

Users, Goals and Needs: Approaching the Usability of 3D Co-Planning Tools

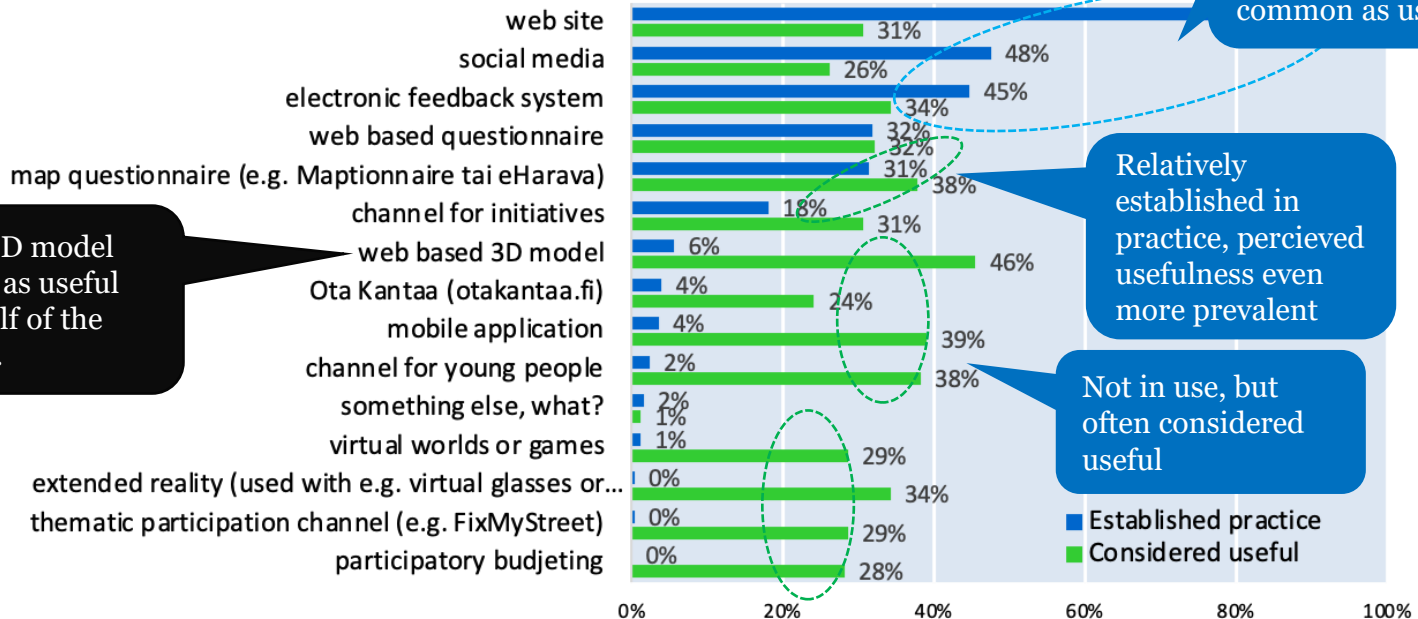
Pilvi Nummi, postdoctoral researcher
21.4.2021 Smart and Livable City



Aalto-yliopisto
Insinöörیتieteiden
korkeakoulu



Which eParticipation tools are established in the organization? Which tools do you consider useful? (n = 248)



Web based 3D model was selected as useful by almost half of the respondents.

Established in practice, perceived usefulness not as common as use

Relatively established in practice, perceived usefulness even more prevalent

Not in use, but often considered useful

Source: Nummi (2018). Sähköinen osallistuminen alueiden käytön suunnittelussa (eParticipation in urban planning survey), Ministry of the Environment, Finland.

21.4.2021

You may end up designing digital tools for urban planning

GreenTwins



The GreenTwins project develops a layer of **green infrastructure** in urban digital twins of Helsinki and Tallinn, and produces **three new user interfaces** to urban digital twins in order to harness the potential of urban digital twins in advancing planning processes and democratic decision-making.

One of the tools is a **web-based co-planning application** developed by Petri Kangassalo.



Screen capture of the GreenTwins Co-planning tool © Petri Kangassalo and Smart City Center of Excellence

Co-planning

- Collaborative urban planning with different stakeholders
- Administration-led or citizen-led (bottom-up)
- Builds on the tradition of participatory planning theory, that emphasizes **communicative activities** and **collaborative knowledge building** in planning practices



3D co-planning can be carried out in different settings: face-to-face, online and hybrid setting. Picture © Pilvi Nummi

User-centered approach

- Users and their needs are in the center of the development
- Usability is user, context and task dependent
- The development team has to understand:
 - *Who are the users? (user groups)*
 - *What are they aiming at, and why? (needs, goals and activities)*
 - *In what context are they using the tool? (use context)*



User-centered approach is needed to understand the different contexts and user groups of co-planning tools. Big room may be one use context for these tools.

