Planning & Designing with People

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Abstract. This paper details the use of visual simulations by the Environmental Simulation Center, Ltd. (ESC) and its collaborators to involve citizens in the neighborhood/city/regional visioning and planning process. It does so by examining three visioning projects undertaken in the last three years. The case studies demonstrate how to obtain citizen input regarding their values and group identity through their participation in designing the place in which they would like to live. Fully integrating 3D/Geographic Information System-based simulations and visualizations into the visioning process makes it possible for citizens to better understand their choices at both a policy and experiential level and arrive at consensus for the future of their communities.

1. Overview

The use of digital simulation and visualization is explored through the experience of three planning projects:

- *Vision 2030: Shaping our Region's Future Together* for the five-county Baltimore (Maryland) Regional Transportation Board (January 2003)
- *Southwest Santa Fe City/County Master Planning Initiative* for the City and County of Santa Fe, New Mexico (April 2002)
- Near Northside Economic Revitalization Planning Process for the City of Houston, Texas (September 2001)

The impetus for these plans derives from and is a negative reaction to current development practice, generally automobile based-planning manifesting itself in traffic jams and chaotic development patterns (e.g., the loss of open space in the Baltimore region; sprawling, commercial strip, gated community development and the loss of desert and the "sense of place" unique to Santa Fe; and a hostile pedestrian experience in Houston's Near Northside). The plans themselves are to guide future growth and development. Each project assumed growth, with pressure on the development of "greenfields" (typically undeveloped or agricultural land) in the cases of the Baltimore region and Santa Fe.

Each project is different in terms of scale, landscape, degree of anticipated change, governmental and regulatory structures, and the nature of public participation. As a result, each presents different challenges for simulation and visualization. The integration of simulation and visualization into the public participation process, facilitating informed discussion and decision-making, was guided by the number of people involved, propinquity, and localism. Regardless of the form the application of the technology took, it was consistently used to develop the plan in

a variety of settings, from hands-on workshops to large "town hall" meetings, not merely to represent or visualize outcomes. Technology has typically been used toward the end of a planning process; used to sell the project or place but not to help the public develop the plan. Our objective has always been that simulations and visualizations are a means to the end of informing communities which are making decisions about their future.

The ESC has used simulations and real time interactive visualizations in planning and visioning since the early 1990's. To facilitate the process, the ESC developed its first 3D kit-of-parts (Fig. 1) in 1994 for a series of community planning and visioning prospects done in collaboration with the Regional Plan Association (Yaro and Hiss, 1996; Morgan, 1996). Advances in both hardware and software (e.g., ArcViewGIS and CommunityViz™ Planning and Design Decision Support System) made it possible to use real time 3D simulations and visualizations and GIS in the process of formulating a vision with citizens. The Santa Fe case study was among the first vision plans that fully integrates these digital tools in the process.

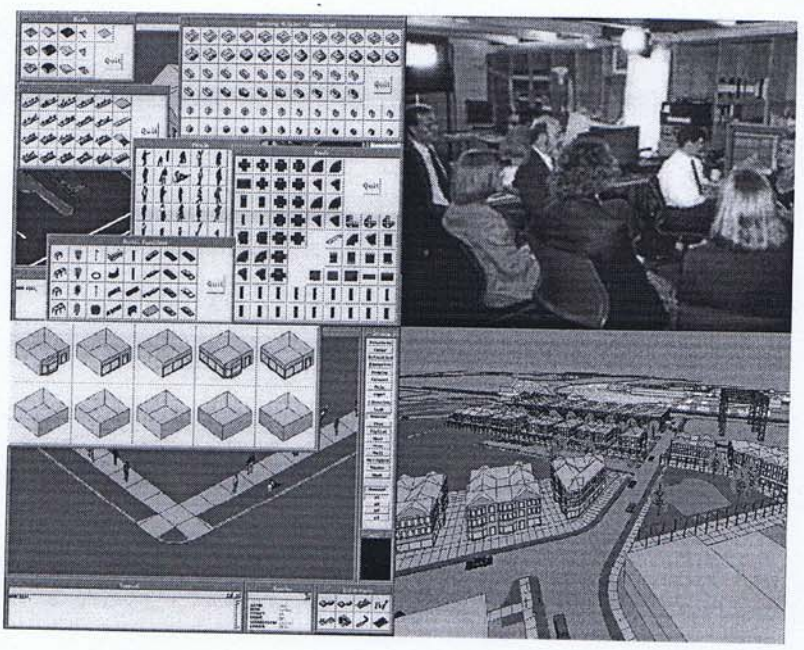


Fig. 1. 3D kit-of-parts developed by the ESC being used by the participants to design a transit village in "real-time".

While each of the planning projects is unique, all have commonalities that are useful for comparing why, how, and under what circumstances simulation and

visualization are used to enhance public participation and, most importantly, decision-making. Conceptually, they all share a common base: all employ visioning processes based on the methodology first developed by Gianni Longo in his groundbreaking work with Chattanooga, Tennessee in the early 1980's, in which visioning is a citizen-driven process where all of the results are derived from public input. It is neither top-down nor bottom-up. It is inclusive of both the private-sector stakeholders (from business leaders to NGOs) and the public sector. Its purpose is to reach consensus on issues regarding values and group identity. It is less concerned with differences. – what sets citizens apart – than with what a community, town, city or region share in common. It is about finding common ground in our pluralistic society.

