An Experimental Determination of Perceived Liveability in Sydney

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July 2012

Abstract: Liveability is a concept and factor being used by urban planners and designers to better understand how people perceive the places they live and work in and how it affects their life choices. Existing normative liveability indices are based on measurable and reproducible factors. They aim to objectively compare various residential conditions and their evolution. However, better understanding decisional processes attached to transport or residential choices necessitates a more dynamic approach. The concept of perceived liveability addresses the subjective nature of individual assessments of local environmental conditions. First, we have developed an empirical model based on subjective ranking and evaluation of six environmental factors. Then, we have conducted a pilot Computer Assisted Telephone Interviewing (CATI) survey in Sydney to inform our empirical model. Finally, a linear additive model was fitted to the survey data in order to represent various levels of satisfaction based on residential and socio-demographic conditions.

Keywords: *Perceived Liveability; Urban Environment; CATI Survey; General Well-being.*

1. Introduction

As urban population grows, urban design and infrastructures need to maintain or improve the quality of living environments. Living environments are defined by Detwyler and Marcus (1972) as the external conditions which affect the total population life. The quality of living conditions, also known as 'liveability', is defined by Cox (1972) through eight indicators: nuisance-free, healthful, providing proper housing, educational, employment, health and recreational opportunities, as well as modern amenities.

Liveability is a concept closely related to notions like quality of life and well-being (Aked *et al.* 2008). The term 'quality of life' is used to evaluate the general well-being of individuals and societies. Standard indicators of the quality of life include not only

wealth and employment, but also the built environment, physical and mental health, education, recreation and leisure time, and social belonging (Gregory *et al.* 2009). In a nutshell, liveability refers to the environmental conditions that contribute to the quality of life, alongside individual features. It describes the degree to which a place supports quality of life, health and well-being. In broad terms, liveable cities are healthy, safe, harmonious, attractive and affordable. They have high amenity, provide good accessibility and are environmentally sustainable (DIT 2011, p. 139).

In recent years, the concept of liveability has gained some traction in the media due to the creation of a series of well-publicized quantitative indices used to compare and rank cities around the World (Mercer's Quality of Living index, The Economist's World's Most Livable Cities index or Monocle's Most Liveable Cities index). Initially designed for use by employers assigning hardship allowances as part of job relocation, these indices provide a single rating based on a composite of mostly objective indicators of living conditions. These two characteristics – single ranking and objective indicators – have been subjected to serious criticisms from many experts. Regarding the single ranking issue, Woolcock *et al.* (2008) remind us that the validity and relevance of composite indicators for developing policy is limited due to the component measures losing their separate meanings through being aggregated. The other issue associated with these indices is their reliance on mostly normative criteria of liveability (so-called 'objective' indicators). As a matter of fact, it seems reasonable to assume that safety of a given precinct can be interpreted differently depending on whether you use crime rates (objective indicator) or individual perceptions from local residents (subjective indicator). In reaction to the growing dominance of objective indices, Constanza and colleagues (2008) argue for an integrative framework to evaluate quality of life, drawing from studies on subjective well-being (Diener 2000).

In 2008, the Victorian Competition & Efficiency Commission (VCEC, 2008) proposed a list of liveability indicators to be evaluated individually against objective and

subjective criteria: safety, sense of community, cultural diversity, access to services, connectivity (through ICT), transport and housing affordability. More recently, the Property Council of Australia commissioned a national survey ('My City: The People's Verdict') using seventeen indicators to compare major Australian capital cities (Stolper 2011): urban aesthetics, cleanness, recreational outdoors, cultural venues, public transport, road network, safety, natural environment, sustainability, healthcare services, education facilities, affordable housing, housing diversity, employment opportunities, standard of living, local climate and social diversity. Participants were asked to rank and value these indicators, providing a rich picture of how people perceived their cities.

