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Structuring Relations Between User Tasks and Interactive Tasks using a Visual Problem-Solving Approach

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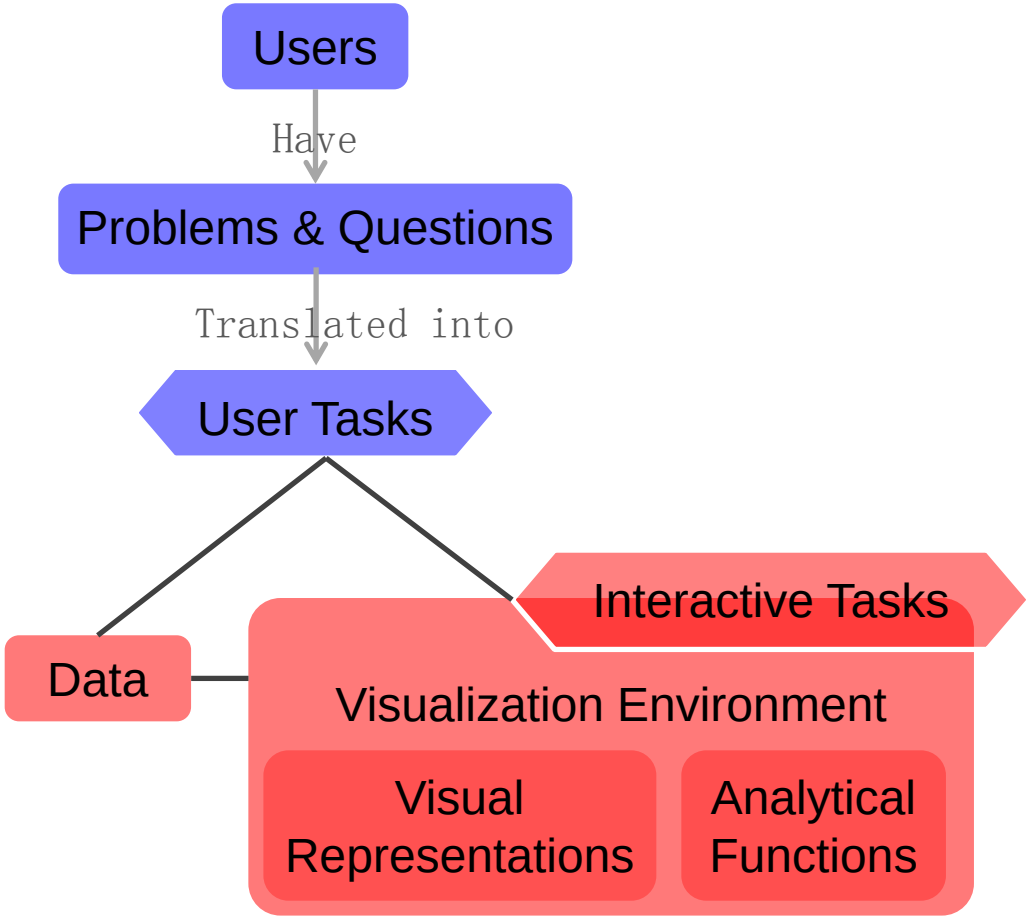
DEFINITION

- A task is a two-faceted concept that includes:
  - **User tasks** refer to cognitive operations performed by a user to address domain problems.
  - **Interactive tasks** refer to logical sequences of interactions that carry out the user tasks.
- User tasks and interactive tasks are related according to their role in a visual problem-solving approach.

