

Beijing, China

The Research on Design Framework for citizen science

Zhiyong Fu, Jia Lin, Lu Wang

Tsinghua University



Citizen Science Background

Citizen science is a process in which ordinary citizens involve and contribute to scientific research. In some ways, citizen science is crowdsourced science. Leveraging well designed, accessible social media, crowdsourcing, cloud computing, remote sensing, visualization and gamification technologies holds great promise for citizen science.

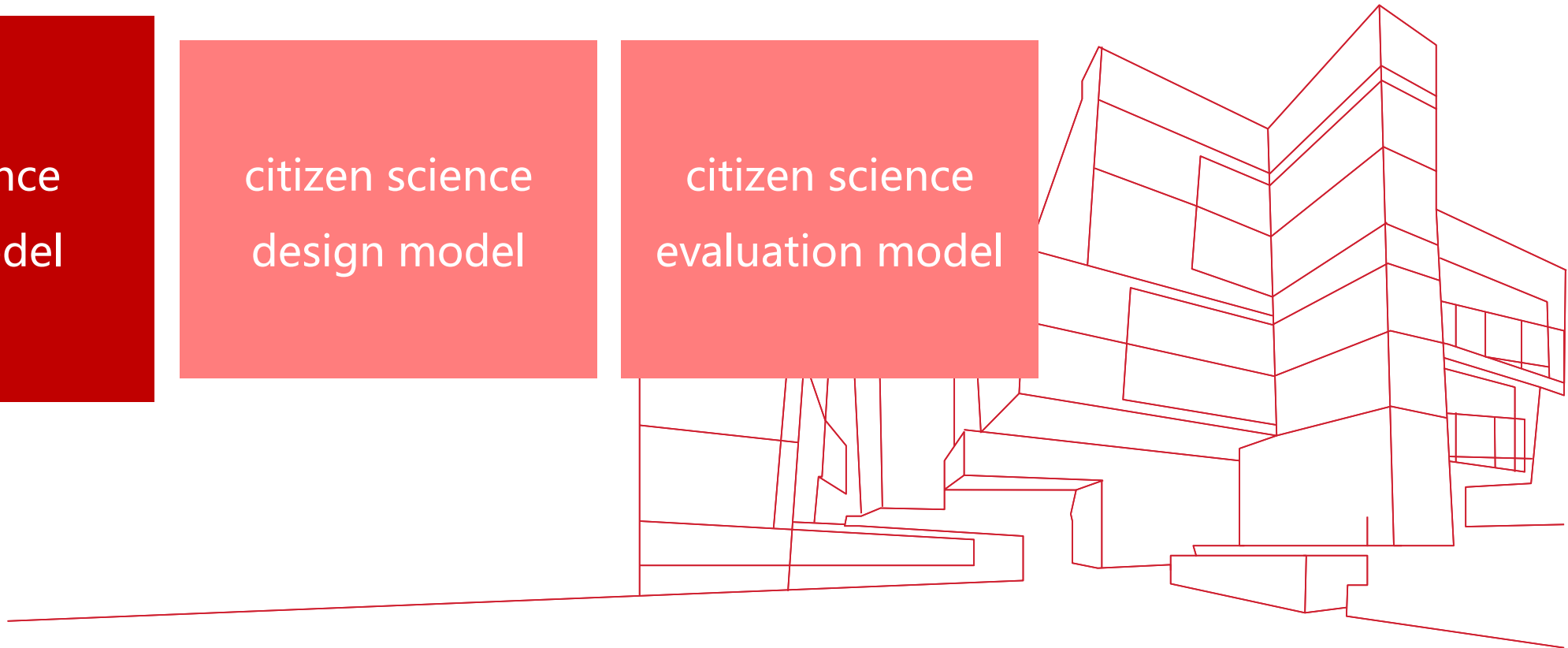


Models

citizen science
content model

citizen science
design model

citizen science
evaluation model

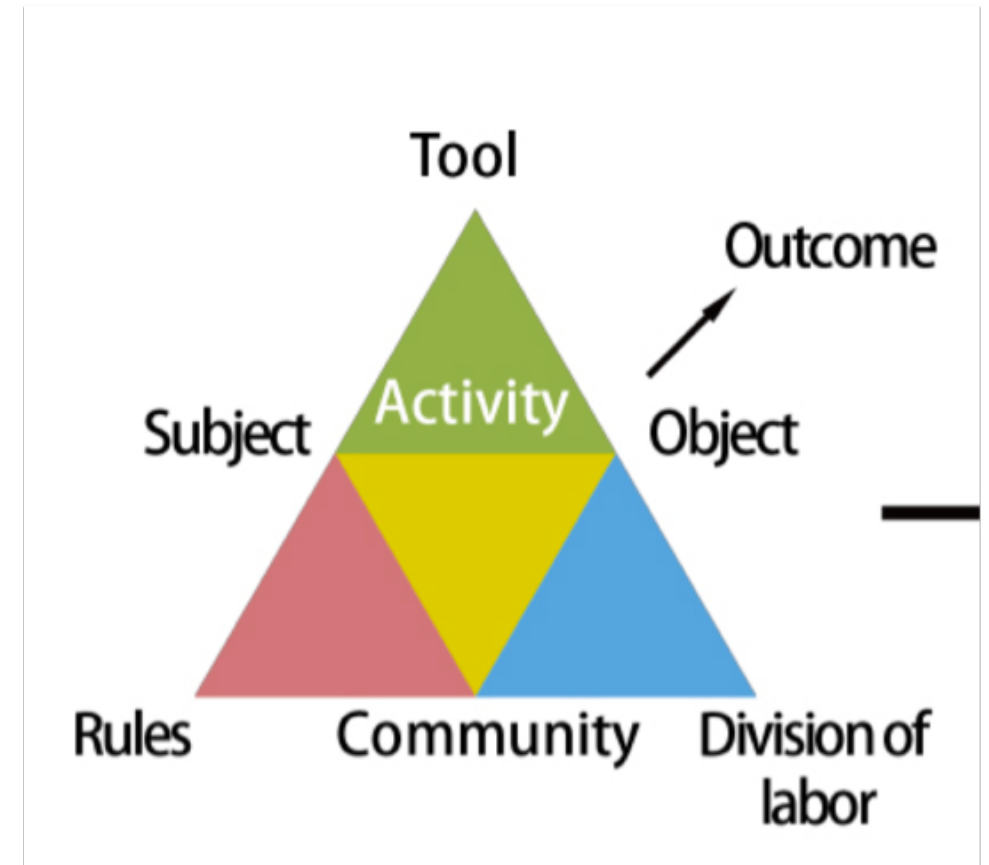


Activity Theory (AT)

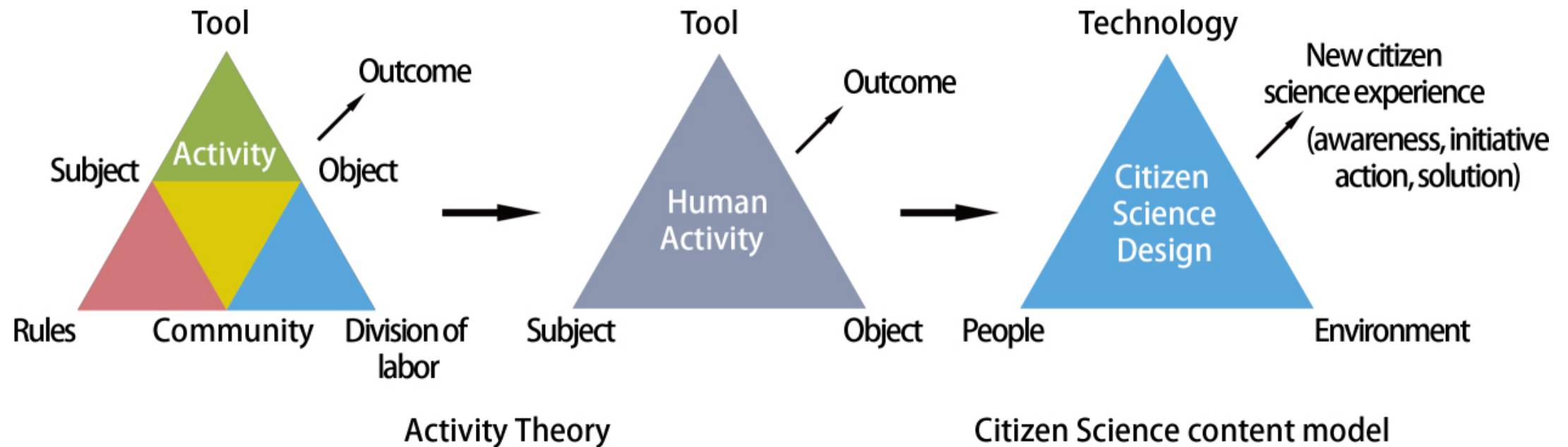
The unit of analysis in AT is the concept of object-oriented, collective and culturally mediated human activity, or activity system.

