

# Human Computation and Crowdsourcing for Knowledge Elicitation in Citizen Design Science

How to use citizen design to inform design in urban design and planning

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PhD student

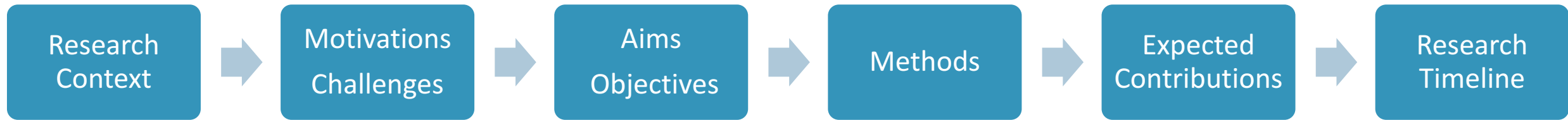
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Supervisor: Prof. Dr. Gerhard Schmitt

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LABORATORY

**ia** Chair of  
Information  
Architecture

# Contents





# I. Research Context

Human-centered urban design and planning

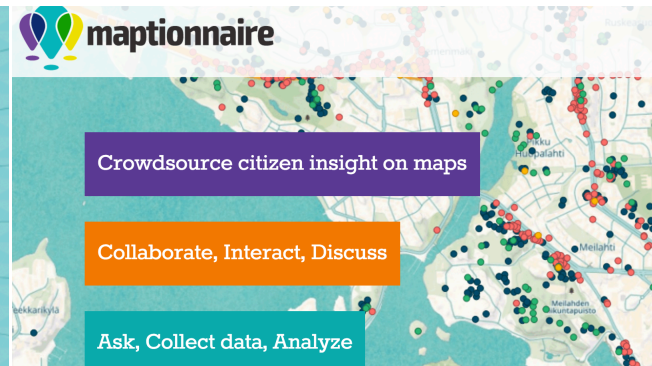
Participatory urban design and planning

# Research Context: Cities for people

- Urban design and planning need to be human-centered by understanding citizens' requirements, concerns and ideas of urban spaces.
- Most related works on urban design is **qualitative**, such as Kevin Lynch's theory about the image of cities.
- **Participatory urban design and planning** use various methods to engage citizens in many stages of planning projects: town hall meetings and workshops.
- Participatory urban planning starts to apply **crowdsourcing and digital tools** to share information about spatial projects with local people and get to know their concerns, knowledge and ideas.



# Research Context: Digital tools used in participatory planning



Social Enterprises  
Crowdsourcing

<https://www.metroquest.com>

Government  
Crowdsourcing

<https://idee.paris.fr/>

Business Startup  
Crowdsourcing

<https://maptionnaire.com/>

NGO  
3D games

<http://blockbyblock.org/using-minecraft-to-plan-public-spaces-in-divided-communities-in-kosovo/>

# II. Motivations and Challenges

Research Gap

Citizen Design Science

Human Computation and Crowdsourcing

# Motivations: Research Gap

## Research Gap

- Most methods with crowdsourcing and digital tools focus on **qualitatively** aspects. There is a lack of **quantitative** and **computational** approach to collect and analyze the information for massive citizens' feedbacks.
- There is no effective way how to improve design by incorporating human inputs because of the **unstructured information** and the barrier of **standard features**.



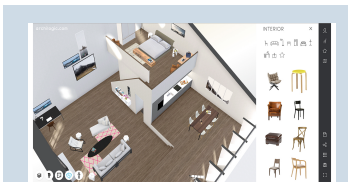
## Motivation

Provide **computational support** for massive scale participatory urban planning by collecting and **eliciting knowledge** from citizens' opinions and ideas **quantitatively**, such that can be helpful to experts' design with **structured information and shared features**.