RELATION

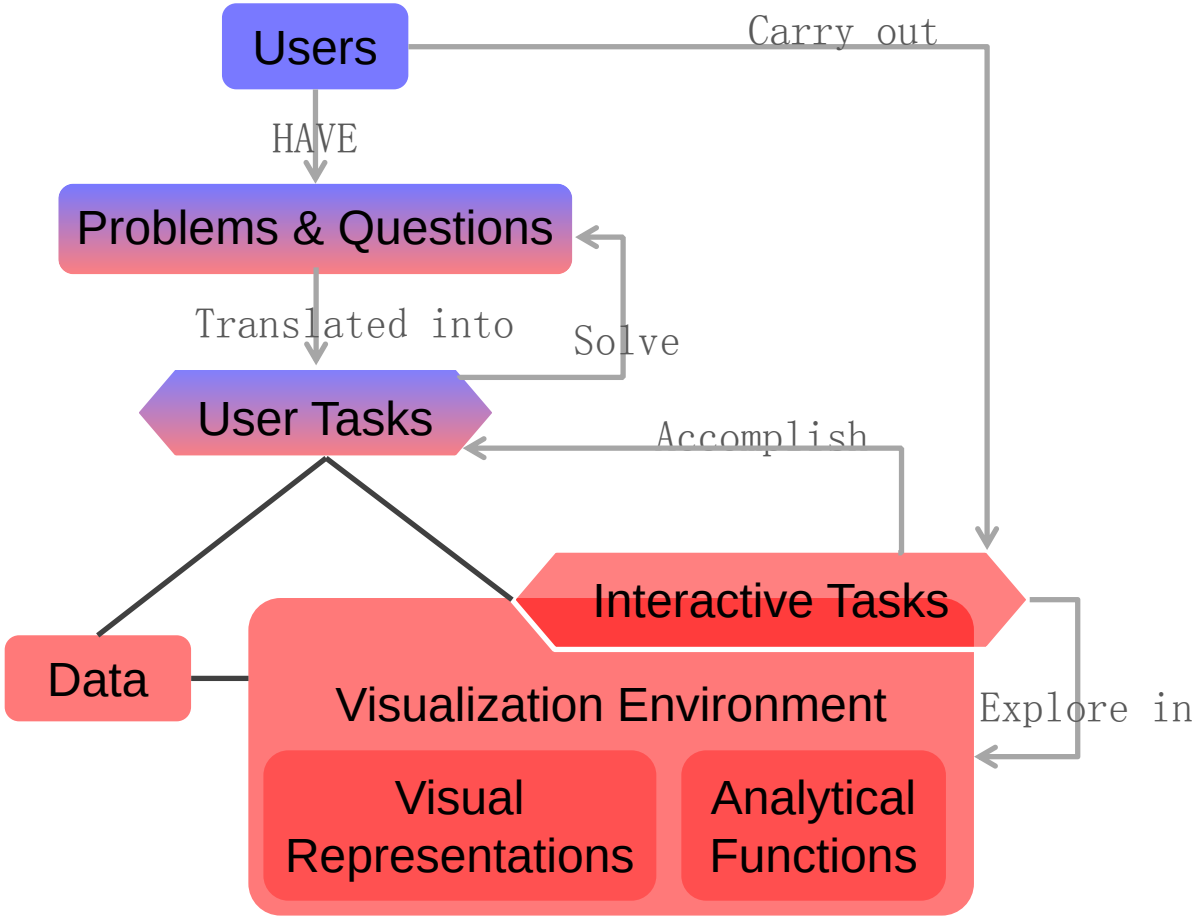
Domain of User's problems



Domain of Designer's Visual Solutions

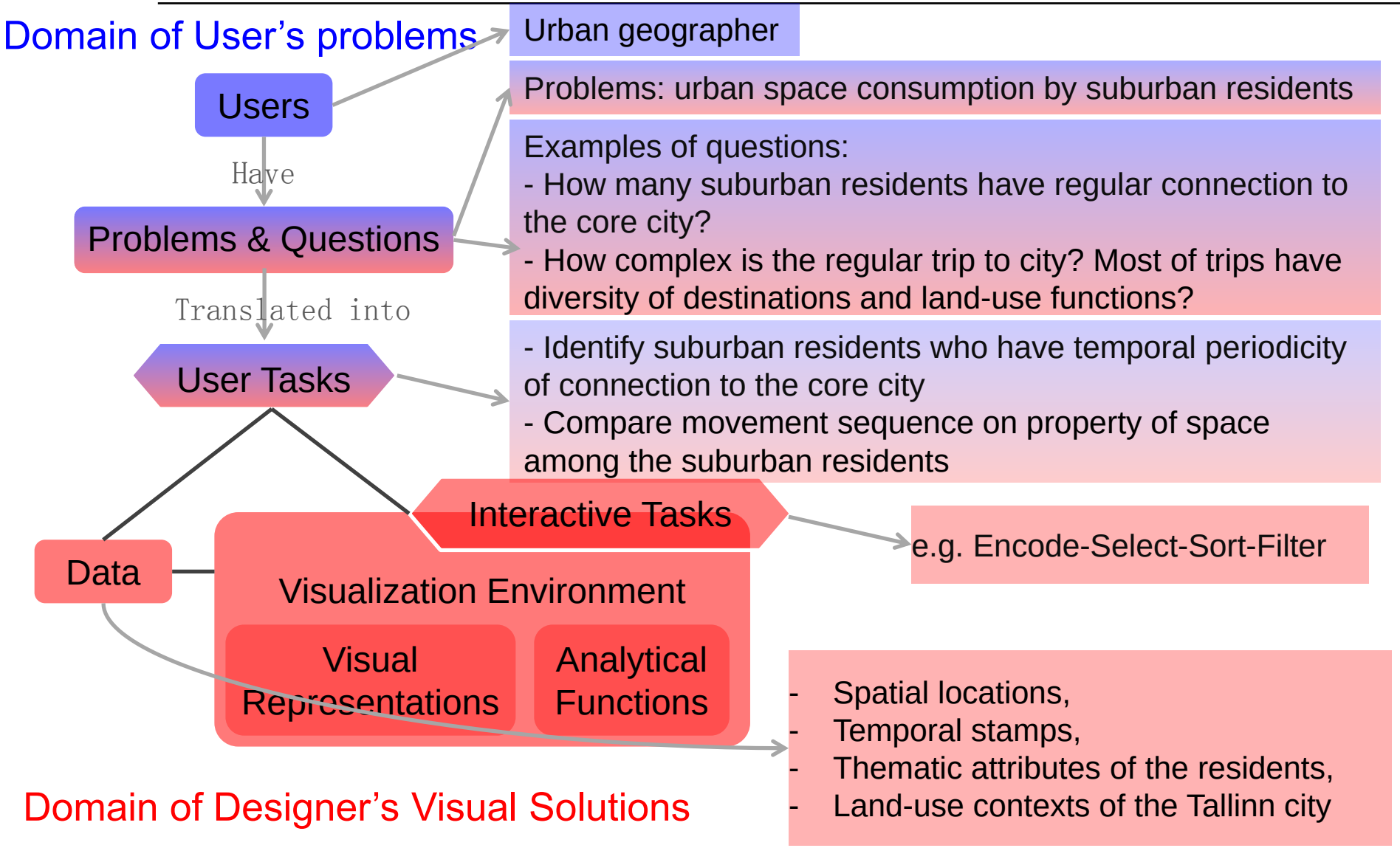
RELATION

Domain of User's problems

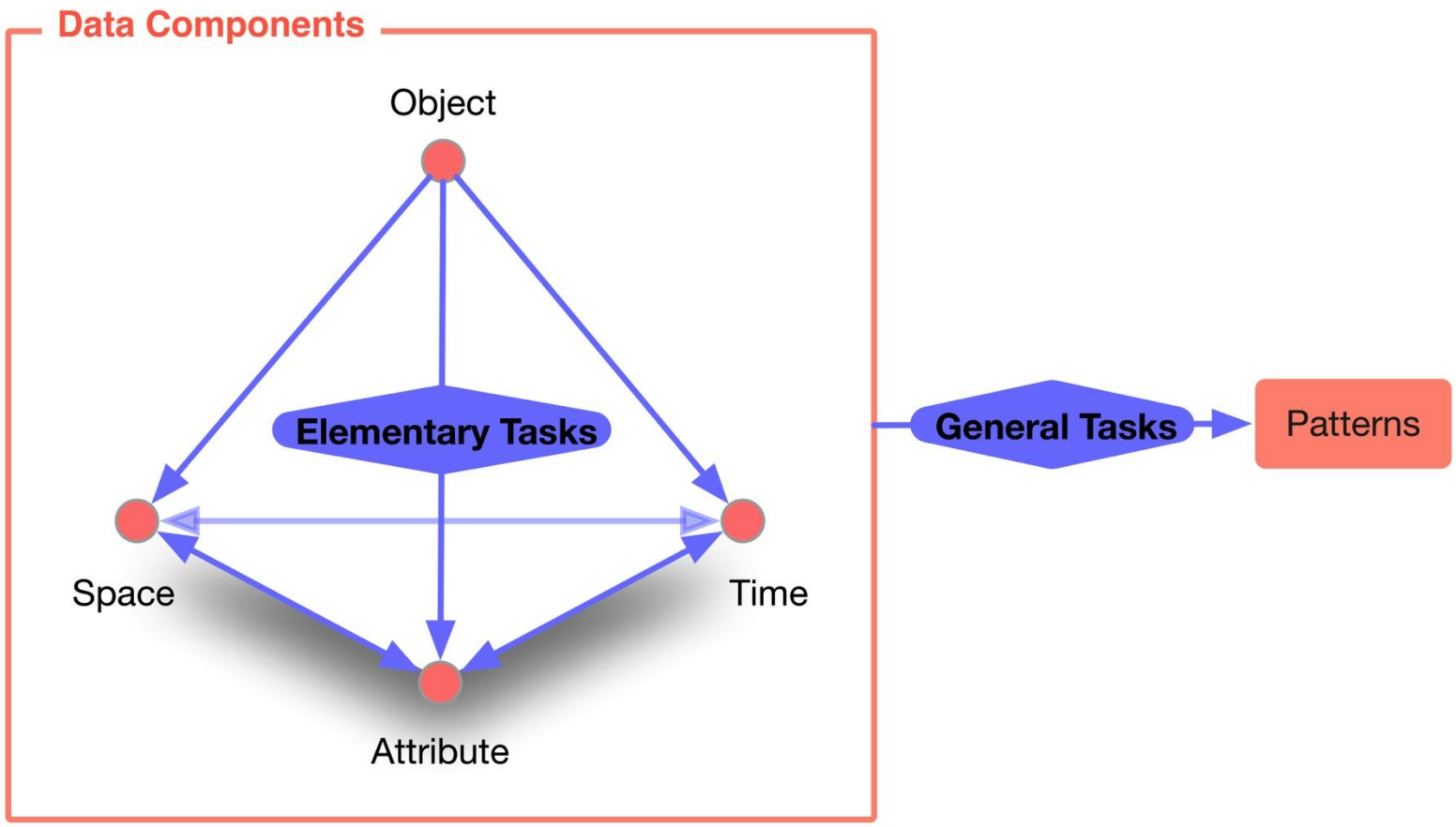