"Place" plays a critical role in locating common ground. As Donald Appleyard (1979) observed,

> *(T)echnical planning and environmental decisions are not only value-based...but identity-based...(P)hysical planning decisions can, and frequently do, threaten the identity and status of certain groups while enlarging the power of others...The environment is divided into "ours" and "theirs;" the trees may be ours, the billboards theirs, the authentic is ours, the phony theirs, downtown may be ours or theirs, as may be the wilderness, the oil, or other natural resources. The city and the natural environment are areas of symbolic social conflicts and as such raise their own issues of social justice.*

From the perspective of the lay public, place -- their neighborhood, district, town, city or region -- is experienced as a whole in all of its glorious messiness, and not as a series of abstract planning categories (Casey, 1997). The "quality of place", the combination of its experiential and functional attributes and group values and identity are recognized as being synchronous in visioning. Visioning uses physical design as a form of inquiry, exploring the match and mismatch between words, numbers and images. Words and numbers are abstractions that have very specific real world implications. It is not unusual to hear, as has often been the case at the ESC, "That's not what I meant at all...." When the words and numbers in a standard master plan or zoning resolutions are simulated and visualized dynamically in three dimensions. The simulations and visualizations used in these three visioning processes and plans all play a similar role: grounding metaphor in reality.

Ironically, many of the proponents of "place" share an implicit tendency to be anti-technology and to regard the outcome of technology as "placelessness" (Relph, 1976; Lowenthal, 1985). In the three case studies we demonstrate that state-of-the-art technology can be used to help citizens and public officials *create place* and even to transform placelessness into place by using simulations and visualizations in a citizen driven process.

Regarding the digital technology, the projects were all done within a three year period, and made use of similar simulation and visualization tools and techniques

(although the applications were obviously adapted to each project's needs and scale).

2. Baltimore Region

2.1 Vision 2030: Shaping our Region's Future Together

Over a 15-month period Vision 2030 explored six thematic areas that dealt with a broad range of issues that were, for the first time, brought together to form a comprehensive regional perspective. The areas were: Economic Development, Education, Environment, Government and Public Policy, Livable Communities, and Transportation.

The visioning process involved six interrelated and sequential steps:

- Step One: Understanding the Region – Perception and Reality
- Step Two: Involving Stakeholders
- Step Three: Prototypical Development Patterns and Scenarios
- Step Four: Gathering Ideas and Testing Results with the Public
- Step Five: Developing Vision Statements and Strategies
- Step Six: Testing the Vision Statements and Strategies with the Public

Within the overall context of the Vision 2030 process, simulation and visualization played a central role in helping the public and the project's Oversight Committee reach consensus on the "hot button" issue of where and how to accommodate growth in the region identified by the focus groups in Step One.

2.2 The Regional Workshop ("Where to Grow")

In response to the "hot button" growth issue, the Regional Workshop focused on "where to grow". Organized as a game, the purpose of the workshop was threefold:

1. To understand the complexity of thinking regionally,
2. To gain "intuitive" public input on future growth and land consumption considerations, and
3. To prepare for future subcommittee work (e.g., developing the vision statements, strategies, and principles that form the core of Vision 2030).

The participants consisted of 65 stakeholders, including elected officials, planners, educators, citizen activists, staff from NGOs, and business leaders. Participants were divided into eight groups, each with a facilitator.

As a first step, participants agreed on a percentage (average of all eight groups) of the region's total land they would like to protect over the next 30 years, in addition to land already protected. The next step was to agree on a common set of criteria, weighted differently by each of the eight groups, to help guide the choice of

areas to protect for the future (e.g., the creation of contiguous natural environments, protecting forest and trail areas, etc.).

A three-foot by four-foot Geographic Information Systems (GIS) generated map of the region – which included layers delineating urbanized areas, areas already protected, agricultural areas, and unprotected land (e.g., forests, wetlands, etc.) – was overlayered (Fig. 2). Then each group was given green "chips", each representing one square mile of land, and asked to place them onto areas on the map that the group believed should be protected. During a brief break, the results of each group's approach to future land protection were hand-tabulated and a workshop average of protected land was calculated. The patterns of each group's placement of chips were compared and discussed by the workshop participants, revealing an underlying consistency in the choices made by each group: on average, 12 percent of the land was inside Priority Funding Areas (PFAs) (areas in the five county region that receive State of Maryland incentives for new development in urbanized areas) and 88 percent was outside the PFAs.

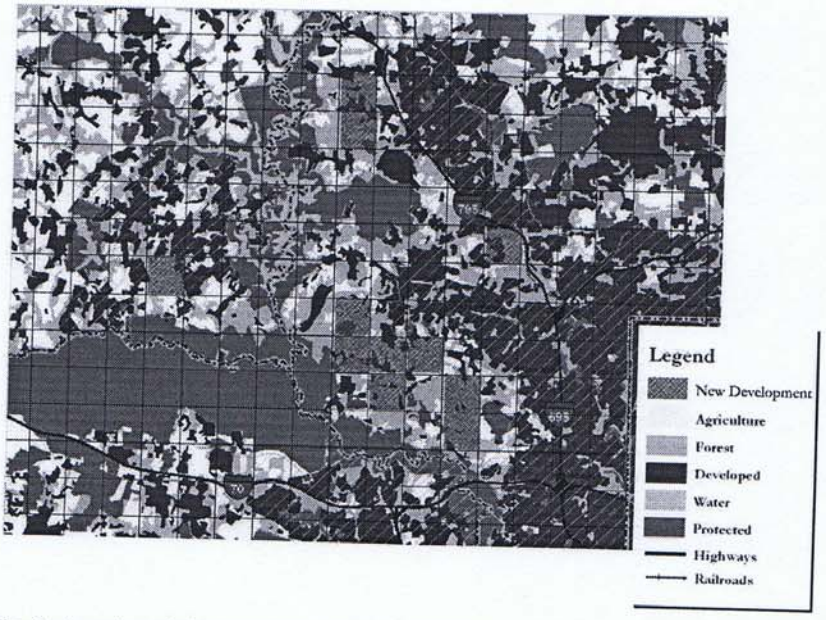


Fig. 2. A portion of the GIS generated map of the Baltimore region with one mile square grid overlay.