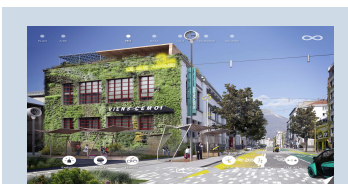


# Motivations: Citizen Design Science as an Enabler

Open Design  
Urban Science  
Inclusive Governance



Home Planning Tools for everyone



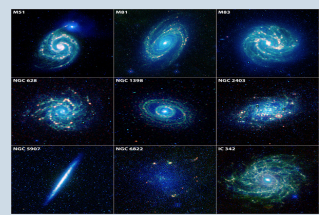
Community Collaborative Designing Tool



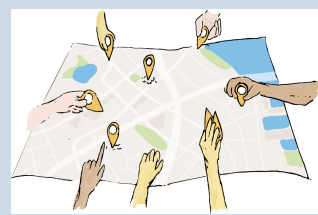
Participatory Design Methods



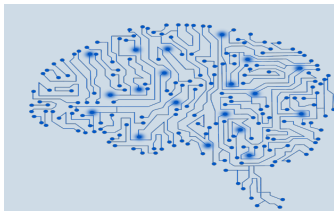
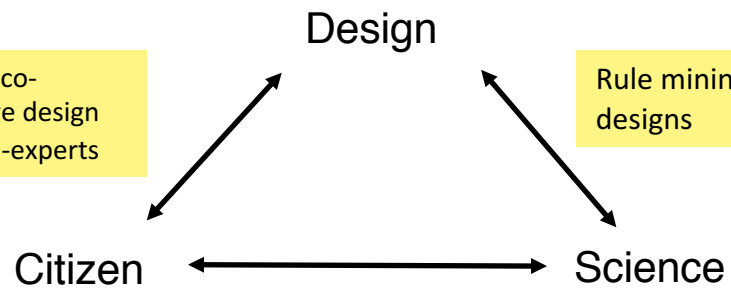
Citizens record their observations of plants and animals.



People providing labels online to shapes of stars in galaxy



Participatory Mapping/crowdsourcing Openstreetmap, Wikipedia



Machine Learning Data Mining



Collaborative Design System and Workflow



Human computation for multi-agent crowdsourcing system

- Quantitatively crowdsource **active design ideas** from the crowd.
- Support for **massive online** participation in urban design and planning .

Published journal article:

Mueller, J., Lu, H., Chirkin, A., Klein, B., & Schmitt, G. (2018). Citizen Design Science: A strategy for crowd-creative urban design. *Cities*, 72, 181–188.

# Motivations: Qua-Kit (Quick Urban Analysis Kit) as an enabler

qua-kit anonymous edX student AE

User	Date	Description	Icons	VIEW
394051	2016-09-25	I designed the layout based on the type of community this place strives to become. It's not a posh locality and thus in an informal...	82 90 81 86	VIEW
Avolyn Fisher	2016-09-26	Non-symmetrical design (people typically don't like living in cookie cutter environments). Close walls to help insulate from weather and...	95 82 79 79	VIEW
anonymous edX student	2016-11-08	This project incorporates all criteria: 1. Accessibility and connectivity, due to connection between close buildings for free access. Cars...	72 82 95 84	VIEW
Kenneth Andres	2016-09-25	I have designed the neighbourhood in a cluster of houses (duplex and sometimes tenement-style) instead of arranging each house separately...	92 85 70 82	VIEW
anonymous edX student	2016-09-22	take advantage of the space, providing spaces for internal mobility and out of area.	69 82 89 82	VIEW
schulerp	2016-10-02	VE-G-A Community with middle Townhall and 4 main gates	80 72 97 73	VIEW
anonymous edX student	2016-09-24	High buildings in the back so they don't block view or sunlight. U-shaped buildings for privacy and free spaces in between to do spare time...	77 82 97 64	VIEW
anonymous edX student	2016-09-29	1. 4 clusters are formed to promote connectivity and accessibility. 2. The arrangement of each cluster enable visibility and centrality...	87 90 76 64	VIEW
anonymous edX student	2016-09-21	The goal of this plan is to design spaces with a mix of concept of superblocks opened to big squares and some flexibility in the shape...	74 92 79 70	VIEW
anonymous edX student	2016-10-19	The layout was thought out to interact with the surrounding environment, to be fluid and flexible. Allow circulation and public spaces for...	85 92 68 70	VIEW
soledadprandi	2016-10-17	In order to make the space more livable, social buildings have been developed and also individual housing. In any case, each unit has a...	69 84 94 63	VIEW
leonardoharth	2016-09-20	My concept is to build a T-shaped boulevard serving the whole community - with direct access to both adjacent streets - as well as a system...	77 93 62 73	VIEW
Samuel Thomas	2016-10-02	My proposal suggests that the houses be organised around a series of internal streets. This allows the neighbourhood to continue to be part...	90 70 76 68	VIEW
JasonBSantos	2016-09-27	The concept used to arrange the shacks was "clustering". This was based on the building areas, heights, and massing of the building blocks...	90 62 73 77	VIEW
anonymous edX student				
Marcela Miranda				
anonymous edX student				

