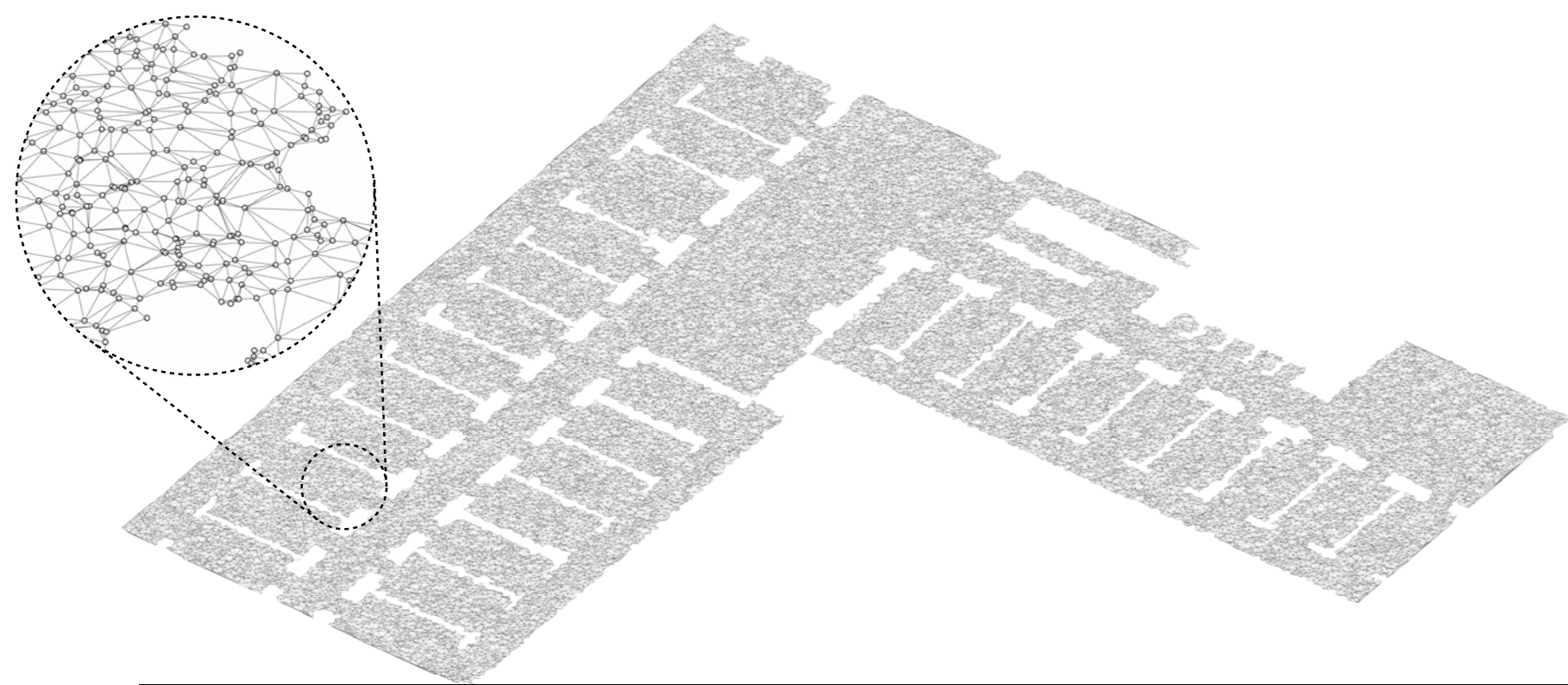# ARAI LAB.

Updating an architectural design

Department of Human and Social Systems
Asian Urban TOD Research

Information-centric design

Ⅰ. A new notation of spaces


QCD(Quantification/Calculation/Desing) of spaces

Where a place is located, how large and what shape it is, and what can be seen from it are closely related to the activities that take place in that place. Spatial information can vary from place to place, making proper understanding of this information essential for spatial analysis and design. We are developing a new notation of spaces by scattering millions of points all over the space and connecting them to each other, while researching what is possible by considering architectural space as a distribution of spatial information.