PACT framework for UCD

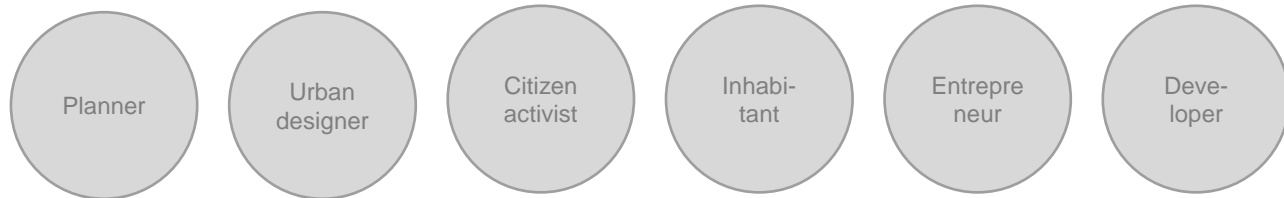
Usability aims to achieve a balance between PACT elements

People	<i>Who are the users? What are their physical and physiological characteristics? What kind of mental models they have?</i>
Activities	<i>What are the users trying to achieve with the tool and why (purpose of the activity)? What features support these activities? How frequently tasks are carried out? Is it co-operative or not? Safety-critical? What content is needed (information, media)?</i>
Context	<i>Activities happen in contexts. What is the social and organizational context like? What about physical circumstances?</i>
Technology	<i>Technology can improve the activities in the context. What possibilities and restrictions the available technology gives?</i>

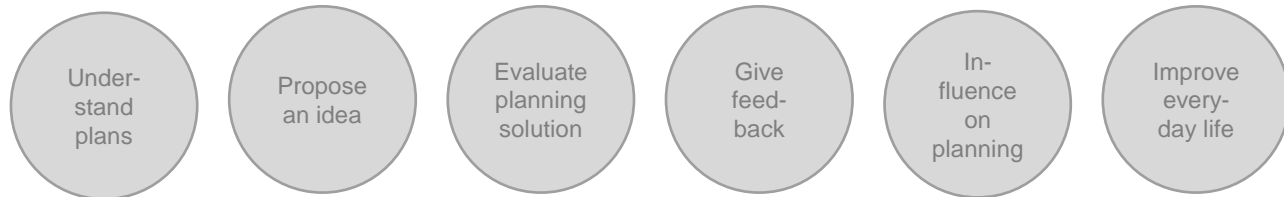
Benyon, Turner & Turner, 2005; Benyon, 2019