The next step was to determine where growth might be located. The groups were given brown chips that represented the amount of land that would be needed to accommodate the region's projected growth for the next 25 years (Fig. 3). In a similar way to the land protection exercise, the participants discussed and agreed

on criteria that they could use to guide their decision-making regarding where growth should occur (e.g., along transit lines in already developed areas, in undeveloped areas, near employment centers, etc.) Again, the results were tabulated, averaged, and discussed, and revealed a consensus for redevelopment rather than "greenfields" development.

Fig. 3. Participants allocating the Baltimore region's projected growth on the GIS map.

The responses to the Regional Workshop "game" reflected consensus. Most groups chose to locate growth the region's developed areas and protect land in the outer areas. The groups placed an average of 70 percent of the growth within the PFAs, 6 percent of the growth in greenfields outside the PFAs, and 24 percent of the growth in Baltimore City.

2.3 The Regional Public Meetings ("How to Grow")

Over a two-month period 17 facilitated Regional Public Meetings were held. Presentations were made of prototypical development patterns, region-wide development scenarios and the absolute and relative performance of each development scenario. Questionnaires were administered and small group idea sessions were conducted.

The Oversight Committee and its Thematic Subcommittee identified and tested three development patterns, four future regional development scenarios, and per-

formance indicators. The development patterns became the building blocks for these future regional development scenarios. Each scenario showed how the region would develop depending upon the allocation of the development patterns/building blocks.

The three development patterns reflected trends that were occurring in the Baltimore region as well as those emerging nationwide. Each had different implications for land consumption, housing types mix, and proximity to jobs, shopping, and entertainment. They were:

1. *Type A: Conventional development pattern in undeveloped land.* This reflected a continuation of how the region had been growing with single-family detached houses, shopping entertainment, and employment in auto-centered malls (Fig. 4).
2. *Type B: Mixed-use walkable community on undeveloped land.* This assumed the creation of more compact neighborhoods with a mix of housing types and nearby shopping, entertainment, and employment (Fig. 5).
3. *Type C: Mixed-use walkable communities on redeveloped land.* This also assumed the creation of more walkable compact communities but on redeveloped land (Fig. 6).

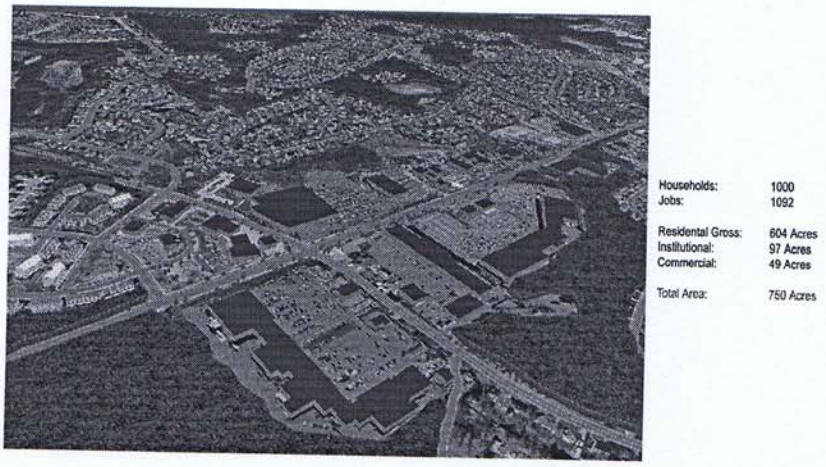


Fig. 4. Type A: Conventional development pattern on undeveloped land.

Fig. 5. Type B: Mixed-use walkable community on undeveloped land.

Fig. 6. Type C: Mixed-use walkable community on redeveloped land.

Each building block or development pattern had the same goal: to accommodate 1,000 households with supporting commercial, schools, and open space. This allowed for "apples to apples" comparisons.

Unlike the Santa Fe and Houşton vision plans, Vision 2030 was not focused on a particular place or places in the Baltimore region but rather on public policy, which required a focus on places characteristic of the region. In fact, given the region's emphasis on home rule (where each jurisdiction has land-use powers), it was critical that Vision 2030 not appear to be usurping local authority. Working collaboratively with the client, the ESC composited two characteristic places using

the five-county GIS orthophotographs and database: one with large tracts of undeveloped land and existing suburban and rural development patterns with the possibility of "greenfields" development (Fig. 7) and another in an urbanized center with the possibility of infill/redevelopment (Fig. 8).

Fig. 7. Composited existing suburban and rural development pattern representative of the Baltimore region.

Fig. 8. Composited existing urbanized center development pattern representative of the Baltimore region.

Prototypical building types were created and introduced into the model development patterns that were included in the regional scenarios. Each development pattern was designed in the composite (layout of blocks, lots, streets, uses, open spaces, distribution of building types, etc.) and modeled in three dimensions to reflect the architectural character of historic and contemporary buildings in the region. The real-time 3D/GIS environment allowed the client to view the development patterns dynamically, to comment on the design of the development pattern, and to select views and real-time walk-through paths to be presented to the public at the 17 Regional Public Meetings. Because the development patterns were composed of a kit-of-parts that ranged from the building to the block (with each block having different combination of lot sizes), the ESC was able to quickly and efficiently respond in "real time" to subcommittee comments and suggestions in an iterative design process.