This system includes the object (or objective), subject, mediating artifacts (signs and tools), rules, community and division of labor.

A particular activity is a goal-directed or purposeful interaction of a subject with an object through the use of tools, which indicates that citizen science can be thought as a purposeful interaction of a citizen subject with a science object through the use of technology tools.

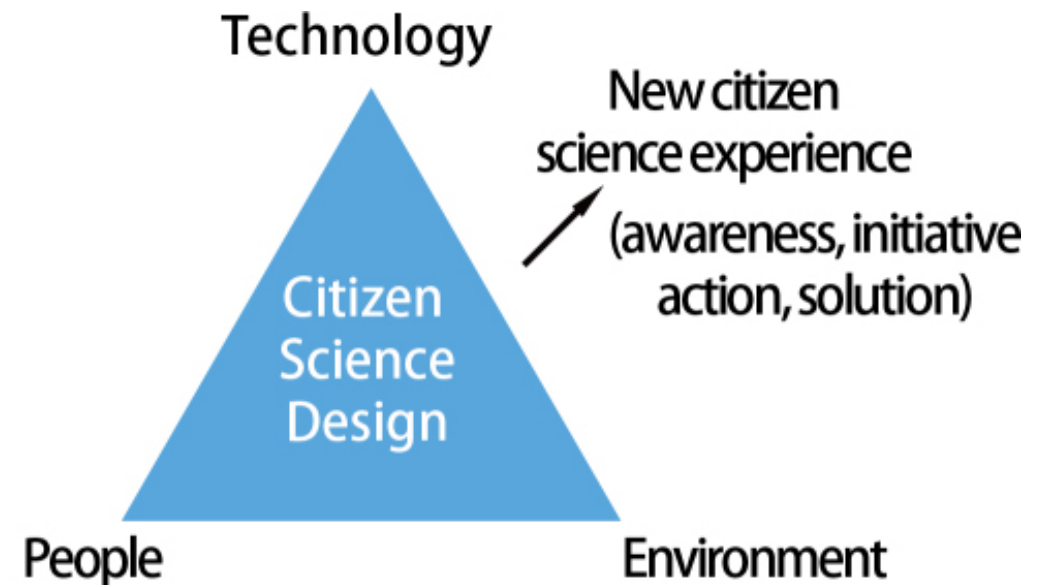


Citizen Science Content Model on Activity Theory



Citizen Science Content Model on Activity Theory

“Outcome” in activity theory is interpreted as “new citizen science experience” here that specifically includes better awareness, initiatives, actions, solutions.