2. Towards a dynamic model of perceived liveability

Since 2010, Transport for NSW and the SMART Infrastructure Facility (SMART), University of Wollongong, have collaborated on an interactive, visually intuitive and highly flexible simulation platform to support transport and urban planning in Sydney. The simulation workflow includes an agent-based social model (RePAST), a micro-simulation traffic model (TranSims) and an online geospatial visual interface (Google-Map-based). In the current phase of the project, the aim is to build a 'realistic' population of around 150,000 agents for the City of Randwick and Green Square precincts (baseline population). Then, this population needs to evolve over a 20-year simulated period.

We seek to build long-term decision making by the agents into our model, including residential mobility, for which we have decided to use a liveability-based approach. We also seek to understand how infrastructure relates to and is shaped by the liveability of a region. To be useful, this liveability component needs to provide:

- A subjective standpoint on how agents perceive their living conditions, based on personal criteria, and how this informs their location choice and interactions with infrastructure.

• A dynamical representation of liveability taking into account changes in life circumstances and how they shape preferences, demographic changes in suburbs, and changes of hard and social infrastructure in suburbs.

• The economic constraints that exist on the satisfaction of other perceived liveability components, and

• A generic framework easily extendable to other urban areas.

Following Fernandez *et al.* (2005), we intend to drive our residential mobility model through a dynamical model of perceived liveability. The conceptual structure of our liveability model is synthesized in the diagram below. From a subjective perspective on liveability, individuals tend to shape their preferences according to six factors describing various aspects of living conditions: (1) home, (2) neighbourhood, (3) transport, (4) entertainment, (5) services and (6) work. Each factor can be described through a series of attributes. The mix of attributes and their associated valence depend on individual perceptions (e.g. an attribute can be perceived negatively or positively).

Figure 1. Environmental and Social Living Elements

In order to implement a decisional process we propose to adapt the conceptual model proposed by Lindberg *et al.* (1992) for residential (re)location. The model assumes that a

preference is established or a choice is made based on evaluations of the attribute level. For each factor, attributes are given even weights and they contribute equally to the overall valence of the factor. The factor level can be interpreted as a value/belief structure in which factors can be ranked and given different weights. According to Lindberg *et al.* (1992), for a given individual, factor ranking and attribute evaluation processes depend his/her life cycle stage, current location and peer influence. This was confirmed through the empirical work of Li and Walker (2007).