With the 3D simulations and visualizations of the three development patterns validated by the Thematic Subcommittees, the three development patterns (Types A, B, and C) were then used to assemble the four regional development scenarios identified by Vision 2030. The scenarios accommodated the forecasted population and employment growth for the region by using the development patterns in different combinations. The four prototypical regional scenarios were:

- Scenario 1: Current trends and plans
- Scenario 2: Emphasis on road capacity
- Scenario 3: Emphasis on mass transit
- Scenario 4: Emphasis on redevelopment

The compositing of development pattern types into scenarios is illustrated by comparing the mix of development types between Scenarios 2 and 3:

Scenario 2

Type A: Conventional development pattern on undeveloped land	75%
Type B: Mixed-use walkable communities on undeveloped land	20%
Type C: Mixed-use walkable communities on redeveloped land	5%

Scenario 3

Type A: Conventional development pattern on undeveloped land	25%
Type B: Mixed-use walkable communities on undeveloped land	37.5%
Type C: Mixed-use walkable communities on redeveloped land	37.5%

The comparison of the four scenarios was analyzed through an enhanced version of the Baltimore Metropolitan Council's travel demand model (enhancements by Smart Mobility Inc.). Model enhancements included improved sensitivity to transportation infrastructure and land-use, and improved fit with observed traffic data and travel survey data. The four scenarios were translated into transportation analysis zones ("TAZ") that were used to distribute the projected household and employment growth through the region. Distribution factors such as availability of land (for greenfield development only), vacancy rates for redevelopment, and proximity to public transit utilized GIS data and information derived from the

3D/GIS simulations and visualizations of the three development pattern types. Performance indicators (e.g. gasoline consumption, vehicle miles traveled, walking trips, transit trips, etc.) were used to quantify the performance of each of the four scenarios.

The analysis revealed that the *Current Trends* (Scenario 1) and *Emphasis on Road Capacity* (Scenario 2), would result in vehicle miles of travel and gasoline consumption that were three to four times greater than *Emphasis on Mass Transit* (Scenario 3) and *Emphasis on Redevelopment* (Scenario 4). The reason is that driving trips would be shorter as a result of a compact land-use pattern and the concomitant larger number of walk and transit trips. Further, the *Emphasis on Redevelopment* scenario performed particularly well because the region has a significant potential for redevelopment in areas close to the region's core.

The three development patterns (Types A, B, and C), the four regional development scenarios and the scenarios' performance as measured by the indicators were all presented at each of the 17 Regional Public Meetings, in conjunction with a questionnaire (entitled "Choices for the Future") that focused on the regional scenarios. The questionnaire presented a number of quality of life and transportation indicators related to the four prototypical regional development scenarios. Participants were first asked to select the scenario that they preferred according to the effect each had on each indicator. For example, the indicator "acres of new land consumed by development from the year 2000 to the year 2030" had a range of 41,242 acres to 138,316 acres, depending on the scenario.

The four scenarios and the performance indicators represented "what ifs"; hypothetical situations that were intentionally designed to offer a wide range of choices. Their abstraction, particularly when expanded to the five-county region was made palpable by the simulations and visualizations that employed 3D models and eye-level walk-throughs (Figs. 9a,b). They communicated to the public the question: "If you think or prefer this, then this is probably the kind of place that will result; is this acceptable?" The simulations and visualizations were compelling and, in conjunction with the performance indicators, provided the comfort level the respondents needed to complete the questionnaire. The results demonstrated overwhelming support for the *Emphasis on Redevelopment* and *Emphasis on Mass Transit* scenarios, both of which consumed less than half the amount of land in accommodating future growth as opposed to the other two scenarios.

