to get a high score is to post suggestions that receive many agreements.

## 5 Design Process and Evaluation

The prototype described in Sect. 4 was developed through three iterations. The first iteration defined the concept, a low-fidelity prototype was created and evaluated using expert interviews. In the second iteration a functional prototype was developed and its usability tested. On the third iteration the prototype was refined and another expert evaluation was conducted. More information is available in (Reiersølmoen 2016).

### 5.1 Iteration 1: Expert evaluation

A first interactive mockup for internal use was built using an online diagram tool<sup>2</sup>. The mockup was then used as a blueprint for the first prototype of the Android app that was tested during the expert evaluation. The app allowed to navigate into different views, but the content displayed was static. The evaluation of the first iteration consisted of semi-structured interviews with four persons, with the main goal to present the concept and collect feedback regarding its potential. The subject of the interviews were: F1, 15 years old, member of the youth city council and representative of the end users of the app; F2, 28 years old and M1, 44 years old, respectively researcher and professor from the faculty of Architecture and Fine Arts, with expertise in urban planning; M2, 45 years old, employee in the local municipality with responsibility for involvement of young people. The interviews started showing some pictures of the app while in use in several urban contexts, then more detailed questions were asked while demonstrating different functionalities. Audio recording were collected and transcribed for analysis.

**Results.** F1 was positive about the concept, it was perceived as a tool to allow more people to participate, not only those who are actively engaged in committees. The ability to comment people suggestions was seen as a useful way to understand different

---

<sup>2</sup> [www.lucidchart.com](http://www.lucidchart.com).

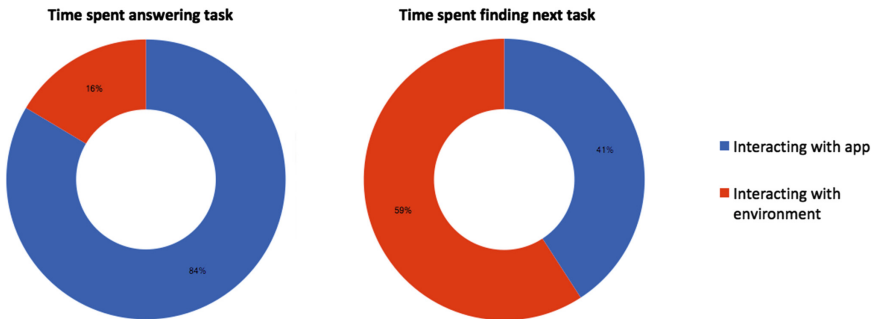
viewpoints. F1 believed that young people can be willing to perform the survey/treasure hunt on their own initiative if they are interested in the urban area. M2 reflected on how the approach of physically going in the area of interest to provide feedback might facilitate participation. It was also highlighted how different it is from the approach currently in use by the municipality. In comparison to other projects M2 was familiar with, DELTA was seen as more focused and connected to specific planning projects, which facilitated the planners in getting direct feedback and provided more guidance to the users. Discussing the requirement of being situated in the urban area, M2 thought that situatedness would increase awareness, especially if the area is not usually frequented by the user. However, he was unsure if a treasure hunt would make sense without a preliminary briefing with the users. Overall M2 believed that the tool “*can be valuable when facilitating children and youth’s influence*” and the score mechanism can be an engaging factor when users compare their performance at the end of the day. M1 and F2 provided feedback more connected to the planner interface, that was desired as easy to use as the rest of the app. The fact that participants had to navigate using reference points in their surroundings, and not only an interactive map, was seen as a positive factor. M1 expressed some concerns regarding the motivation for using the app, and whether or not the game elements were enough to engage. Additional motivation could possibly come in the form of physical rewards along the treasure hunt. Another proposal to increase the engagement was to let people draw on top of the pictures added as suggestions, which was believed to be particularly fun for younger users.

