Deliverable # 5

The Digital Workshop: Exploring the effectiveness of interactive visualizations and real time data analysis in enhancing participation in planning processes

By: David (Cam) Campbell & Jonathan Salter

Project: Towards Best Practices for Public Processes in Sustainable Forest Management: Phase 2 R04-082

Submitted by: Collaborative for Advanced Landscape Planning CALP, Forest Resources Management, UBC

March 31, 2004

Submitted To: Forestry Innovation Investment Forestry Research Program

Please note: Some of this material is intended for future publication/technical review/practitioner testing and should not be made available publicly without first contacting Dr. S. Sheppard at CALP.
1.0 INTRODUCTION .................................................................................................................1
  1.1 Research Overview and Context..................................................................................2
  1.2 Research Aims ..............................................................................................................3

2.0 METHODS.........................................................................................................................5
  2.1 Traditional vs. Digital Workshop ..................................................................................5
  2.2 The Digital Tool: An Overview of CommunityViz .......................................................6
  2.3 Creating the Virtual Environment ...............................................................................6
    2.3.1 Level of Realism ....................................................................................................6
    2.3.2 The 3D Model .....................................................................................................7
    2.3.3 Creating the 3D Elements ..................................................................................8
    2.3.4 Indicators ..........................................................................................................9
    2.3.5 Sketch-Plans .....................................................................................................10

3.0 PROCEDURES ..................................................................................................................11
  3.1 Landscape Immersion Lab Set-up ...............................................................................11
  3.2 Workshop Ori .............................................................................................................11
  3.3 Presenting and Exploring the Residential Density Variants .....................................12
  3.4 Indicator Analysis ......................................................................................................13

4.0 RESULTS .........................................................................................................................14
  4.1 Familiarity with/Level of Support for the Proposed Residential Policies ..................14
  4.2 Usefulness of the 3D Visualizations ...........................................................................17
  4.3 Perceived Usefulness of Other Workshop Components ..........................................18
  4.4 Other Comments .......................................................................................................19

5.0 CONCLUSIONS ...............................................................................................................20
  5.1 Considerations for Further Research .........................................................................20

6.0 Acknowledgements .......................................................................................................19

7.0 REFERENCES ..................................................................................................................22

8.0 APPENDIX .......................................................................................................................24
    Consent for Questionnaire ............................................................................................25
1.0 INTRODUCTION

Communities in BC are becoming increasingly involved in making choices about a wide range of social and environmental values as part of land and resource planning initiatives. These processes are, in the main, committed to engaging community members, agencies and others in the collaborative review and assessment of policy and planning proposals, yet it is difficult for laypeople and professionals alike to envision and fully understand the consequences of the choices made or the range of available alternatives. What are the potential impacts of changing land use and management on scarce natural resources, the landscape, and quality of life? Is the nature or extent of landscape change socially as well as environmentally acceptable? What will it look like? What types of information and assumptions are being used to make decisions? How can communities participate in planning processes in a more informed and meaningful manner? As well, how can the consequences associated with trade-offs among resources and values be accurately represented and communicated to stakeholders in an explicit and understandable way?

Conventional modes for representing and communicating information about planning policy typically involve the use of 2D GIS mapping and technical reports summarizing outputs or impacts, sometimes in combination with static 3D landscape visualizations that explain context or suggest what changes in the landscape might look like. The information is typically offered for review at venues such as public information meetings, stakeholder/focus group meetings or, more recently, using web based delivery (Lewis, et al 2004). The nature of stakeholder engagement in such processes may be characterized as largely reactive. Participants respond to information, scenarios and proposals rather than actively engaging with information to increase understanding about issues and implications or to re-shape data into new configurations to explore alternatives. Conventional approaches to land planning do not typically communicate the consequences of trade-offs across a full range of environmental and social variables or depict their dynamic interactions. Recent innovation in integrated, scenario-based multi-criteria analysis methods employing both 2D information and 3D landscape visualizations to communicate the consequences and trade-offs associated with policy choices (i.e. Tress and Tress, 2003; Sheppard and Meitner, 2003), may provide stakeholders with an enhanced understanding for planning alternatives and more meaningful opportunities for input. However, the nature of engagement and opportunities for active participation with the information remains largely reactive.