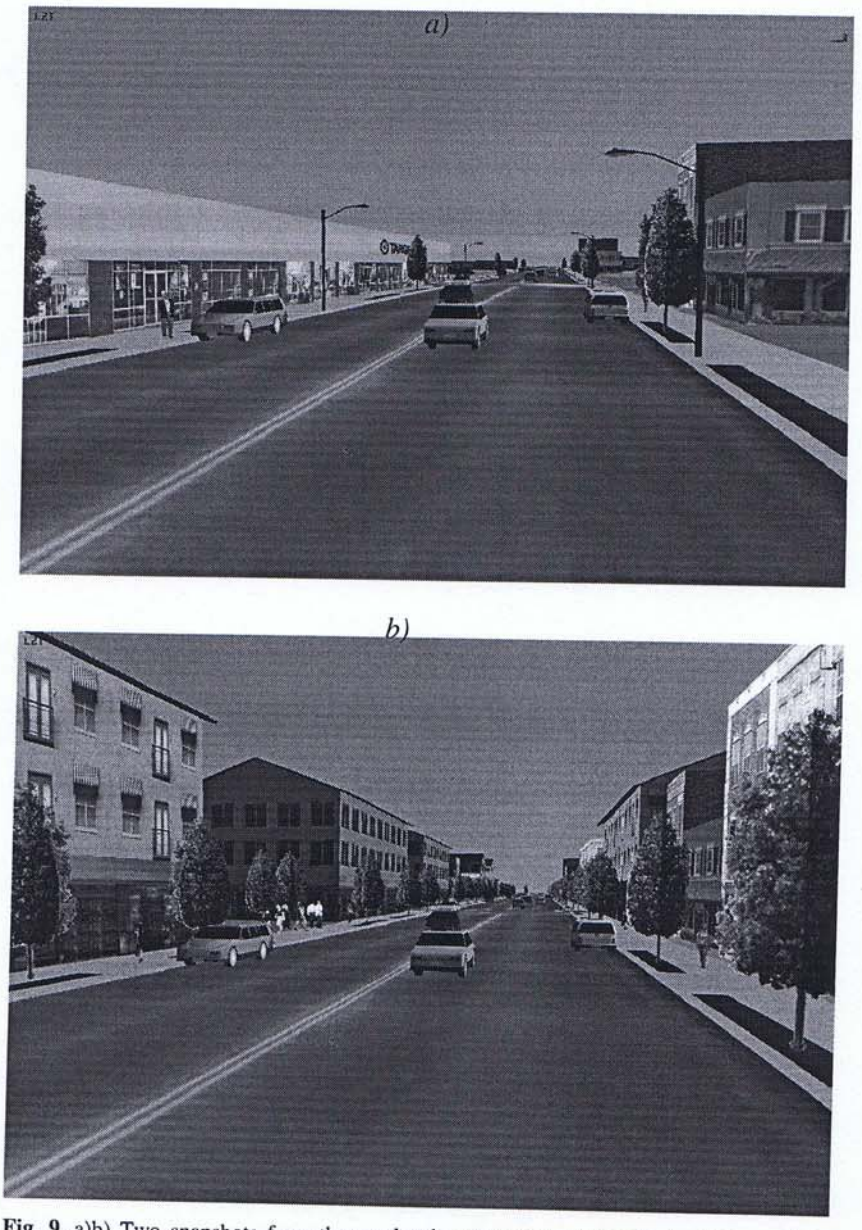


Fig. 9. a)b) Two snapshots from the eye-level real time walkthrough simulations of the mixed-use walkable community on redeveloped land where a) shows existing conditions and b) redevelopment.

The ways in which the simulations and visualizations were used in Vision 2030 were a function of the scale of the community participation in the process in a five-county region. When working with the Oversight Committee's Thematic Subcommittee the participants had an opportunity to work in the real-time 3D/GIS environment Similarly, the Regional Workshop, with its groups of eight participants, allowed for direct participation in the workshop. The results of the "where to grow" and "how to grow" workshop and meetings needed to be presented to the region's constituency where they lived. By definition, the Regional Public Meetings could not be "hands on" in terms of determining or even changing the content, but rather were designed to take the pulse of the community, to register their response to a series of scenarios from which they were asked to choose. Given the possibility of checking "none of the above" it was clear that the public outreach and communications effort, the simulations, visualizations, and indicators of the development patterns and scenarios, and the iterative nature of the process (that at key points attempted to validate positions taken at that time in the visioning process) were effective at keeping people both informed and involved.

To insure the credibility of the Vision 2030 results, the core values and key strategies of the team were tested in a random regional phone survey. The survey focused on four primary goals: to understand which Vision 2030 issues were "hot button" issues for the region's residents, to test the degree to which the core values that came out of the visioning process resonated with the public, to compare regional attitudes to those nationally, and to derive a demographic and profile of residents across issue areas. The 1,200 random telephone interviews insured that there was a large enough number of interviews in each of the region's jurisdictions. The telephone survey validated the results of the visioning process, indicating that the region's citizens have a strong environmental ethic, are concerned about growth and sprawl, believe that there should be a balance between economic development and environmental protection, and have a heightened concern about traffic and congestion. Interestingly, notwithstanding the residents' support for public transportation, it would require a cultural shift of the respondents to actually use public transportation, assuming an adequate system was in place. Public participation in planning decisions was a mid-tier concern among those interviewed, although the interest in "encouraging public participation" was greater than "developing regional cooperation" and "coordination among the region's communities and counties". This revealed one of the problems facing regional planning: creating a regional identity that the residents could relate to.

3. Southwest Santa Fe

3.1 Southwest Santa Fe City/County Master Planning Initiative

The objective of this 25-week study was to develop a public participation process which would yield a policy framework for future development (a "vision plan"). The study was seen as the first step in the formulation of a master plan with corresponding development regulations that would implement the policy framework established by the vision plan.

Unlike Baltimore's Vision 2030, the issue of "where to grow" was explicit, in that Southwest Santa Fe was, realistically, the only area left to accommodate growth within the City of Santa Fe. In fact, this area was already growing rapidly, if not chaotically, and all indications were that development pressure would continue. Southwest Santa Fe was at a crossroads. It could continue to develop as an entirely auto-dependent "suburb" of anonymous strip malls and "adobesque" gated communities or it could grow in a way that was sympathetic to Santa Fe's historic development pattern (Reps, 1979; Longo 1996), considered the values of the existing population, and conserved the high desert landscape. Hence, the public participation processes focus was on "how to grow".

3.2 Methodology/Process

While the vision plan was to be a policy document, its focus was on a clearly delineated and hotly contested area in which existing residents had a clear, if not personal interest that resonated Appleyard's comment: "Planning is not only technical but value and identity based". Because the study area was in their backyard, passions ran high. If consensus was to be achieved to guide the area's future, the process needed to be inclusive, open, and informative. Most importantly, the vision plan needed to incorporate the values of all the participants and establish an area identity that all could support, relate to, and implement; that is, to find common ground.

The process that was designed to identify a vision for the Southwest Santa Fe area consisted of three sequential steps, each of which involved public participation, review, comment, and decision-making. The steps were:

1. Identify three prototypical areas where principles and possible development scenarios could be developed and applied to similar parts of the study area.
2. Develop land-use and urban design alternatives, including:
   - Identifying local patterns and conventions of development,
   - Translating those patterns and conventions into the development of 3D building blocks,
   - Extracting development principles from the building blocks, and
   - Applying the building blocks to each of the three prototypical areas.

3. Test the land-use and urban design alternatives and present them to the residents, the general public and the stakeholders in addition to the monthly meetings with the plan's Steering Group.

The following paragraphs explore the role of simulation and visualization throughout the visioning process, with a focus on creating the "building blocks", principles, and the planning area GIS for the three planning areas, and explains how they were used in the public review and decision-making process

The principle advocate for the stakeholders, the existing residents, and the NGOs was the Steering Group. This 28 member committee was continuously involved in all aspects of the process, meeting monthly with the consultants. They participated in the process of developing land-use and design alternatives for each prototypical area. The process included identifying recurring patterns of development, translating those patterns into development building blocks, and applying the building blocks to the prototypical areas of "New Development", "Corridor Development", and "Rural Protection".