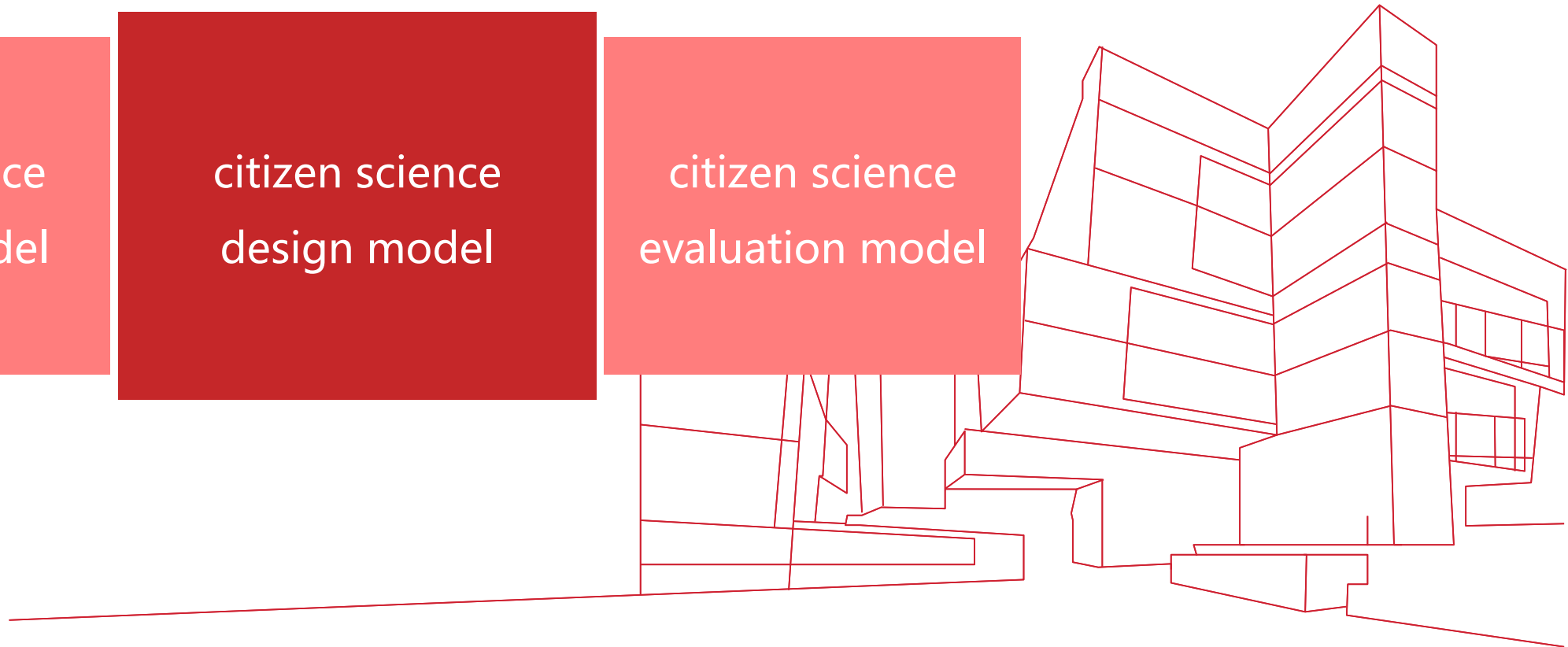
Citizen Science content model

Models

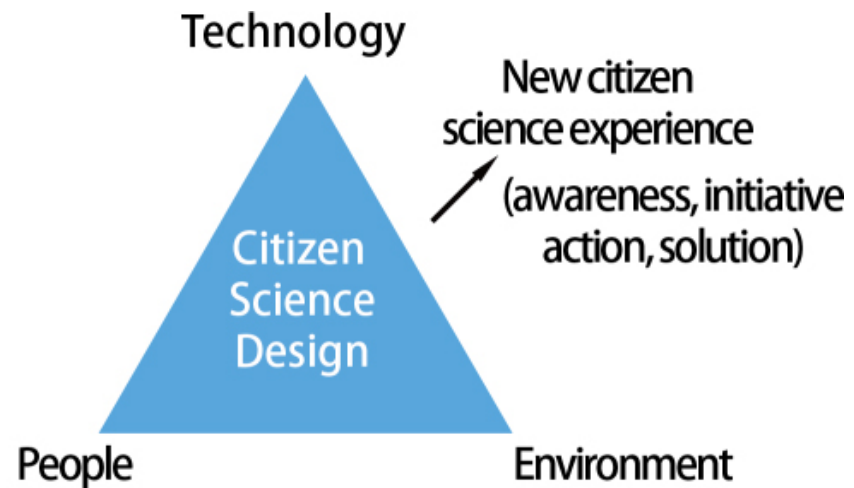
citizen science
content model

citizen science
design model

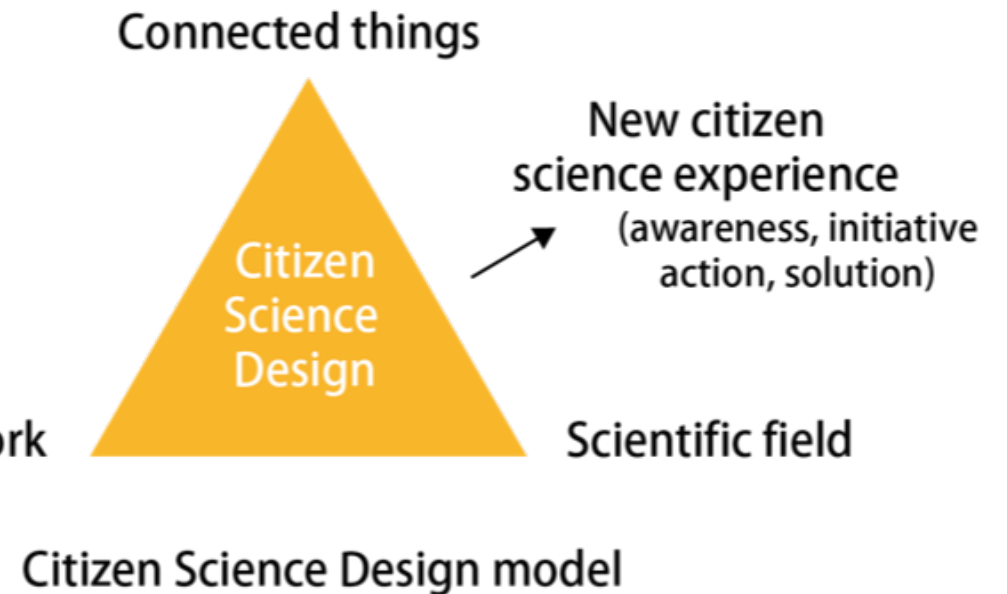
citizen science
evaluation model



Citizen Science Design Model on DSI

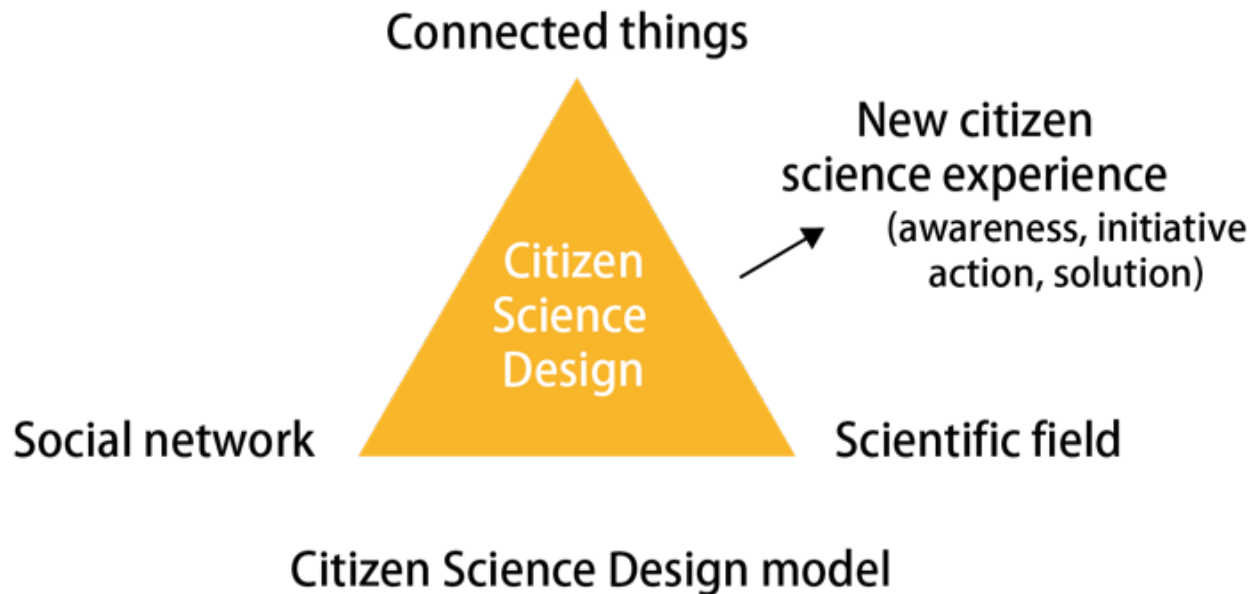


Citizen Science content model



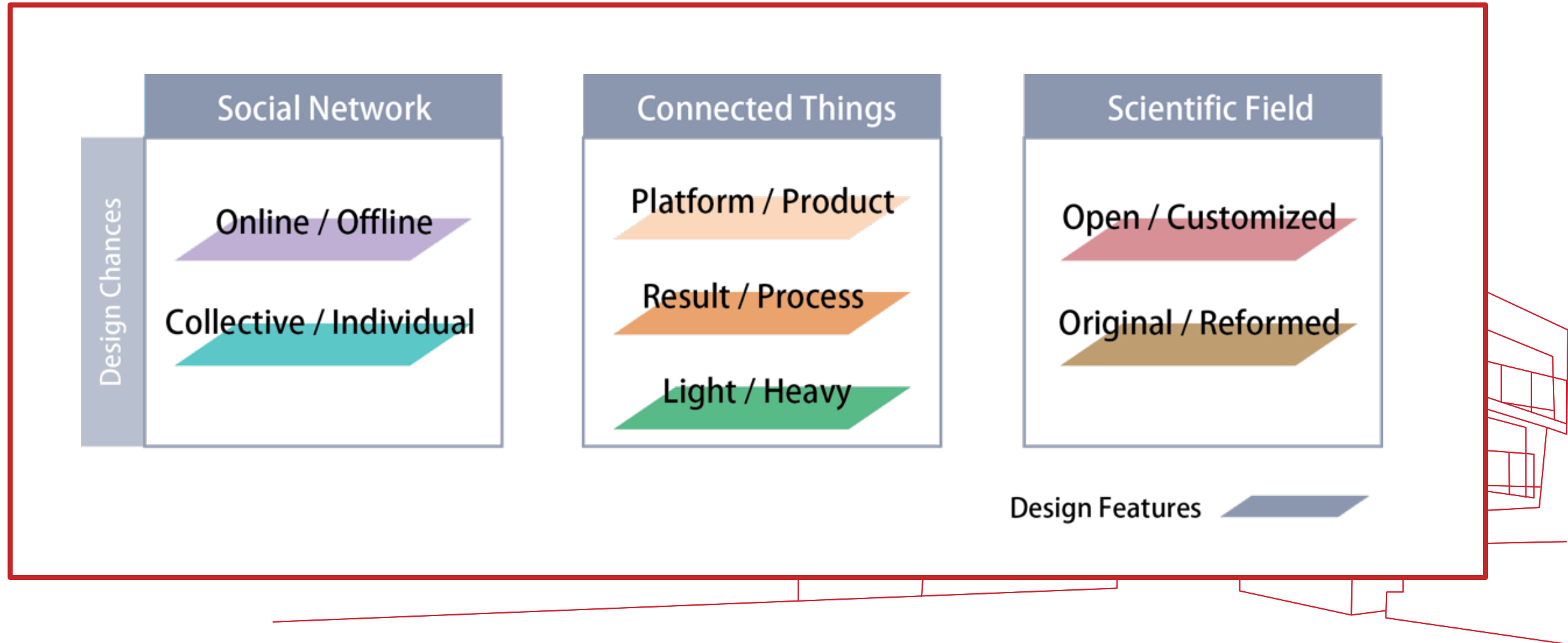
Citizen Science Design model

Citizen Science Design Model on DSI



the concept “community” popular in smart city and DSI gives us suggestions on how to embody “environment”. citizen science actions and operations are executed in local community, regional community and global community. These communities all play a part as “knowledge or science containers”. To be specific, we call it scientific field where science is stored, discovered, spread and popularized.