PACT in co-planning context

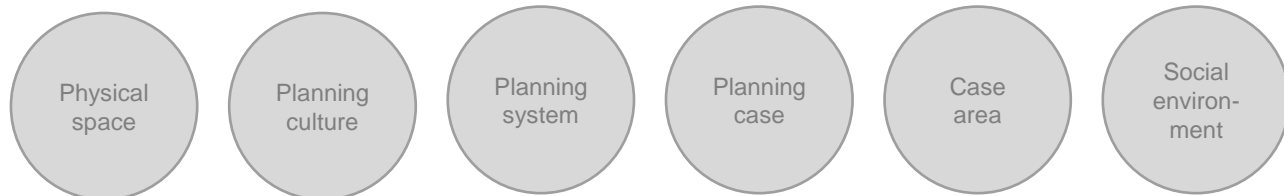
People



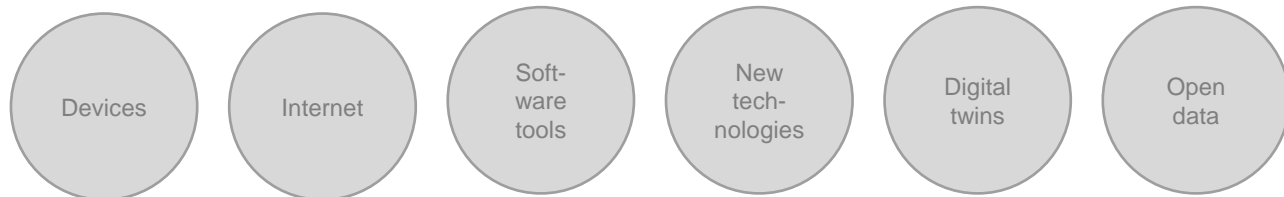
Activities and goals



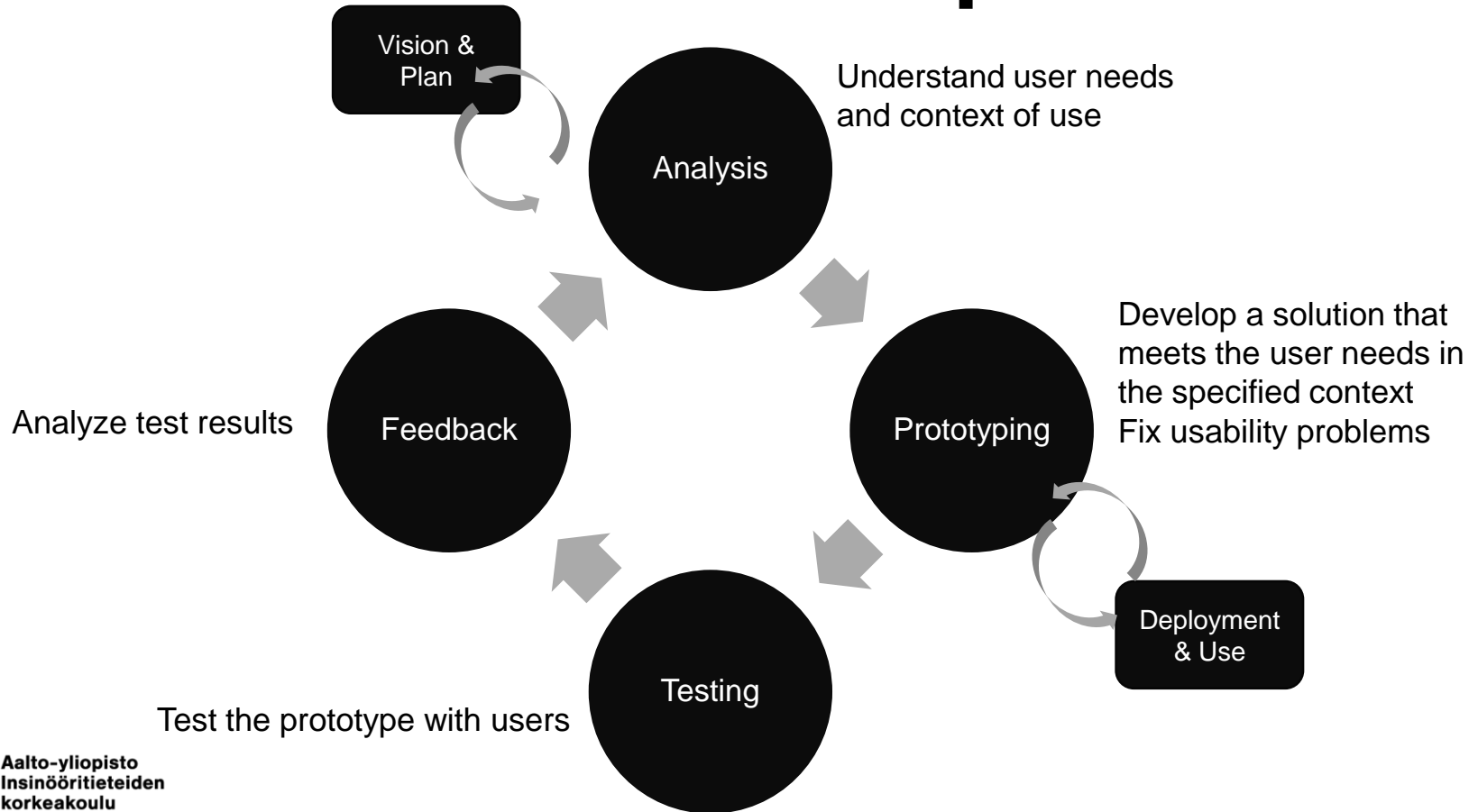
Contexts



Technology

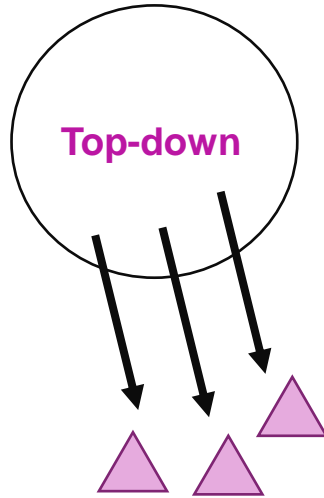


Iterative user-centered process

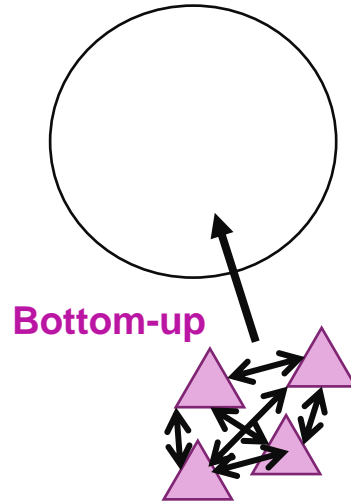


Role of the user

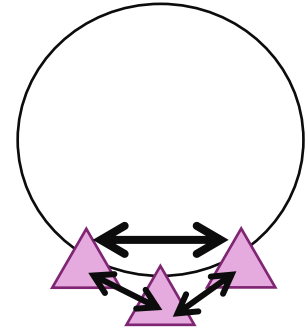
Design
process



User-centered



User-Driven



Co-creation

Defining usability

Five quality components of usability (Nielsen, 1993; Nielsen Norman Group, 2012):

- **Learnability:** How easy is it for users to accomplish basic tasks the first time they encounter the design?
- **Efficiency:** Once users have learned the design, how quickly can they perform tasks?
- **Memorability:** When users return to the design after a period of not using it, how easily can they reestablish proficiency?
- **Errors:** How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
- **Satisfaction:** How pleasant is it to use the design?