Places to a great degree derive their character from conventions or patterns that are implicitly agreed upon by the community. Two examples are the more or less uniform setback of houses in New England, or the diversity of fences and walls that enclose the front yards of Santa Fe's houses. The patterns used by the ESC to design the building blocks derived from historic Santa Fe and from the planning area itself. Over fifteen large and small recurring patterns or urban design conventions in historic Santa Fe were identified.

The next step was to translate local patterns into digital 3D building blocks (blocks and lots consisting of houses, sidewalks, street widths, and on-street parking). The building blocks became the basic components used in developing the vision for each of the protypical areas. For example, for the New Development prototypical area building blocks included a variety of blocks and lots representative of Santa Fe, a hierarchy of streets, sidewalks and traffic calming devices, linear parks (based on the land subdivision of narrow long lots) and squares, mixed-use commercial buildings, and residential buildings. A draft of the 3D building blocks was presented to the Steering Group for its review and comment. Each block was reviewed individually and as aggregated patterns in the real-time 3D model.

The hierarchy of new streets and block sizes was reviewed in its entirety and as individual components, which determined each street's width, design speed, sidewalks and on-street parking patterns. Because safety of pedestrians (and particularly children) was one of the overarching themes that emerged from the stakeholder meetings and focus groups, the Steering Group carefully scrutinized the components prepared by the consultant team. Each street type, from alley to collector street, was modeled in 3D using the building blocks based on historic street widths in Santa Fe. The Santa Fe Department of Transportation standard issue street widths were also modeled for comparison.

The street patterns and widths were thoroughly discussed and voted on, and each street was assigned a grade based on comfort level (Fig. 10). With this input the Steering Group reduced the number of street types. Not all street patterns and building blocks survived the scrutiny of the Steering Group; in some cases they were modified to better match local conditions (as in the case of the commercial

building whose height was reduced from three to two stories). In other cases, components were rejected as inappropriate for Santa Fe.

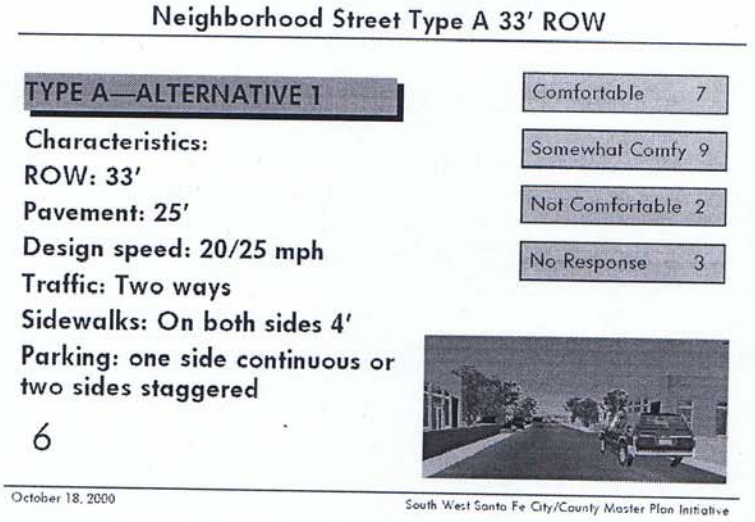


Fig. 10. Example of neighborhood street type with characteristics, visual simulation using the Santa Fe "Building Blocks", and participant votes.

As the planning process proceeded, the individual building blocks were aggregated into development scenarios and reviewed by the Steering Group. The building blocks were applied to the prototypical areas using a GIS-based existing conditions 3D model of the three prototypical areas to show how they might go together to create a neighborhood, a mixed-use commercial area, or a development pattern in low-density rural protection areas.

Fitting the building blocks and land-use patterns to existing conditions demonstrated how the areas could develop incrementally and inclusively. The simulations and 3D visualizations were not meant to be finished, static designs rigidly applied, but rather used to illustrate how the building blocks might be organized to show a possible, but by no means singular end result (Fig. 11).

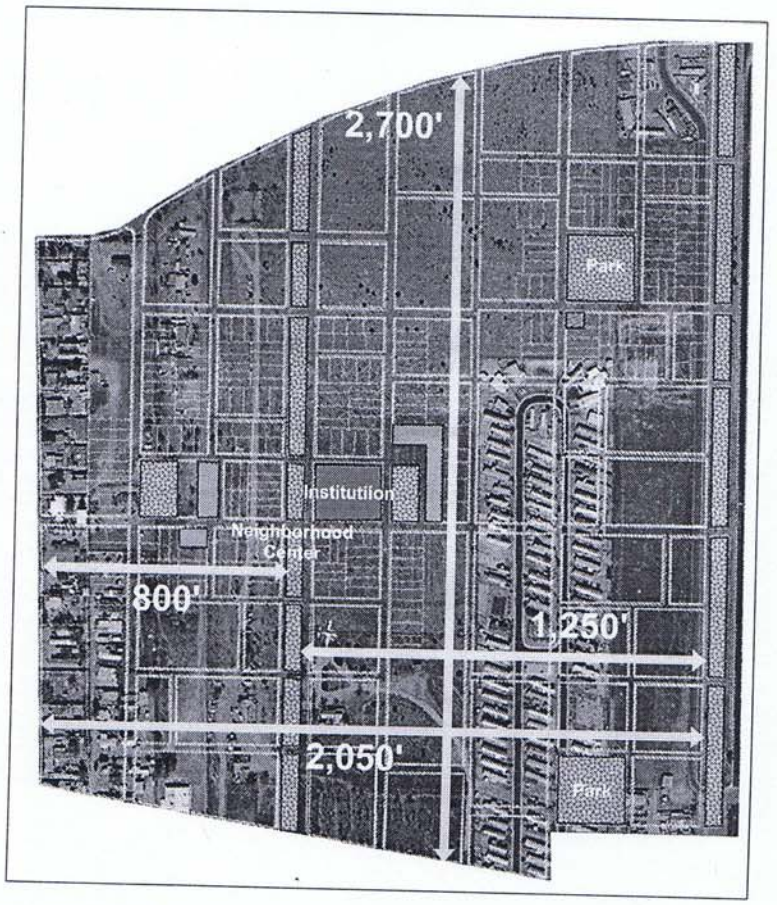


Fig. 11. Integrating the building blocks with existing land-uses and development. The measurements indicate walking distances.

