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Concept Verification and Validation Using Psychological Scales through an “Eating-Together” System Enhancing Connectivity for Busy-Generation Urbanites with Neighborhood Community in Japan

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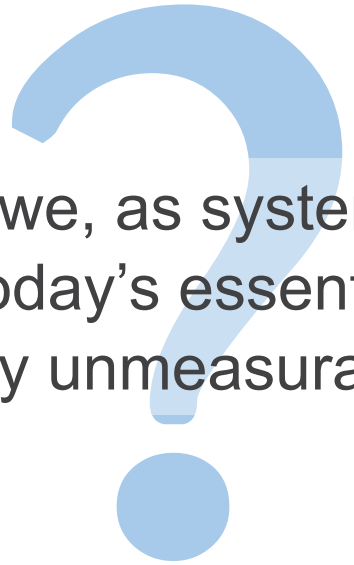
Introduction

- Recently, there has been a growing societal demand for systems engineers to create human-centered and sustainable social systems.
- In developing systems, it is fundamental to use mechanically measurable data to measure their performance. However, these measures are inadequate when dealing with mechanically unmeasurable elements, such as well-being.
- It is challenging to accurately develop, operate, evaluate, and improve systems suitable for handling these unmeasurable elements.

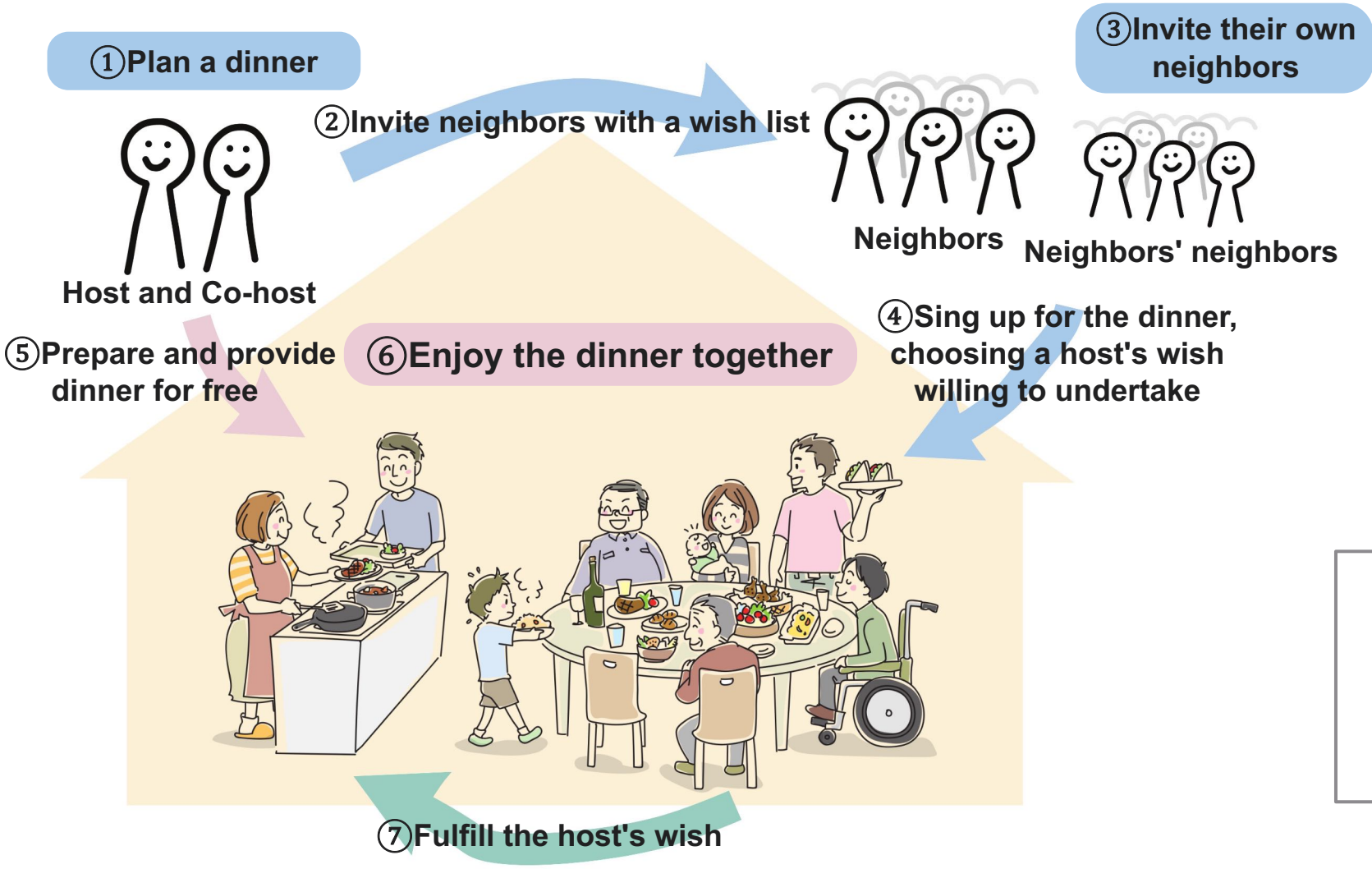


How might we, as systems engineers, respond to today's essential and societal mechanically unmeasurable demands?

Overview of the approach utilized in this study

- A prototype was created for the early concept verification and validation
- The system's performance was scored and evaluated by questionnaires including 3 psychological scales.
- The psychological scales utilized were as below:
  - The Positive and Negative Affect Schedule (PANAS) (Watson et al. 1988, Kawato et al. 2011)
  - General Self-Efficacy Scale (GSES) (Scholz et al. 2002, Kawato et al. 2011)
  - Social Worth (Grant 2008)
- The SOI is the "Eating-Together" System whose mission is to enhance connectivities among neighbors, especially for busy-generation in the cities.
- 9 Prototype tests were conducted in Nov.-Dec. 2019.

Concept Image of the “Eating-Together” System



Before the event

During the event

Any time

Why #1 Impact of neighborhood connections

Neighborhood connections and interactions
contribute to wellness and wellbeing
in the present and the future
for individuals and society [6-18]

Many countries aims to revitalize social ties and connections

Fights against loneliness are about health and social wellbeing significance, but also, there is an issue around productivity. There are economic consequences for a country, which have a considerable impact.

— Tracey Crounch Apr. 1, 2019
The first Minister for Loneliness in the U.K.

Why #2 Extremely limited Social Interaction

Japan, in particular, is experiencing a social crisis from limited social interaction.

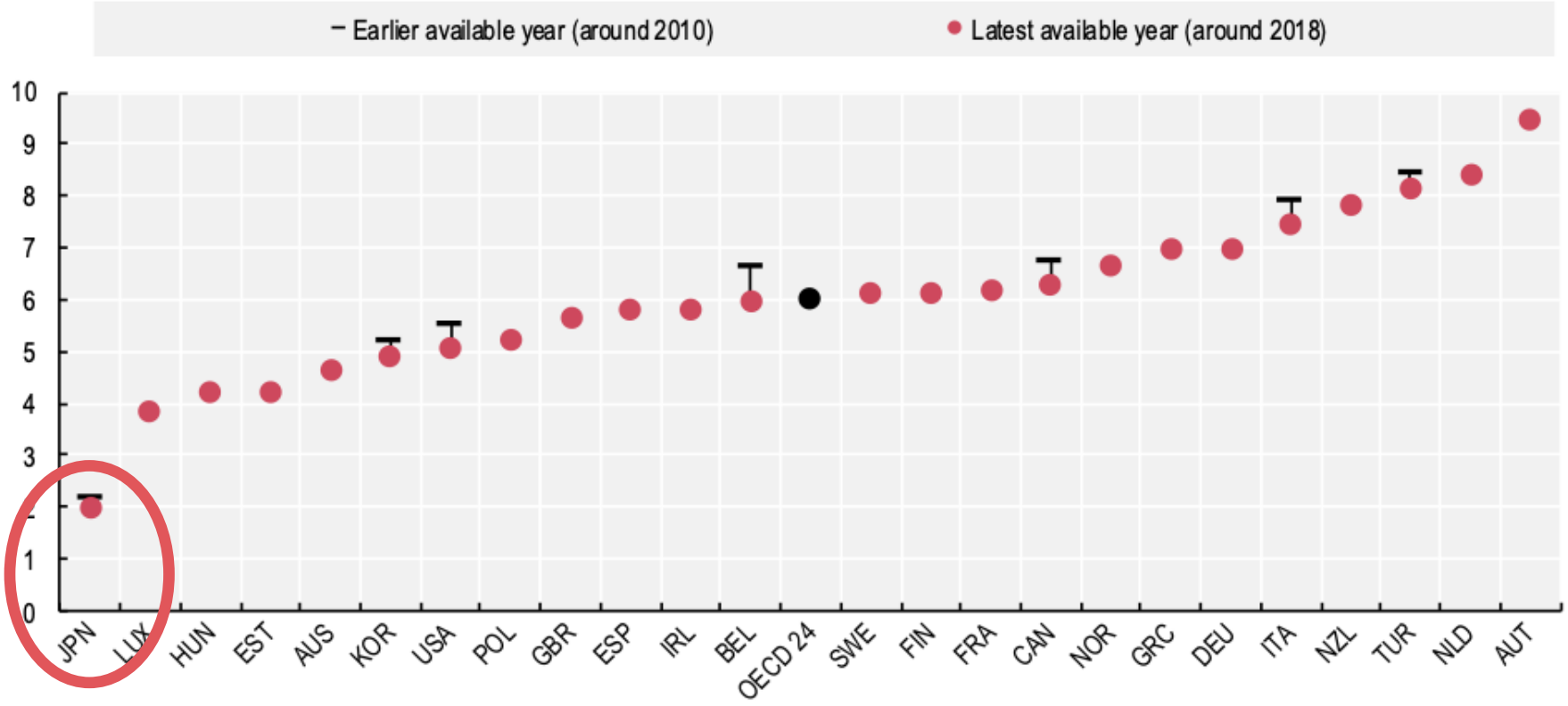


Figure 1. Time spent on Socializing in OECD Countries Ranges From Two-Nine+ hours Per Week (Average Time Allocated to Social Interactions, Hours Per Week) Source: OECD 2020.