The literature (e.g. Orland, 2001, Al-Kodmany, 2000) suggests that conventional approaches are inadequate if informed and meaningful participation is desired given the difficulty many people have in deciphering and understanding maps or complex analyses (Forest Practices Board, 2000; Sheppard and Lewis, 2002). As Al-Kodmany (2000) explains "user participation is meaningless if participants cannot understand what is being proposed".
Recent advances in computer technology have produced a number of interactive GIS-based scenario analysis tools (e.g. CommunityViz, Place3S, What If?, Quest, and Index, etc.) that can manage and represent information in a manner that helps communities both understand the complexities of planning issues and make better decisions. Their relative ease of use, low cost and powerful integrated real-time modeling and visualization capabilities have the potential to revolutionize the design-planning process (Danahy 2000), changing it from a reactive vicarious experience into a more democratic, participatory and meaningful activity (Al-Kodmany 2000). However, the merit of employing interactive 3D landscape visualizations and real time data analysis in collaborative community planning workshops as a communication, idea exploration and decision-aiding tool remains largely unproven. We hypothesize that such technology can provide decision-makers and community members with an enhanced understanding of their environment, better ability to plan proposals, increased knowledge of the implications of planning policy and the relative merits of design alternatives than is possible with traditional planning methods.

1.1 Research Overview and Context

This paper examines the emerging role of digital tools (in this case CommunityViz) in collaborative planning processes and explores their potential as communication and decision-aids that can enhance the nature of community engagement in planning processes. CommunityViz, a GIS based decision support system, is perhaps today’s leading off-the-shelf software programme for integrated, real-time interactive modeling and visualisation of planning scenarios. Although, to-date, it has been applied most commonly in the land use and urban planning sectors, it is potentially well-suited to sustainable resource management as it is structured to analyse planning scenarios against multiple management objectives or performance criteria which can be tailored to the areas and issues of relevance. It includes a fairly realistic visualisation capability which permits interactive dynamic viewing of landscapes with trees, vegetation, and man-made objects. The main goal of this research was therefore to investigate the validity and effectiveness of a new kind of ‘digital workshop’, combining the interactive CommunityViz tool with the immersive controlled lab facilities at CALP, as an aid to the overall participatory decision-making process.

The case study selected for this research was the “BowenViz” project, an ongoing collaborative research and planning project of the Bowen Island Sustainable Communities Advisory Committee, the Bowen Island Municipal Planning Department, Natural Resources Canada, the UBC Collaborative for Advanced Landscape Planning (CALP) and the UBC Sustainable Development Research Initiative (SDRI). This project focuses on the participatory planning process associated with decision-making on sustainability options and associated policies for the community of Snug Cove, Bowen Island. It integrates community consultation, scenario modeling and landscape visualization as part
of the community engagement process. This project was chosen for the following reasons:

- Bowen Island and its supporting collaborators at Natural Resources Canada are actively implementing CommunityViz and are one of the first communities in Canada to be doing so.
- There is an unusually rich and comprehensive geo-database (with high-resolution orthophotography) already collected for the area which is available to support visualisation and indicator development at no cost to the FII project.
- The community of Snug Cove represents a large number of small communities on the forest edge, dependent economically on their forested hinterland and scenery for tourism, quality of life, and other environmental services. It therefore combines aspects typical of many small rural communities in BC, as well as aspects of urban forestry, community forestry, and sustainability planning.
- Existing relationships with the BowenVIZ team and community provide a unique opportunity to conduct validation exercises with visualisations in the context of an actual participatory planning process and real community members/users.
- Easy access for researchers to visit the study area, and for community members to access the UBC lab facilities.

In support of the larger community dialogue process, two community-planning workshops were held at the Collaborative for Advanced Landscape Planning’s (CALP) Landscape Immersion Lab at the University of British Columbia. These ‘digital workshops’ were designed to explore the implications of conceptual land use scenarios with different levels of development in previously undeveloped forested areas around the community. To facilitate collaborative exploration, the interactive 3D landscape visualisation and real time data analysis capabilities of CommunityViz were employed to illustrate the possible outcomes of the policy.

1.2 Research Aims

The research seeks insight into whether interactive 3D landscape visualizations and real time data analysis in collaborative workshop settings further participant understanding for planning proposals and result in more meaningful public engagement. It also explores the significance of digital tools as a communication and decision-aiding tool. Specifically the research will focus on:

1. How the technology is employed by participants to further their understanding of a planning area and planning proposals and to explore design alternatives and solutions and identify other issues;
2. The extent to which participants feel the technology enhanced their understanding of the planning context and issues and contributed to their decision making processes;
2.0 METHODS

The following provides an overview of the digital workshop format, venue, the CommunityViz decision support system and the tasks associated with crafting a virtual representation of the Bowen Island study area that could be used to represent and explore proposed land use scenarios.