Citizen Science Design Model on DSI

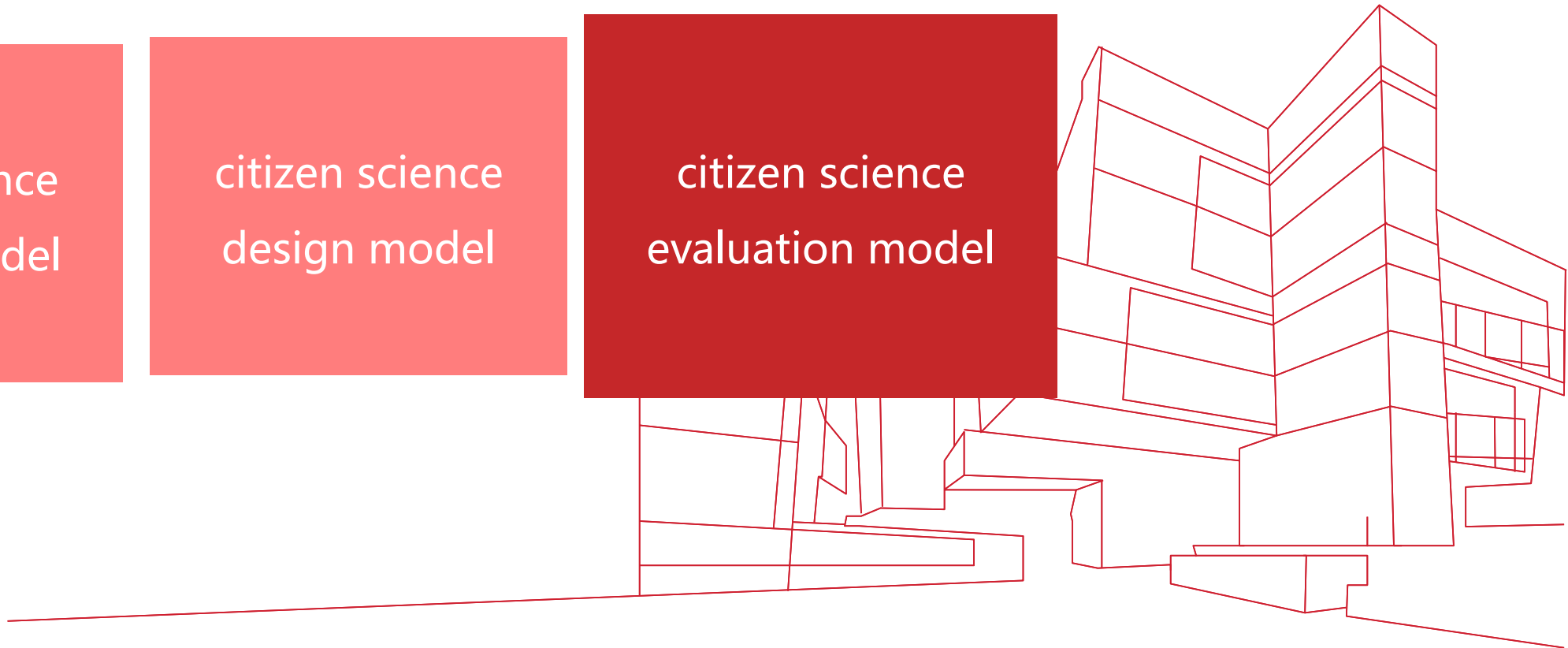


Models

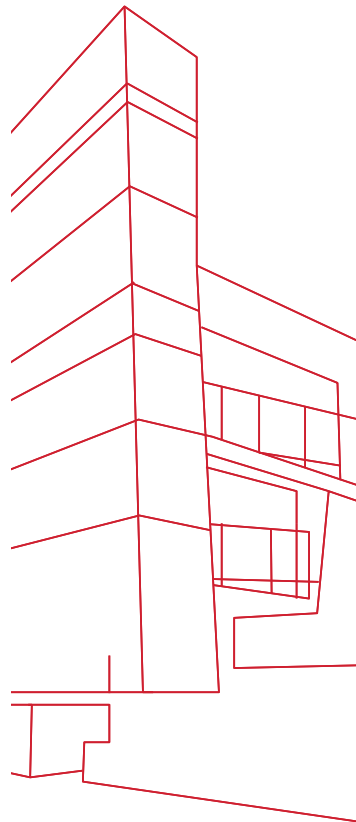
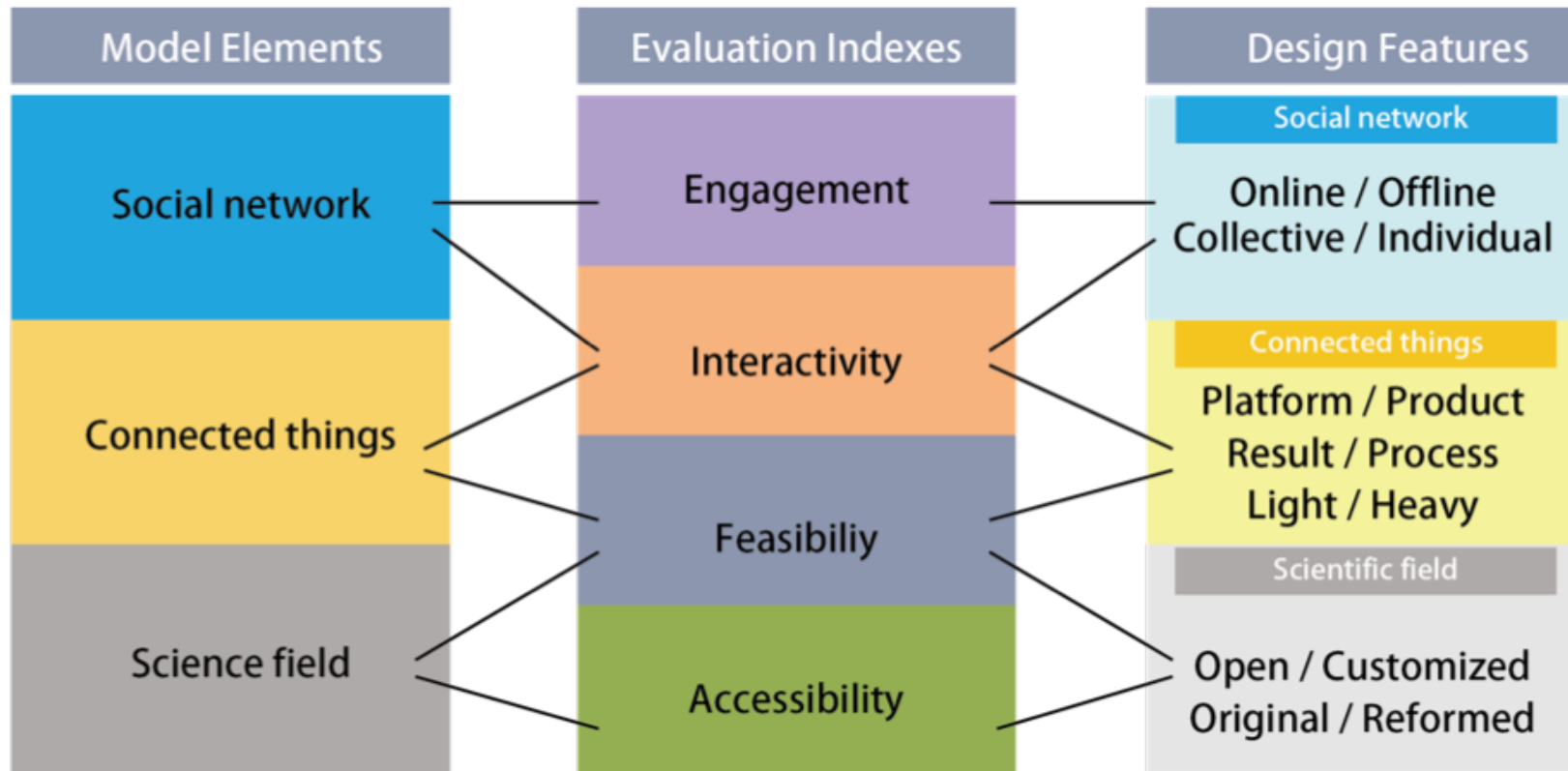
citizen science
content model