Why #3 Rapid Negative Change

The degree of social interaction with neighbors in Japan is rapidly declining.

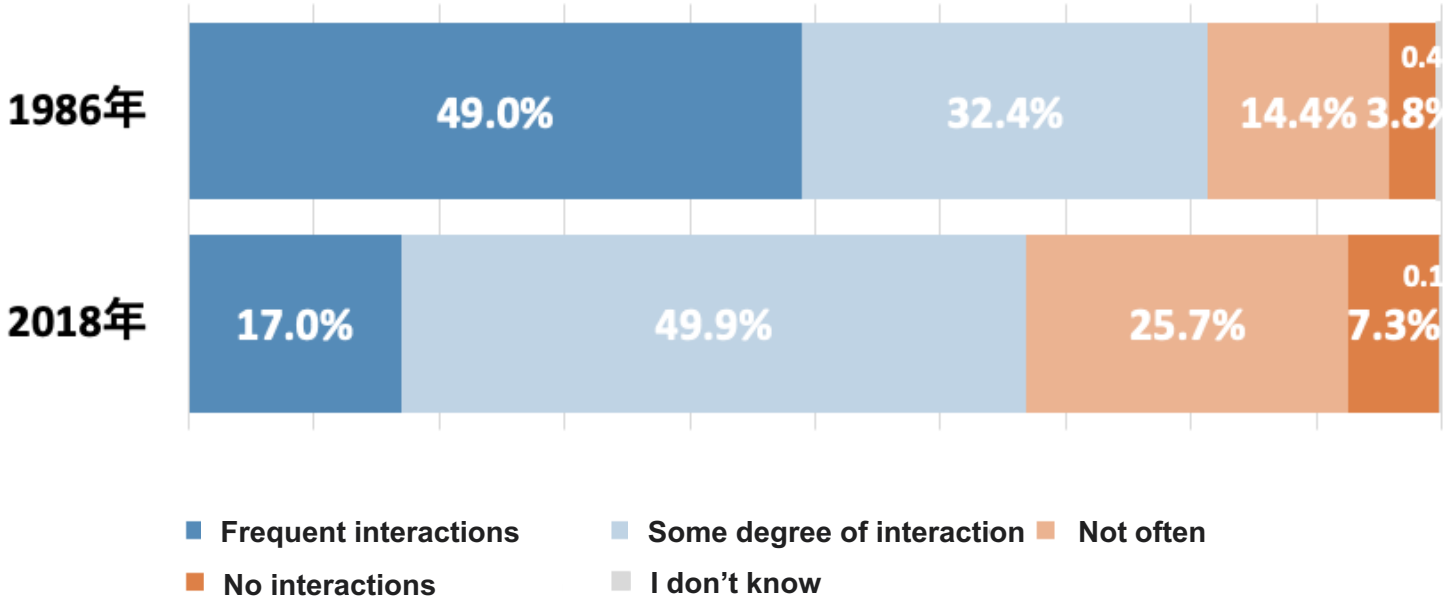
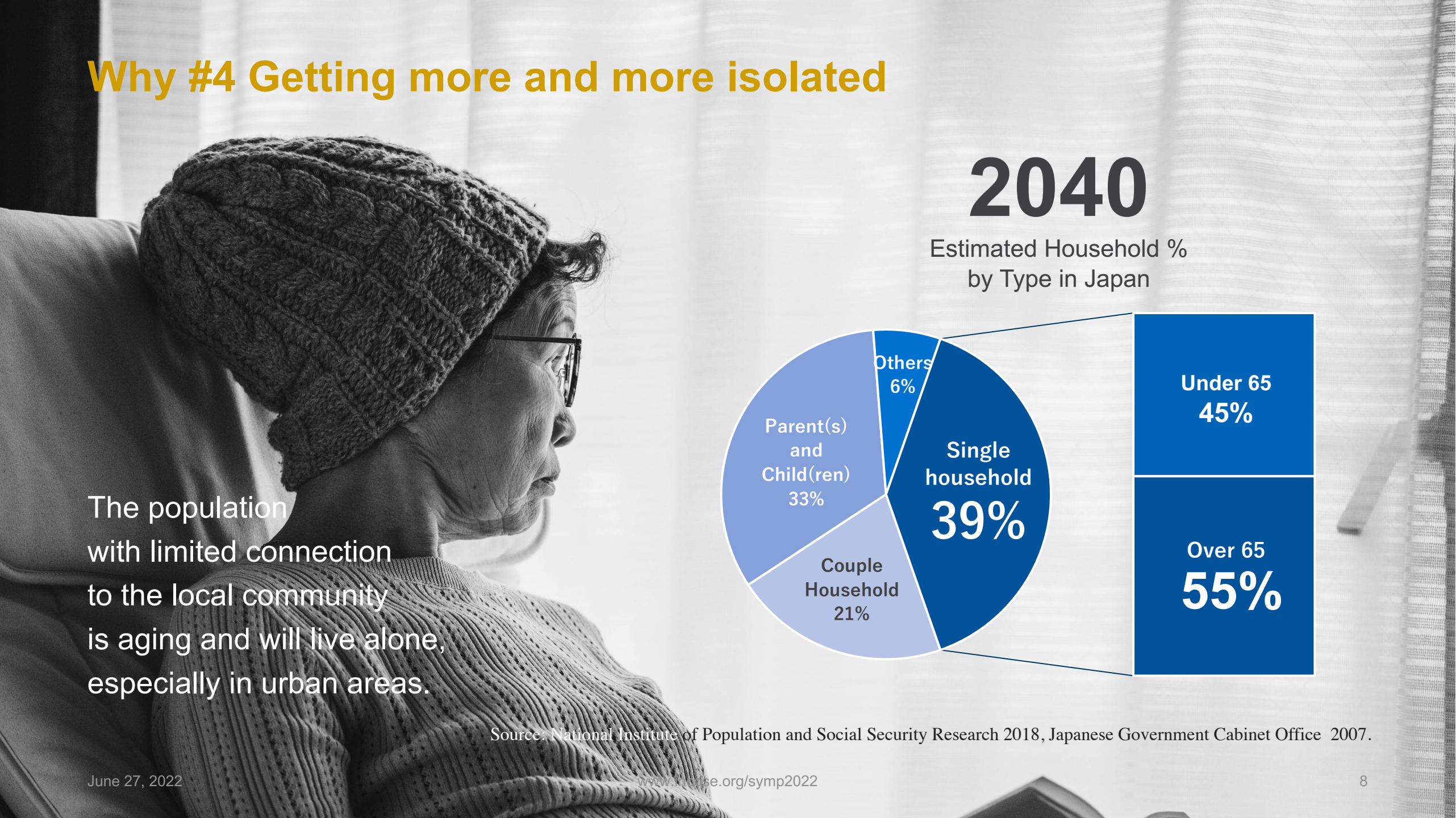


Figure 2. Change in the Degree of Social Interaction with Neighbors
Source: Japanese Government Cabinet Office 1986; 2019.

Why #4 Getting more and more isolated



The population
with limited connection
to the local community
is aging and will live alone,
especially in urban areas.