## 5.2 Iteration 2: Usability evaluation

On the second iteration, the static data used in the first prototype was replaced by real data. A short pilot evaluation took place right after the functional prototype was ready, then the usability test was performed outdoor with a group of five university students coming from three different study programs. Participants were given first a short presentation of the concept, then they were requested to perform a set of tasks covering all the functionalities. The most comprehensive task required to complete a treasure hunt outside, around the university campus. Participants were encouraged to follow a think-aloud protocol. Data logging was performed following multiple strategies: (i) smartphone screen was recorded, including on-screen touch events; (ii) suggestions and notes were taken by the facilitator which acted as an external observer; (iii) users were equipped with a head-mounted camera, which allowed to capture how they interacted with the smartphone and the environment. At the end of the tasks, users compiled a questionnaire about the perceived usability of the app using the System Usability Scale (Tullis and Stetson 2004). In the analysis of the data we focused on identifying errors in the user interaction, defined as unintended or wrong actions the user made while completing a task. The footage from the head-mounted camera was used to extract the following metrics: (i) time spent on the survey; (ii) time spent finding locations; (iii) time spent answering tasks; (iv) time spent interacting with the app; (v) time spent interacting with the environment.



**Results.** We recorded 8 minor usability errors. In all the cases except one, the user expected a certain interaction, but nothing happened. Participants still managed to complete the given task in all case. Three more severe errors were reported, where the app resulted in an unwanted state. Only one of these errors was considered of high severity, based on how hard was for the user to recover from the unwanted state. During the survey, on average users spent 27% of their time answering the tasks and the remaining 73% finding the next one. In Fig. 2 we report statistics on the average time spent by the users interacting with the app versus the surrounding environment. Results from the questionnaires showed high usability (Tullis and Stetson 2004).



**Fig. 2.** Time spent interacting with app and environment.

### 5.3 Iteration 3: Final expert evaluation

The most critical problems highlighted during the usability evaluation were fixed to make the prototype ready for the final evaluation. This evaluation was different from the usability test in a number of ways: (i) the evaluation was conducted in a real environment, at a place with an active redevelopment process; (ii) the survey in the prototype was more carefully designed with the help of experts; (iii) the participants volunteered because of their interest in the concept; and (iv) the participants just completed the survey, without performing predefined tasks. These factors, along with a refined prototype, resulted in valuable feedback on the potential of the concept. To start with, tasks for the survey were defined by architects. Their contribution was a set of questions with possible answers.

When the survey was ready, participants were recruited from the Physical Planning program at Department of Urban Design and Planning, four people volunteered because of their interest in the concept, 2 males and 2 females. Choosing Urban Design and Planning students had a twofold role, on one side they were close to the age of the target user, on the other they had knowledge about planning and could see the concept also from the perspective of an urban planner. After the in-app survey was completed by the users, participants had the opportunity to post suggestions and interact with the rest of the app. A semi-structured group interview was held afterwards.

**Results.** The contribution from the architects to create a survey worked as an evaluation of task types, and two of the task types in DELTA, multiple choice and check-boxes, were introduced in this phase. Creating surveys emerged as a process requiring a good degree of situatedness. For example, when the defined questions were mapped to specific places, some of the questions were far away from any other question, and it would be difficult to describe the path between them without using pins on the map. To solve this problem, some of the more general questions not referring to a specific place were placed strategically to create a route without very long distances between each task. Also, one task had to be removed, since the whole area was closed by a fence.

During the evaluation, the participants provided suggestions for improving engagement and effectiveness of the solution. One suggestion was to physically tag urban objects using the smartphone or draw upon pictures of them. It was unclear how this would support public participation, but was perceived as a way to increase the awareness of the public space. One participant declared that she was motivated in reaching the next location by the distance indicator. However, some kind of reward was expected at the end of the treasure hunt. The time spent finding tasks was suggested to be used as a performance indicator to assign extra points to the users. Some users suggested to allow participants to add different symbols on the map in order to provide specific feedback connected to the exact point where the participant is located. The symbols could simply be a green and red mark to indicate positive and negative places. On the overall, the evaluation of DELTA was positive and all participants evaluated it as a tool with good potential to improve participation among young people.

## 6 Discussion

Results from the evaluation of DELTA confirmed the effectiveness and attractiveness of the concept. Situated action was perceived as useful, especially when the geographic area was not usually frequented. Situated engagement in this context fits especially well, compared to just sitting in a room browsing maps or other support material. A challenge connected to deploying the app for a short time in a certain context, is that it might not give enough time for the reward system to reach its full potential, which requires users to post suggestions and interact with them during time. However, if the participants are sufficiently engaged in the app and the context, they can be willing to continue using the app also when the organized event is over.