citizen science
design model

citizen science
evaluation model



Citizen Science Evaluation Model





“ZooseeFun” application and citizen science for zoological knowledge



动物喜欢者了解动物知识的新奇应用

更直接:实时实地拿出手机扫描

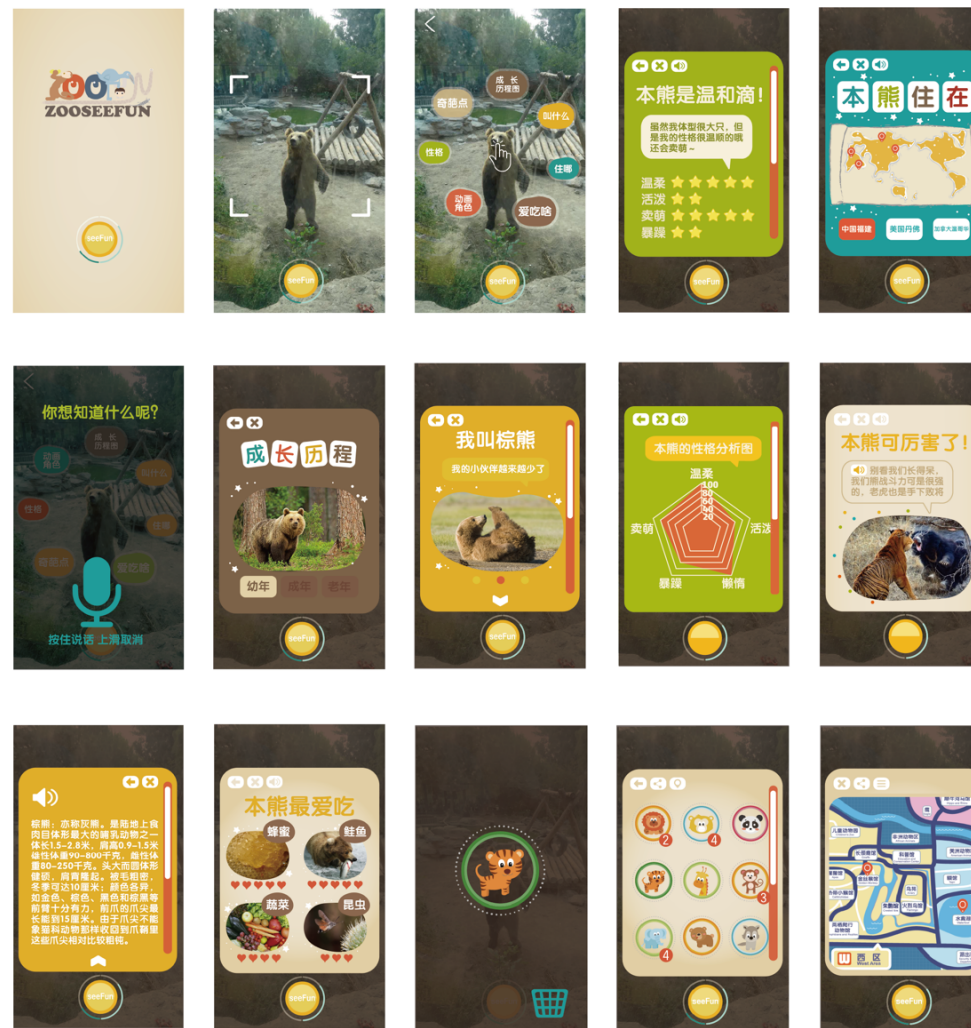
更有趣:更有趣丰富的内容和多语言

更多样:更丰富有趣的交互方式和内容展示方式



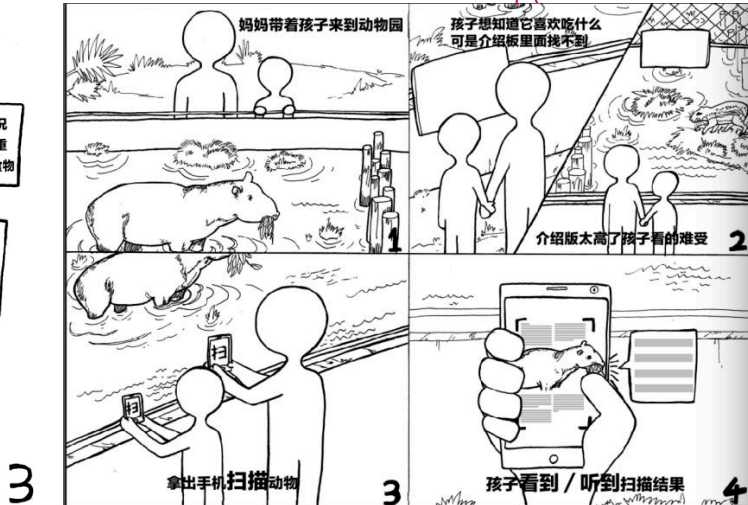
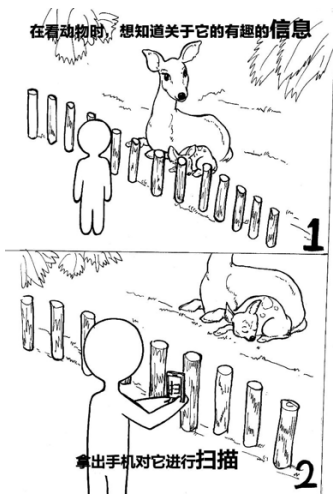


“ZooseeFun” is a Application with the aim to make people/citizen have more convenient and direct access to animal introduction and knowledge on a visit in a zoo, in the wild and in normal life.



Citizen science content model of “ZooseeFun” application.