2040

Estimated Household %
by Type in Japan

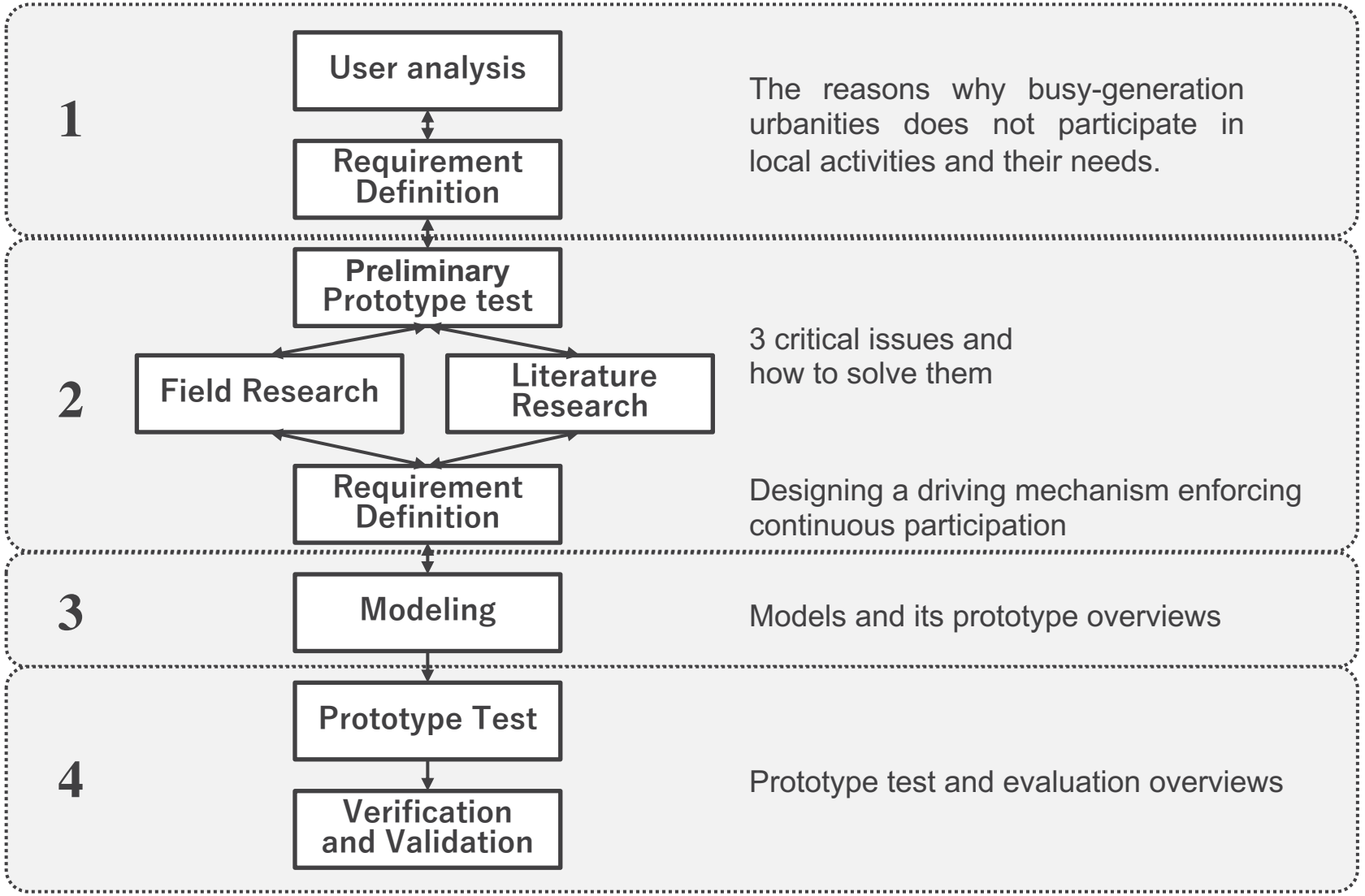
Source: National Institute of Population and Social Security Research 2018, Japanese Government Cabinet Office 2007.

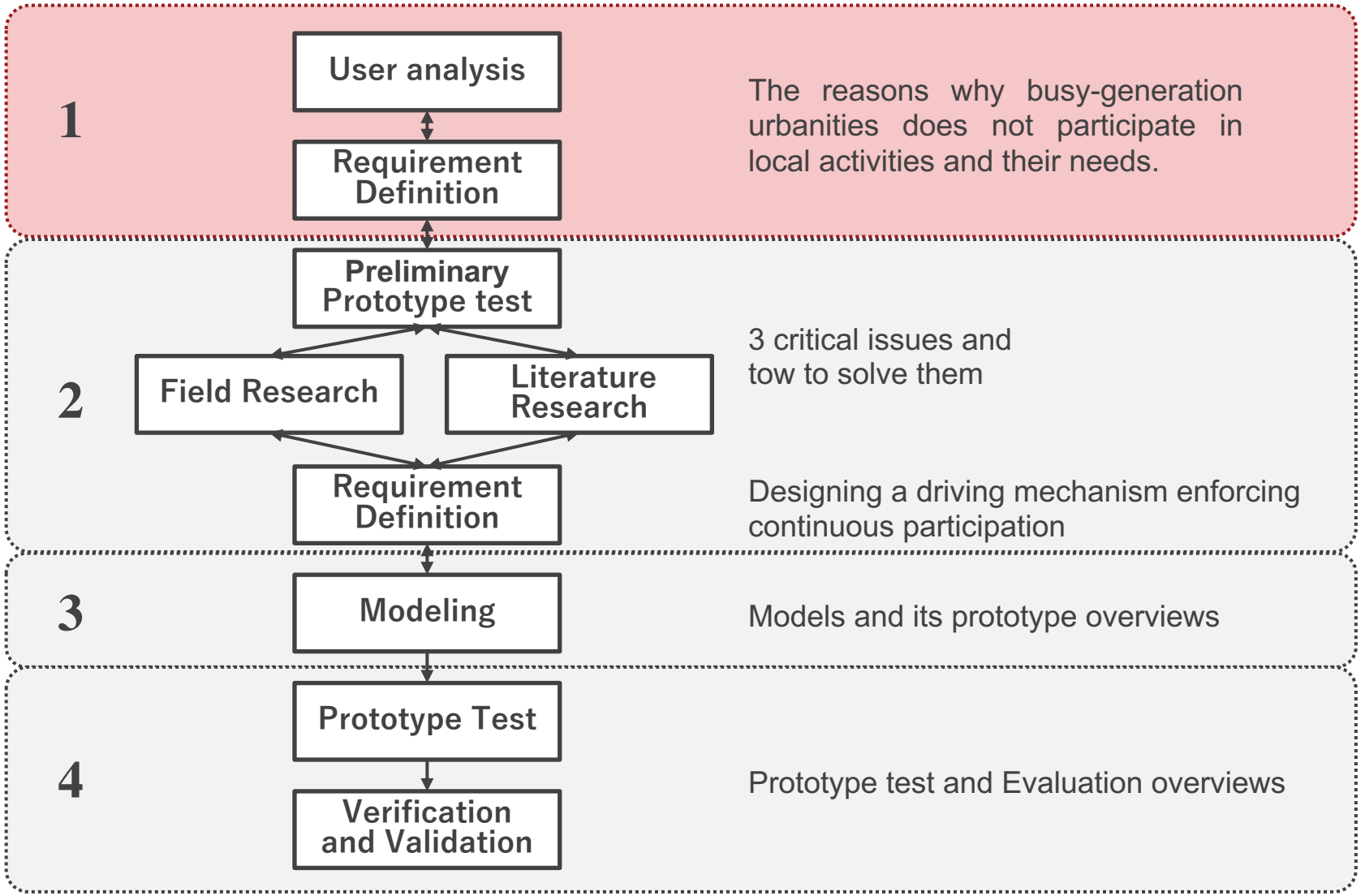
Mission Statement

Encourage “co-eating” among neighbors
for connecting neighbors and fostering relationships,
accessible to the busy individuals living in cities.

”Busy generation” , in this study, refers to the "working 50s or younger". This generation in the cities is shown to have little experience in committing to local activities in the past, and to be less involved with neighbors. [24,25]

Process of Concept Development




1
User analysis
Requirement Definition
The reasons why busy-generation urbanities does not participate in local activities and their needs.
2
Preliminary Prototype test
Field Research
Literature Research
3 critical issues and tow to solve them
Requirement Definition
Designing a driving mechanism enforcing continuous participation
3
Modeling
Models and its prototype overviews
4
Prototype Test
Verification and Validation
Prototype test and Evaluation overviews

