

University of Wollongong

## Research Online

---

Applied Statistics Education and Research  
Collaboration (ASEARC) - Conference Papers

Faculty of Engineering and Information  
Sciences

---

2012

### A Heuristic Analytical Technique for Location-based Liveability Measurement

Mohammad-Reza Namazi-Rad  
*University of Wollongong, mrad@uow.edu.au*

Francois Lamy  
*University of Wollongong, flamy@uow.edu.au*

Pascal Perez  
*University of Wollongong, pascal@uow.edu.au*

Matthew J. Berryman  
*University of Wollongong, mberryma@uow.edu.au*

Follow this and additional works at: <https://ro.uow.edu.au/asearc>

---

#### Recommended Citation

Namazi-Rad, Mohammad-Reza; Lamy, Francois; Perez, Pascal; and Berryman, Matthew J., "A Heuristic Analytical Technique for Location-based Liveability Measurement" (2012). *Applied Statistics Education and Research Collaboration (ASEARC) - Conference Papers*. 7.  
<https://ro.uow.edu.au/asearc/7>

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library: [research-pubs@uow.edu.au](mailto:research-pubs@uow.edu.au)

---

## A Heuristic Analytical Technique for Location-based Liveability Measurement

### Abstract

The increasing population in Australia is highly urbanized. There is no doubt that the rapid growth in the numbers of residents in the metropolitan areas can highly affect the conditions in the public realm, places where people naturally interact with each other and their community. Therefore, a valid measurement of well-being is required for a planner to come up with solid decisions for improving the quality of urban management. An experimental technique is proposed in this paper for calculating the subjective area-based indicators of liveability based on the people's perception of surrounding environmental and social quality. In our study, a telephone survey on perceived liveability is conducted for Randwick and Green Square area in Sydney. Calculated indices based on the survey data are discussed among several population categories.

### Publication Details

Namazi-Rad, Mohammad-Reza; Lamy, Francois; Perez, Pascal; and Berryman, Matthew, A Heuristic Analytical Technique for Location-based Liveability Measurement, Proceedings of the Fifth Annual ASEARC Conference - Looking to the future - Programme and Proceedings, 2 - 3 February 2012, University of Wollongong.

# A Heuristic Analytical Technique for Location-based Liveability Measurement

Mohammad-Reza Namazi-Rad\*§, François Lamy\*‡, Pascal Perez\*, and Matthew Berryman\*

\* *SMART Infrastructure Facility, University of Wollongong, NSW 2522, Australia*

§ *Centre for Statistical and Survey Methodology, University of Wollongong, NSW 2522, Australia*

‡ *Centre of Research in Complex Systems, Charles Sturt University, NSW 2750, Australia*

---

## Abstract

The increasing population in Australia is highly urbanized. There is no doubt that the rapid growth in the numbers of residents in the metropolitan areas can highly affect the conditions in the public realm, places where people naturally interact with each other and their community. Therefore, a valid measurement of well-being is required for a planner to come up with solid decisions for improving the quality of urban management. An experimental technique is proposed in this paper for calculating the subjective area-based indicators of liveability based on the people's perception of surrounding environmental and social quality. In our study, a telephone survey on perceived liveability is conducted for Randwick and Green Square area in Sydney. Calculated indices based on the survey data are discussed among several population categories.

*Key words:* Liveable Community; Measures of Well-being; CATI Survey.

---

## 1. Introduction

The complexity of global cities such as Sydney makes planning challenging. Increasingly, planners require sophisticated insights on social behaviour and the interdependencies characterising urban systems. As urban population grows, urban design and infrastructures are required in order to maintain or improve the quality of living environments. Surrounding environment is defined by Detwyler and Marcus (1972) as the external conditions which affect the total population life. Obviously, the quality of surrounding environments can differ significantly from one place to another (Omuta, 1988). Different social activities and the measurement of life satisfaction for a particular type of population are highly influenced by the features of their surrounding environment (Michelson, 1973).

The quality of the local environment is defined by Cox (1972) based on eight major features. He believes a good local environment is the one which is nuisance free and healthful and provides proper housing, educational, employment, health and recreational opportunities, as well as modern amenities. The Victorian Competition & Efficiency Commission (VCEC) (2009) proposes a list of 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 Auspoll survey (Sto-

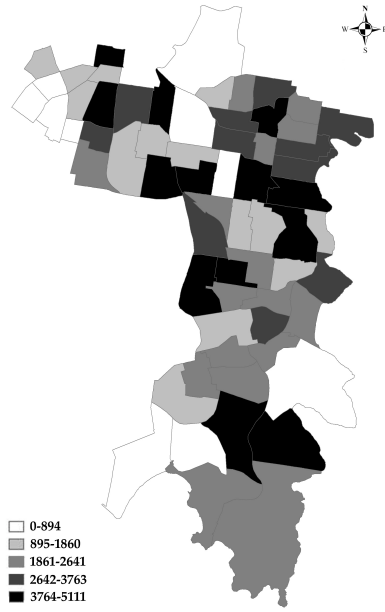
pler, 2011) uses seventeen indicators to compare major Australian capital cities: urban aesthetics, cleanliness, recreational outdoors, cultural venues, public transport, road network, safety, natural environment, sustainability, healthcare services, education facilities, affordable housing, housing diversity, employment opportunities, standard of living, local climate and social diversity.