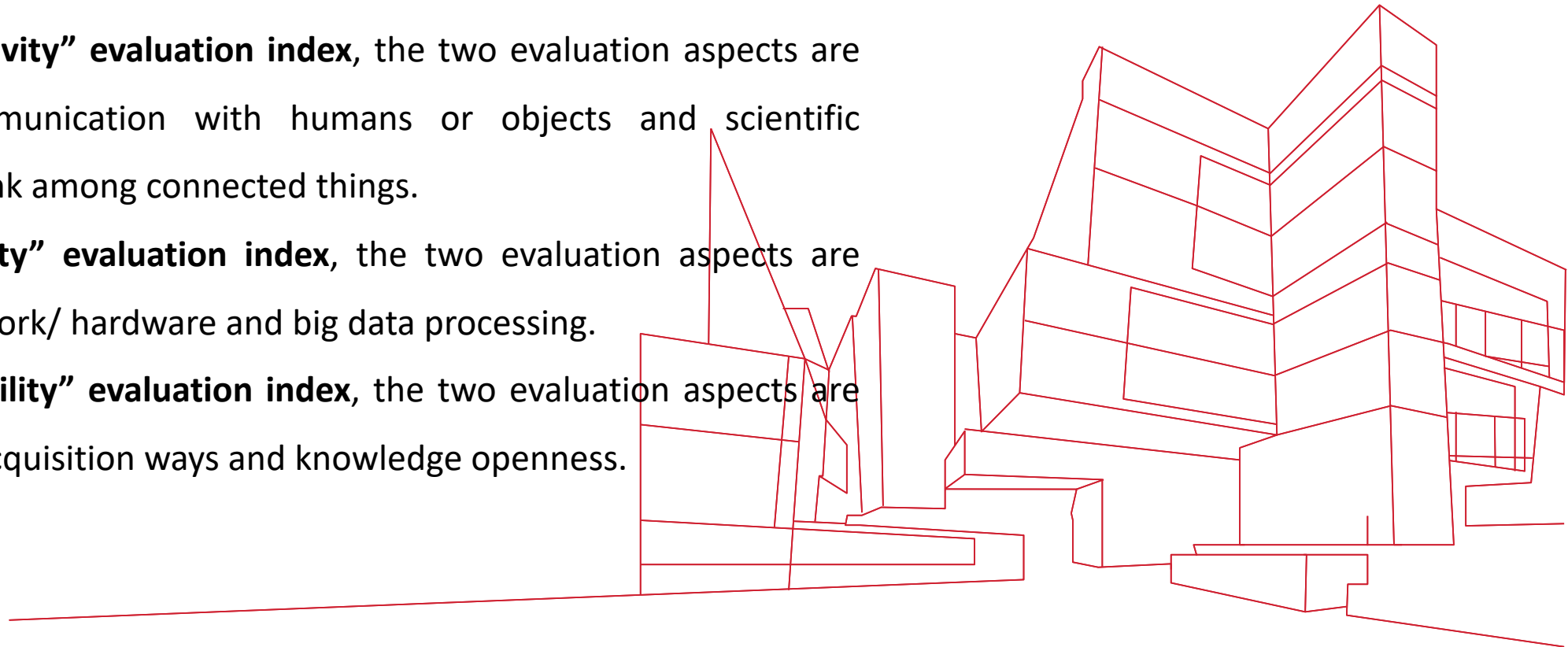
In “ZooseeFun” application, we specify three elements of citizen science content model, “Environment” as “Zoo” ,”Zoo” here is a broad concept including physical zoo in city and natural zoo in wild and normal life, “People” as “Animal observers” and “Tech” as “Connection and Recognition”.



Element	Pair features	Design opportunities
Social network	Online/ Offline	For online feature, participants upload zoological science observation results and views, have discussions in online community to help each other to know zoological science, which inspires us to design a online platform on which people share animal knowledge and do some social activities. For offline feature, online community helps to form zoological science offline community where people take part in a citizen science program by conducting field observing together.
	Collective/ Individual	Collective feature inspires us not to ignore amateurs' knowledge which is indispensable for collective intelligence. Individual feature inspires us to consult experts on zoological science regularly in citizen science design to better fulfill new citizen science experience.
Connected things	Platform/ Product	Platform feature tells us to create a open and collaborative platform for zoological science. Product feature inspires us not to confine our focus on platform, smart hardware product for zoological science can be a great design choice in the context of Internet of Things.
	Result/ Process	Result and process features inspire us attach importance to not only people's knowing animal knowledge, but also big data in zoo for better zoo management.
	Light/ Heavy	Light feature means a simple and interesting way to get zoological science is needed such as scanning or taking a picture. Heavy features means Internet of Things can be made best use of, to be specific, connected zoo infrastructures to create a smart zoo for better citizen science though more resources will be cost.
Scientific field	Open/ Customized	Open feature inspires us to create a open environment for people free to share and obtain zoological science, for instance, observing panda activity. Customized feature inspires us to arrange customized zoological science learning and playing activities for customized needs.
	Original/ Reformed	Original and reform features remind us to design a iterative zoological science systems where zoological science is updated from the original state.

Citizen science evaluation model of “ZooseeFun” Application

- For **“engagement” evaluation index**, the two evaluation aspects are knowledge and experience sharing and offline observation participation.
- For **“interactivity” evaluation index**, the two evaluation aspects are human communication with humans or objects and scientific knowledge link among connected things.
- For **“feasibility” evaluation index**, the two evaluation aspects are open framework/ hardware and big data processing.
- For **“accessibility” evaluation index**, the two evaluation aspects are knowledge acquisition ways and knowledge openness.