Domain of Designer's Visual Solutions

RELATION-CASE EXAMPLE



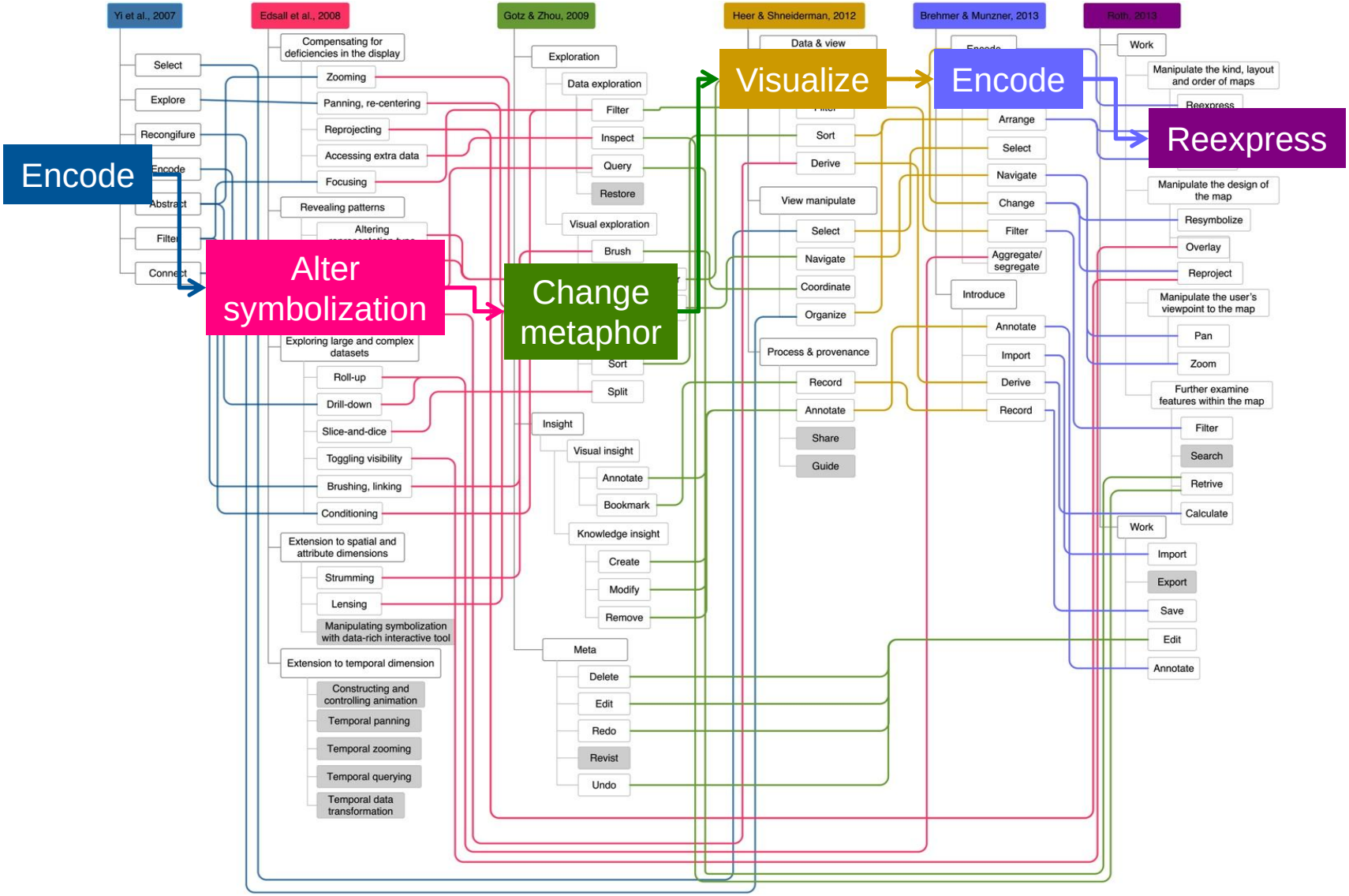
USER TASKS


Data Components
Object
Elementary Tasks
Space
Time
Attribute
General Tasks
Patterns