3. Survey Design and Conceptual Framework

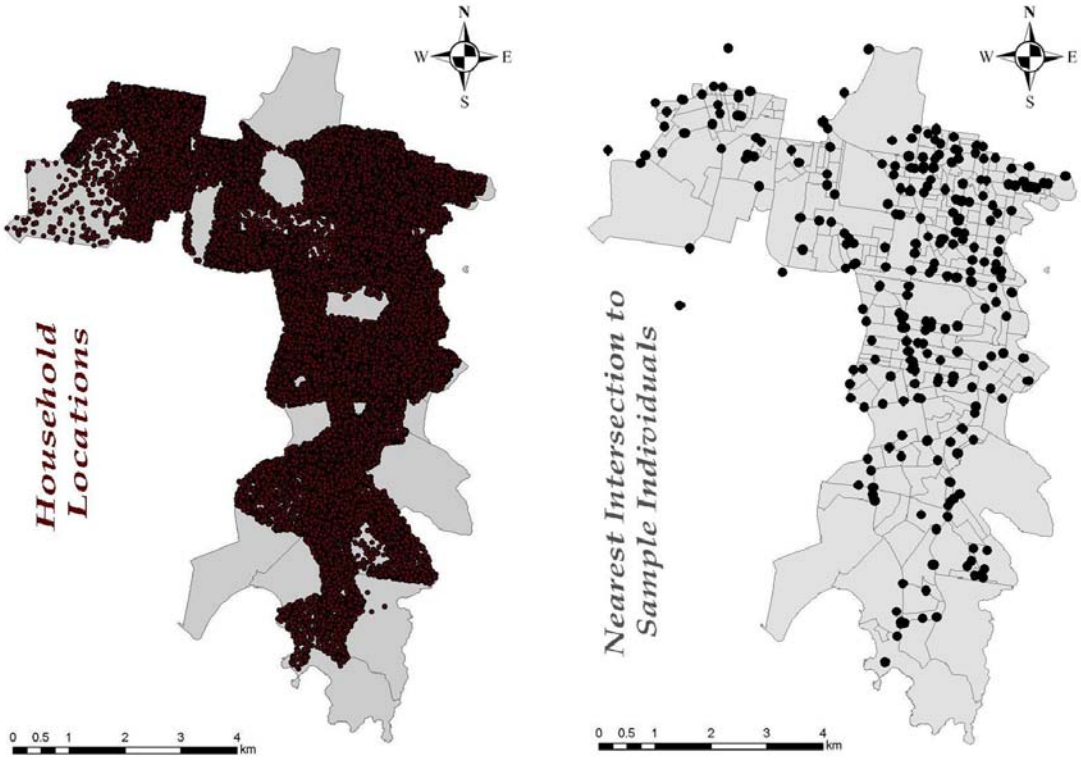
As mentioned, there are increasing demands for comprehensive statistical information about different liveability factors in Australia. Sampling design is a key device for efficient estimation and other forms of inference about a large population. Computers have been used increasingly during the last decades in various research topics as a tool for data collection. As an example, Computer Assisted Telephone Interviewing (CATI) employs interactive computing systems as an efficient tool being used by interviewers instead of paper and pencil. Using the CATI system, data is automatically recorded for administrative and analytical purposes (Farrell, 2000; Niemann, 2003).

In order to estimate required aspects of liveability within the study area (Randwick and Green Square), a survey was conducted by Illawarra Regional Information Service (IRIS) Research using Random Digit Dialling (RDD). All possible telephone numbers in the target area are considered in RDD as a sampling frame. This is a cost efficient approach to get a complete or near-complete coverage of the target geographic survey area. RDD selects sampled individuals in a statistical survey by generating random telephone numbers (Lepkowski, 1988; Massey et al., 1997).

In 2011, approximately 170,000 individuals were living within the study area. A sample of size 500 was interviewed using the CATI system developed by IRIS Research. Figure 1 presents the 2011 density population map of the target areas based on the TDC

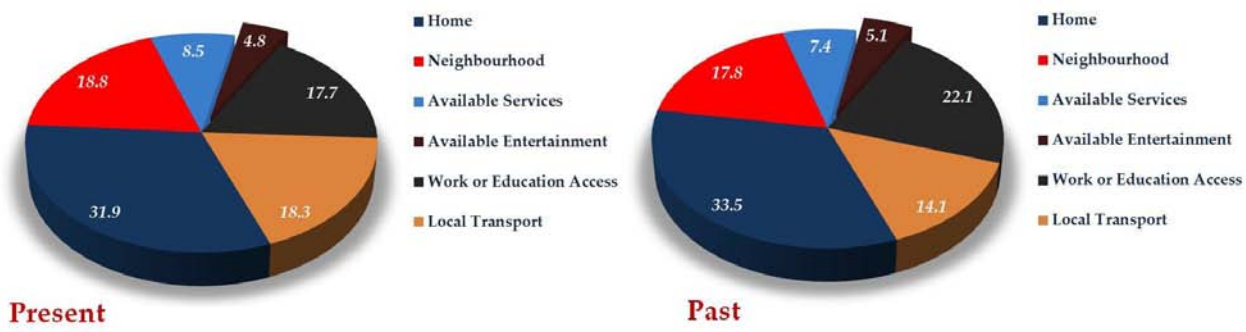
Travel Zone Population Forecasts released by the Bureau of Transport Statistics (BTS) in October 2009. The sample density map is also presented in Figure 1. As shown in Figure 1, the sample data is gathered from different Travel Zones (TZs).