The next step was to extract the development principles implicit in the development scenarios reviewed by the Steering Committee. Ten development principles were identified as representing the community core values. Each principle lists the action necessary, and the combination of building blocks required, to realize its intent. The principles generalized the results of the process, making the principles and the building blocks applicable throughout the entire planning area, rather than being limited in their application to a specific site or location within the prototypical area.

At the Public Forum each of the principles and corresponding combinations of building blocks were presented and discussed individually. To help the public better understand what kind of neighborhood would result if the principles were im-

plemented in the aggregate, the ESC created a representative portion of a prototypical mixed-use neighborhood using the building blocks (a "cluster"). The cluster allowed the ESC to simulate – at eye level and in real-time within the context of the 3D model – what it would be like to leave your house in the morning, walk to the daycare center to drop off your child, pick-up a snack at the corner deli, and get on your bicycle and ride along the linear park to work at the commercial center (Fig. 12).

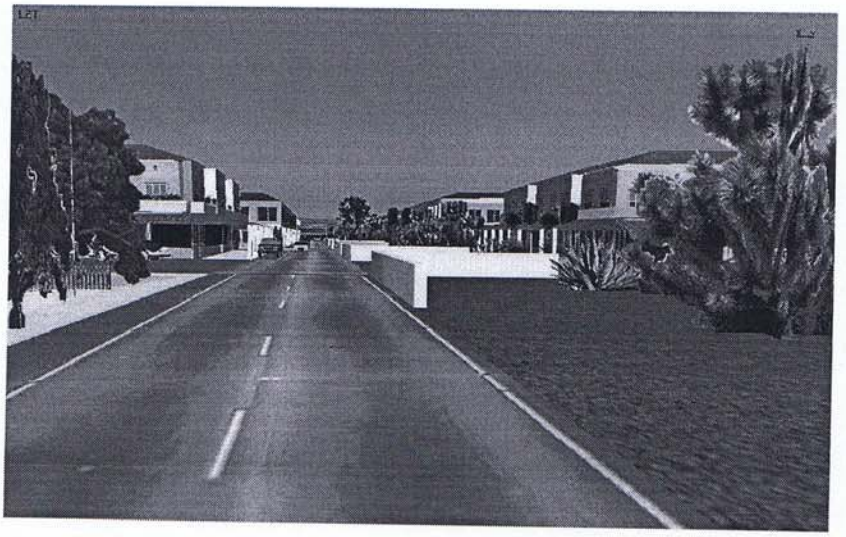


Fig. 12. An eye level visual simulation of a mixed use neighborhood and linear trail park.

The real-time walk-through was very effective in conveying to the public the future identity of Southwest Santa Fe. The real-time 3D model also made it possible to respond to requests to walk down other streets or what it would look like from someone's front yard. Being able to be "in the model" and to make choices was critical to engendering a spirited discussion of the pros and cons of the principles.

After considerable discussion, the Public Forum's participants were asked to rank the principles on a scale ranging from 1 (indicating the lowest level of support) to 5 (indicating the highest level of support), and an average score for each principle was tabulated. For example, Principle 5 ("Neighborhoods in Southwest Santa Fe should have a variety of lot sizes and building styles to allow for economic diversity, affordability and an inclusive community") received 4.13 out of 5 points. All ten principles received "strong" to "very strong" support at the Public Forum.

To increase public input, the designs and concept for Southwest Santa Fe were further reviewed and scrutinized through seven small scale workshops with neighborhood associations and professional groups and through a survey widely distributed to residents, business owners, students and others throughout the planning area.

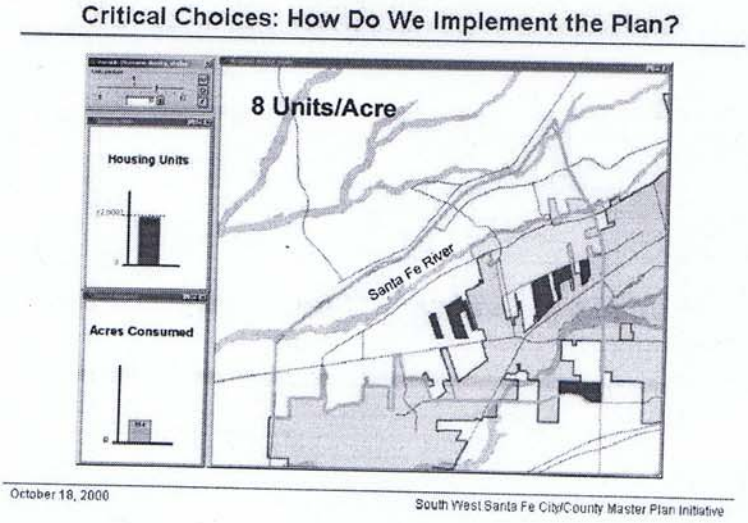
The second of the Community Choices Workshops presented the emerging community consensus around the principles for the three prototypical areas. Up to this point density had not been mentioned. As in Baltimore it was critical for the methodology to separate "what we want" from "how we get there". This is critical to the visioning process, so that the vision is not compromised and consensus is built to support implementation. For example, Principle 5 ("Neighborhoods in Southwest Santa Fe should have a variety of lot sizes and building styles to allow for economic diversity, affordability and an inclusive community") is extremely difficult to achieve in new developments and communities due to bank lending preferences (where economic stratification is preferred), zoning regulations (that set minimum lot and house sizes), and difficulty marketing the development to a public that has an expectation of uniformity. Simulations and visualizations were done that showed "apples to apples" comparisons of a neighborhood where each block had the identical lot and house size, and another where the same number of lots and houses were randomly mixed on each block. The latter was closer to a typical Santa Fe neighborhood that has developed over time (not "cookie cutter", regimented or stratified economically). This principle was one of the highest ranked, notwithstanding its difficulty of being achieved, only because implementation was not to be considered in the voting. The same was true with density.