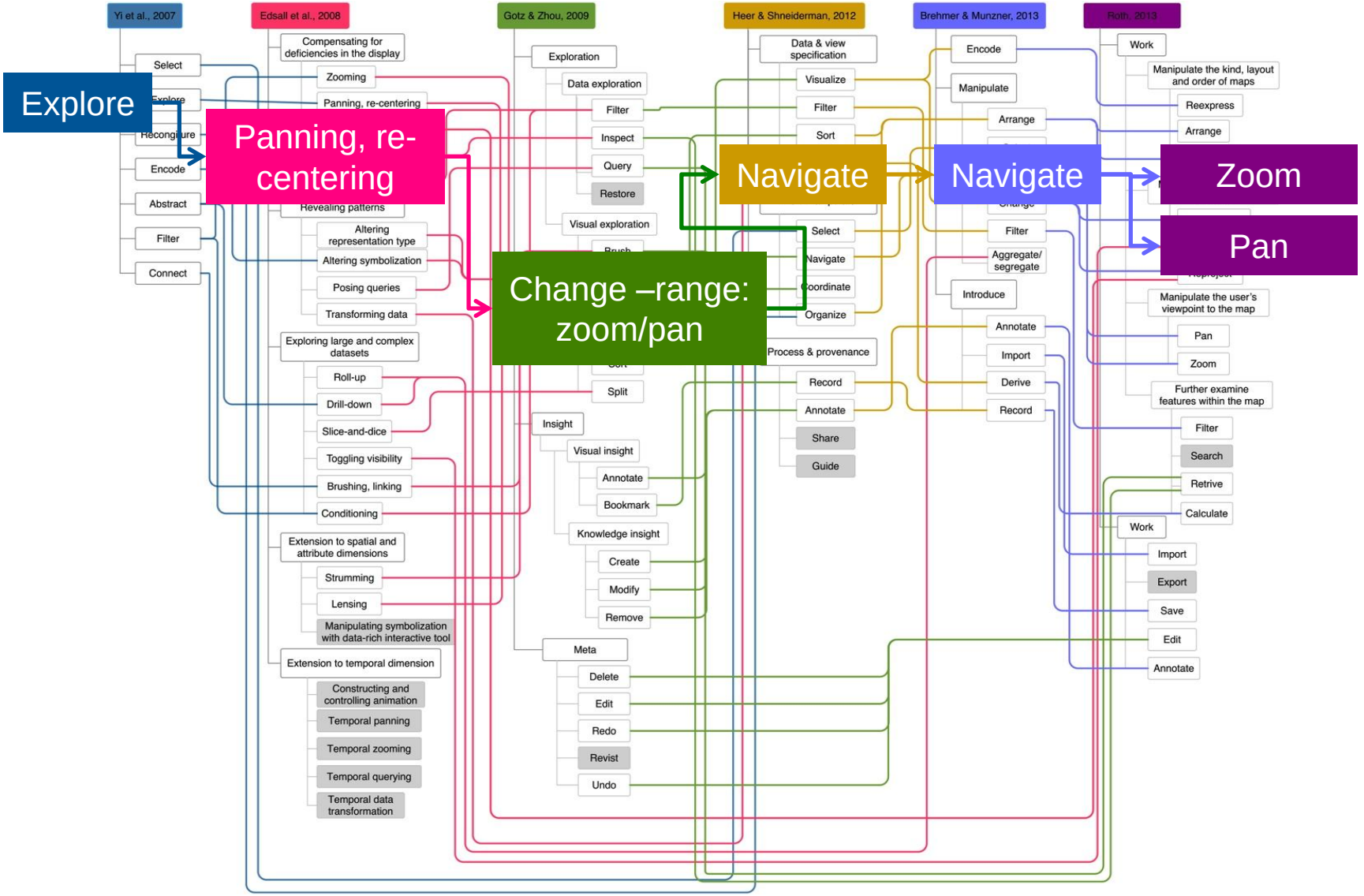
THREE PRIMITIVE USER TASKS

- **Identification** focuses on finding attribute values at the elementary level or patterns at the general level, corresponding to the questions who and what.
- **Localization** focuses on positioning the known data components and their attributes at the elementary level or known patterns at the general level in space and/or time, corresponding to the questions where and when.
- **Comparison** focuses on finding the similarities and differences among data components, corresponding to the questions how.
- Other user tasks apart from the above three primitives can be decomposed into a sequence of primitive tasks.