The project involved facilitating and observing two 3 hour community planning workshops structured to provide participants with the opportunity to explore, discuss and assess specific aspects of the draft Snug Cove Plan (Bowen Island, B.C.). A total of 14 individuals participated in the sessions. Participants included Municipal staff, community members serving on Municipal advisory boards (notably the Sustainability Advisory Committee) or similarly qualified individuals drawn from the community at large (these included past members of the Municipal Council, business interests and interested citizens). Those participating were representative of individuals who would normally engage in the review and assessment tasks associated with land use and resource planning functions (and would be typical of the primary potential users of the digital tools examined).

2.1 Traditional vs. Digital Workshop Formats

The workshops differed from traditional methods in that they employed dynamic 3D landscape visualizations and real time data analysis generated by the CommunityViz software suite, and utilized the large, multi-screen display of CALP's Landscape Immersion Lab (LIL) at the University of British Columbia. This permitted the information to be presented in a controlled setting that capitalized on LIL’s large screen immersive setting. The nature of the software and the presentation format allowed participants to interactively view and explore the planning area and aspects of the proposals contained in the plan in an immersive setting. To assess the role and effectiveness of the technology on the levels of understanding and acceptance for the plan among technical staff and potential decision makers, the workshop participants were queried about select
aspects of the plan both prior to and after the use of the visualizations and data analysis.

Given time constraints and the exploratory nature of the research, the workshops focused on one subset of proposed planning issues, focused on potential development areas with differing levels of sustainability on the urban-wildland transition around Snug Cove Village. Within these areas residential densities may, subject to conditions, increase to between 15 and 25 Units per Acre (UPA) with 20 UPA as an average density. Increasing the residential densities could result in significant landscape change (i.e. the removal of forest cover) in areas currently undeveloped, which is a key concern in the community. CommunityViz was used to explore the implications of the 3 alternative development scenarios in the digital workshops.

2.2 The Digital Tool: An Overview of CommunityViz

CommunityViz is a relatively inexpensive and moderately easy to use GIS based decision support system offering integrated scenario analysis and visualization capabilities. It is particularly innovative given the ease with which it can provide direct links to community defined sustainability indicators.

The CommunityViz suite employed in this research consists of Scenario Constructor, SiteBuilder 3D, and ModelBuilder 3D. Scenario Constructor, the core CommunityViz module, is a quantitative data analysis tool facilitating “what if” explorations of scenarios or alternatives by permitting users to dynamically modify scenario assumptions and attributes associated with key indicators. As assumptions or source data are changed, the values associated with the indicators are automatically re-calculated in real time using adaptable formulae, making the resulting impacts and trade-offs among indicators explicit. SiteBuilder 3D allows the user to create 3D representations of ArcView source data and provides an interactive real-time 3D environment that permits users to dynamically explore visualizations. Combined, these two modules create a robust, decision support system with dynamic analysis capabilities that can be employed to assess land use proposals simultaneously with 2D indicator and 3D visual output. ModelBuilder3D is used to create and texture 3D models that can be used in SiteBuilder 3D visualizations.

2.3 Creating the Virtual Environment

2.3.1 Level of Realism

The first step in the 3D modeling process was to define an appropriate level of realism. It was decided that existing vegetation (primarily mature trees), which set the context for the Snug Cove community, should be rendered with fairly high realism, based on tree images of coniferous and deciduous trees from the area.
The existing iconic buildings lining the main street, a major set of landmarks for the community were developed to a moderate level of realism, their forms and textures providing a reasonably accurate depiction of existing conditions. Given that the development scenarios examined were analogous to a designer’s sketch (intended to quickly assess the appropriateness of ideas/concepts), they were represented semi-abstractly with a lesser level of detail than the main street buildings. The reduced realism was intended to avoid focusing discussion on details (i.e. buildings, landscape design, revegetation) instead of concepts (i.e. are the proposed policies acceptable from a spatial/visual perspective?) and to avoid the impression that the proposals were a fait accompli. Both the informal comments and questionnaire findings (see below) suggest that the participants felt the level of realism was appropriate given the workshop aims; only one respondent (an architect) strongly disagreed and felt the abstract forms were not adequate.