During our tests, all the users managed to correctly complete all the tasks without help. From the questionnaire, participants perceived the app as very usable. It is here important to underline that most of the participants interacted more with the environment than with the smartphone when navigating between the tasks. This is a positive outcome compatible with the objective of increasing awareness of the surroundings environment and consequently improving quality in the contribution.

Suggested improvements included adding some activities along the route of the survey, providing some hints about how the next location is like and publishing the results in order to freely share the contributions. These suggestions can be interpreted as the need for more diverse engagement mechanics based on the physical environment

and the recognition of a significant outcome, perceived important enough to be shared with the community to facilitate the change.

Participants highlighted the limitations of traditional methods and the increased awareness provided by DELTA: (i) maps can be easily misunderstood; (ii) it's easier to provide feedback when physically located in the context; (iii) moving around allows contributing from a new perspective, increasing the quality of the feedback. The game elements adopted to shape the survey served well for the purpose and were positively accepted during the tests, contributing in engaging participants. Game elements in the prototype were intended to also motivate and support continuous participation. However, this outcome cannot be confirmed without testing over a longer period. Also, it remains unsure whether or not the app would be used by young people on their own initiative, although the youth city council member that we interviewed during the first iteration suggested that people would be willing to engage on their own initiative as long as the projects were also seen as interesting and close to their home.

## 7 Conclusions

The research presented in this paper investigates how to support participation of young people in urban planning. Based on a review of methods of participation, we decided to focus on situated engagement and include game elements in the design of an application for smartphones. A state of the art analysis on public participation apps was performed to ground the work and build on top of current research on the topic. DELTA was then developed and tested in three iterations. The evaluation of the app in the three phases was very positive and some of the experts have expressed their willingness to try it out to promote participation in some of the controversial redevelopment projects currently ongoing in the city.

Technically, this requires to port the app to other platforms, so that it can be used in a large scale field study. Future work will also focus on how DELTA can be integrated into e.g. school activities so to motivate usage, but also to improve its learning impact. Finally, an in-app or web-based interface for planners needs to be created. Until now we have focused on using the app, rather than creating projects and surveys. This is however critical if the app has to be used on a regular basis. As part of this work it will be interesting also to consider how surveys could be created not only by city planners or teachers, but also by young people themselves. This will allow to move one step further in the ladder of participation (Hart 1992).

## References

- Allen M, Regenbrecht H, Abbott M (2011) Smart-Phone Augmented Reality for Public Participation in Urban Planning, pp 11–20
- Bartlett S (2002) Building Better Cities with Children and Youth
- Bohøj M, Borchorst NG, Bødker S, Korn M, Zander, P-O (2011) Public deliberation in municipal planning: supporting action and reflection with mobile technology. In: Proceedings of the 5th international conference on communities and technologies, pp 88–97. ACM