qua-kit luhangxin LU

User	Date	Description	Icons	VIEW
Benjamin Villa Wiesner	2017-10-10	A green corridor was used to connect parks and housing blocks all along the bay, penetrating the blocks strategically to permit every...	88 99 86 87	VIEW
Gianluca Genova	2017-11-12	Green Concept: The green is integrated with the building cluster to prevent heat island effect. One green pattern follows the waterside...	88 - 92 88	VIEW
anonymous edX student	2017-10-21	Tall buildings to shade smaller, building positioned so that the east and west façades have smallest area (low solar gains)	99 99 69 78	VIEW
Fernando Moncayo Serrano	2017-11-07	Recover the nature of the maritime edge by proposing green areas that limit it and protect buildings. Place arborized areas between the...	- 90 79 93	VIEW
anonymous edX student	2017-10-21	2nd design (use of all housing, not moving blue/yellow structures): 1.) Main goal of 2nd attempt to fit all the housing types. All...	95 92 83 77	VIEW
krimskii edX	2017-10-09	In this design I've used all types of buildings. Area is divided to sections, with lots of greenery linking them. New area going to attract...	82 82 88 95	VIEW
anonymous edX student	2017-10-23			
anonymous edX student	2017-10-14			



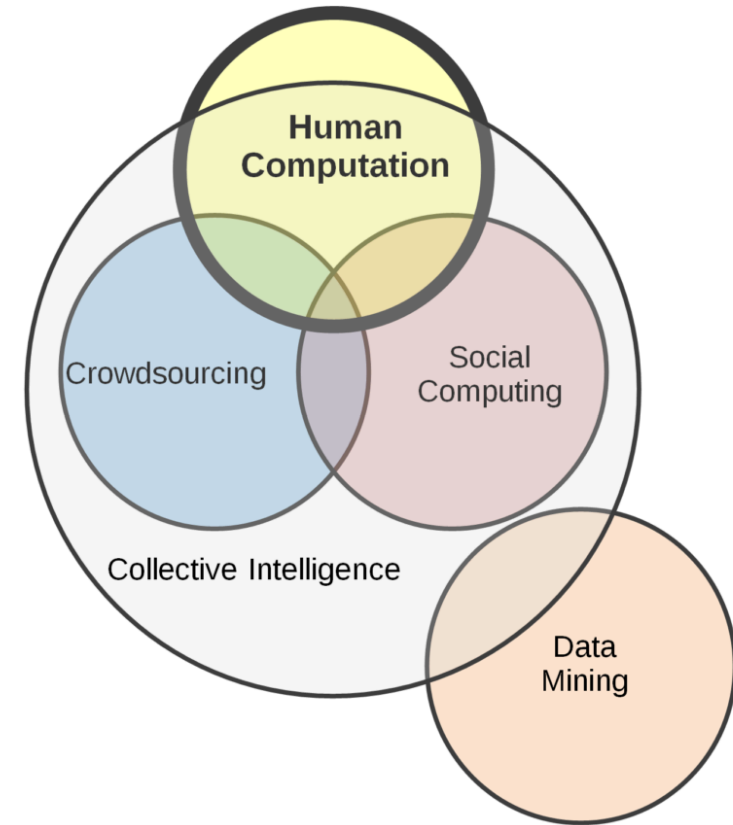
# Motivations: Human Computation and Crowdsourcing as the Technology Enabler

## Human Computation:

A new domain in Computer Science to design system, algorithms and application to deal with complex social, political, and ethical problems that require humans to solve through **online distributed information processing system**.

## Challenges:

- No one has use human computation and crowdsourcing to quantitatively collect and analysis **citizens'**(users) input which has been largely applied in other fields e.g. Engineering design, UX design and citizen science.





# III. Aims and Objectives

Hypothesis

Research Questions

# Aims and Objectives

## Hypothesis:

- Experts need input from citizens both **qualitative and quantitatively**, to make urban design more human-centered.
- Computational tools, human computation & crowdsourcing, and artificial intelligence (AI) provide opportunities to collect and interpret **citizens' input**.
- Citizens can reflect their concerns, ideas, requirements and knowledge through **design**.