Usability of eParticipation:

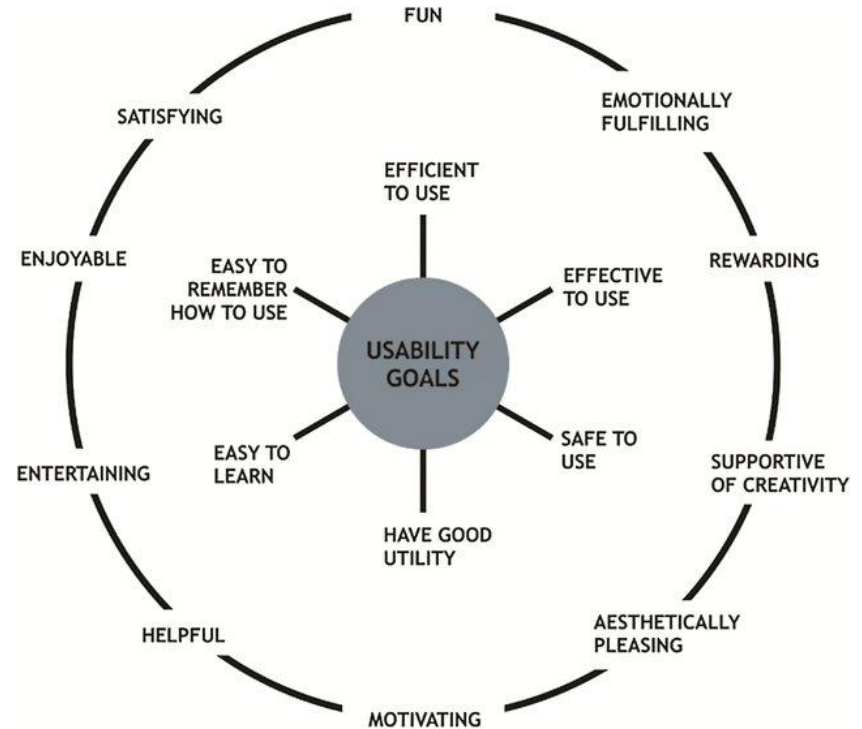
- **Accessibility:** Inclusiveness for people with disabilities has become even more important during the pandemic (Bricout et al, 2021)

Other usability goals that are relevant in the context. For example:

- **Readability** (part of learnability)
- **Inclusiveness** (context dependent, see Zhang et al 2019)
- **Interactivity** (Zhang et al 2019)

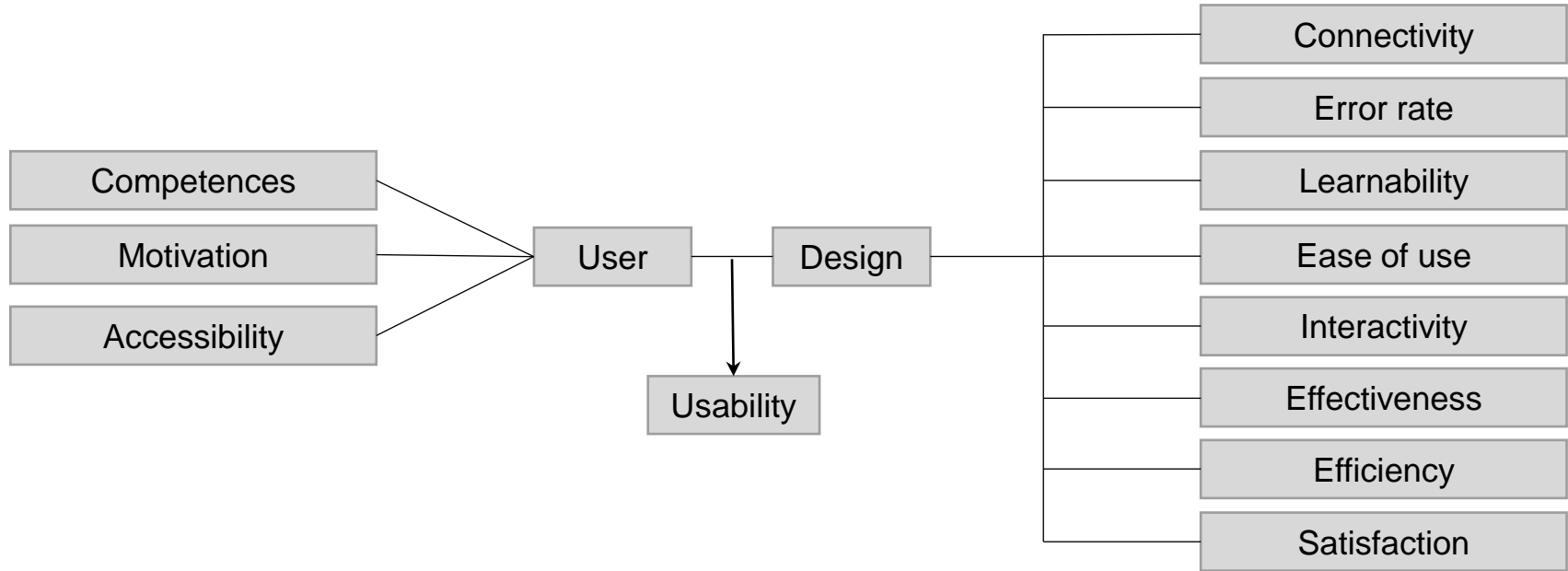
User Experience (UX)