Figure 2. Population Density Map of Randwick & Green Square



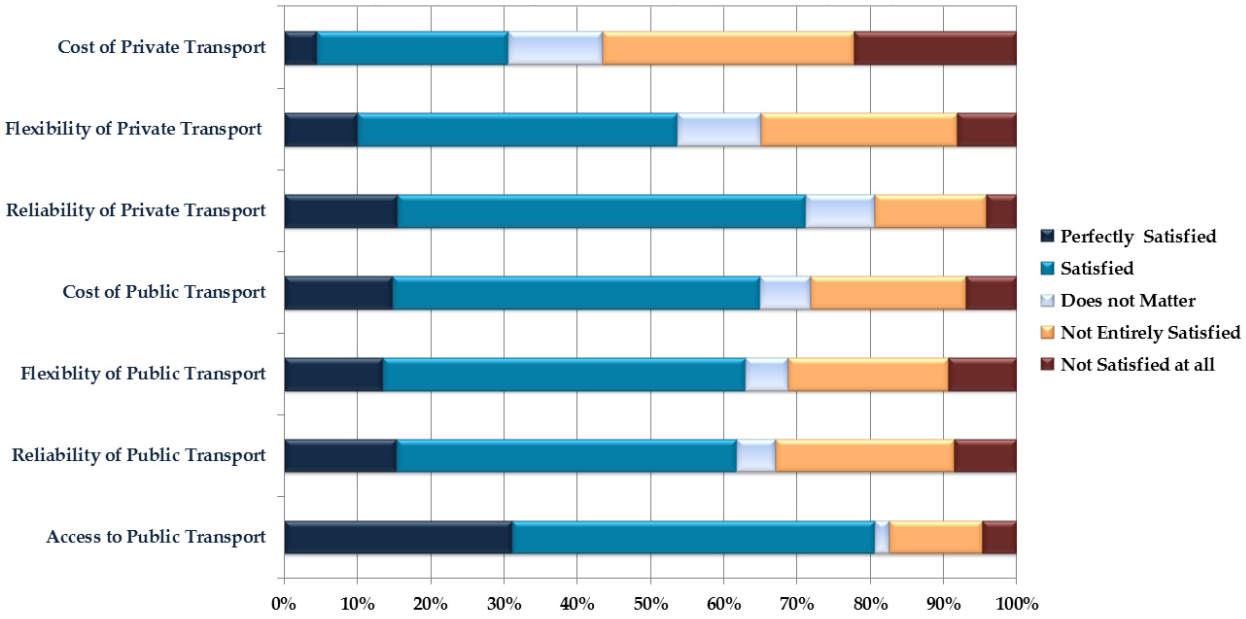
The sampled individuals in our study tend to shape their preferences from subjective perspective on liveability according to six factors describing various aspects of living conditions. Figure 3 shows the most important features based on the perception of sampled individuals at present and in the past.

Figure 3: Most important lifestyle aspects at the current and previous residential address



As shown in Figure 3, home features and available work and education facilities were more important at the previous address. In an overall look, we can see that people are more concerned about available transport choices at the current residential address comparing to the past. Figure 4 summarizes the current satisfactory conditions in the available local transport facilities. As can be seen, more that 50% of all survey individuals are satisfied or perfectly satisfied with local private and public transport facilities at their current residential address. However, more than a quarter of people were not happy about the public transport affordability and flexibility, and more that 55% of all sampled individuals are not satisfied with the cost of private transport options.