# Aims and Objectives

## Research Question

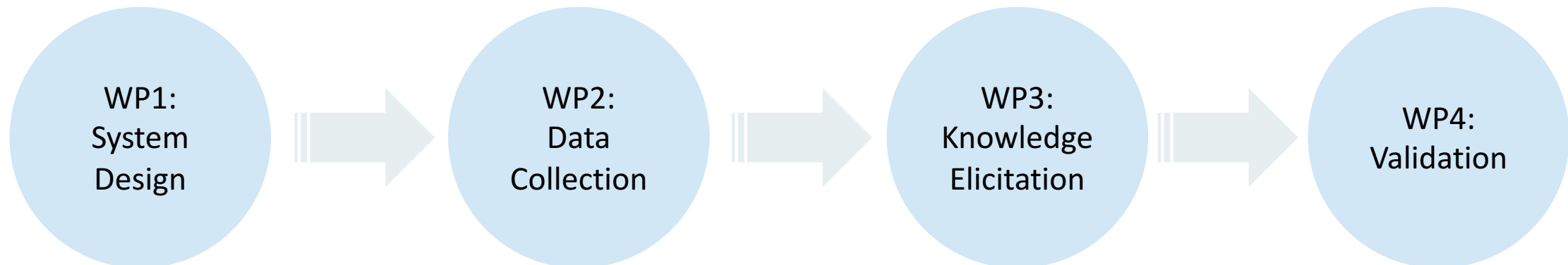
To what degree does **citizen design** help to improve **expert design** in the context of urban design and planning?  
*By using computational approach to collect and elicit knowledges from citizens' design ideas quantitatively .*

Is it possible to **collect** design ideas from citizens **quantitatively** ?

Can citizens design **truly** reflect what they want?

What forms of **knowledge** can be **elicited** from the citizen design and how?

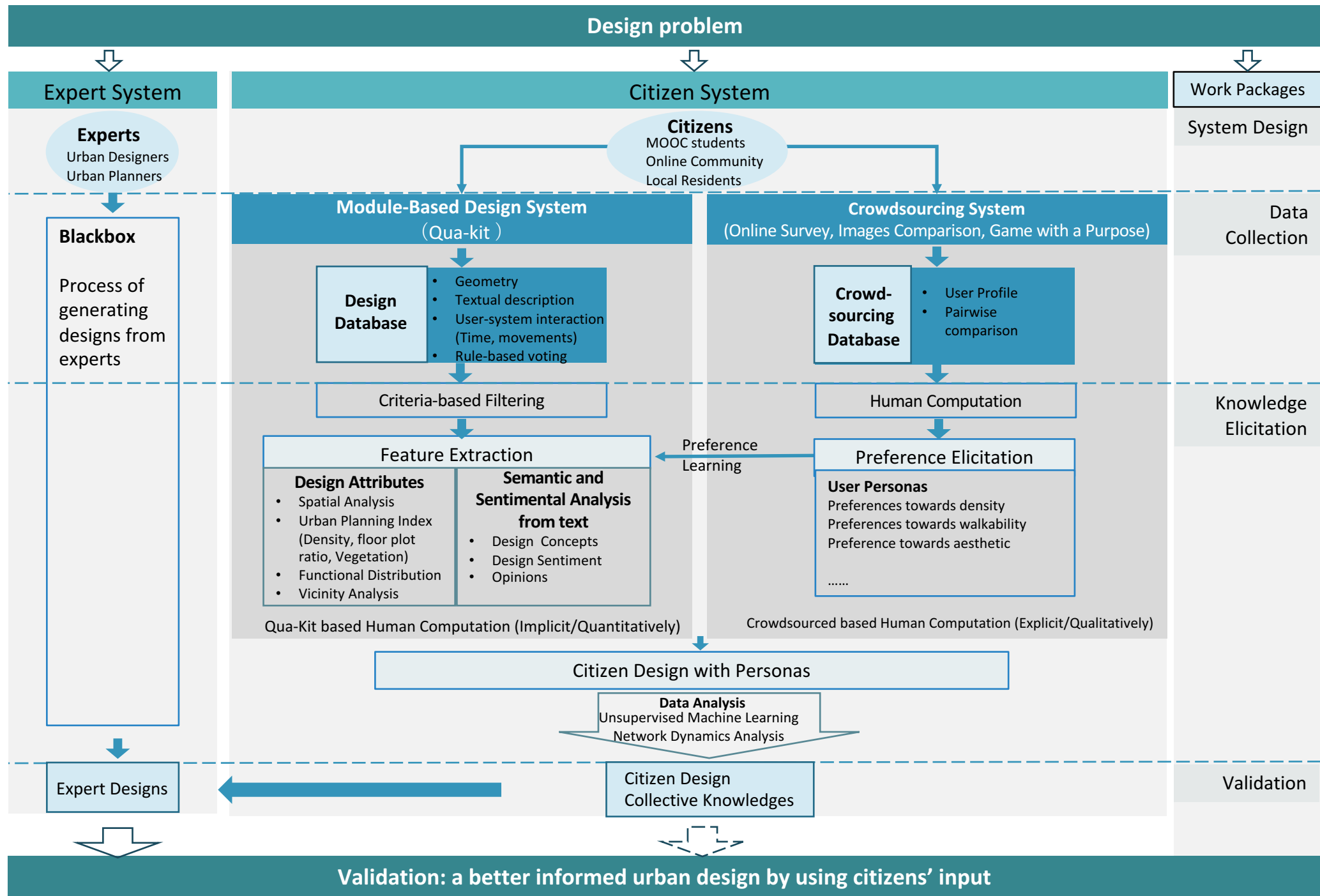
How can the knowledge collected from the citizens be **helpful** to experts?