- **UX is a wider concept than usability:**
 - user experience starts before the actual tool is used and continues after using it



Usability goals and dimensions of user experience
(Preece et al, 2002)

User-design fit model for Web-based PPSS



Usability inspection (analytical)

- **Heuristic evaluation is an analysis of usability of the user interface done by an expert**
- **Usability heuristics are rules of thumb that are used to analyse possible usability problems of a user interface**

Jacob Nielsen's 10 Usability heuristics:

- #1: Visibility of system status
- #2: Match between system and the real world
- #3: User control and freedom
- #4: Consistency and standards
- #5: Error prevention
- #6: Recognition rather than recall
- #7: Flexibility and efficiency of use
- #8: Aesthetic and minimalist design
- #9: Help users recognize, diagnose, and recover from errors
- #10: Help and documentation

Testing with users (empirical)

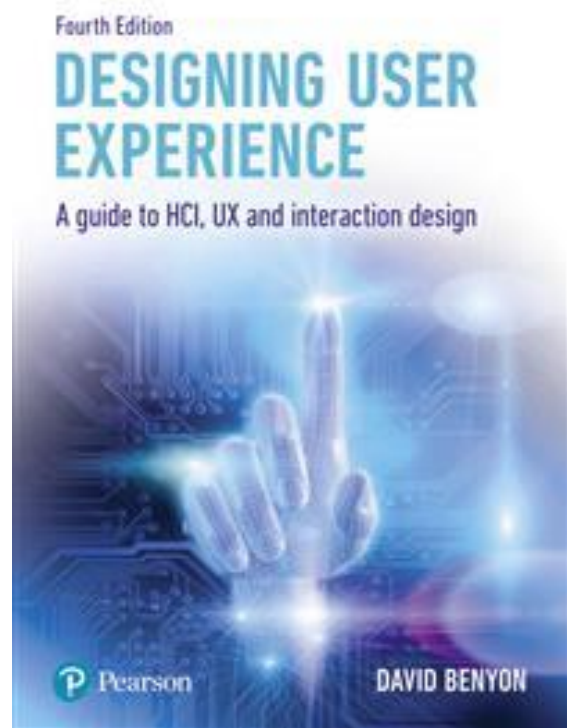
Empirical evaluation of the usability:

- Observation of the use
- Logging user's activities
- Interviews
- Surveys
- Etc.

Reading recommendation

Benyon, David (2019)

Fourth Edition
Designing User Experience
A guide to HCI, UX and interaction design
Pearson, UK



Usefulness of 3D visualization tools for participatory planning

Usefulness as a communication and visualization tool:

- 3D visualization helps to **communicate** plans with various stakeholders. (Onyimbi, Koeva & Flacke, 2018)
- Reduces participants frustration and fear against density by helping to **understand the planning proposals impact** (e.g. building height, mass) (Polys, Dunay, & Schenk, 2018)
- **Stimulates discussion** and **piques interest**, helps to **build shared understanding** about density (Polys, Dunay, & Schenk, 2018)
- May **change** the participants **perception** about a plan (Pouke et al, 2019; Polys, Dunay, & Schenk, 2018)
- Preferences about the **level of detail** / abstraction differs per user group (expectations, risk of misunderstanding) (Nielsen, 2005)

→ **Helps to assess physical and visual change, but what about other aspects like cultural, social, functional and ecological impacts?**

Usefulness of 3D visualization tools for participatory planning

Usefulness of 3D vs. 2D is closely related to the planning tasks undertaken (Herbert & Chen, 2015)

- **Creating a mental image**: 3D is helpful in improving site familiarity and sense of context, and understanding the relationship between buildings and their surroundings (Herbert & Chen, 2015)
- 3D visualizations are more useful in **complex tasks** that require more imagination (like shadow impact analysis) (Herbert & Chen, 2015)

→ **3D co-planning tools should be designed to fit to the specific tasks in different stages of the planning process, also taking into account the planning level**

Analysis of two 3D Co-Planning Tools

Users' role in the process:
What was the role of the end users in the process?
How did they engage end-users?