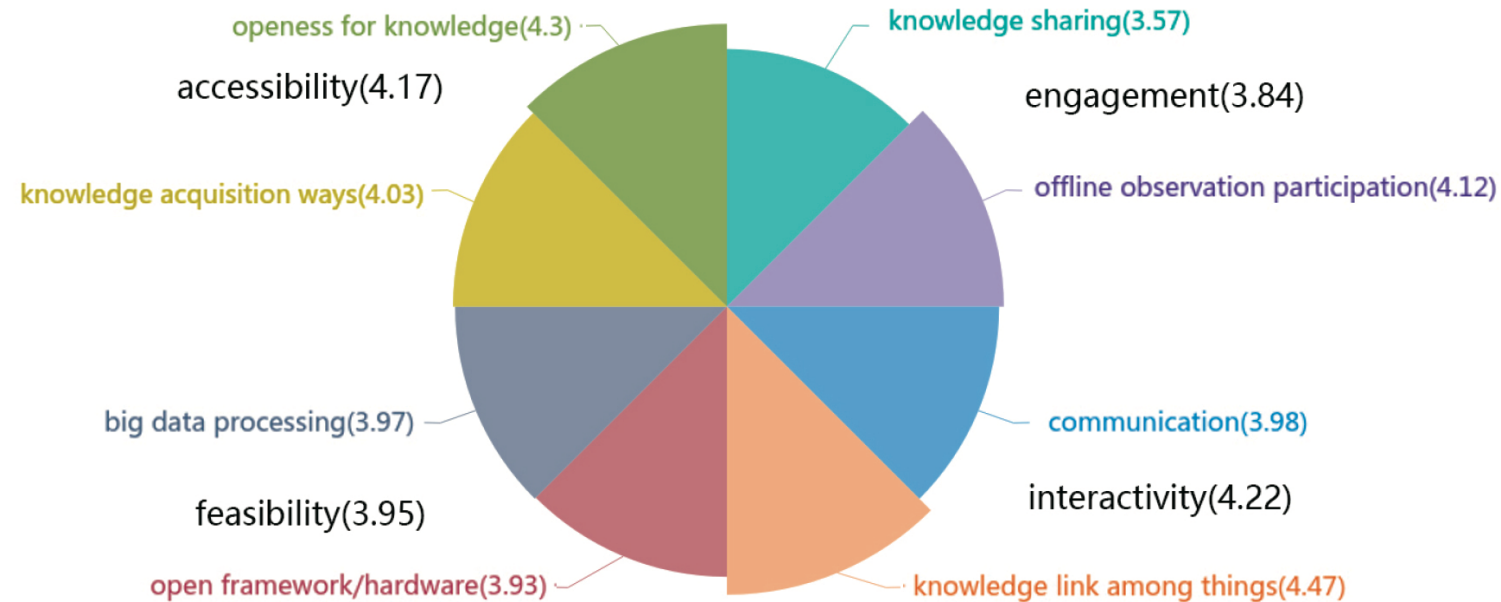


Citizen science evaluation model of “ZooseeFun” Application

Items	Aspects
Adding information to a real scene allows me to better understand the animal and learn the relevant knowledge.	Offline observation participation
When visiting the animals, it's a kind of boring if I can only see the animals through the fence.	
If I can see someone else's sharing relevant information, I think it will be more interesting.	Knowledge sharing
When I visit the animals, I want to be able to learn the ideas and opinions of others and see what others are paying attention to.	
If I can comment and communicate with others through this software, I think it will be more interesting.	Communication/commenting
I want to “take these animals home” to communicate and share with families or friends who cannot come along with me.	
If the software can help me link and set up the knowledge between animals, I think I will understand the animals and the relationship between them better.	Knowledge link among things
When I visit the animals, I want to know or see how animals live in different seasons.	
It is more convenient for me to get a description by scanning or taking pictures of animals.	Openness for knowledge
It's a kind of trouble when I need to squeeze the crowd and get close to the introduction card to get the relevant knowledge of animals.	
It's very natural and easy for me to get information by clicking the button or voice.	Knowledge acquisition ways
I hope that someone can give me an introduction when I am watching animals.	
Through a large amount of data of the various aspects of the animal, my understanding of animals can be deeper.	Big data processing
I would like to learn the data of how much food animals eat every day, the amount of exercise they take and their weight etc., which makes me feel very interested.	
If this software allows users to modify and improve their content and functions, I will be more inclined to use it.	Open framework
I would like to have a software that can be edited and defined with functions about the various animal information.	

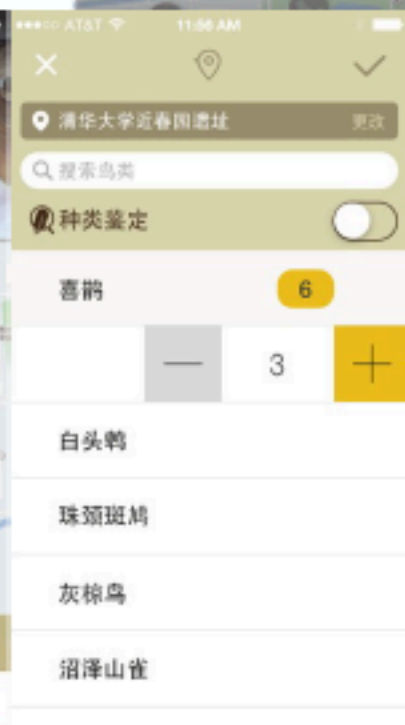
Citizen science evaluation model of “ZooseeFun” program

we did an evaluation survey among 30 users of “ZooseeFun” program where users give rating for each evaluation aspect. All the indexes are significant higher than 3 (all $p < 0.000$). So all the indexes are important for design. **Interactivity index** got the highest score, which indicates that human communication with humans or objects and scientific knowledge link among connected things are very important to people when visiting the zoo.

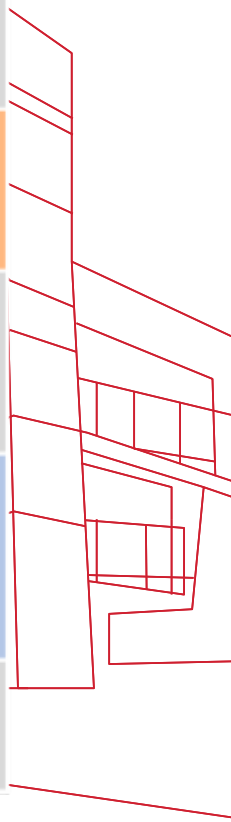


THU Bird -- Bird Observation in Tsinghua University and citizen science for natural observation



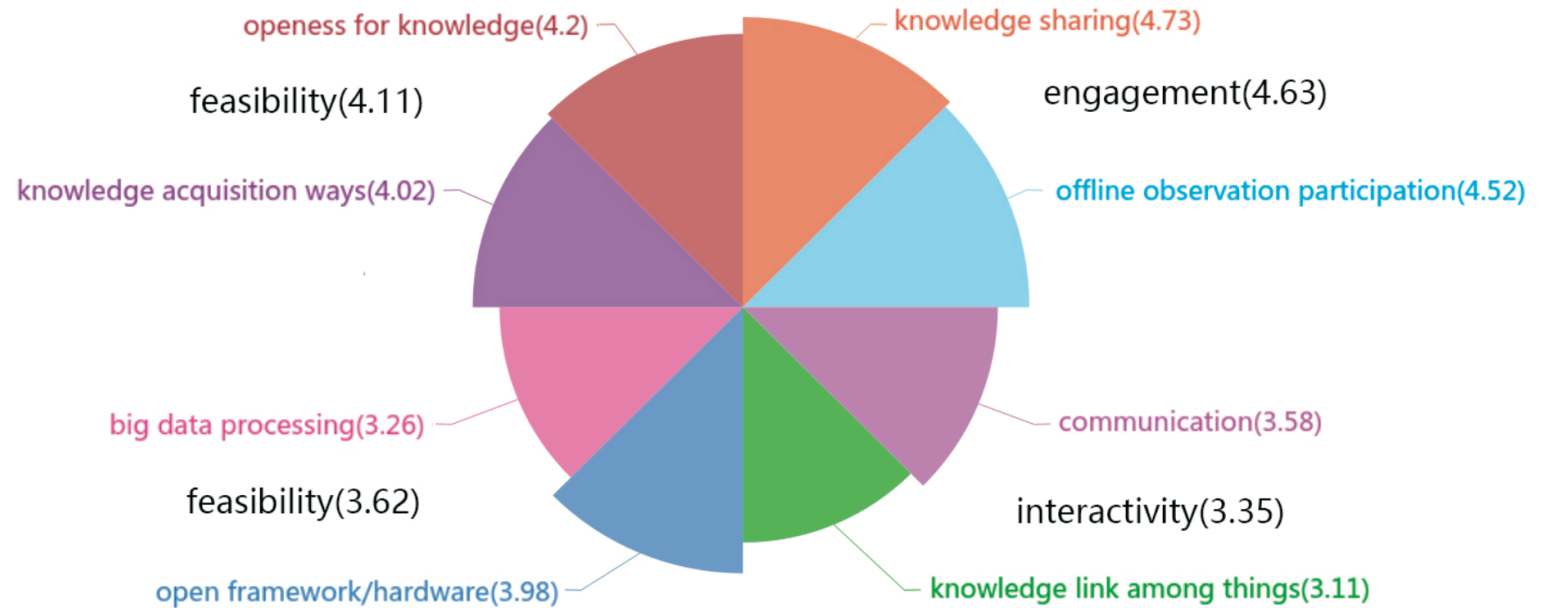


Element	Pair features	Design opportunities
Social network	Online/ Offline	For online feature, database and data storage makes it easy for students browse bird data and record bird observation activity, which inspires us to design a online information map on which people get access to bird knowledge in different time, space and technologies. For offline feature, online community helps us to form bird observation offline activity, which inspires us to design message push systems to inform users of offline bird observation activities.
	Collective/ Individual	Collective feature and individual feature enlighten us to do users group partition including beginner level, intermediate level and expert level. Enough individual participants record individual observing and publish bird data to achieve new citizen science experience by crowdsourcing.
Connected things	Platform/ Product	Platform feature tells us to create an open and collaborative platform for bird science on campus. Product feature inspires us to notice that smart hardware product for bird science on campus can be a great design choice in the context of Internet of Things.
	Result/ Process	Result and process features inspire us focus on not only people's acquiring bird knowledge, but also the process of bird science acquisition such as where to find observation site, what to do when birds don't show up.
	Light/ Heavy	Light feature means simple and interesting ways to get bird science on campus are needed such as data map and bird data filtering. Heavy feature in this program is abandoned in accordance with light application expectation.
Scientific field	Open/ Customized	Open feature inspires us to create a open but appropriate environment for students to do bird observation. Customized feature inspires us to design application which is able to meet customized bird observation needs such as contextual navigation and message push of bird migration.
	Original/ Reformed	Original and reform features remind us to design an iterative bird science systems where bird science is updated from the original state.