A survey is conducted in our study for monitoring the area-based perceived liveability factors. The City of Randwick (a Local Government Area in the Eastern Suburbs of Sydney) and Green Square (a district in the inner-city of Sydney) are the target areas in this study. 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. Using the survey data, a linear additive model is proposed in this paper in order to calculate a liveability index for each sampled individual based on his/her perception of well-being. The methodology of this study is presented in the following sections.

## 2. Survey Design

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

Figure 1: Population Density Map of Randwick & Green Square



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. Some demographic analysis of the CATI survey data is given in this paper. The key aim of this survey is to produce reliable estimates for effective liveability factors within the target area based on demographic characteristics. 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 asso-

ciated valence depend on individual perceptions. We have synthesized these different sources of information into the diagram below.

Figure 2: Environmental and Social Living Elements



### 3. Liveability Indices

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. 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:

$$W_1 = \frac{(7-H)}{21} ; W_2 = \frac{(7-N)}{21} ; W_3 = \frac{(7-S)}{21} ;$$

$$W_4 = \frac{(7-E)}{21} ; W_5 = \frac{(7-WE)}{21} ; W_6 = \frac{(7-T)}{21}$$
(1)

Note that:

$$\sum_{i=1}^6 W_i = 1$$

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.

Table 1: Environmental Features in the CATI Survey

<b>H: House</b>	$h_1$ : Home Size $h_2$ : Home Affordability $h_3$ : Home Quality $h_4$ : Communication Networks
<b>N: Neighbourhood</b>	$n_1$ : Neighbourhood Safety $n_2$ : Neighbourhood Attractiveness $n_3$ : Neighbourhood Cleanliness $n_4$ : Neighbourhood Friendliness $n_5$ : Neighbourhood Cultural Diversity
<b>S: Services</b>	$s_1$ : Access to Childcare Centres Schools/ Higher Education Facilities $s_2$ : Quality of Education Services $s_3$ : Access to Essential Shoppings $s_4$ : Access to Healthcare Facilities
<b>E: Entertainment</b>	$e_1$ : 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
<b>WE: Work and Education</b>	$we_1$ : Access to Work or Education Locations $we_2$ : Other Job Opportunities $we_3$ : Job Security $we_4$ : Rewarding Jobs
<b>T: Transport</b>	$t_1$ : 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

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 2: The Values Assigned to the Satisfactory Levels

Response	Allocated Value
Perfectly 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:

$$\begin{aligned}
LiveabilityIndex = & W_1 \times \sum_{i=1}^4 \frac{h_i}{4} + W_2 \times \sum_{i=1}^5 \frac{n_i}{5} \\
& + W_3 \times \sum_{i=1}^4 \frac{s_i}{4} + W_4 \times \sum_{i=1}^5 \frac{e_i}{5} \\
& + W_5 \times \sum_{i=1}^4 \frac{we_i}{4} + W_6 \times \sum_{i=1}^7 \frac{t_i}{7}
\end{aligned} \quad (2)$$

Figure 3 summarizes the survey data on preferences in the lifestyle features previously discussed. As can be seen in Figure 3, home features was the most important factor at the current address based on the survey data. Then, ‘local transport options’ and ‘easy access to job-and education-related tasks’ were ranked as the second and third important life factors, respectively, by most sampled individuals.

Figure 3: Level of Importance of Different Lifestyle Aspects at the Current Residential Address

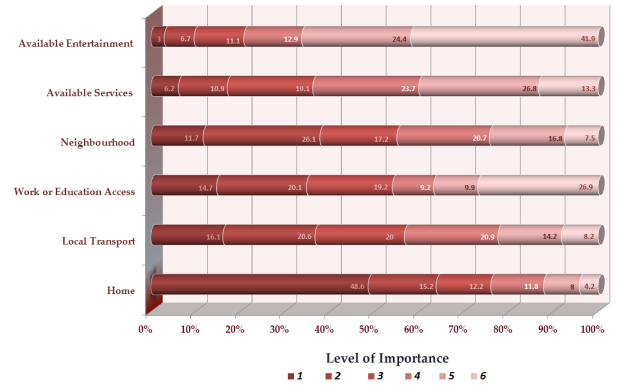


Figure 4 summarizes the distribution of gender-based indices calculated based in the survey data. The survey results show that female individuals in this survey were slightly happier about their life standards at their current residential address.