Strategic goals:
What kind of expectations and goals are set for 3D participation tools?
How are these goals met with the tools?

Usability goals:
What kind of usability goals are set?
How are these goals met with the tools?



Methods

- **Literature review**
 - Usefulness and usability in the context of 3D and participatory / collaborative urban planning
- **Empirical:**
 - Document analysis (project reports of the tools)
 - Expert evaluation of the tools (usability inspection)
- **Further research methods:**
 - Interviews to unravel the development process in detail?
 - Usability testing with actual users to reveal critical problems and usefulness?

OULU Digikaava

Hanke 1.8.2017 - 31.12.2018

Oulun Lasaretti-korttelin alueelle suunnitellaan täydennysrakentamista. Nykyiset toiminnot ja arvokkaat rakennukset alueella säilyvät. Maankäytön suunnitteluratkaisun löytämiseksi järjestettiin 2017 arkkitehtuurikutsukilpailu, jonka voittajatyö on ollut maankäytön suunnittelun perustana.

Asemakaavan muutosalue lähiympäristöineen kuuluu Oulujoen suistoalueen historialliseen



AIKAJANA

“Digikaava” on MapGets

Does the tool answer to strategic goals?

Strategic goals:

- Lean and short planning process
- Interconnect processes, plans and information
- Effective and enhanced interaction between stakeholders

Usability goals:

- Readability and clarity of planning information
- One-click method to find the root cause of a planning solution

What's the benefit of 3D?

One workshop

Beta testing

Feedback at the end

Top-down



Was the process it really user-centered?

HYVINKÄÄ

Näytä 3D-mallissa Tutustu suunnitelmiin
Tee suunnitelma

- Käynnissä olevat kaavahankkeet
- Yritysten ideasuunnitelmat
- Rakentaminen aloitettu
- Kaupunkilaisten vapaat ideat
- Ideakilpailuun saapuneet ehdotukset

Valitse suunnitelma jota haluat tarkastella.

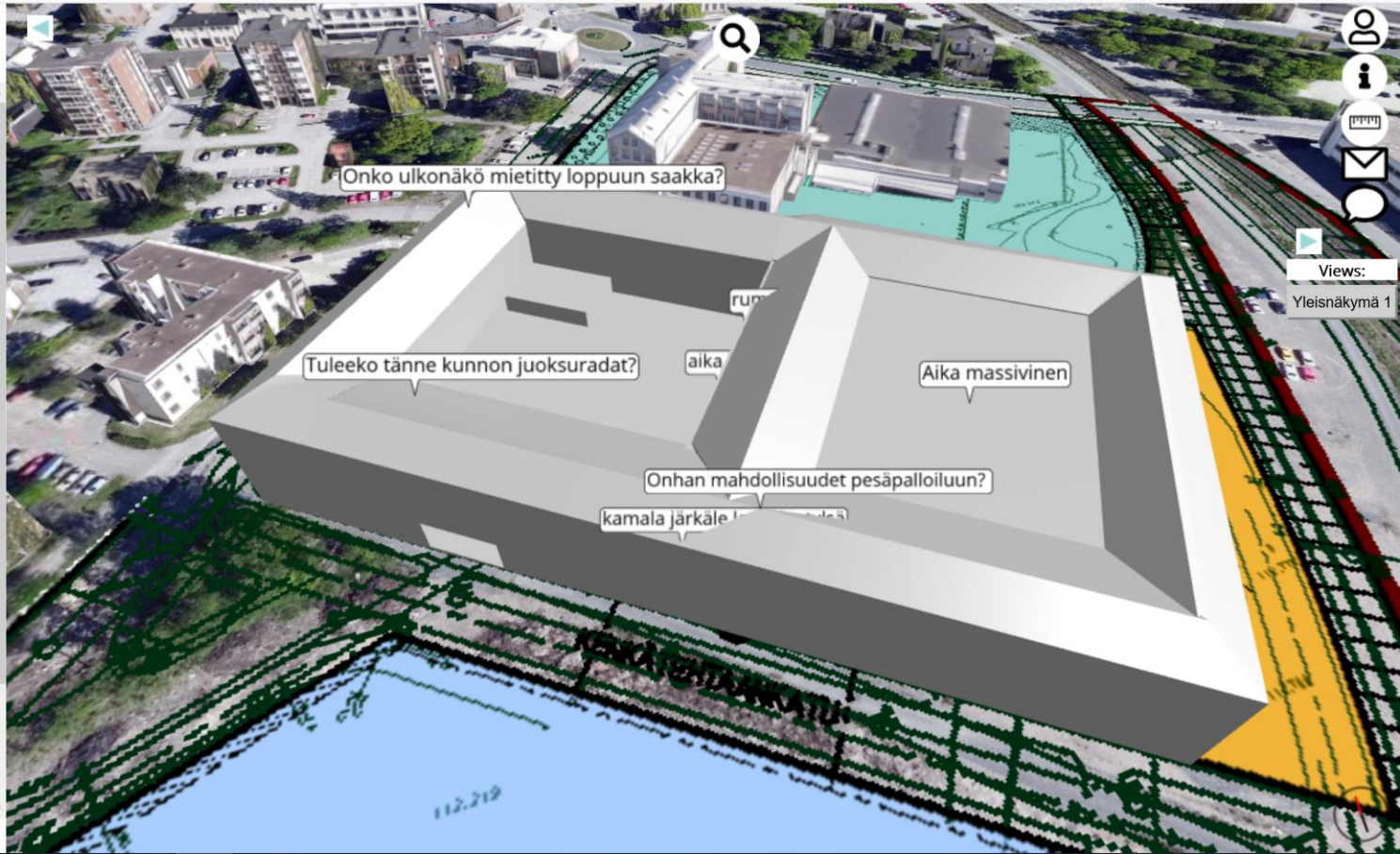
- Käynnissä olevat kaavahankkeet
- Hangonsillan monitoimihalli
 - Helenenkatu 31-33
 - Parantolankatu 10 - 12