2.3.2 The 3D Model

A 3D digital model of the planning area was produced to serve as a base for assessing the physical/visual impacts of the scenario alternatives. The model was populated with digital 3D elements representing the existing forest cover and built environment for the planning area. The terrain model was based on BC Government TRIM mapping contour data (20 metre contour interval). A high-resolution air-photo of the planning area (15cm resolution) was draped on the terrain as a texture to provide additional character. The coarse resolution of the terrain model did not adequately depict actual topographic conditions or incorporate the effects of grading to accommodate roads and site development. This presented problems in how the tree and building models appeared in the visualization, with objects sometimes appearing to hover above or burrow into the terrain. While distracting, the participants were willing to accept the limitations of the technology once they were apprised of its cause and did not comment negatively about this aspect of the visualisations.
2.3.3 *Creating the 3D Elements*

Preparing the 3D elements such as digital tree and building models required substantial amounts of time and effort on the part of the planning team. The 3D tree models representing the planning area’s forest cover were created as double (intersecting) billboards and textured with digital images from the image library, using Multi-Gen’s ModelBuilder 3D tree-building wizard. To ensure relatively accurate tree heights and densities, sample tree heights and observations about species composition were made in the field. An ArcView point theme was created from the high resolution air-photo and used to position individual 3D tree models within the view. Two conifer and four deciduous model categories were created, each representing a different height or canopy width.

Preparing the building models necessitated a detailed photographic inventory of all major buildings in the planning area. The photographs were used to guide construction of the 3D building models and were compiled as a texture library. To ensure the building models were accurately dimensioned, field measurements were made of building heights. Plan dimensions were taken from an ArcView building footprint theme based on the high resolution air-photo. Using the photographs as guides, the 3D geometry for each structure was created in SketchUp 3D, an easy to use, intuitive 3D sketching programme. The simple building models were exported to Multi-gen’s ModelBuilder 3D for texturing. Textures for each building had to be created using Photoshop to cut details from each building photograph as required (e.g. roof, facade, dormer). These were placed on the model surfaces using ModelBuilder 3D’s texture tools.
2.3.5 Indicators

The Indicators used in CommunityViz provide a means for assessing the consequences and impacts of proposals to aid in the selection of alternatives. The output makes these explicit and easily understood via graphs and numerical output that provide a representation of the Snug Cove community in terms of key values or resources. This, in tandem with the 3D visualizations, creates a virtual model of the planning area. To avoid undue complexity, exploration of the scenarios was limited to four sustainability indicators:

- Water consumption
- Population
- Energy Consumption
- Solid Waste Production

It is worth noting that Bowen Island is relatively well-placed for testing decision-support systems such as CommunityViz, compared with other communities in British Columbia, in that it is a data rich environment, benefiting a legacy of prior agency and community based research studies. Data used to develop the indicators and define assumptions included Statistics Canada population information, The Bowen Island Digital Atlas, Community Energy Plan and community initiatives such as the commercial use survey and refined population data and projections. Elements of this information were incorporated as assumptions into the indicator formulae to provide a dynamic representation of Snug Cove’s structure and function. Even with large amounts of data readily available, the collection, collation and preparation of this information for use in
ArcView/ArcGIS and CommunityViz was a daunting task, requiring considerable time and effort on the part of agencies, individuals and organizations.

2.3.6 Sketch-Plans

A prototypical site was selected to illustrate the possible consequences resulting from the policies, in terms of the physical landscape and key sustainability indicator values. Rough sketch-plans were developed depicting what the development scenarios might look like at 15, 20 and 25 Units per Acre (UPA) as per the proposed policies. While crude, the 2D sketch-plans were resolved to a level of detail that made tree retention, building footprints, road layout and the ratio of developed/undeveloped land explicit. These formed the basis for the 3D visualizations and indicator analysis.
3.0 DIGITAL WORKSHOP PROCEDURES

3.1 Landscape Immersion Lab Set-up

Attempts were made to conduct the workshop in an informal, relaxed manner. The arrangement of the LIL lab attempted to keep the facilitators, participants, and information in close proximity to one another to facilitate discussion and to capitalize on the large screen display. Where possible, the technical infrastructure was kept away from the discussion area and out of the sight of participants in order to keep distractions to a minimum.

3.2 Workshop Orientation

Prior to reviewing the planning alternatives, the participants were briefed about the assumptions governing development of the sketch-plans, visualizations and indicators and were afforded an opportunity to challenge or discuss them. This included a review of the proposed land use policy, summary of assumptions including tree removal, building types, road standards, areas excluded from development for open space or the protection of sensitive areas, and the source and nature of the data sets used to build the indicators. The participants were cautioned that the sketch-plans were not designs per se but rather quick depictions of what the scenarios might mean in terms of spatial/physical impacts.
3.3 Presenting and Exploring the Residential Density Variants

The 3 development alternatives were introduced using the 2D sketch-plans to summarize the physical design implications (i.e. extent of developed area/open space, road lengths, number of units). On the adjacent screen the 3D landscape visualisation of the planning area was displayed. To orient the participants and to familiarize them with the model and dynamic viewing capabilities, the facilitators walked them through the planning area at a low oblique angle, identifying reference points and using the 3D imagery to describe the density variant. Participants were provided with laser pens they could use to highlight areas or features on the screen and were prompted to direct how exploration occurred. The participants were generally willing to direct the facilitators as to where and how they wished to view the model – where to pause, how to move, whether to view from ground level or aerial oblique, viewing distance, etc. When providing guidance as to how they wished to explore the residential density variant, the participants made numerous references to geographical reference points in the model (e.g. “stop at the corner of Government Street and look into the site” or, “follow Government Street from the Ferry Landing to the site”). The participants were comfortable using the model as a surrogate representation of the Village. Low oblique aerial views were the preferred mode of viewing as were requests to physically explore the scenarios at close quarters.