Ⅰ-1. Spatial analysis

QCD of movements

Constructing a Delaunay network with a set of points scattered throughout the space, the shortest path between any two points can be approximated. This method can quickly determine the actual shortest path regardless of the placement of obstacles, thus enabling spatial analysis in which distance is dominant.
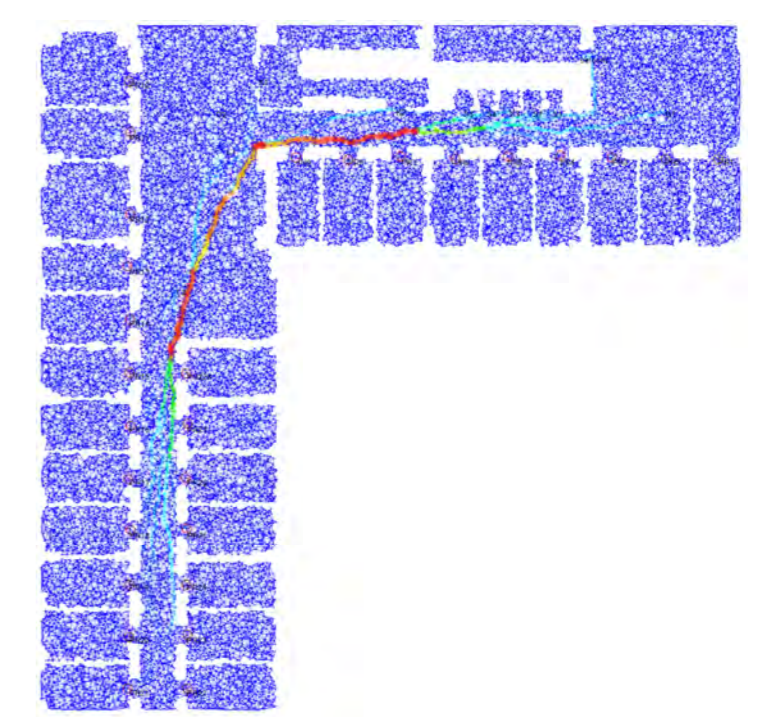

Betweenness centrality


Ⅰ-2. Visual environment description
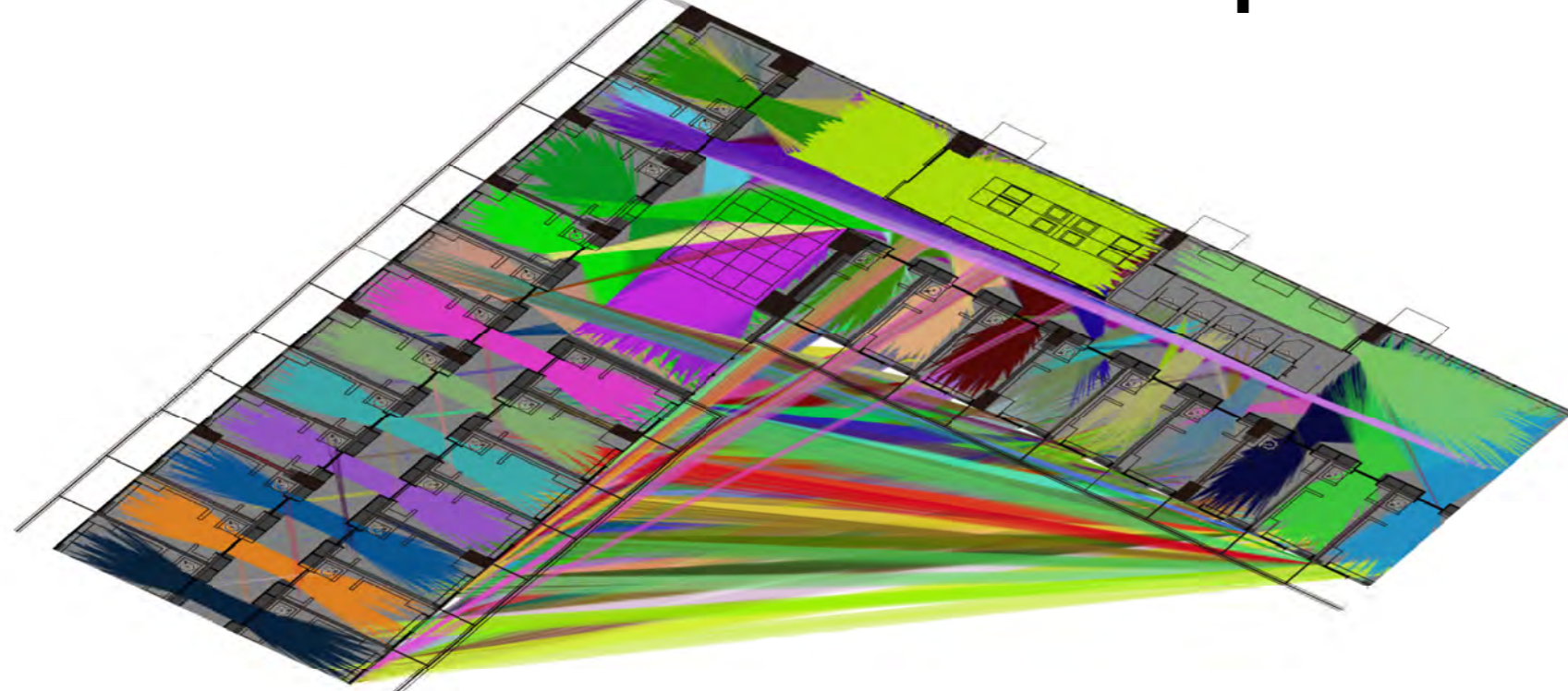
QCD of visibility