Suunnitelman nimi:
Hangonsillan monitoimihalli

Idealuonnos Rentto Oy:n monitoimihallista.
Etelä päädyssä monitoimihalli ja
pohjoispäädyssä asuntoja.

Tekijä: Kaavahankkeet

Powered by: SOVA3D



Platform for co-planning

KAUPUNKILAISEN KÄYTTÖLIITTYMÄ Tutustu suunnitelmiin

- Suunnitelmien ryhmittely: kaavahankkeet, yritysten suunnitelmat ja kaupunkilaisten ideat omiksi ryhmikseen
- Suunnitelmien selailu helppoa
- Suunnitelmien kommentointi puhekuplalla 3D-malliin

HYVINKÄÄ 

Osoitehaku

Näytä 3D-mallissa **Tutustu suunnitelmiin**
Tee suunnitelma

- Käynnissä olevat kaavahankkeet
- Yritysten ideasuunnitelmat
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Valitse suunnitelma jota haluat tarkastella.

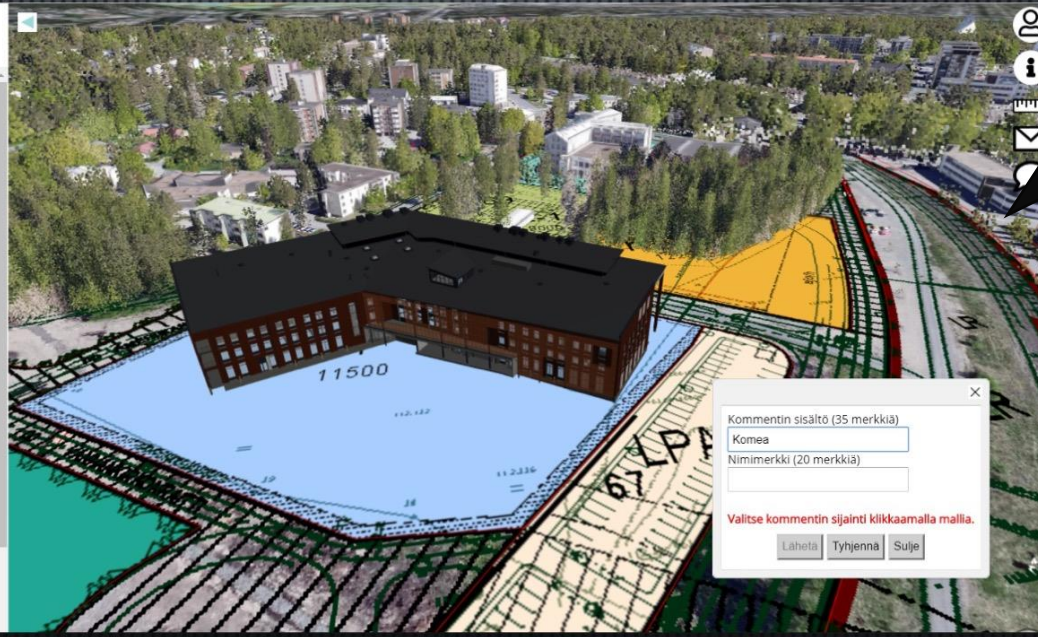
Rakentaminen aloitettu

- Hangonsillan asuinkorttelit 70-71
- Kipinä

Suunnitelman nimi:

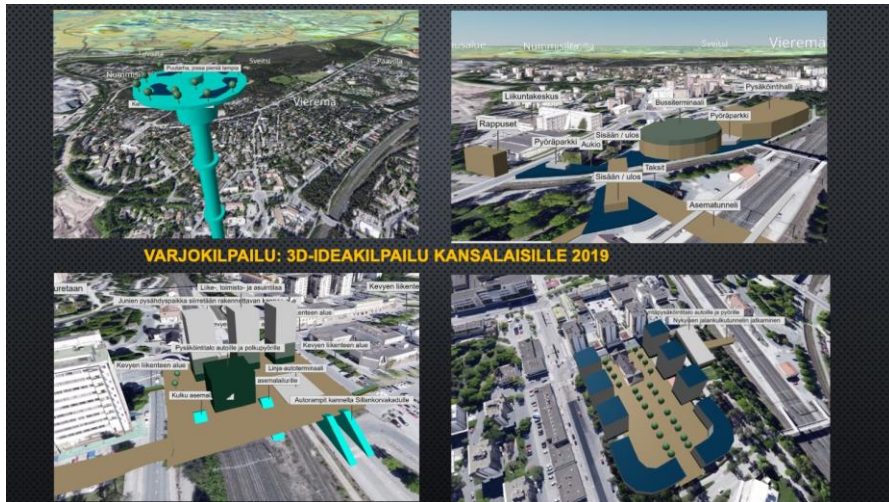
Kipinä

Oppimiskeskus Kipinässä on modernit tilat lukiolle ja Hyvinkään Opistolle.



Crossing administrative boundaries: plans made by the municipality, private companies and people on the same platform.


Citizen-led co-planning



Screen captures of the city model of Hyvinkää © SOVA3D, City of Hyvinkää

KAUPUNKILAISEN KÄYTTÖLIITYMÄ
Tee suunnitelma

- Helppokäyttöiset piirtötyökalut
- 3D-elementtien pudottelu malliin, siirto, skaalaus, pyörittys jne.
- Tekstien ja valokuvien liittäminen

HYVINKÄÄ 

Osoitehaku

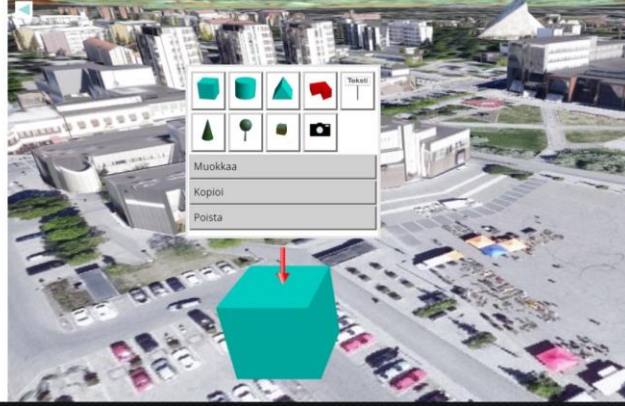
Näytä 3D-mallissa Tutustu suunnitelmiin

Tee suunnitelma

Uusi suunnitelma

Voit piirtää oman 3D suunnitelman toiminnoin jotka aukeavat kaupunkimallia klikkaamalla. Tallenna/julkaise suunnitelmasi "Tallentaminen" toiminnalla. Jos valmistelut useita suunnitelmiä voit hallinnoida niitä "Omat suunnitelmani" toiminnoin.

Tallentaminen
 Omat suunnitelmani



Hyvinkää City Model

Strategic goals:

- Experimental use of web-based 3D city model
- Visually appealing model
- Platform for co-planning the center of Hyvinkää
 - Collaboration between city, local companies, inhabitants
- Supporting also bottom-up participation

Usability goals:

- “Easy-to-use”, intuitiveness, easy to access

Meaning only “web-based”?

3D was a strategic choice

Successful as a
participation tool

Citizen-driven ideas:
How are they linked to the
actual planning process?

What does they mean by
“easy-to-use”?

Several usability problems
found in the heuristic
analysis – are they severe?

Preliminary findings

- Using 3D is a strategic choice in these examples.
It is possible that the usefulness of the tools have not been considered critically.
- Goals are mainly set by the developers and only partly achieved
- Unclear, how did the users' needs have an impact on the goals
- Some usability goals have been set, but there is no evidence about achieving these goals
- User-centeredness is mentioned, but user needs don't seem to be in the main focus (maybe because these were experimental piloting projects)
- Heuristic evaluation reveals a lot of cosmetic and annoying usability problems in both examples. Usability testing with users would be needed to find out if these problems are critical.

Discussion

- The evidence of the usefulness of 3D visualization tools seems to be related to **detail planning level**, where it is relevant to understand the visual and physical impact of the plan.
- Digital tools have an impact on what aspects of the plan will be evaluated (visual, architectural, social, cultural, ecological, functional etc. impacts). We should be careful of balancing different impacts.
- When designing a co-planning app, we are dealing with different activities and goals, and maybe also different planning level(s). Therefore, we still need to understand better:
 - *How useful 3D tools are for co-planning activities for different user groups?*
 - *How are usefulness of 3D planning tools perceived on local master plan level?*
 - *For what co-planning tasks is 3D the most suitable for? Which tasks are more intuitive to solve in 2D (or in other ways)?*

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