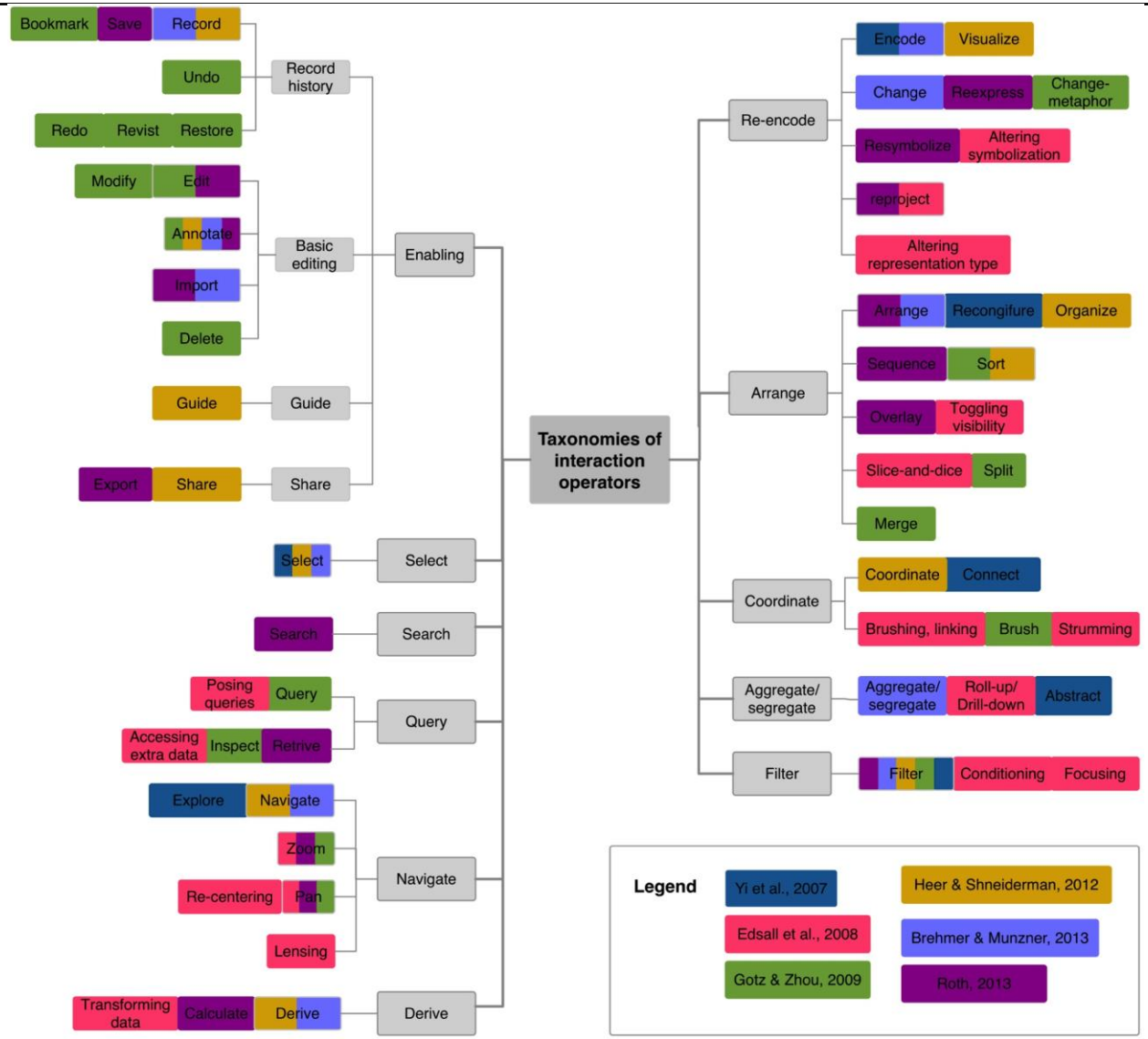
INTERACTIVE TASKS: A SUMMARIZATION OF TAXONOMIES OF INTERACTION OPERATORS



INTERACTIVE TASKS: A SUMMARIZATION OF TAXONOMIES OF INTERACTION OPERATORS



INTERACTIVE TASKS: TAXONOMY OF INTERACTION OPERATORS



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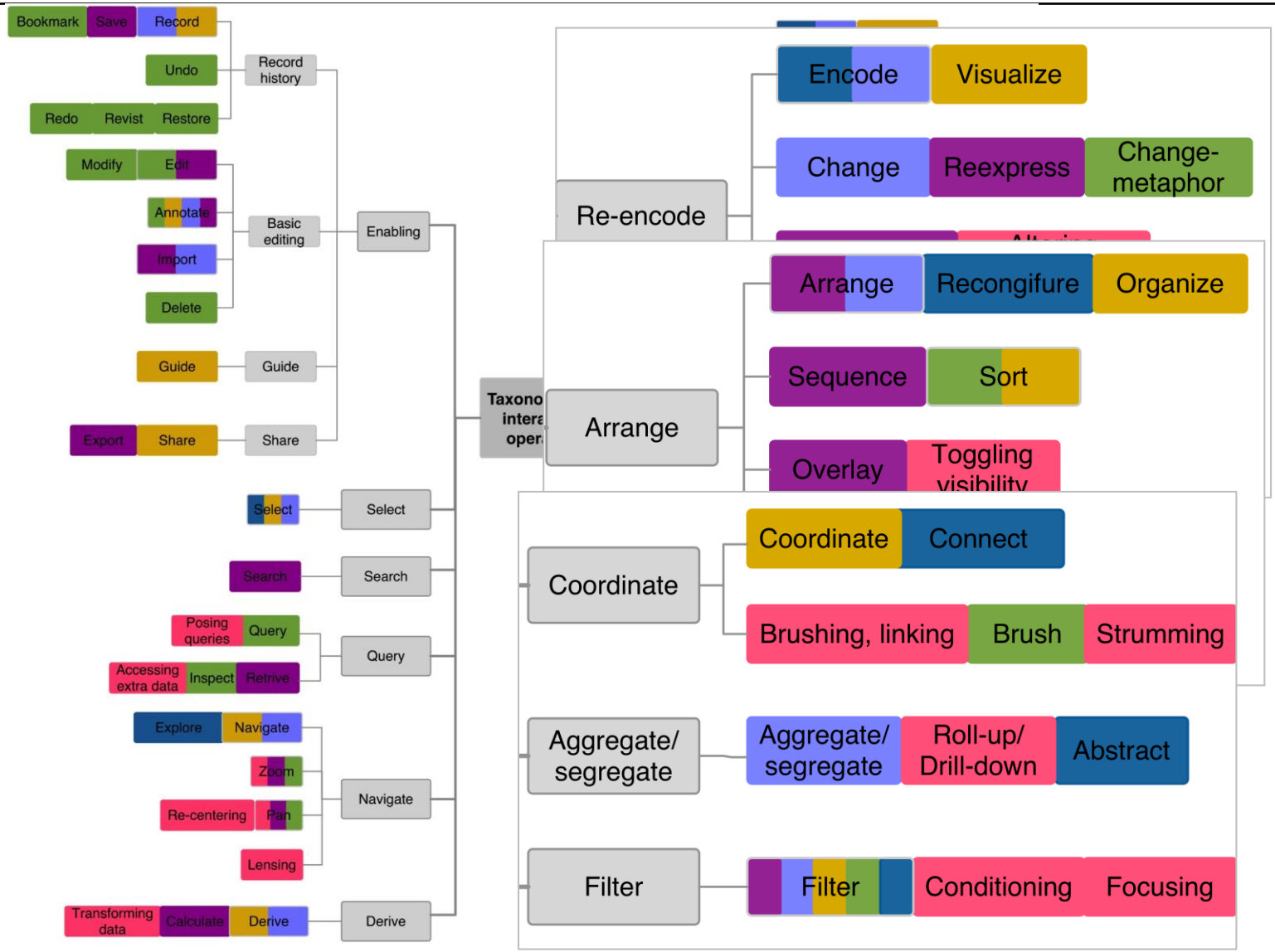
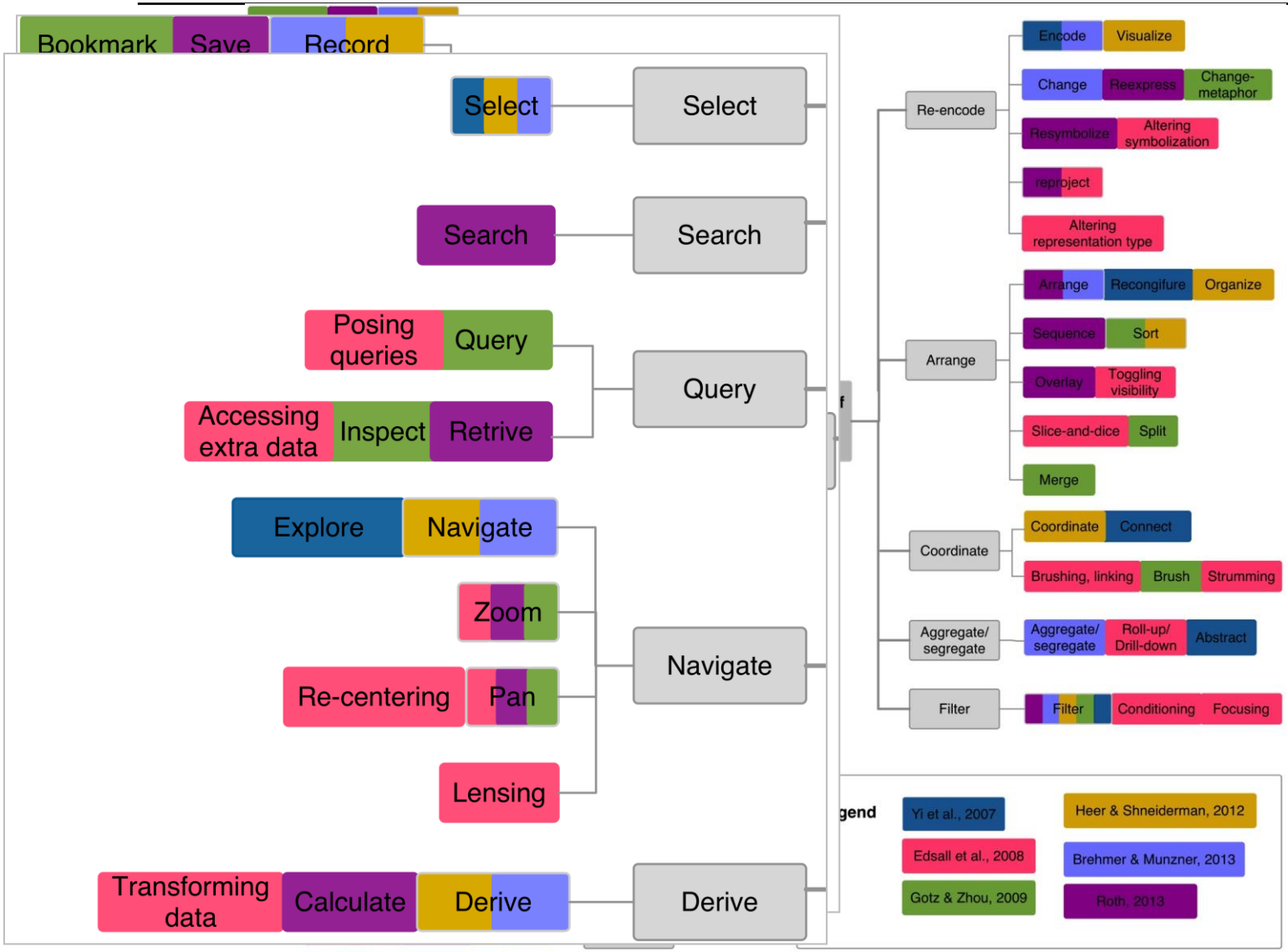


INTERACTIVE TASKS: TAXONOMY OF INTERACTION OPERATORS



RELATION-CASE EXAMPLE

User: Urban geographer

Problems: urban space consumption by suburban residents

Examples of questions:
- How many suburban residents have regular connection to the core city?
- How complex is the regular trip to city? Most of trips have diversity of destinations and land-use functions?