As can be seen in Figure 5, it was more important for sampled individuals over 65 to have reliable local transport facilities in the residential area rather than having a good work or education access. Based on the survey results, having easy access to work and education facilities become less important as the survey individuals get older. Available services was another important factor for the older groups while individuals between 18 and 29 were more interested in having entertainment facilities in the surrounding residential area.

Figure 4: Gender-based Distribution of Liveability Indexes Calculated for the Survey Individuals

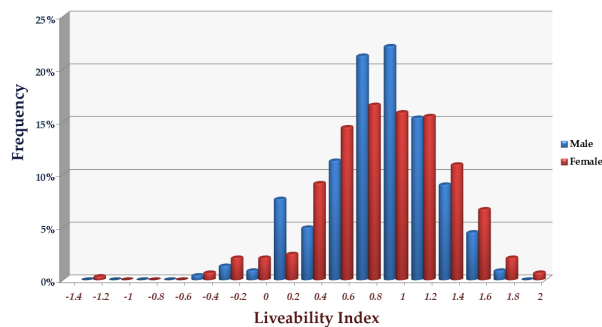


Figure 5: Important Lifestyle Factors Associated with Different Age Categories

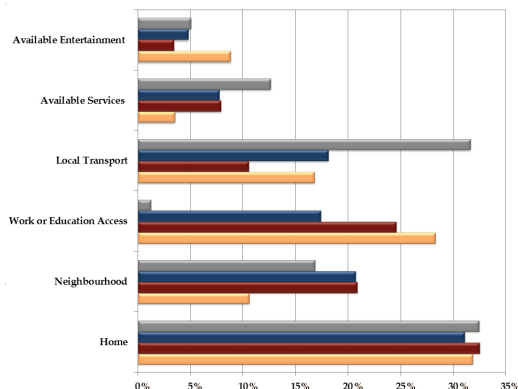
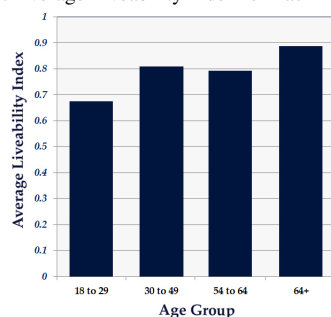


Figure 6 presents the average liveability index calculated for each age category. As shown in the graph, older people believed that their current residential address was more liveable on average while the average index for the individuals between 18 to 29 was less than the average index calculated for other age groups.

Figure 6: Average Liveability Index for Each Age Group



## 4. Discussion

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 government and non-government organizations planning for better infrastructure. In this paper a new experimental method was 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.

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 was 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).

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

## References

- [1] Cox, K.R. (1972). *Man, Location and Behavior: An Introduction to Human Geography*. John Wiley and Sons; New York.
- [2] Detwyler, T.R. and Marcus, M.G. editors, (1972). *Urbanization and environment: the physical geography of the city*, Duxbury Press; Belmont.
- [3] Lepkowski, J.M. (1988). Telephone Sampling Methods in the United States. Chapter 5 in *Telephone Survey Methodology*, John Wiley and Sons, Inc.; 73-98.
- [4] Farrell, E. (2000). Review of Computer Assisted Telephone Interviewing (CATI) Procedures in Overseas Statistical Agencies. Methodology Division of Australian Bureau of Statistics.
- [5] Massey, J. T., O'Connor, D., and Krotki, K. (1997). Response Rates in Random Digit Dialing (RDD) Telephone Surveys. In Proceeding of the Section on Sampling with Random Digit Dialing (RDD), American Statistical Association, 707-712.
- [6] Michelson, W. (1980). Long and Short Range Criteria for Housing Choice and Environmental Behavior. *Journal of Social Issues*. **36**, 135-149.
- [7] Niemann, S. (2003). Using CATI in survey research by telephone. *Soz Praventivmed*. **48**, 327-328.
- [8] Omuta G.E.D. (1988). The Quality of Urban Life and the Perception of Livability: A Case Study of Neighbourhoods in Benin City, Nigeria, *Social Indicators Research*. **20**; 417-440.
- [9] Stopler D. (2011). *My City: the People's Verdict*. The Property Council of Australia.
- [10] VCEC (2009). *A Sustainable Future for Victoria: Getting Environmental Regulation Right*. Victorian Competition and Efficiency Commission.