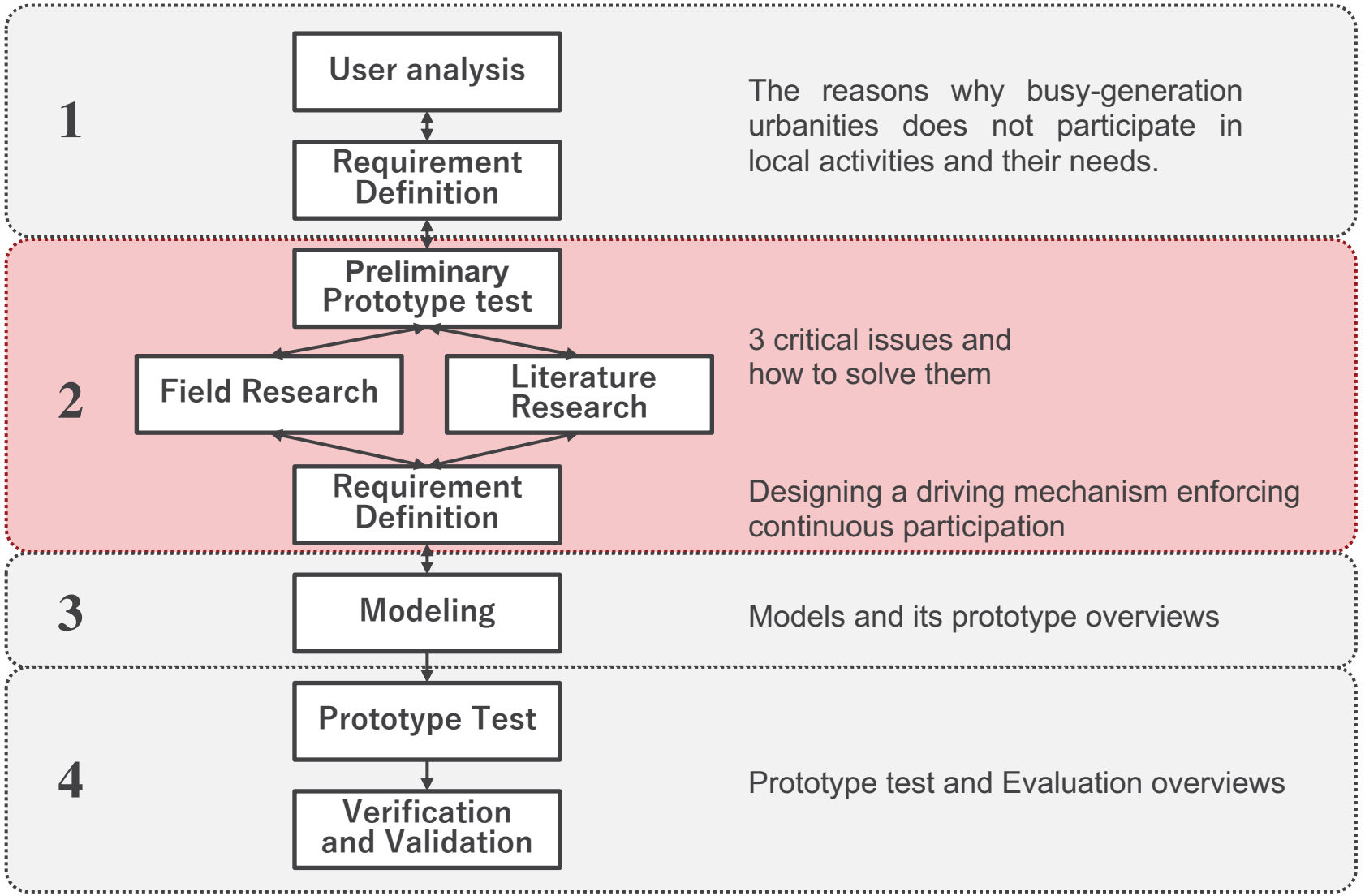
1. Identifying Causes and Needs

To connect with neighbors, they should participate in local activities. However…

1. Busy with work and raising child and no time left
2. If they can, they want to spend time with family and friends, rather than with neighbors
3. Reasons for not participating in local activities are as below
    - Not attracted or interested activities
    - No time available for activities, the schedule doesn't fit into their lifestyle
    - Members are fixed and hard to fit in

12 stakeholder needs were identified

Source: Ministry of Land, Infrastructure, Transport and Tourism 2005, Lifestyles and Values of the Busy Generation Living in Cities, Spring 2019 (N=349), Winter 2019 (N=283).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2.1. Preliminary Prototype Test – A Neighbor's dinner version of Airbnb

2.2. 3 Critical Issues Found in the Test

The main critical issues found from the preliminary prototype test

1. Too much of a burden on the host.
2. Guests become customers and passive.
3. Monetary role and value are unclear.

Unsustainable!!

2.3. Success Case in Fields：The Clapton Pod

- Run by Violaine and Robbie
- In their 5th year
- Held every 6-8 weeks
- Bringing out £20 each and serve 3 courses
- Asking each guest to bring a bottle
- Both enjoying keeping this activity in the first place