User Tasks:
- Identify suburban residents who have temporal periodicity of connection to the core city
- Compare movement sequence on property of space among the suburban residents

Interactive tasks: Encode-Select-Sort-Filter

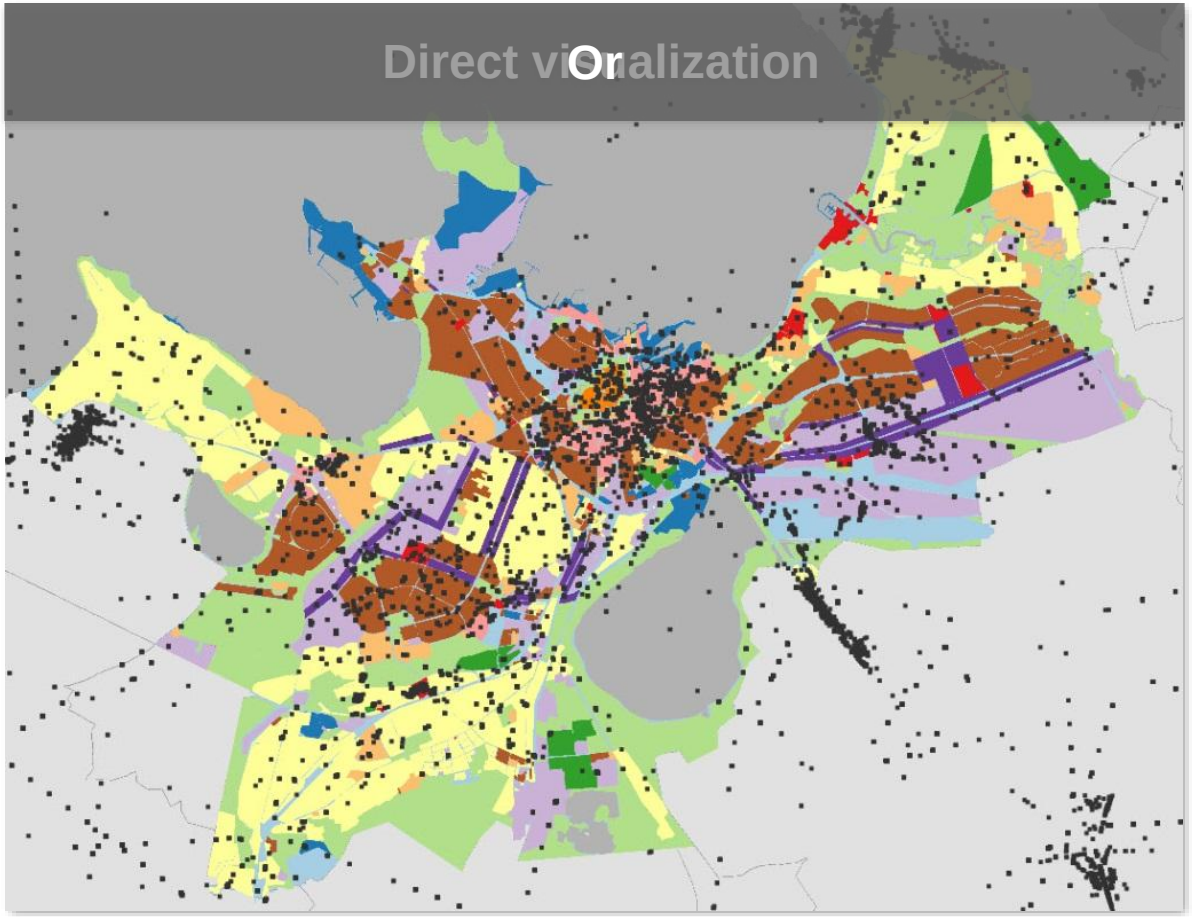
Data components:
- Spatial locations,
- Temporal stamps,
- Thematic attributes of the residents,
- Land-use contexts of the Tallinn city

CASE EXAMPLE

Encode data

Direct visualization

Or



Connection to the city view

A ***Entry/exit times and duration***

X axis 277 participants

Y axis

One gray column

Size

B

X axis

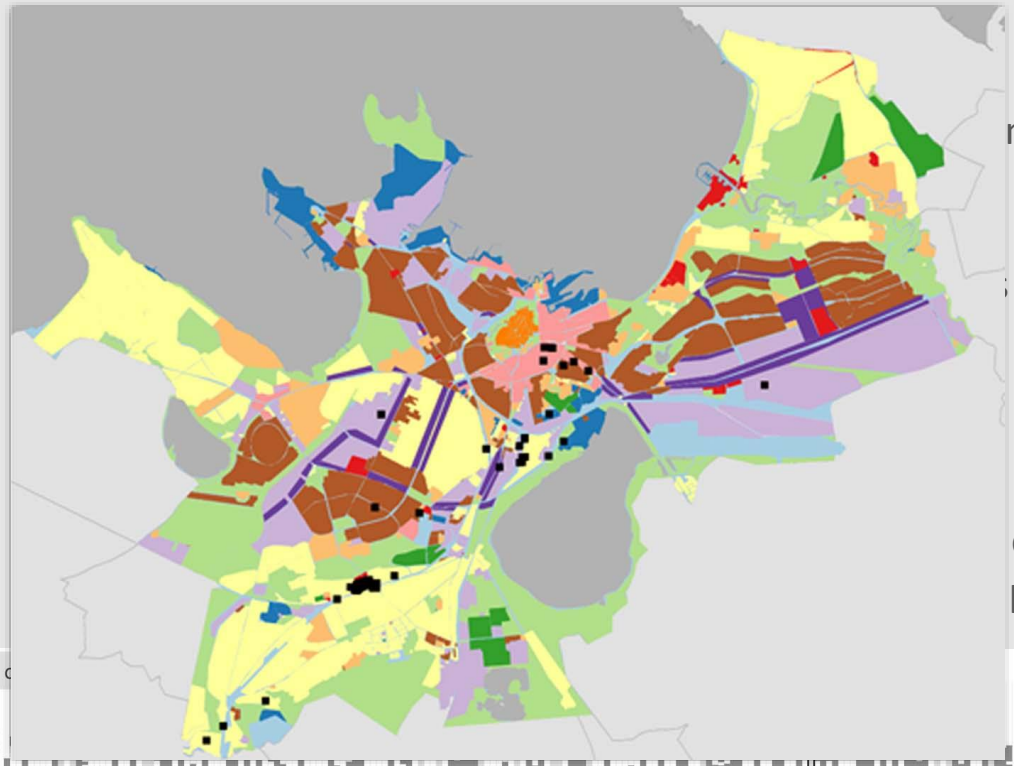
Size (of bar chart)

Order

C

Y axis

Size (of bar chart)