Fig. 6 Visualization of the 25 UPA Density Variant

During the 3D exploration, it was observed that while participants largely confined their questions and discussion to the selected policy issues at a broad, conceptual level, the visualisations and indicators invariably led the participants
to raise and discuss other related topics and issues, such as form and character of development, tree retention and the appropriateness of increasing density at the Village periphery. After reviewing all 3 scenarios, as described above, a comparison was made between each in terms of number of units, road lengths and extent of open space.

3.4 Indicator Analysis

Subsequent to the 3D exploration of physical/visual consequences, each scenario was examined in terms of the indicator values: population, water consumption, energy consumption and solid waste production. The presentation sparked considerable discussion about water supply issues in the face of increased population, the contributions to island wide sustainability resulting from increasing village densities and the impacts of clustered vs. non-clustered growth on the island as a whole.
To acquire an appreciation of the use of CommunityViz and its influence on levels of knowledge and support for the proposed planning policies, a 4-part questionnaire (see Appendix) was administered at varying points during the workshop. The first part, Plan Knowledge – Initial Review, administered prior to the actual workshop session, asked participants to provide:

1. an assessment of their level of knowledge about the proposed planning policies;
2. level of support for the proposed development policies;
3. an assessment of how well the policies conform to the guiding principles of the plan, and;
4. an assessment as to whether Snug Cove will be a more sustainable community once the plan is implemented.

Respondents were asked to use a five-point scale to express their level of knowledge (from ‘little/ no knowledge to ‘very knowledgeable) about the proposed policies, and level of agreement with several statements regarding the policies (from ‘strongly disagree to ‘strongly agree). This provided a baseline from which responses in subsequent parts of the questionnaire could be compared.

Immediately following the 3D/Indicator analysis exploration of the policies, the participants were asked to answer Part 2, Plan Knowledge – 2nd Review, which repeated the questions posed in Part 1. This permitted comparisons to be made between the initial and second questioning and assisted in identifying whether the digital technology influenced the responses. Part 3 of the questionnaire, The Review Workshop Process, sought participant perspectives about how well individual components of the workshop (i.e. non-visual data, 2D data, 3D information, etc.) contributed to their understanding for the planning policies and decision-making. The responses offer a broad evaluation of the relative utility of both digital and non-digital information in furthering participant understanding and decision-making. Part 4: Visualizations /Perspective Views asked participants to assess the extent to which the interactive 3D information furthered their understanding of the planning area and policies and whether the level of realism was appropriate given the nature of the workshop. As well, participants were asked to comment about the strengths and weaknesses of the digital tools in a series of open-ended questions.

4.1 Familiarity with and Level of Support for the Proposed Development Policies

Responses to the questions posed in Parts 1 and 2 of the questionnaire suggest CommunityViz influenced participant levels of familiarity and support for the proposed policies. Of the 14 respondents, 7 indicated no change in their level of
familiarity with the proposed policies (these individuals indicated they were very or somewhat familiar with the policies). The remaining participants indicated that their level of familiarity was enhanced subsequent to the CommunityViz explorations. Of these, the majority indicated a one level increase in their assessment (i.e. from not at all to limited familiarity or some to moderate familiarity) while 2 individuals indicated an increase of two levels (from limited to some familiarity).

![Familiarity with Proposed Residential Policies: Pre and Post CommunityViz](image)

Fig.7 Familiarity with the proposed residential policies: a comparison between the initial and 2nd review.

In terms of levels of agreement with the policies, a negative pattern appears, with 5 respondents indicating weakened levels of agreement subsequent to the CommunityViz explorations. The degree of influence is significant, with 1 respondent dropping 3 levels of agreement, from moderate agreement to strong disagreement, 2 respondents dropping 2 levels from moderate agreement to moderate disagreement and 1 from neutral to moderate disagreement. One half of the respondents (7) indicated no change from their original assessments. One respondent indicated an increase in support from moderate agreement to strong agreement with the policies.