# IV. Methods

Framework

Case studies and dataset



1

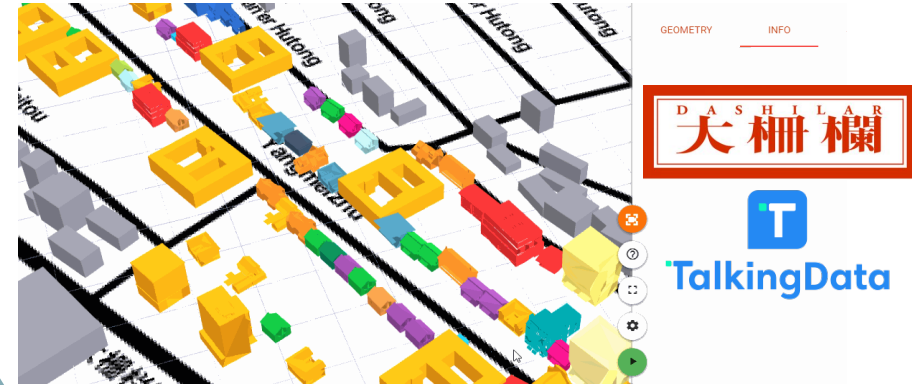
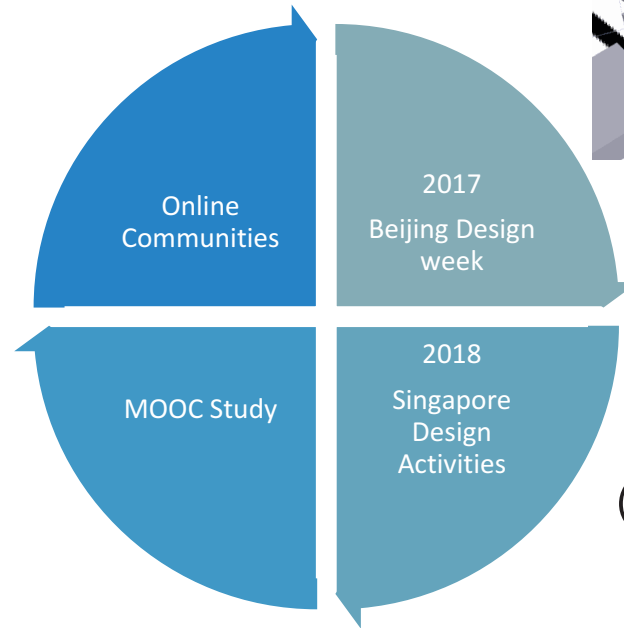
2

3

4

# Case studies

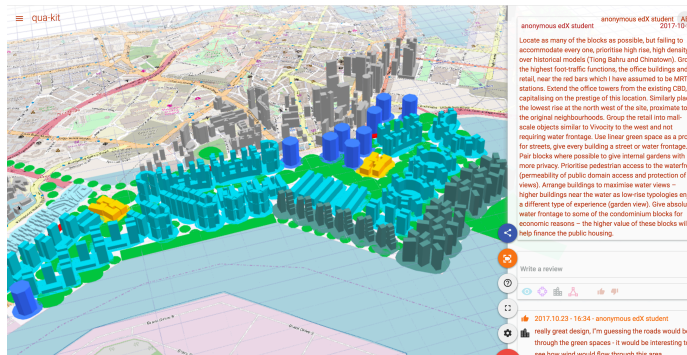

  
**Crowdsourcing Marketplace**  
**Citizen Science**



**Dashilar Urban Renewal Platform**  
 (Finished in 10.2017)  
 10 days exhibition 100+ cases done by citizens

(FCL) **FUTURE CITIES LABORATORY**


(Planned in March 2018)



**Massive Open Online Course**  
**EdX Smart Cities Course**  
 (1500+ cases done by students)

# V. Expected Contributions

# Expected Contributions

Questions

Is it possible to collect design ideas from citizens quantitatively ?