2.4. Driving Mechanism enforcing continuous utilization

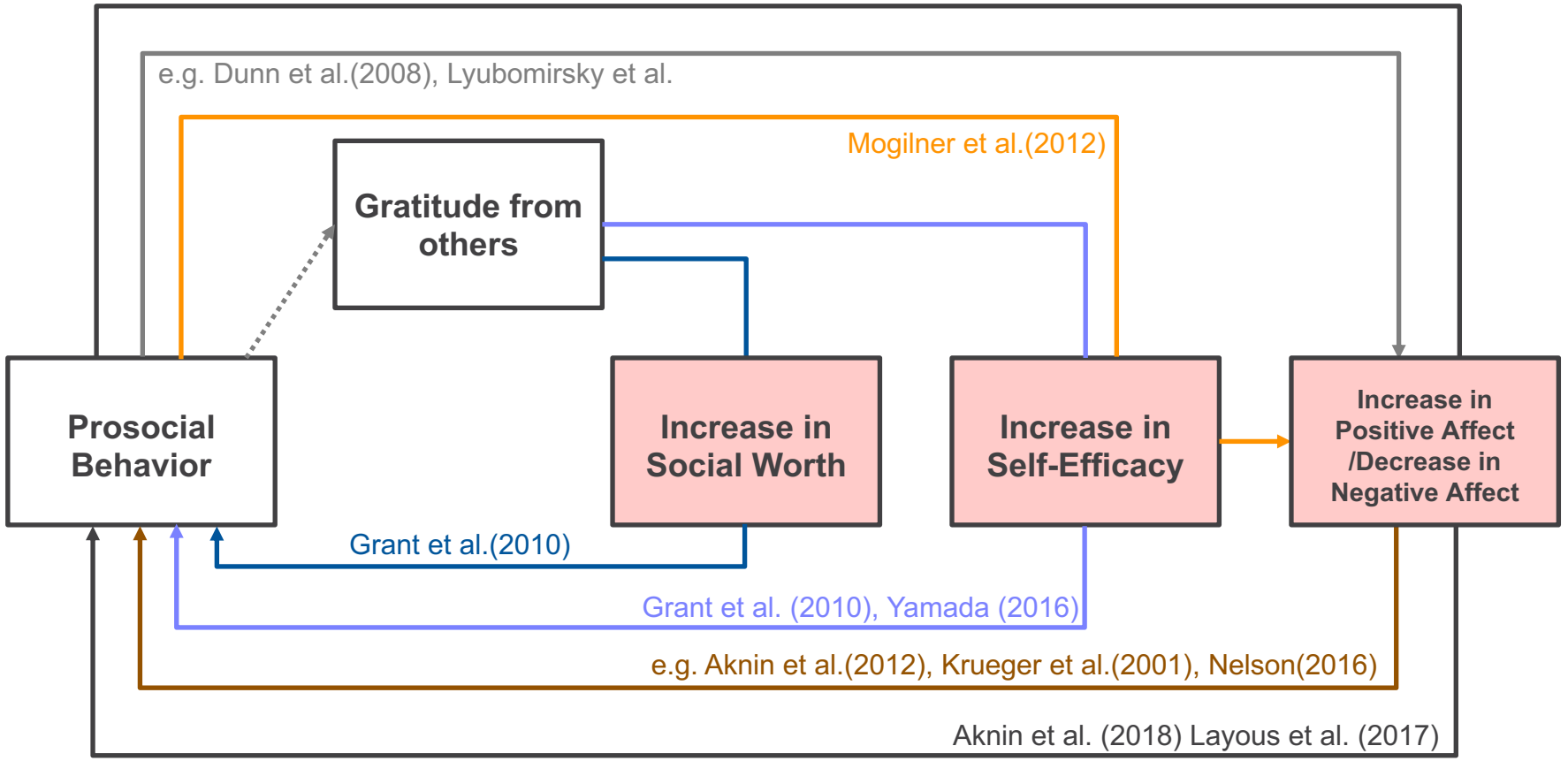


Figure 3. Positive Feedback Loops Stemming from Prosocial Behavior

2.5. The Critical Issues and Improvement Policies

The main critical issues found in the preliminary prototype test

1. Too much of a burden on the host.
2. Guests become customers and passive.
3. Monetary role and value are unclear.

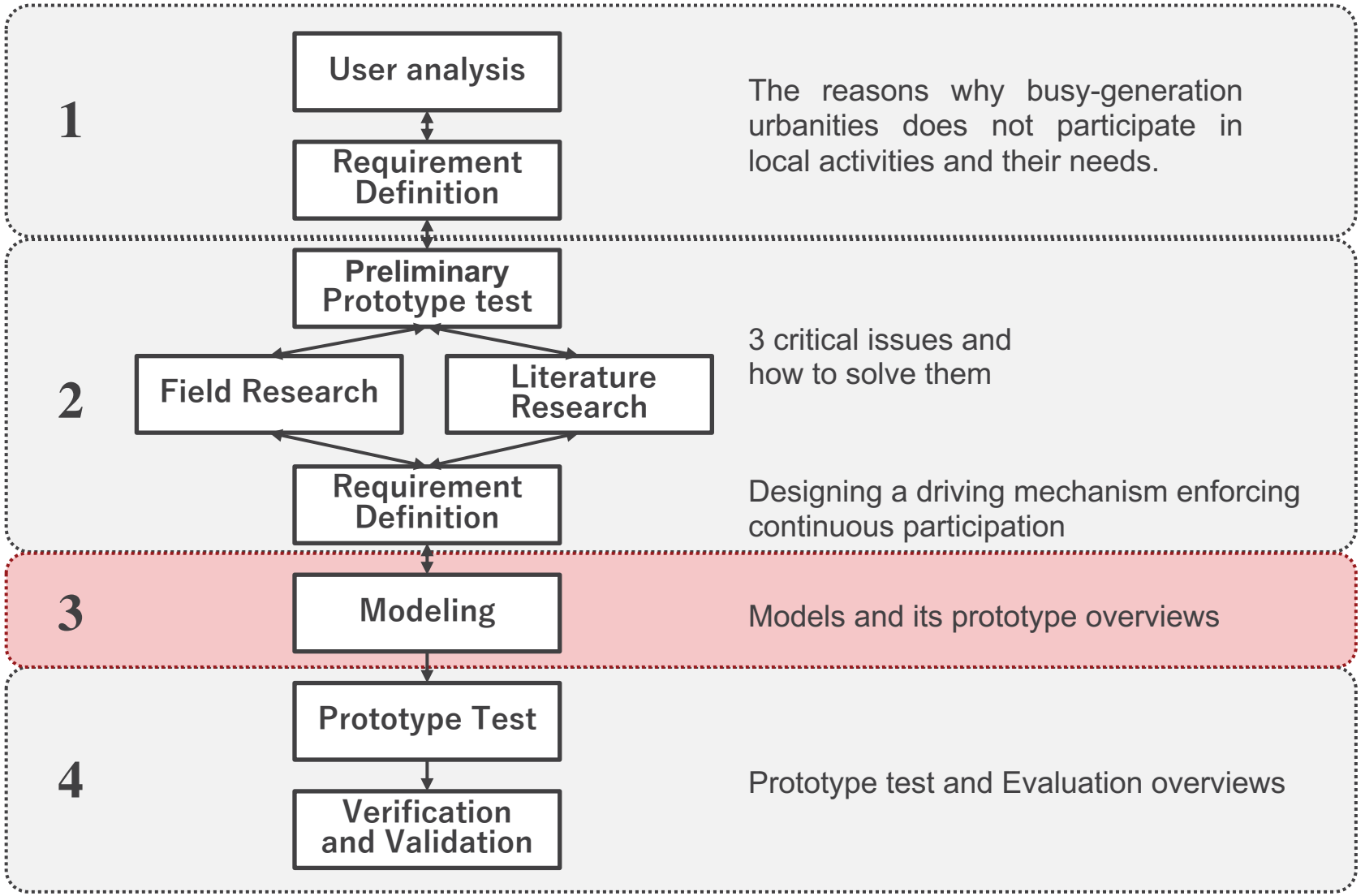
1. Encouraging and supporting hosts to recruit a "co-hosts" from their neighbors.
2. Allowing for and prompt hosts to create a wish list and guests to select one of the assistances they wish to undertake from the list.
3. No money involved. Design to create a positive feedback loop triggered by the host sharing dinner.

2.6. Updated Mission Requirements and User Requirements

Table 3: The Mission Statement and Requirements for the "Eating-Together" System

Mission statement	Req#	Mission requirements		
Encourage "co-eating" among neighbors for connecting neighbors and fostering relationships, accessible to the busy individuals living in cities.	MissionReq 1	The system shall be suitable for urbanites with busy lifestyles.		
	MissionReq2	The system shall create opportunities for people living in the same neighborhood to eat together.		
	MissionReq3	The system shall enable people to meet and get to know their neighbors.		
	MissionReq4	The system shall include a positive feedback loop based on prosocial behavior to enable the maintenance and expansion of the system.	Mission Req4.1	The system shall generate triggers (self-rewards) for future participation through prosocial behavior.
			Mission Req4.2	The system shall provide more rewards than the cost (for users to want to participate repeatedly).

+ 11 User requirements were redefined.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3.1. Context Diagram of the “Eating-Together” System