A general question was posed about whether Snug Cove would be a more sustainable community once the plan was implemented. Of the 13 respondents (one respondent did not answer this question), the majority (6) indicated their level of agreement diminished subsequent to the CommunityViz explorations (3 moving from neutral to moderate disagreement, 1 moving from moderate agreement to moderate disagreement, 2 moving from moderate to neutral), while 4 respondents indicated stronger agreement with the statement (3 moving from neutral to moderate agreement and 1 from moderate to strong agreement).
While it cannot be discerned with confidence at this stage which particular workshop components influenced participant levels of support, informal discussions with the participants during and after the workshops suggest the indicator values may have had a greater impact on their assessments. No strong negative comments were expressed about the physical impacts of the density scenarios during the dynamic review of the visualizations. Members of the group commented that “It’s not as bad as I thought” or, “that doesn't look too bad” suggesting a neutral to supportive tone for the policies as represented.
4.2 Usefulness of the 3D Visualizations

All respondents either moderately or strongly agreed that the dynamic 3D visualisations enhanced their understanding of the planning area and the implications associated with the residential density variants. Relative to other components of the workshop (i.e. indicator analysis, hardcopy mapping etc.) the dynamic views of the 3D model and ability to choose what to look at in the 3D visualization were, just after the ability to see changes to indicators on-screen, perceived as the most helpful in their deliberations.

Participant comments about the positive aspects of the visualisations and large screen display focused on the following aspects of CommunityViz:

1. dynamic viewing capabilities ("ability to see from any viewpoint – ground or aerial"), effectiveness in communicating concepts and ideas ("better than maps", "good depiction of spatial relationships", "easy for the group to see", "good for group viewing");
2. representation of impacts ("gives a sense of how the place could change", "gives sense of impacts", gives perspective of issues and growth", "assisted in understanding concepts of policy") and;
3. role in facilitating group discussion ("easy to share and focus", "good for group viewing"). One respondent commented that it was "reassuring to have this tool (CommunityViz), especially for fear-based thinking", suggesting the tool helped them demystify the policy proposals by making the concepts more understandable.

![Participant Evaluation of Usefulness of Visualisations](image)

Fig.8 Participant evaluations of the usefulness of the 3D visualizations
Criticisms of the visualisations were few, focusing largely on issues of detail ("missing parking/impacts of automobiles") and concerns that it was hard to "remind self that this is gross modelling, not reality". With one exception, the participants moderately to strongly agreed that the level of realism was adequate for the purposes of the workshop. The respondent (an architect) who strongly disagreed, commented that the abstract building images were "too off-putting".

Unfortunately there was no time to allow for truly interactive exploration of the visualizations (i.e. where the participants take control of the hardware to independently explore the model and/or indicators as they wish) and as such, the value of this capability to participants remains unknown.

![Participant Evaluation of Usefulness of Workshop Components](image)

Fig. 9 Participant evaluations of the usefulness of the workshop components

4.3 **Perceived Usefulness of Other Workshop Components**

All components of the workshop were seen to be helpful in enhancing understanding and assisting in decision-making. The ability to see changes in indicators on-screen, the control over what was seen and being able to dynamically explore the visualizations were all perceived as being particularly helpful with the presenter’s narrative being slightly less useful. Interestingly, assessments of the indicator analysis and non-visual information, while still perceived as useful, are markedly lower than other components.
4.4 Other Comments

A common theme in both written and verbal comments was that there was not enough time to reflect on what was learned or to examine/interact with the information at sufficient detail in the workshop. This suggests that a need exists to radically rethink the manner of presentation (i.e. to ensure there is enough time) or, that there is a limit to the amount of information that can be absorbed meaningfully when considering complex land use policy. It is important to consider that only one set of policies was being considered here and that exploration was confined to simple 3D visualizations and 4 indicator values during the 3 hour duration of the workshop.
5.0 CONCLUSIONS

The research results suggest that digital tools such as CommunityViz are perceived as useful by individuals who would normally engage in the review and assessment tasks associated with land use and policy planning functions and that it can serve both an educational and decision-aiding function. The use of the technology was generally well received by the workshop participants and valued for its modeling and representational capabilities. Interactivity of dynamic viewing and real time analysis was especially appreciated. The format of the digital workshop and the use of the multiple large screens, laser pointers controlled by participants and the semi-immersive deliberation space created by the Landscape Immersion Lab seemed also to be positively received.