Figure 4: Current transport condition



4. Liveability Indices

Each sampled individual was asked to rank different life aspects and allocate a value between one and six to each aspect based on the order of their importance to the person. Here, H, N, S, E, WE, and T respectively denote the ranking for six main aspects in (H:

Home, N: Neighbourhood, S: Services, E: Entertainment, WE: Work and Education, and T: Transport) for a certain individual. Using the given rankings, we define a weighting method as follows:

$$W_1 = \frac{7-H}{21} \;;\; W_2 = \frac{7-N}{21} \;;\; W_3 = \frac{7-S}{21} \;;\; W_4 = \frac{7-E}{21} \;;\; W_5 = \frac{7-WE}{21} ;\; W_5 = \frac{7-T}{21} \quad \textbf{(1)}$$

Note that,

$$\sum_{i=1}^{6} W_i = 1. \quad \textbf{(2)}$$

Using this method, a larger weight is allocated to the factor with a higher ranking in the life performance of each individual. For example, if a person selects the local transport as the most important factor, the weight allocated to the local transport by this individual will be equal to: $6/21$. If another person selects this factor as the least important one, the allocated weight will be equal to: $1/21$.

Each aspect can be described through a series of attributes. Table 1 summarizes the attributes considered in this study. The satisfaction level of each attribute is specified then by each individual based on the current residential facilities and services. In order to assess the current level of well-being within the target area, a value is allocated to each feature shown in Table 2.

Table 1: Environmental Features in the CATI Survey

H: Home	h_1: Home Size
	h_2: Home Affordability
	h_3: Home Quality
	h_4: Communication Networks
N: Neighborhood	n_1: Neighborhood Safety
	n_2: Neighborhood Attractiveness
	n_3: Neighborhood Cleanliness
	n_4: Neighborhood Friendliness
	n_5: Neighborhood Cultural Diversity
S: Services	s_1: Access to Childcare Centres/ Schools/ Higher Education Facilities
	s_2: Quality of Education Services
	s_3: Access to Essential Shopping Facilities
	s_4: Access to Healthcare Facilities
E: Entertainment	e_1: Access to the Recreational Outdoors
	e_2: Access to the Indoor Sporting Venues
	e_3: Access to Social Venues
	e_4: Access to Cultural Venues
	e_5: Access to Leisure Shopping Venues
WE: Work and Education	we_1: Access to Work or Education Locations
	we_2: Possibility to Explore other Job Opportunities
	we_3: Possibility to Preserve the Job Security
	we_4: Possibility to Keep a Rewarding Job
T: Transport	t_1: Access to Public Transport
	t_2: The Reliability of Public Transport
	t_3: The Flexibility of Public Transport
	t_4: The cost of public Transport
	t_5: Reliability of Private Transport
	t_6: The Flexibility of Private Transport on a Daily Basis
	t_7: Cost of Private Transport

Table 2: The Values Assigned to the Satisfactory Levels

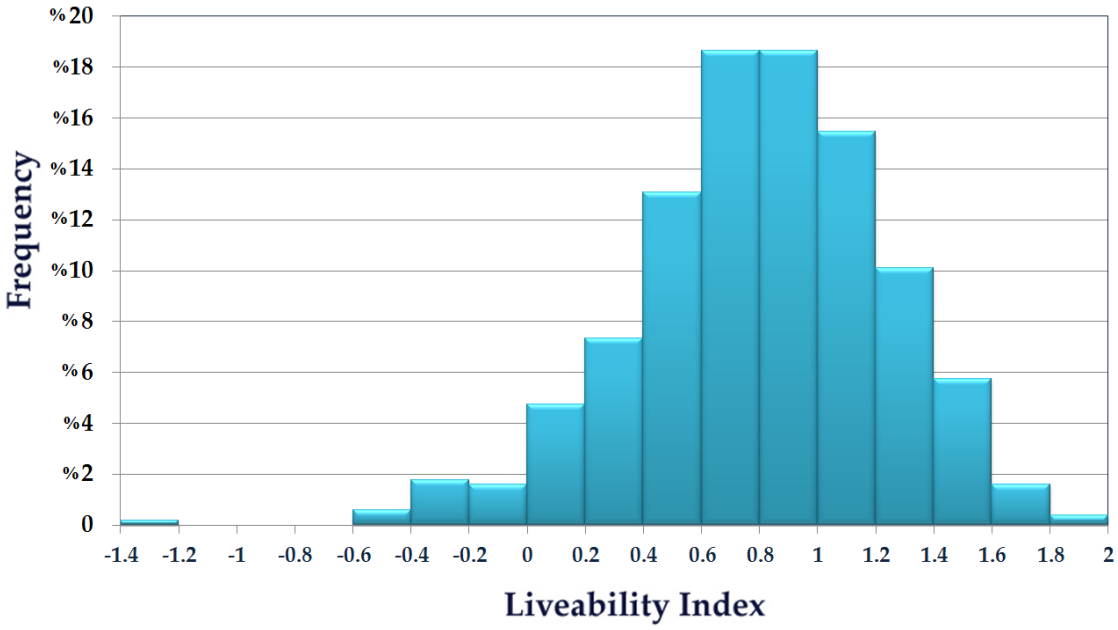
Response	Allocated Value
satisfied	2
Satisfied	1
Does not matter	0
Not entirely satisfied	-1
Not satisfied at all	-2