Can citizens truly reflect what they want?

What forms of knowledge can be elicited from the citizen design and how?

How can the knowledge collected from the citizens be helpful to experts?



Expected Contributions

Develop a **method** based on **crowdsourcing** to collect design ideas from citizens quantitatively

Application: Qua-Kit  
That enable citizens to contribute their ideas and visualize the effect directly

Develop a **computational method** to extract knowledges from citizens' design

Machine Learning  
Human Computation  
Methods and Algorithms

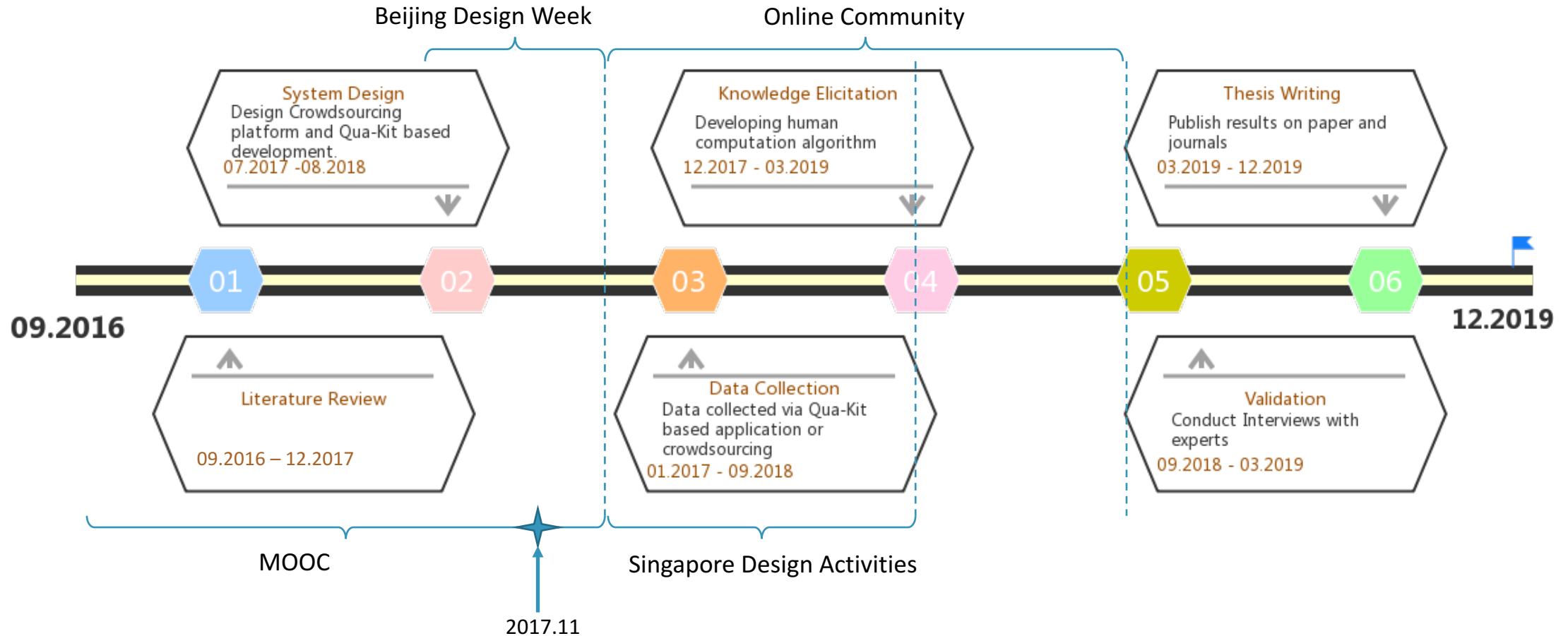
Develop a **framework** that combine citizens' design and help designers to make better informed designs

Theoretical Framework



# VI. Research Timeline

# Research Timeline



# Thank you !

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Chair of Information Architecture

# BACKUPS