Digital support systems such as CommunityViz are potentially powerful tools for describing and representing landscapes and planning proposals, providing enhanced opportunities for communities to intimately engage with information, evaluate landscape change and make choices about trade-offs between social and environmental values. It is argued that dynamic decision support systems, such as CommunityViz, can both complement and significantly improve conventional approaches in collaborative land planning. Although the benefits of this technology are readily apparent, its technical complexity and information needs are potential barriers to its widespread use. The significant investments of time and associated costs of data collection and preparation and 3D model preparation are particularly prohibitive. As well, the effective use of this decision support system software requires considerable expertise in photography, data modeling and 3D modelling. Lastly, the organisational efforts and trust-building required to run an in-depth digital workshop such as this is considerable, given that this was a real-world planning process with many variables uncontrollable by the researchers/facilitators.

The decision support tools and digital workshop format seems highly applicable to more mainstream forest planning applications where participation is required with small-medium sized groups with various levels of technical expertise. However, there may be considerable work to be done to link the emerging forms of spatio-temporal modelling for forest growth, forest health forecasting and harvest allocation, to the simpler GIS-based data sets used to model indicators and support 3D visualisation models in CommunityViz. Software of the type described by Cavens (2000) may be needed to support the scale and complexity if data typically used in forestry applications. There may also be significant barriers in terms of the scale of landscape under consideration, in any application involving CommunityViz.

5.1 Considerations for Further Research
This research highlights the need for a more extensive research agenda that more explicitly explores how such technology can be used to support collaborative land planning tasks. Aspects meriting closer examination include appraisals of how and when digital tools such as CommunityViz can be most effectively employed in collaborative planning processes for resource management at larger geographic scales, and what the protocols are for its use in terms of setting, levels of realism, and methods of data. Examinations into how interactive decision support systems integrate with and support conventional methods are critical.

An aspect of the technology remaining relatively unknown is how the full expression of interactive 3D visualization and data analysis capabilities would be perceived and employed by end users such as statutory decision makers, agencies or community groups to evaluate policy and generate alternatives. To date, most true group interactions with the technology have been limited and remain somewhat reactive, rather than fully interactive.

6.0 ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial support of Forest Innovation Investment Ltd. and Natural Resources Canada GEOIDE which made this research possible.

We also greatfully acknowledge Dr. Murray Journeay, Research Scientist with Natural Resources Canada and Gina McKay, Community Planner with the Bown Island Municipality for their active collaboration and assistance throughout the project. Thanks are also due to Conrad Verushka for his photographic inventory of the Snug Cove planning area and Eric Christiansen and Lex Ivey of CommunityViz for technical support and advice regarding the use of the CommunityViz software.

Special thanks are offered to the Bowen Island community members who, through their participation in the Digital Workshop sessions, generously contributed to the research.
7.0 REFERENCES


8.0 APPENDIX
Consent for Questionnaire

**Project Title:** The Snug Cove Planning Workshop: A First Look at the Role of Interactive Visualizations and Real Time Data Analysis to Enhance Participant Understanding of Planning Proposals

**Project Investigators:** Dr. Stephen R.J. Sheppard (office: 604-822-6582) and Mr. Cam Campbell (604 - 736-3257).

**Project Overview:** This research project explores the role of interactive visualizations and real time data analysis in enhancing understanding of planning issues and to facilitate the exploration of ideas in a local government planning Workshop. The workshop component of the research will be of approximately four hours in duration. At several points during the Workshop I will be asked to answer questions about my knowledge of the planning area and plan content, the extent to which the use of the technology enhanced my understanding about each, and the utility of the process and technology in facilitating discussion.

The research is being conducted by Dr. Stephen Sheppard and Mr. Cam Campbell.

I will participate in the research project, subject to the following conditions:

- I understand that all information associated with individual responses in this study will be held in confidence and only the investigators will have access to that information. The investigators guarantee access to all recorded data will be limited to the project investigators and will be kept secure in a locked faculty office. Your anonymity will be protected in any publicly accessible reports, papers, and presentations resulting from this work.

- I understand that I may refuse to participate or withdraw from the research project at any time.

- I have received a copy of this consent form for my own records.

- If I have any questions or concerns about the procedures used in this research, Dr. Sheppard and Mr. Campbell have agreed to answer any questions and inquiries that I may have.
By completing this questionnaire it is assumed that my consent has been given to participate in this study.

If you have any questions or concerns about this research project, you may contact Dr. Stephen Sheppard (office: 604-822-6582) at the Faculty of Forestry, University of British Columbia. If you have any questions or concerns about your rights or treatment as research subjects, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598.

Signature: ____________________________ Date: ______

Printed Name of the Person Signing Above:
1.0 The Snug Cove Plan (Initial Review)

1.1 How familiar are you with the proposed Residential Policies in the draft Snug Cove Plan?

☐ Very  ☐ Moderately  ☐ Somewhat  ☐ Limited  ☐ Not at all

1.2 The proposed increase in residential densities and commercial development is acceptable to me?

☐ Strongly agree  ☐ Moderately agree  ☐ Neutral  ☐ Moderately disagree  ☐ Strongly disagree

1.3 The Residential policies conform to the plan’s Guiding Principles -- (Preserve village ambience, promote pedestrian-oriented environment, enhance park ambience, respect heritage character of Snug Cove)?