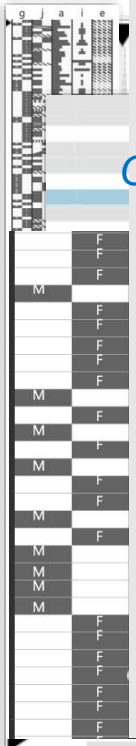


n in the city

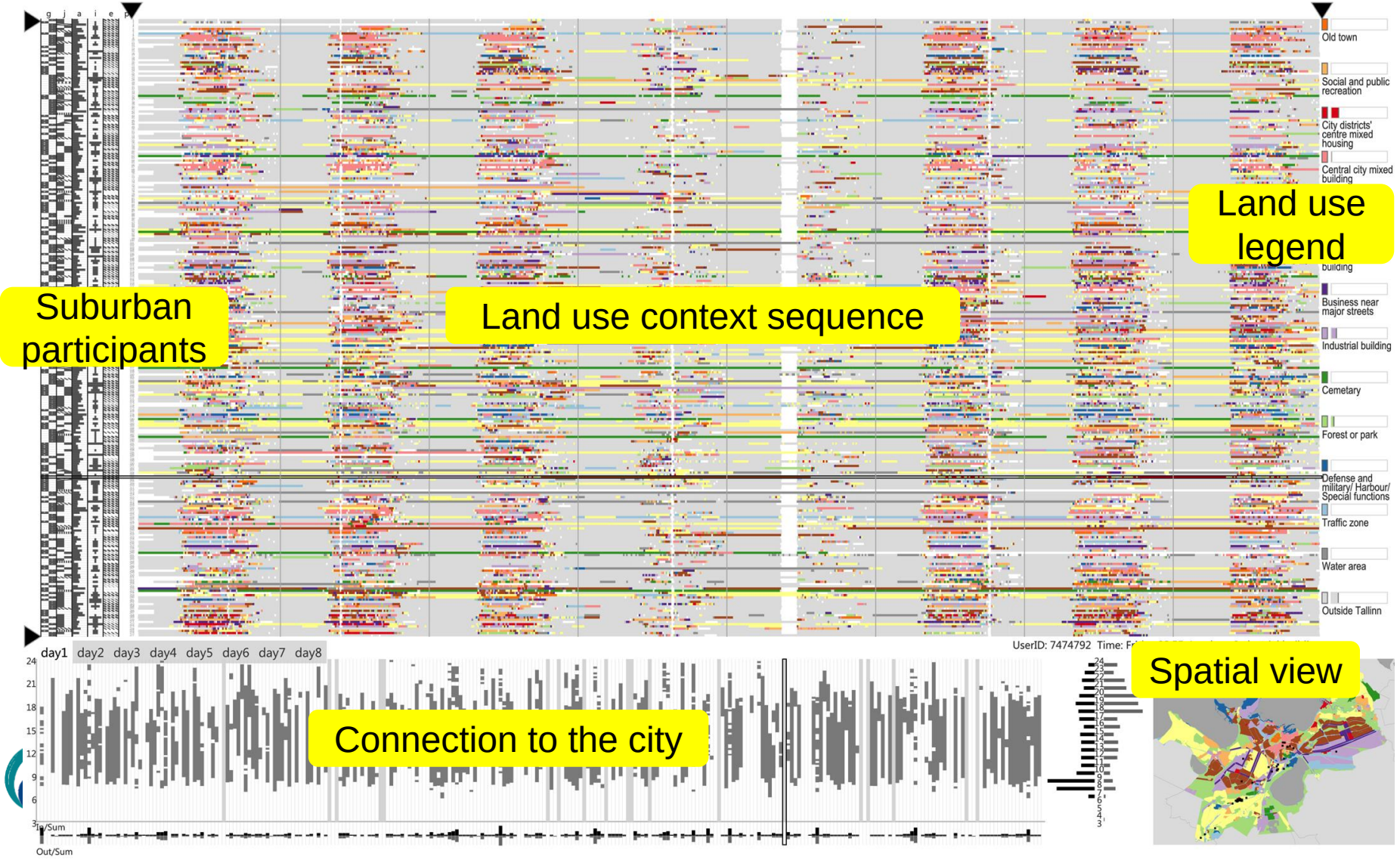
of entry

of entry

participants



CASE EXAMPLE

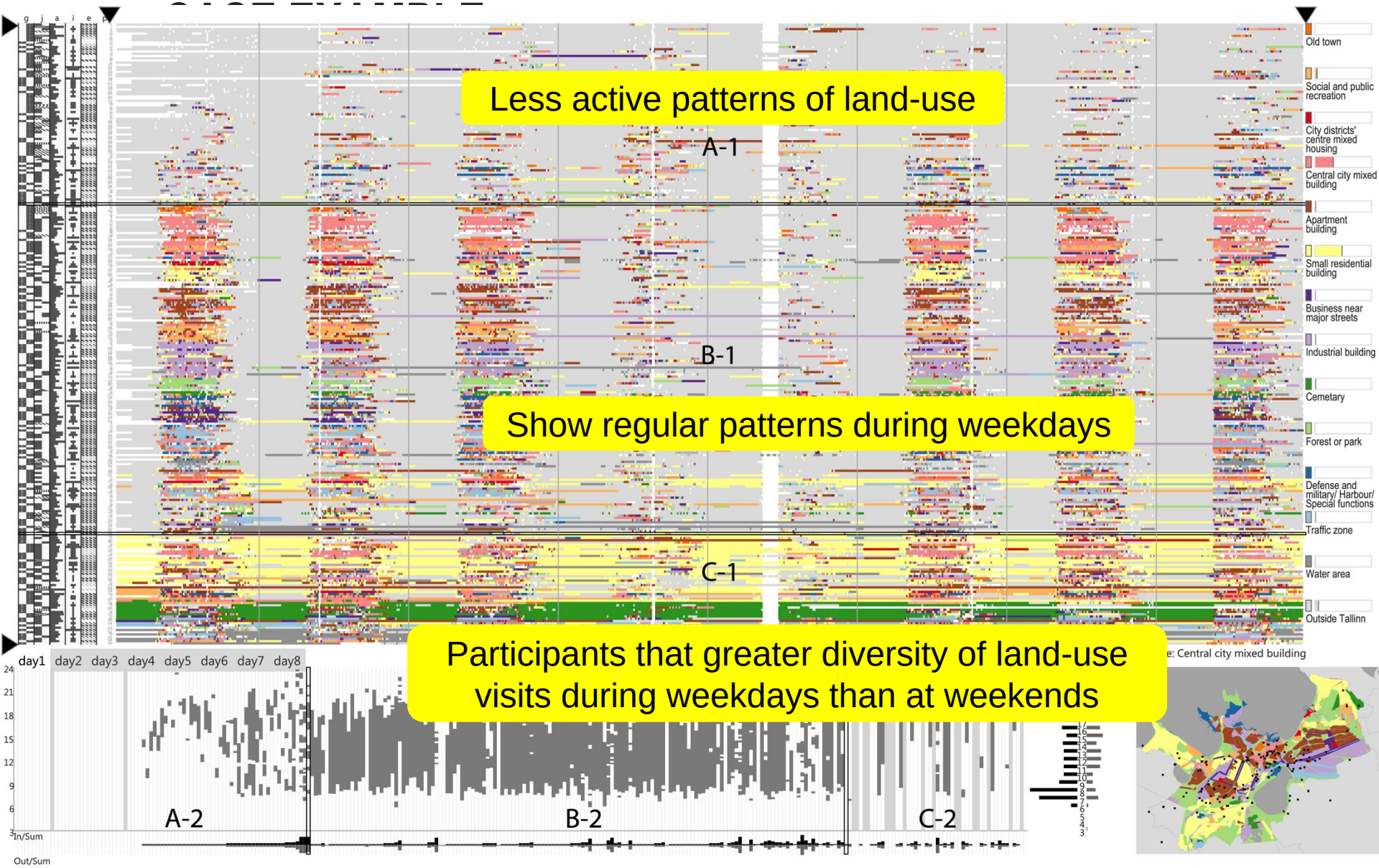


CASE EXAMPLE

Encode data

Sort residents by the number of time they were entering the city on one weekday

Sort residents by land-use types visited by residents at working, then leisure and then home times on the same day


Less active patterns of land-use
A-1
B-1
C-1
Show regular patterns during weekdays
Participants that greater diversity of land-use visits during weekdays than at weekends
Old town
Social and public recreation
City districts' centre mixed housing
Central city mixed building
Apartment building
Small residential building
Business near major streets
Industrial building
Cemetary
Forest or park
Defense and military/ Harbour/ Special functions
Traffic zone
Water area
Outside Tallinn
day1 day2 day3 day4 day5 day6 day7 day8
A-2
B-2
C-2
In/Sum
Out/Sum

CASE EXAMPLE

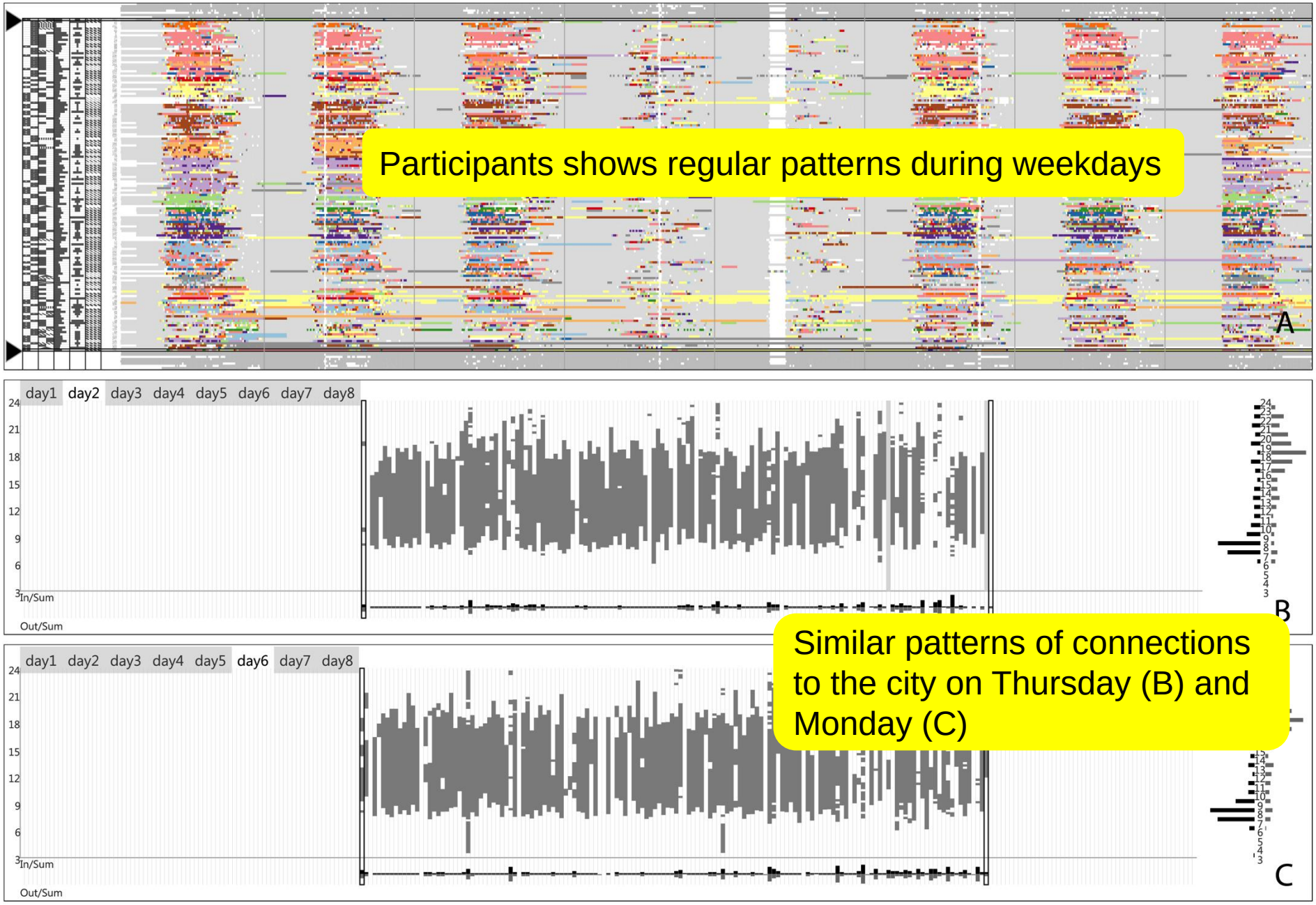
Encode data

Sort residents by the number of time they were entering the city on one weekday

Sort residents by land-use types visited by residents at working, then leisure and then home times on the same day

Filter to show the residents who show regular pattern during weekdays

Filter to show connections to the city on Thursday and Monday