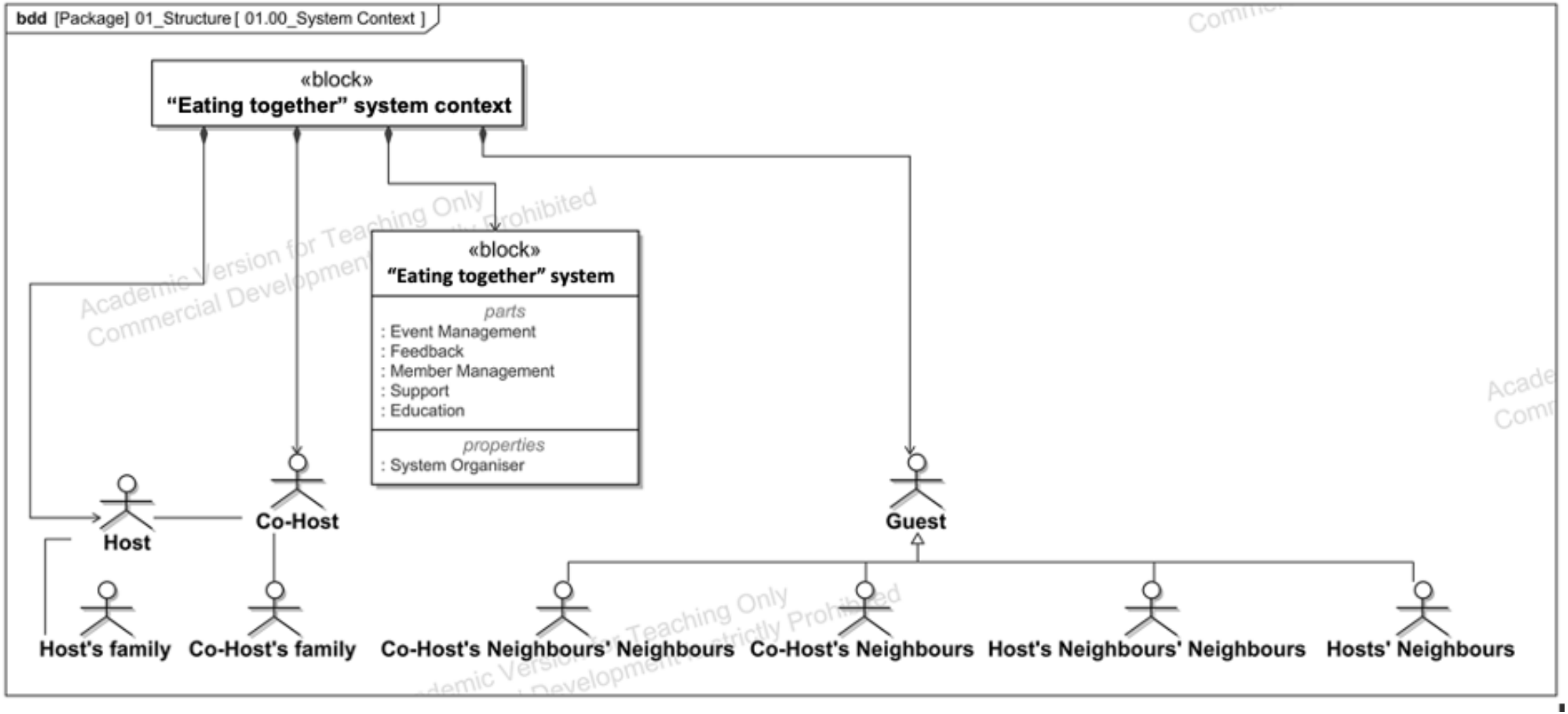


Figure 4. Context Diagram of the “Eating-Together” System

3.2. Internal Structure of the “Eating-Together” System

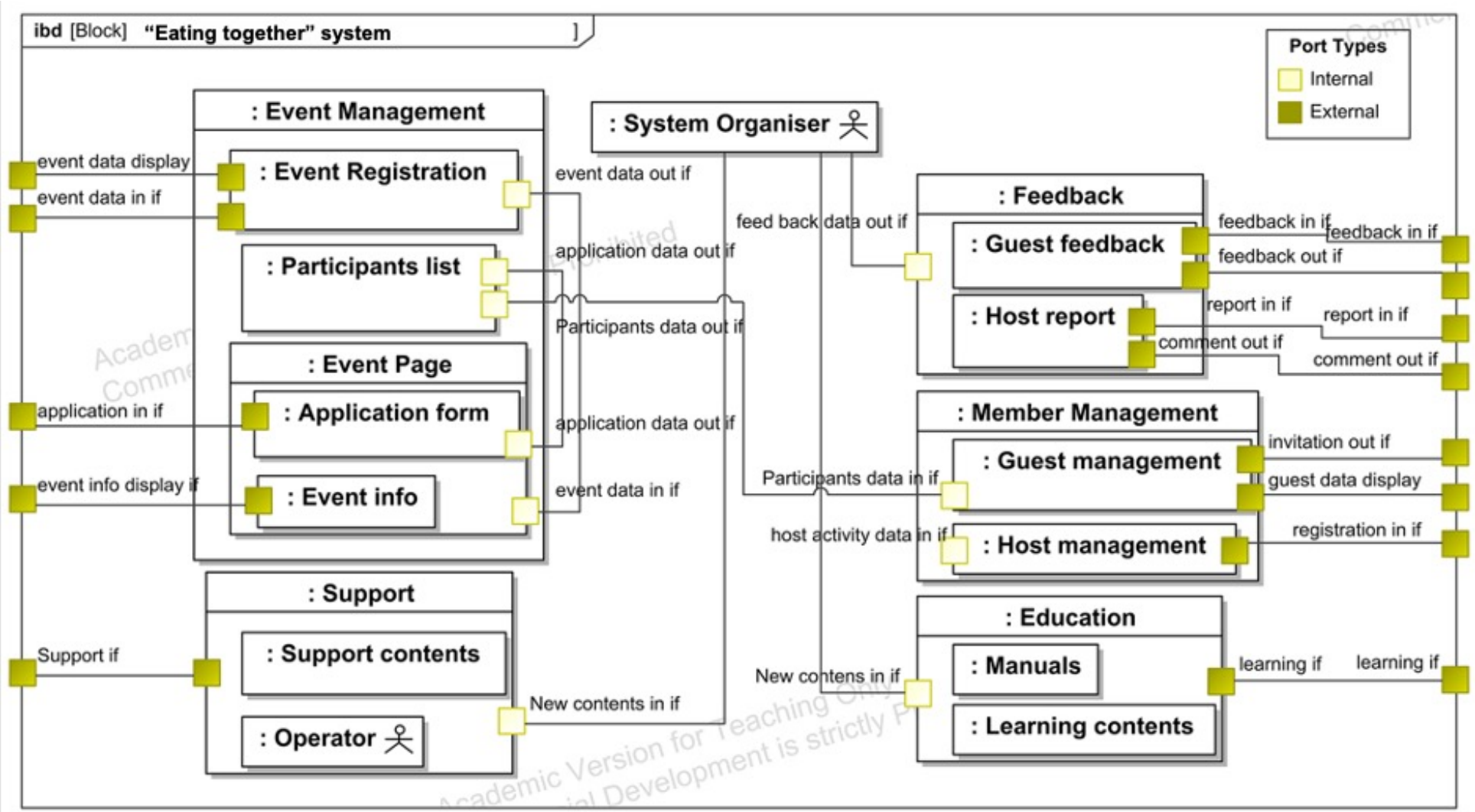


Figure 5. Internal Structure of the “Eating-Together” System

3.3. System Requirements

#	System requirements	#	System requirements
SysReq1	The system shall have the ability to encourage co-eating by neighbors.	**SysReq11**	The system shall encourage hosts and guests to welcome newcomers when they arrive.
SysReq2	The system shall be accessible to even the busiest generations living in cities.	**SysReq12**	The system shall have smartphone-compatible screens for guests and hosts.
SysReq3	The system shall have the ability to allow neighbors who do not know each other to get to know each other.	**SysReq13**	The system shall be accessible for guests at any time they want.
SysReq4	The system shall have the ability to call people who are called to know their neighbors.	**SysReq14**	The system shall encourage the recruitment of co-hosts by the host.
SysReq5	The system shall have the ability to (1) increase positive affect (2) decrease negative affect, (3) increase self-efficacy, (4) increase the social value or at least one of the above for both hosts and guests through its implementation.	**SysReq15**	The system shall not place any constraints on the event's content that are not tied to higher-level requirements for the host or co-hosts.
SysReq6	The system should have the ability to share the burden of hosting and co-hosting.	**SysReq16**	The system shall have the ability to select neighbors that the host or co-hosts want to reach.
SysReq7	The system should have the ability to prompt the host to provide free food.	**SysReq17**	The system shall prompt the selection of hosts and co-hosts without knowing each other during announcements.
SysReq8	The system should have the ability to support the host in organizing a dinner party at a convenient time.	**SysReq18**	The system shall allow for the hosts to create a wish list.
SysReq9	The system should allow guests to participate only when convenient for them.	**SysReq19**	The system shall prompt the host to create a wish list.
SysReq10	The system shall allow hosts to determine the menu.	**SysReq20**	The system shall allow guests to select the assistance they wish to undertake from a wish list at the time of application.

3.3. Prototypes

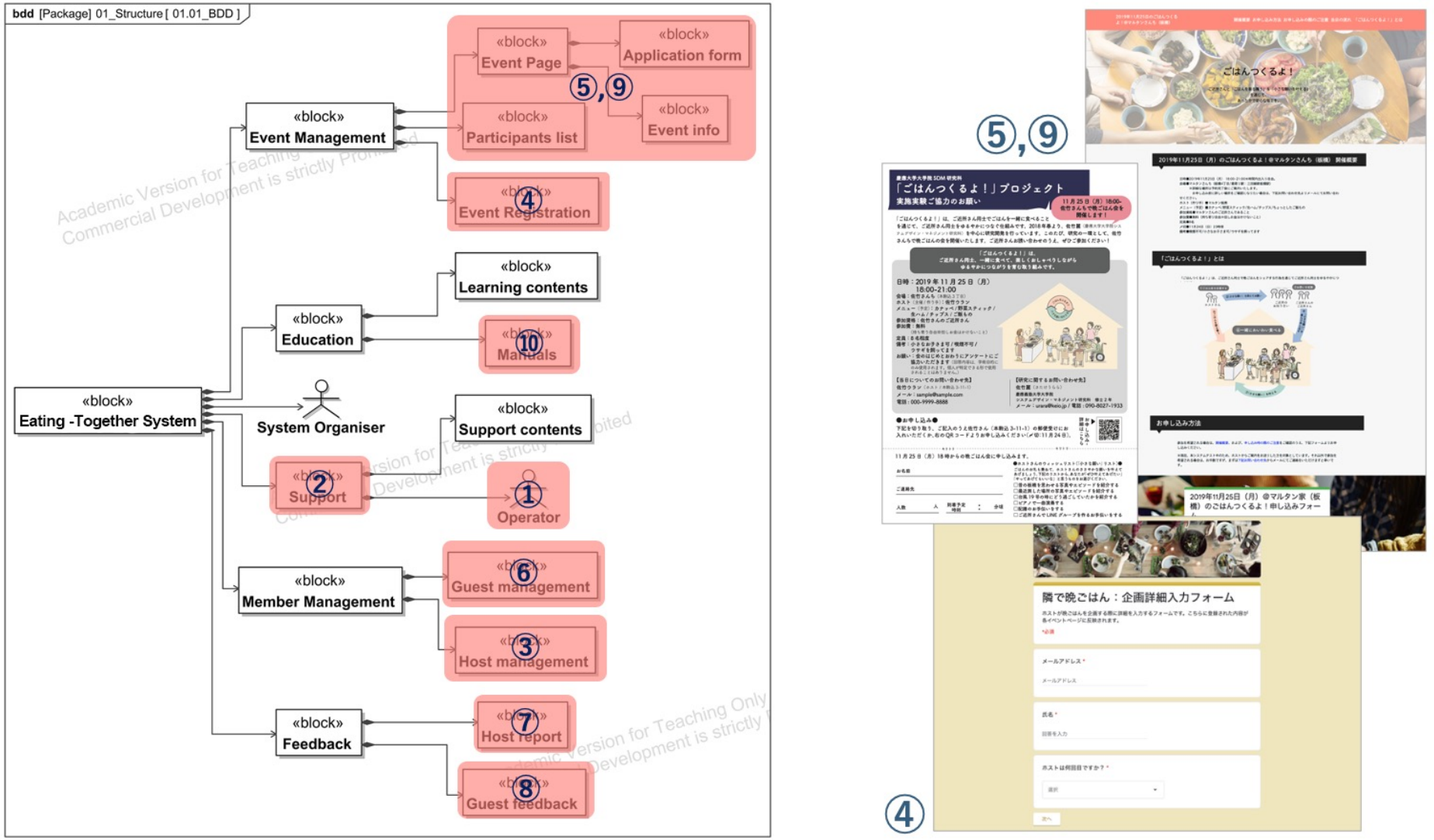
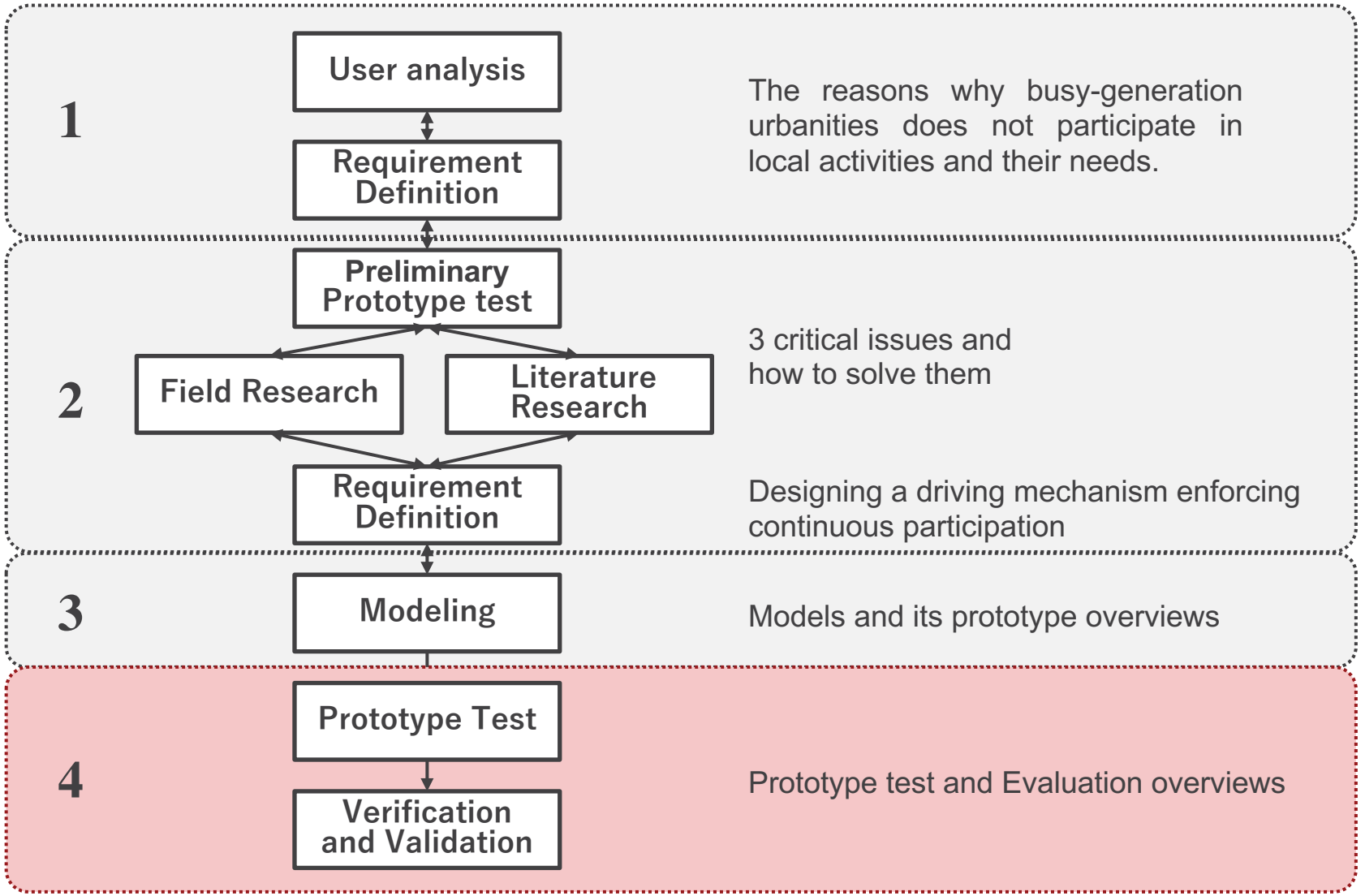