☐ Strongly agree  ☐ Moderately agree  ☐ Neutral  ☐ Moderately disagree  ☐ Strongly disagree

1.4 Snug Cove will be a more sustainable community when the Plan is implemented?

☐ Strongly agree  ☐ Moderately agree  ☐ Neutral  ☐ Moderately disagree  ☐ Strongly disagree

1.5 What problematic or unresolved issues do you see in the proposed Residential policies (indicate briefly in a few words – use back of sheet if necessary)?
2.0 THE SNUG COVE PLAN REVIEW (2ND REVIEW)

2.1 How familiar are you with the proposed Residential policies in the Snug Cove Plan?

☐ Very  ☐ Moderately  ☐ Somewhat  ☐ Limited  ☐ Not at all

2.2 The proposed increase in residential densities and commercial development is acceptable to me?

☐ Strongly agree  ☐ Moderately agree  ☐ Neutral  ☐ Moderately disagree  ☐ Strongly disagree

2.3 The Residential Policies conform to the plan's Guiding Principles -- (Preserve village ambience, promote pedestrian-oriented environment, enhance park ambience, respect heritage character of Snug Cove)?

☐ Strongly agree  ☐ Moderately agree  ☐ Neutral  ☐ Moderately disagree  ☐ Strongly disagree

2.4 Snug Cove will be a more sustainable community when the Plan is implemented?

☐ Strongly agree  ☐ Moderately agree  ☐ Neutral  ☐ Moderately disagree  ☐ Strongly disagree

2.5 What problematic or unresolved issues do you see in the proposed Residential policies (indicate briefly in a few words – use back of sheet if necessary)?
3.0 The Review Workshop Process

Please indicate your level of agreement with the following statements

3.1 Relative to conventional planning processes, overall, the workshop process and use of interactive 3D visualizations and real-time data analysis,

a) facilitated discussion and the exploration of issues and alternatives.

☐ Strongly agree ☐ Moderately agree ☐ Neutral ☐ Moderately disagree ☐ Strongly disagree

b) enhanced understanding for the implications of specific planning policies.

☐ Strongly agree ☐ Moderately agree ☐ Neutral ☐ Moderately disagree ☐ Strongly disagree

c) assisted in making decisions / identifying courses of action.

☐ Strongly agree ☐ Moderately agree ☐ Neutral ☐ Moderately disagree ☐ Strongly disagree

3.2 Please evaluate the various components of the workshop from very helpful to very unhelpful with regard to how each assisted in your understanding of the draft plan.

<table>
<thead>
<tr>
<th>Component:</th>
<th>Very helpful</th>
<th>Moderately helpful</th>
<th>Neither helpful nor unhelpful</th>
<th>Moderately unhelpful</th>
<th>Very unhelpful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of indicators (bar-charts) on-screen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-visual data (maps, reports, indicators, etc. used in addition to the CommunityViz output)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to see changes in indicators instantly on-screen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to see indicator bar-charts, maps and visualisations at the same time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic (moving) views of 3D model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feature</td>
<td>Strongly agree</td>
<td>Moderately agree</td>
<td>Neutral</td>
<td>Moderately disagree</td>
<td>Strongly disagree</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>----------------</td>
<td>------------------</td>
<td>---------</td>
<td>---------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Ability to choose what you want to look at in the 3D visualization on-screen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presenters / narrative accompanying the CommunityViz on-screen presentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard-copy of the Draft Snug Cove Plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard-copy maps on the walls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**4.0 VISUALIZATIONS / PERSPECTIVE VIEWS**

4.1 The 3D perspective visualizations enhanced my understanding about the Snug Cove planning area?

4.2 The Visualizations enhanced my understanding about the implications of the proposed Residential policies in the Snug Cove Plan?

4.3 The level of realism in the visualizations was adequate for the purpose of the workshop?

4.4 What was good about the use of the large panoramic display of visualizations and information (in a few words)?
4.5 What was bad about the use of the large panoramic display of visualizations and information (in a few words)?

4.6 How could the workshop process be improved?
5.0 PARTICIPANT INFORMATION

5.1 Age: _____________

5.2 Gender: □ Male □ Female

5.3 Occupation: ________________________________________________________________

5.4 Role in the Snug Cove Community Planning Process? ________________________________________________________________