A measurement for the level of well-being and happiness for each sampled individual can be then calculated using the equation we used in this study as follows:

$$\text{Liveability Index} = W_1 \times \sum_{i=1}^{4} h_i / 4 + W_2 \times \sum_{i=1}^{5} n_i / 5 + W_3 \times \sum_{i=1}^{4} s_i / 4 + W_4 \times \sum_{i=1}^{5} e_i / 5 + W_5 \times \sum_{i=1}^{4} we_i / 4 + W_6 \times \sum_{i=1}^{7} we_i / 7 \quad (3)$$

Figure 5 summarizes the distribution of perceived liveability indices calculated based in the survey data. The calculated liveability indices for more that more than 95% of all sampled individuals are positive which shows that the target areas are liveable based on the perception of most sampled individuals.

Figure 5. Distribution of liveability indexes calculated for the survey individuals



Here, we want to test whether the observed differences in the category-related means of liveability indices are statistically significant. We used a t-test to compare the index means calculated for male and female individuals. Based on the survey results (p-value= 0.746), the difference between the means of liveability indices allocated to males and females is not statistically significant. A one-way ANOVA test is used to compare the mean liveability indices for different age groups. The results show that age was an effective factor in the perception of liveability in our target area (p-value= 0.028). Their annual household income and the amount time they have lived in Randwick and Green Square are other important factors in their perceived measure of well-being.

Table 3: Comparisons among the means of calculated liveability indices in different categories

	Comparing Means (P-Value)
Gender	0.746
Age	0.028
Income	0.025
Duration Living in the Area	0.044
Living Household Structure	0.063