Figure 6. Some of the Prototypes of the SOI Used in this Study Test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4.1. Outline of the Prototype Tests

November 25 - December 29, 2019 (9 times)

Hosts: 9
Co-hosts: 6
Guests: 31

Total participants: 46

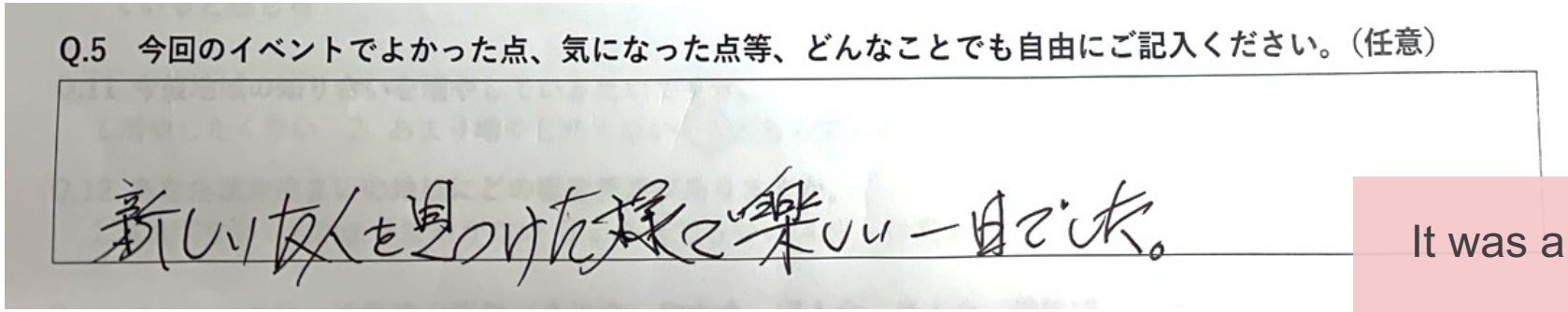
Case ID	Date	Prefecture	Municipality	Number of Guests
A	Nov. 25, 2019	Tokyo	Itabashi Ward	2
B	Nov. 26, 2019	Tokyo	Chuo Ward	2
C	Dec. 1, 2019	Tokyo	Setagaya Ward	5
D	Dec. 7, 2019	Saitama prefecture	Fujimi City	1
E	Dec. 7, 2019	Kanagawa prefecture	Kawasaki City	6
F	Dec. 14, 2019	Kanagawa prefecture	City of Yokohama	4
G	Dec. 17, 2019	Kanagawa prefecture	Kawasaki City	2
H	Dec. 29, 2019	Tokyo	Setagaya Ward	3
I	Dec. 29, 2019	Tokyo	Koto Ward	6
	Total hosts: 9 / co-hosts: 6		**Guest Total**	**31**

4.2. Case A – Different generations' discoveries

- Host had moved to the area about 3 years before.
- Distributed flyers to 4 houses in the neighborhoods, and 2 participated.
- They greeted each other before, but this dinner was the first opportunity for them to talk.
- They discovered each other's needs and what can offer through the conversation.

Case #	Date and Time	Location	menu	No. of participants (18 years old and over)		Cost approx.
				host	guest	
A	Nov 25, 2019 18:00-21:00	Tokyo, Itabashi Ward	Braised pork, chicken in coconut milk, nuts, etc.	1	2	2,000 yen

4.3. Comments from a Guest


Q.5　今回のイベントでよかった点、気になった点等、どんなことでも自由にご記入ください。（任意）

新しい友人を見つけた様で楽しい一日でした。

It was a fun day, as if I had found a new friend.

こちらこそ、昨日は懐かい思いを思い出させて頂き、ありがとうございました。

昔（６５年以上前は）、近所の家に伺う（出入りする）と云う事は、もう当たり前の世界で育ちました。

戦後は皆さんの生活が平均的でしたので、家族も顔見知りも隔たりの無い付き合いだったのです。

そんな付き合い方も経済の高度成長に伴い、いつしか消えていってしまい寂しく思っていました。

この様な思いの中でのお誘いの声を掛けて頂きまして感謝致して居ります。

Unlike today, families and neighbors were connected in the past. I am grateful that I was invited to the dinner, as I miss the connection, as it disappeared with the rapid economic growth.

4.4. Case F Oyaji - Middle aged men - weekend lunch

- A group of men who knew each other for several years from the community in a complex of 600 apartments.
- It was the first opportunity for them to meet with no ”purpose” nor “agenda”, and they could have casual conversation almost for the first time.
- The second round has already been held and will be held once every three months in a wider circle.

Case #	Date and Time	Location	menu	No. of participants (18 years old and over)		Cost approx.
				host	guest	
F	Dec 14, 2019 12:00-16:00	Kanagawa Prefecture, City of Yokohama	Teppanyaki, cold tofu, fried egg, beer, etc.	2	4	5,000 yen

4.5. Performance of the Driving Mechanism in hosts

- In hosts, the questionnaires were taken 3 times, before, immediately after, and after 2-3 weeks of the event.
- Regarding the driving mechanism, the data was analyzed in 8 pairs of 3 scales and 4 items.
- Positive changes in all items.
- Statistically Significant differences in negative affect [before - immediately after] [before - after 2-3weeks] and social value [before - after 2-3 weeks].