- Breitbart MM (1995) Banners for the street: reclaiming space and designing change with urban youth. *J Plann Educ Res* 15(1):35–49
- Castells M, Fernandez-Ardevol M, LinchuanQiu J, Sey A (2009) *Mobile Communication and Society: A Global Perspective*. MIT Press, Cambridge
- Chawla L, Heft H (2002) Children's competence and the ecology of communities: a functional approach to the evaluation of participation. *J Environ. Psychol.* 22(1–2):201–216
- Clark BY, Brudney JL, Jang S-G (2013) Coproduction of government services and the new information technology: investigating the distributional biases. *Public Adm Rev* 73(5):687–701
- Corsi M (2002) The child friendly cities initiative in Italy. *Environ Urbanization* 14(2):169–179
- Cunningham CJ, Jones MA, Dillon R (2003) Children and urban regional planning: participation in the public consultation process through story writing. *Children's Geographies* 1(2):201–221
- Dennis SF (2006) Prospects for qualitative GIS at the intersection of youth development and participatory urban planning. *Environ Plan A* 38(11):2039–2054
- Francis M (1988) Negotiating between children and adult design values in open space projects. *Des Stud* 9(2):67–75
- Frank KI (2006) The potential of youth participation in planning. *J Plan Lit* 20(4):351–371
- Gleeson B, Sipe N (2006) *Creating Child Friendly Cities: New Perspectives and Prospects*. Routledge
- Gordon E, Schirra S, Hollander J (2011) Immersive planning: a conceptual model for designing public participation with new technologies. *Environ Plan B Plan Des* 38(3):505–519
- Haider J (2007) Inclusive design: planning public urban spaces for children. In: *Proceedings of the institution of civil engineers-municipal engineer*, pp 160:83–88. Thomas Telford Ltd
- Halprin L, Hester Jr RT, Mullen D (1999) Lawrence Halprin [Interview]. *Places* 12 (2)
- Hart, RA (1992) *Children's Participation: From Tokenism to Citizenship*, vol 4. Innocenti Essays. ERIC
- Hirsch AB (2011) Scoring the participatory city: lawrence (& Anna) halprin's take part process. *J Architectural Educ* 64(2):127–140
- Horelli L (1997) A methodological approach to children's participation in urban planning. *Scand Hous Plan Res* 14(3):105–115
- Innes JE, Booher DE (2004) Reframing public participation: strategies for the 21st century. *Plan Theory Pract* 5(4):419–436
- Irvin RA, Stansbury J (2004) Citizen participation in decision making: is it worth the effort? *Public Adm Rev* 64(1):55–65
- Kangas A, Rasinmäki J, Eyvindson K, Chambers P (2015) A mobile phone application for the collection of opinion data for forest planning purposes. *Environ Manage* 55(4):961–971. doi: [10.1007/s00267-014-0438-0](https://doi.org/10.1007/s00267-014-0438-0)
- Keele S (2007) Guidelines for performing systematic literature reviews in software engineering. In: *Technical Report, Ver. 2.3, EBSE Technical Report*. EBSE.sn
- Korn M (2013) *Situating Engagement: Ubiquitous Infrastructures for in-Situ Civic Engagement*. Ph.D. thesis, Aarhus Universitet/Aarhus University, Science and Technology/Science and Technology, Institut for Datalogi/Department of Computer Science
- Lansdown, G (2010) The realisation of children's participation rights: critical reflections. In: *A handbook of children and young people's participation: perspectives from theory and practice*
- Laughlin DL, Johnson LC (2011) Defining and exploring public space: perspectives of young people from regent park, Toronto. *Children's Geographies* 9(3–4):439–456

- Lehner U, Reitberger, W, Baldauf M, Fröhlich P, Eranti V (2014) Civic engagement meets pervasive gaming: towards long-term mobile participation. pp 1483–1488. doi: [10.1145/2559206.2581270](https://doi.org/10.1145/2559206.2581270)
- Mallan K, Greenaway R (2011) Radiant with possibility: involving young people in creating a vision for the future of their community. *Futures* 43(4):374–386
- Malone K (2013) The future lies in our hands’: children as researchers and environmental change agents in designing a child-friendly neighbourhood. *Local Environ* 18(3):372–395
- Norwegian Government (2008) Planning and Building Act, June
- O’Hara, K (2008) Understanding geocaching practices and motivations. In: Proceedings of the SIGCHI conference on human factors in computing systems, pp 1177–1186. ACM
- Oksman V, Vääätänen A, Ylikauppila M (2014) Co-creation of sustainable smart cities: users, participation and service design. pp 189–95
- Passon C, Levi D, del Rio V (2008) Implications of adolescents’ perceptions and values for planning and design. *J Plan Educ Res*
- Reiersølmoen M (2016) Facilitating children and youth’s participation in urban planning
- Roberts N (2004) Public deliberation in an age of direct citizen participation. *Am Rev Public Adm* 34(4):315–353
- Schröder C (2014) A mobile app for citizen participation. November 2014, pp 75–78. doi: [10.1145/2729104.2729137](https://doi.org/10.1145/2729104.2729137)
- Spier, JJ (2013) A walk in the park: an experiential approach to youth participation. *Youth Studies Australia* 32 (3)
- Torres J (2012) Participation as a pedagogy of complexity: lessons from two design projects with children. *Urban Des Int* 17(1):62–75
- Tullis TS, Jacqueline NS (2004) A comparison of questionnaires for assessing website usability. In: Usability Professional Association Conference, pp 1–12
- Wilks J, Rudner J (2013) A Voice for Children and Young People in the City. *Aust J Environ Educ* 29(1):1–17