Citizen science evaluation model of “THU Bird” program

According to eight detailed evaluation aspects for each evaluation index, 50 Tsinghua university students are chosen to join in evaluation survey. Engagement index got the highest score, which reveals that sharing birds' knowledge including where and when to observe birds and what birds are in Tsinghua University plays an important role in conducting bird-observing activity.

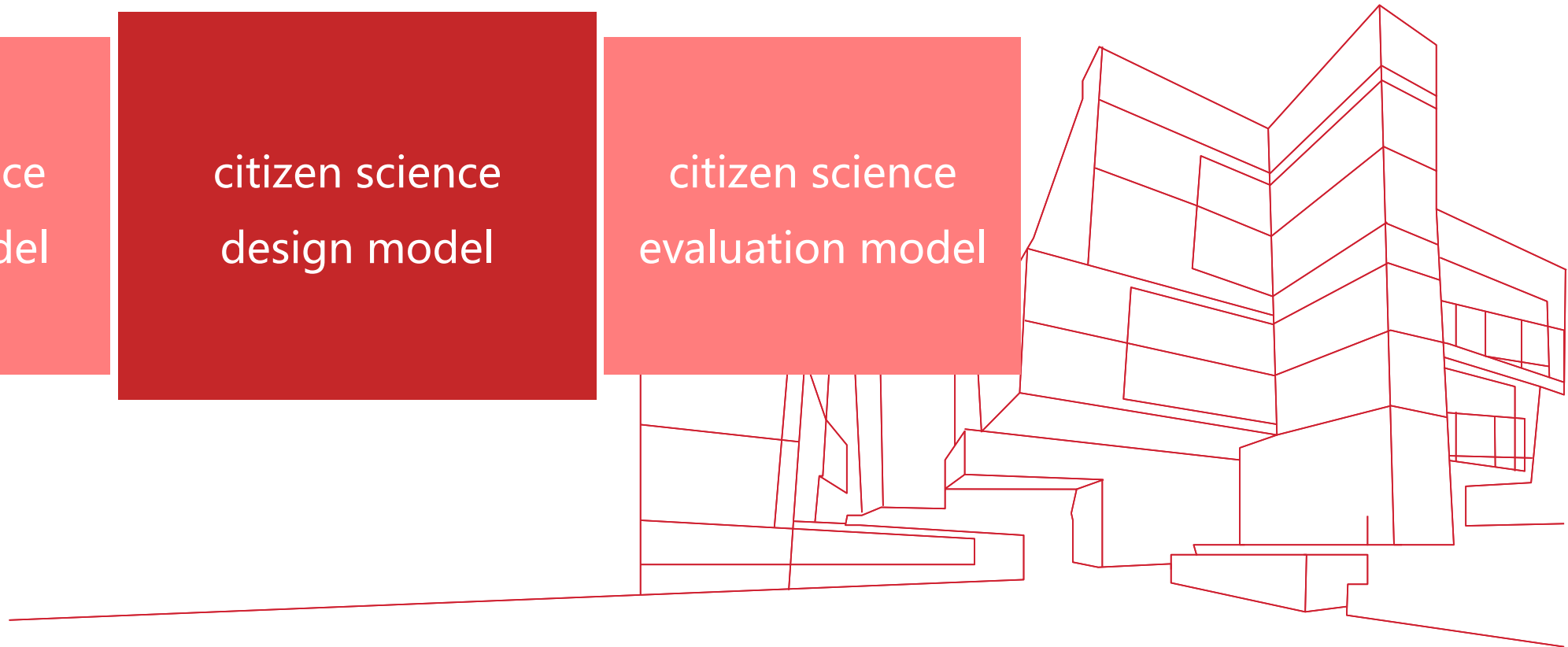


Discussion and Future Works

citizen science
content model

citizen science
design model

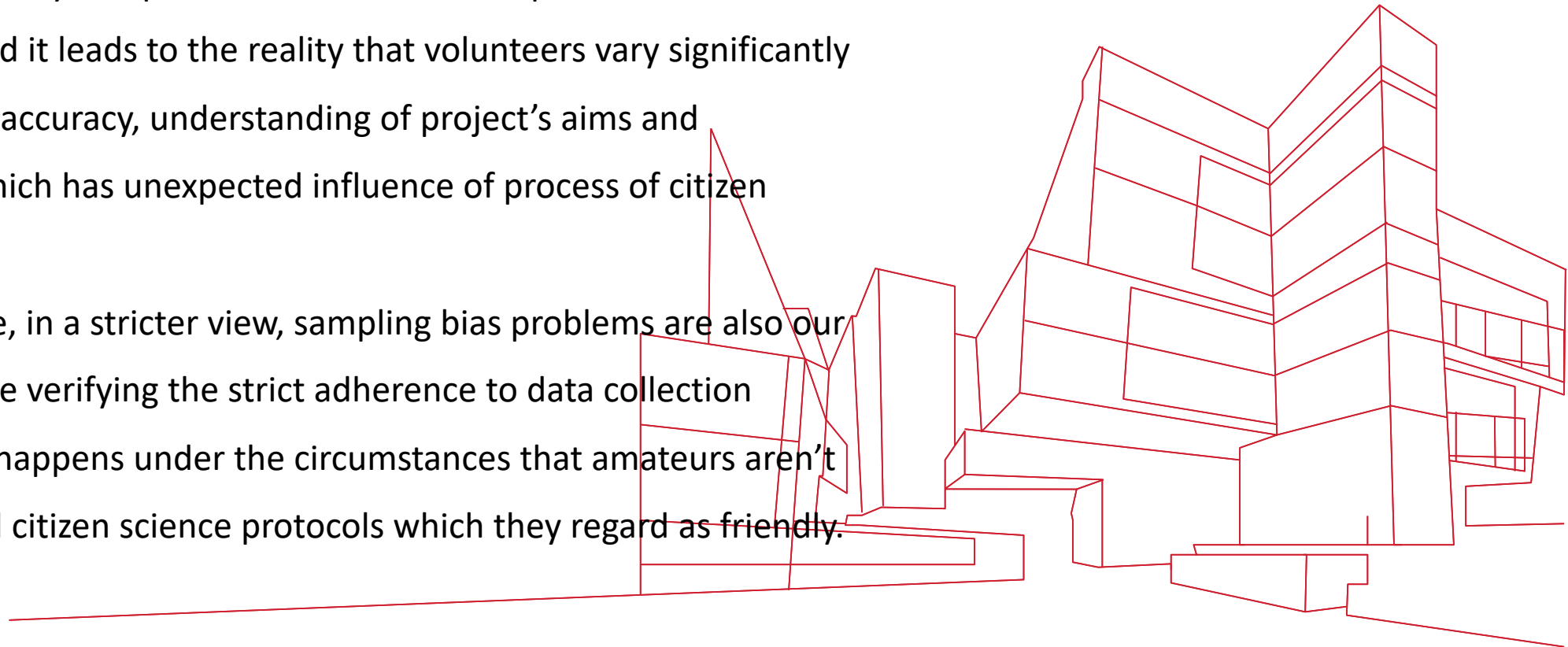
citizen science
evaluation model



Discussion and Future Works

However, there exists variability of participants' competency because amateurs take part in citizen science projects maybe motivated only by interest which hardly compensates lack of relevant professional skill requirements and it leads to the reality that volunteers vary significantly in their training, accuracy, understanding of project's aims and ramifications, which has unexpected influence of process of citizen science projects.

At the same time, in a stricter view, sampling bias problems are also our concerns because verifying the strict adherence to data collection protocols rarely happens under the circumstances that amateurs aren't informed of rigid citizen science protocols which they regard as friendly.



Beijing, China

The Research on Design Framework for citizen science

Zhiyong Fu, Jia Lin, Lu Wang

Tsinghua University