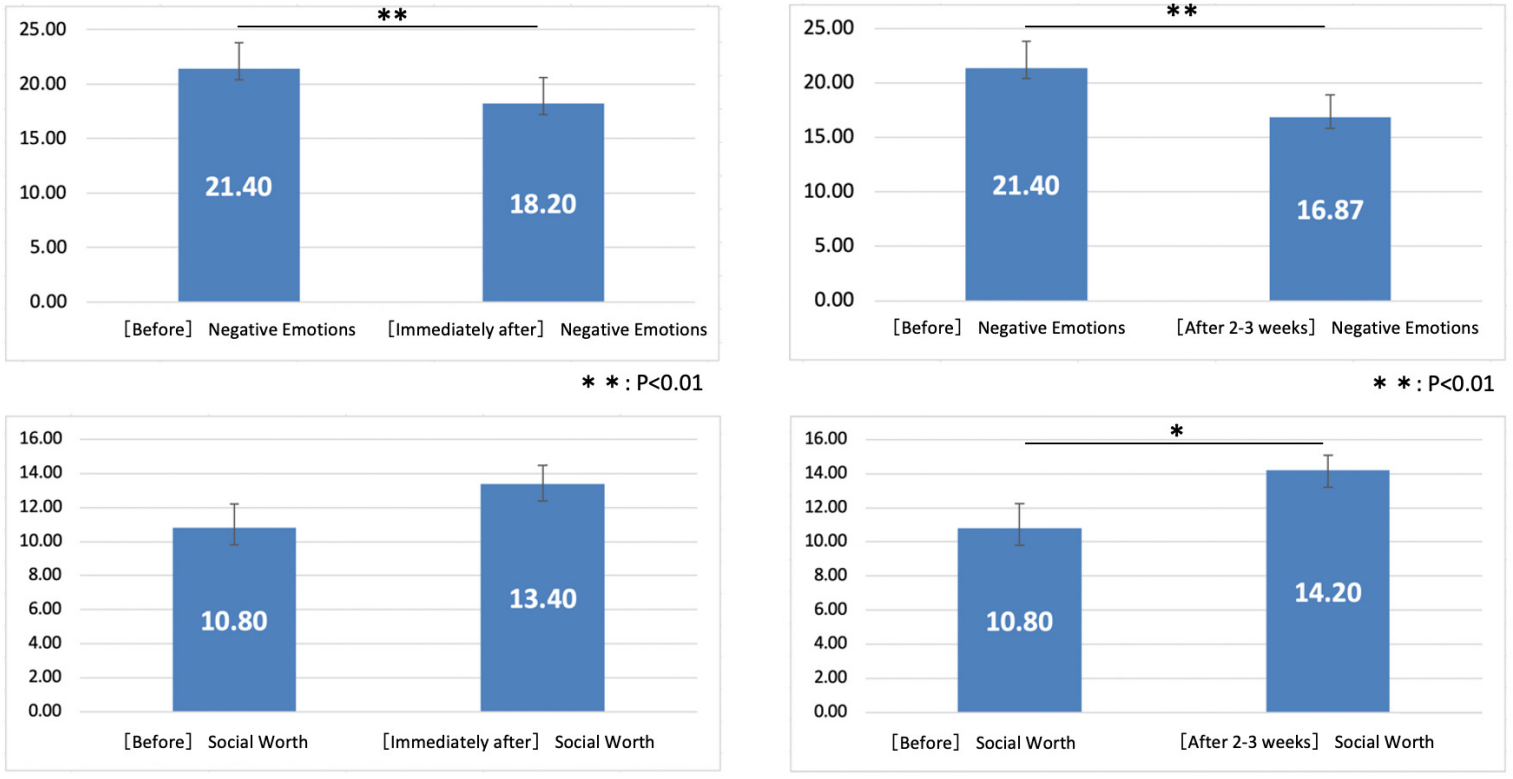


Figure 7. Results of the T-Test of the Comparison of the Mean Scores (Hosts) Note. Hosts n=15.

4.6. Performance of the Driving Mechanism in guests

- In guests, the questionnaires taken twice; before and immediately after the event.
- Regarding the driving mechanism, the data was analyzed in 4 pairs of 3 scales and 4 items.
- Positive changes in all items.
- Statistically significant differences in negative affect and self-efficacy.

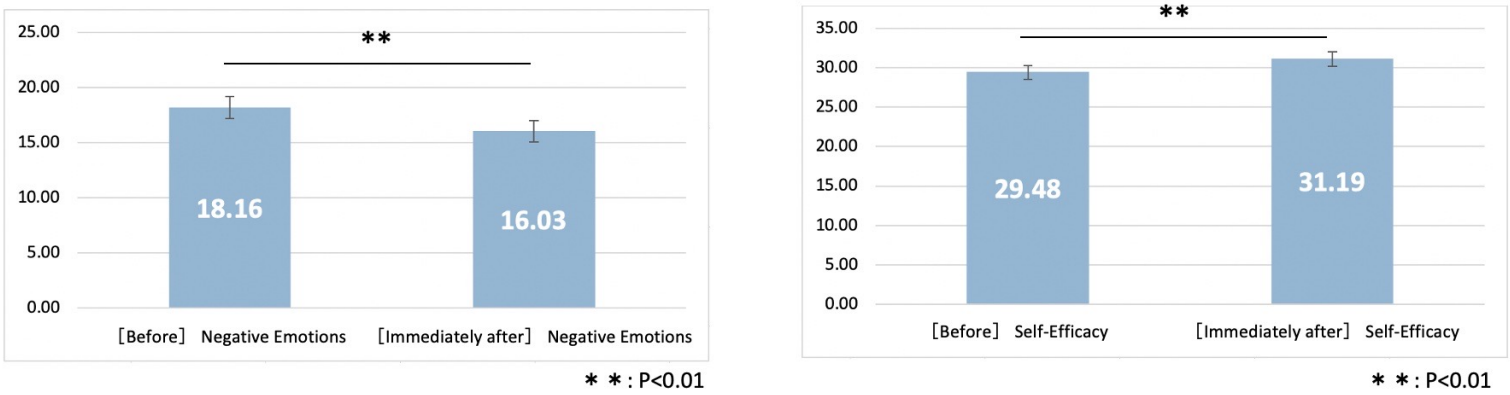


Figure 8. Results of the T-Test of the Comparison of The Mean Scores (Guests) Note. Guests n=31.

4.7. Satisfaction and Intention of Continual Utilization

Hosts

Overall satisfaction

Very Satisfied **86.7**%

Satisfied **13.3**%

Will to hold similar dinner again

Applicable **75.0**%

Slightly Applicable **25.0**%

Guests

Overall satisfaction

Very Satisfied **80.6**%

Satisfied **19.4**%

Will to participate similar dinner again

Applicable **77.4**%

Slightly Applicable **19.4**%

4.8. Verification

Req#	Mission requirements		
MissionReq1	The system shall be suitable for urbanites with busy lifestyles.		
MissionReq2	The system shall create opportunities for people living in the same neighborhood to eat together.		
MissionReq3	The system shall enable people to meet and get to know their neighbors.		
MissionReq4	The system shall include a positive feedback loop based on prosocial behavior to enable the maintenance and expansion of the system.	Mission Req4.1	The system shall generate triggers (self-rewards) for future participation through prosocial behavior.
		Mission Req4.2	The system shall provide more rewards than the cost (Intention of Continual Participation).

11 User requirements

20 System requirements

4.9. Validation Criterion and the Result

1. Whether there was an improvement in the psychological scale that drove the positive feedback loop	Conformant
2. Satisfaction with the event	Conformant
3. Intention to continue to hold events (for hosts) or participate in events (for guests)	Conformant

Acceptable

Conclusion

- This study presented an approach for concept verification and validation by applying questionnaires including psychological scales.
- The verification and validation were considered successful for the prototype of the proposed system.
- This study has some limitations.
  - The small sample size
  - The time constraints
  - The risk for participants to have motivated by the researcher.

Future Study

Future study of the “Eating- Together” system

- Need to confirm that the system will be used voluntarily repeatedly.
- The prototype and the system requirements must be elaborated.
- Business requirements must be considered. For the system's sustainability, it is necessary to have an economic ecosystem involving companies, local authorities, Non-Profit Organizations, other local entities, as well as users as hosts or co-hosts.

Future study of the verification and validation methods

- Improving the strategies for setting and measuring MOPs is necessary to create and improve the system with mechanisms of social rewards and financial rewards or expenses simultaneously.
- Using the questionnaires may increase the burden and reduce the reward on participants. It is important to seek a better strategy to acquire data with less risk of distorting the test data.
- Bringing more knowledge and methodology from other disciplines such as psychology, behavioral economics, and service design is to be accelerated.

Thank you so much for your kind attention.

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