By determining the collision between a line segment connecting any two points and an obstacle, it is possible to quantitatively evaluate the particularly problematic viewing and privacy. This method can also be applied to the evaluation of visibility of landmarks and the sky, etc., by allowing the viewer/seen relationship to be varied.


共用部のビジビリティ成分（Rays/㎡）
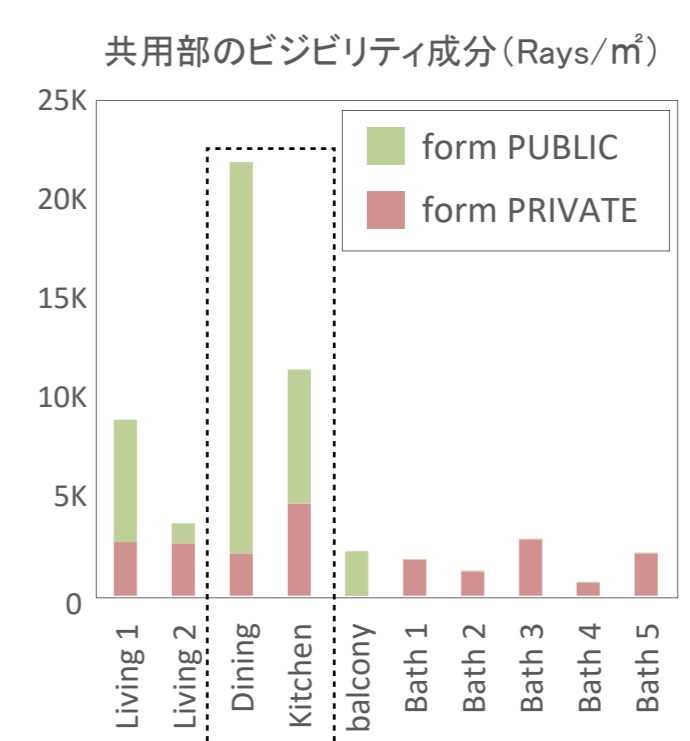
Visibility of rooms

Ⅰ-3. Enumerate convex spaces
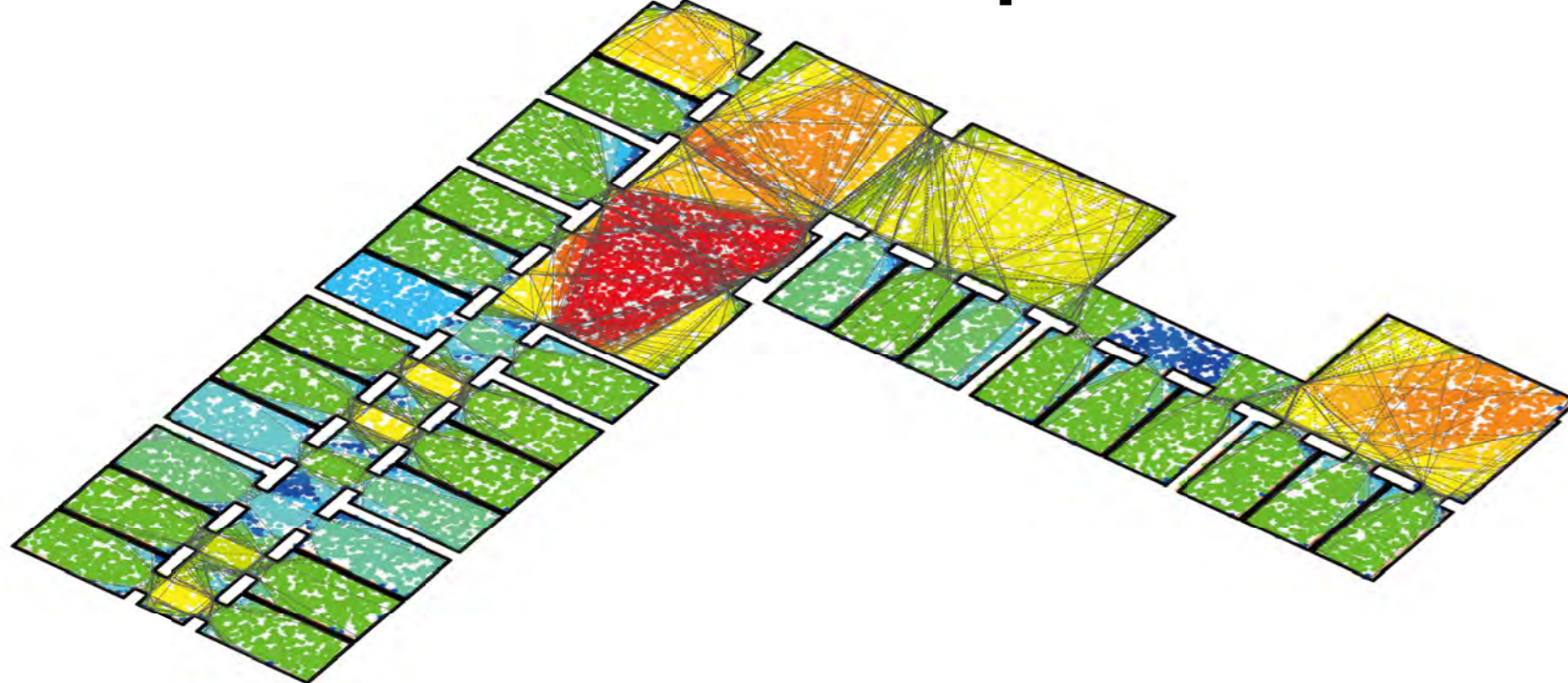
QCD of Assumptions for activities with others