Participants shows regular patterns during weekdays
A
day1 day2 day3 day4 day5 day6 day7 day8
24
21
18
15
12
9
6
3
In/Sum
Out/Sum
B
Similar patterns of connections to the city on Thursday (B) and Monday (C)
day1 day2 day3 day4 day5 day6 day7 day8
24
21
18
15
12
9
6
3
In/Sum
Out/Sum
C

CASE EXAMPLE

Encode data

Sort residents by the number of time they were entering the city on one weekday

Sort residents by land-use types visited by residents at working, then leisure and then home times on the same day

Filter to show the residents who show regular pattern during weekdays

Filter to show connections to the city on Thursday and Monday

Filter to show the group residents of “worker”

Sort by gender


Male workers
Female workers
Male worker
Female worker
A
day1
day2
day3
day4
day5
day6
day7
day8
M
F
In/Sum
Out/Sum
Compare gender differences
B
Male workers
Female workers

CONCLUSION

- This paper presents a refined taxonomy of user tasks and interactive tasks
  - Establish a logical structure between user tasks and interactive tasks through the roles they play in a visual solution design process
  - Investigate the composition of both tasks.
  - Identify three primitive user tasks
  - Extract and merge interaction operators with same functions
- Intends to support those who seek parameters for designing visual solutions to users' domain problems.