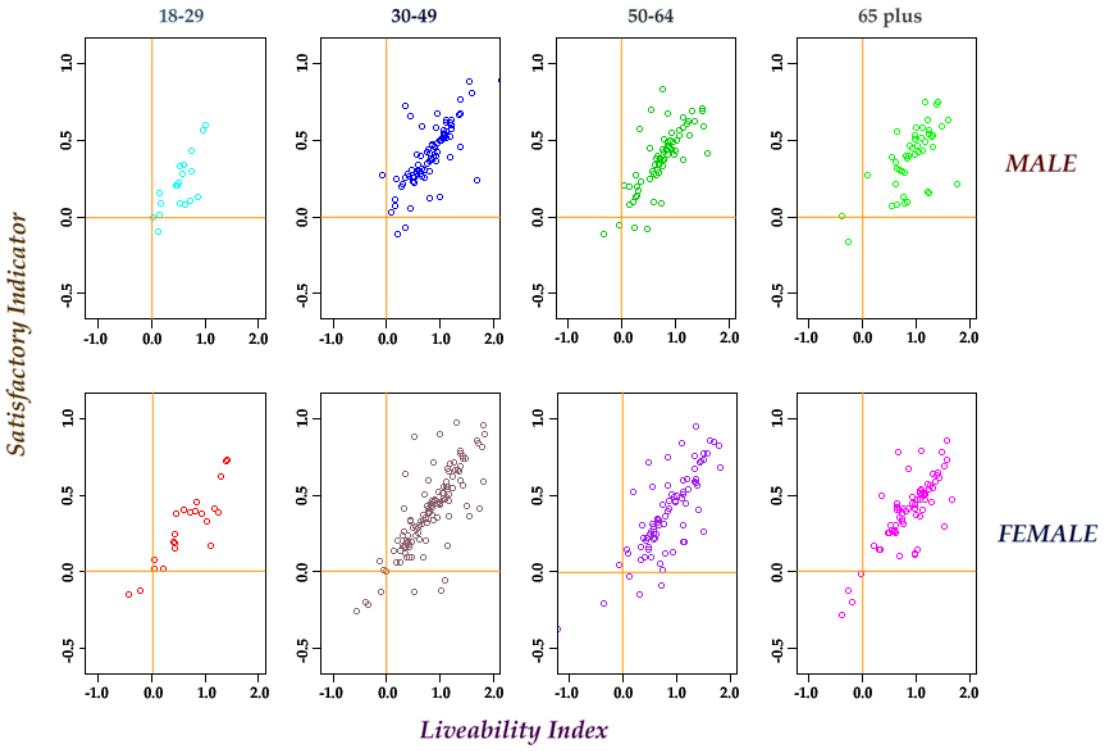
During the survey, each sampled individual was also asked to compare the life facilities at the current residential address with the previous place of living. For each environmental feature presented in Table 1, sampled individuals could say if the current situation was better, the same, or worse than the previous residential address. Here, we want to calculate an indicator for each sampled individual representing the satisfaction level about the current place of living comparing to the past. Table 3 shows the values allocated to each response from a sampled individual.

Table 3: Satisfaction (Comparison between current and previous address)

Response	Allocated Value
Worse	-1
The Same	0
Better	1

Using these values recorded for each sampled individual, an indicator is then calculated based on a formula similar to the one presented in (3). In our study, this value is considered as the satisfaction indicator for re-location. The satisfaction indicators and liveability indices calculated based on the CATI survey data are plotted for each gender and age group shown in Figure 6.

Figure 6: Scatter Plot of Liveability Index vs Satisfactory Indicator



As can be seen in the graphs, the calculated satisfactory indicators and liveability indices for most sampled individuals are positive which means that the majority of people are satisfied with the quality of their life in the target areas. Looking at the individuals whose satisfactory indicators are negative, (which means they believe the current residential address is worse than the previous one,) most of them believe that they are still living in a liveable place as the their perceived liveability indices are positive.

5. Discussion

Concept of livability is a broad term encompasses human needs whose factors include many complex characteristics and states (National Research Council, 2002). The term liveability is used to evaluate the quality of life in a region based on the surrounding physical environment and different location-based social elements. Having a reliable measurement of general well-being of individuals and societies can help the planners to consider the quality of life for residents of a city and to come up with solid decisions for improving the quality of urban management. However, there is no precise or universally agreed-upon definition for this broad term. A variety of factors can impact the social perception of local environmental conditions, many of which are difficult to measure. This makes different liveability concepts quite challenging to be evaluated.

Here, a new experimental method is proposed for measuring the existing individual perceptions of social and environmental elements in the Randwick and Green Square area of Sydney using the CATI survey. These perceptions can be grouped according to six factors describing various aspects of liveability. A linear additive model is defined in order to calculate the required area-based liveability indices using available CATI survey data. The results show that the liveability indices differ for different age groups and income levels. It is also shown that there is a relationship between the satisfaction level of sample individuals about their living area and their calculated perceived liveability indices. Therefore, valid estimation of individual-level liveability indices can help the planner to predict the residential movements.

Acknowledgement: This ongoing study is part of a research project commissioned by Transport for NSW.

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