A convex space can be extracted by constructing a visible graph from a set of points in the vicinity of obstacles. Since all people can see each other in a convex space, if we can extract convex spaces embedded in architectural spaces, it will be possible to identify locations where activities that require the presence of others can occur.
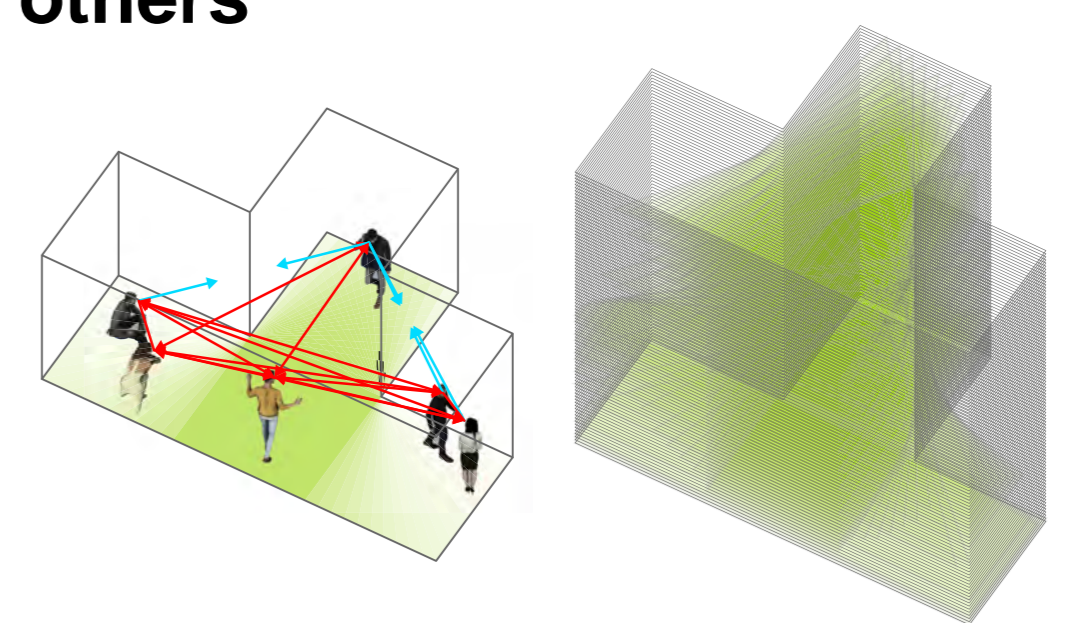
Convexhulls

Ⅱ. Design as Inverse Problem Analysis
Challenges in overcoming asymmetries in research and design

Architecture
Arrangement of architectural elements
X

Research | Numerical simulation Machine learning
$y = f(X)$

Design | mathematical optimization
$X = f^{-1}(y) \quad (min : |y - \hat{y}|, s.t : \hat{y} = f(X))$

Phenomenon
People flow/
How a place is used
y

Information-centric Design is a study that attempts to connect design and research by considering architecture as a distribution of [distance, visual, and geometry] information. In Information-centric Design, research is a forward problem and design is an inverse problem.

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