Valuation of Urban Green Spaces using Virtual Reality

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Environmental Economics
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Urban Green

Enhance Well-being

Virtual reality (VR)
Valuating Citizens’ Preferences for Urban Green Using Virtual Reality

Theoretical framework
Valuating Citizens’ Preferences for Urban Green Using Virtual Reality

Theoretical framework

Experimental design
Valuating Citizens’ Preferences for Urban Green Using Virtual Reality

- Theoretical framework
- Experimental design
- Econometric Analysis

Virtual Reality in Economic Valuation
Valuating Citizens’ Preferences for Urban Green Using Virtual Reality

- Theoretical framework
  - What are ES
  - How do we measure them
  - Criticism of existing models

- Experimental design

- Econometric Analysis
Ecosystem Services & Well-being

Provisioning

Regulatory

Cultural

Source: IUCN
Valuation of Ecosystem Services

Stated Preference
- Contingent Valuation Method
- Discrete Choice Experiment

Based on responses to hypothetical scenarios
Valuation of Ecosystem Services

Stated Preference

Based on responses to hypothetical scenarios

Criticism

Respondents fail to understand what they are valuing

VR to improve people’s ability to imagine hypothetical cases
Valuating Citizens’ Preferences for Urban Green Using Virtual Reality

- Theoretical framework
- Experimental design
- Econometric Analysis

- Questionnaire
- VR environment
## Attributes & Levels

<table>
<thead>
<tr>
<th>Attributes</th>
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<th>Description</th>
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<tr>
<td>Cost</td>
<td>?</td>
<td>Municipality tax to support green management</td>
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### Presentation Format

#### Text-only

<table>
<thead>
<tr>
<th>Neighborhood 1</th>
<th>Neighborhood 2</th>
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<tr>
<td>Housing type in neighborhood: 3 storey apartments (6 or 8 units) (Recently built)</td>
<td>Single Detached Houses (Recently built)</td>
</tr>
<tr>
<td>Spacing between buildings:</td>
<td>20 ft.</td>
</tr>
<tr>
<td>Size of front yard:</td>
<td>6 feet deep</td>
</tr>
<tr>
<td>Travel time to work (by car):</td>
<td>36 minutes</td>
</tr>
<tr>
<td>Travel time to work (by public transit):</td>
<td>46 minutes</td>
</tr>
<tr>
<td>Travel time to nearby shops (by walk):</td>
<td>6 minutes</td>
</tr>
<tr>
<td>Average home value:</td>
<td>$320,000</td>
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Which neighborhood would you prefer?

- Neighborhood 1
- Neighborhood 2

Progress

Continue
Communication Tool

Text-only

Virtual Reality
VR Environment

Street 3D object scanning

Develop scenarios 3DUnity

Headset
Valuating Citizens’ Preferences for Urban Green Using Virtual Reality

- Stated preference methods
- Experimental design
- Econometric Analysis
  - Mixed multinomial logit model (MMNL)
  - Scale parameter
Econometric Analysis

\[ U_{ij} = V(Z_{ij}, S_i) + \varepsilon(Z_{ij}, S_i) \]

- Characteristics of the good: i.e. green type, density, cost
- Characteristics of the individual: i.e. gender, income

\[ \Pr(j | C_i) = \Pr(V_{ji} + \varepsilon_{ji} > V_{ni} + \varepsilon_{ni}), \text{ all } n \in C_j \]

Probability that an individual \( i \) chooses alternative \( j \) from choice set \( C_i \)

\[ k = (1/\lambda)^2 \]

Scale parameter
Valuating Citizens’ Preferences for Urban Green Using Virtual Reality

**Theoretical framework**
- Ecosystem services and stated preference methods

**Experimental design**
- Development surveys using two communication tools

**Econometric Analysis**
- Estimation of preferences using MMNL & the choice uncertainty
VR integration in Stated Preference Methods

Improve validity & reliability of the estimates

Foster participation
Virtual Reality

Smart green cities

Green Roofs & Green Walls

EcoCities

Healthy People in a Healthy Environment