During the visioning process density was not discussed because density per se is not a principle but rather a means, and not an end in and of itself. Instead of the abstraction of density numbers (e.g., dwelling units per hectare), building blocks that encapsulated the public's value system were used to design the new neighborhood the public wanted. The translation of the building blocks into principles was the process of extracting policy from the design of the neighborhood place. Used this way, the simulations and visualizations supported design "as inquiry" rather than "as a product".

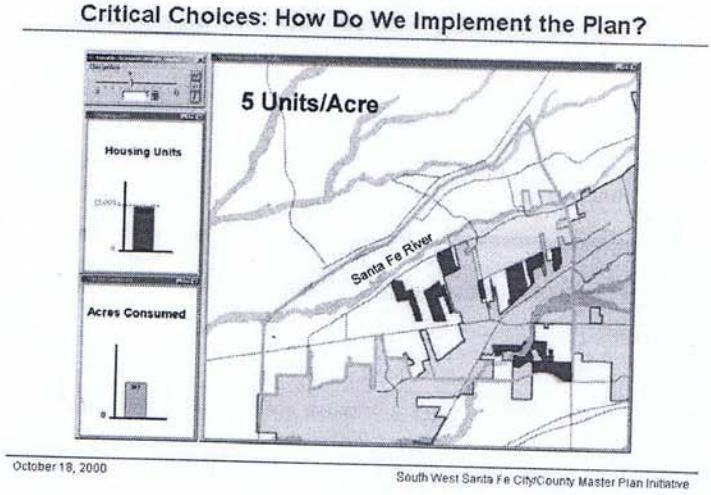
With consensus on the principles achieved, the next step was to explain how density would help achieve the vision plan. The visualized and simulated neighborhoods could be developed at different densities, all meeting the same amount of anticipated future growth. To help the community understand how much of undeveloped Southwest Santa Fe would be needed to accommodate future growth, the consultants used Santa Fe's GIS. To get a general "feel" for density, a figure/ground map was created of the historic core of Santa Fe and superimposed on Southwest Santa Fe adjacent to a mobile house park that occupied the same amount of land. This demonstration was an "eye-opener". One was a complete world and the other...just a mobile home park. In addition, by utilizing the GIS building footprint areas and parcel maps, existing densities of representative neighborhoods, well known to the participants, were calculated, visualized, and used to inform the discussion of density.

The effects of density (or the lack thereof) on the consumption of land was demonstrated by the use of GIS-based dynamic maps and charts that graphically delineated the amount of land needed to meet the area's projected housing needs at existing zoning density (3 dwelling units per acre), and 5 and 8 dwelling units per acre (8 dwelling units per acre being the density of Santa Fe's historic core). These maps and charts, in combination with the 3D model that represented the proposed prototypical development types, effectively conveyed both the quantitative and qualitative effects of development at "sprawl" and "urban" densities (Figs. 13 a,b,c).

a)



b)



c)

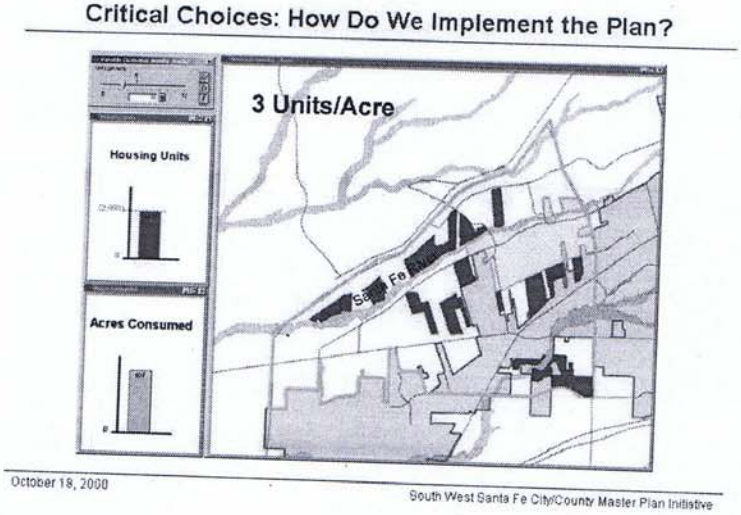


Fig. 13. Land consumption to meet projected housing needs at a) 8 dwelling units per acre, b) 5 dwelling units per acre, and c) 3 dwelling units per acre.

What became instantly clear was that at current zoned densities all available land, including land fronting the Santa Fe River, would be developed in contradiction to the agreed upon principles. The amount of land consumed at the levels of 5 and 8 dwelling units per acre was also visualized and consensus was reached on a density of over 5 dwelling units per acre (or almost twice the current zoned density). Without having first developed the vision for Southwest Santa Fe through simulation and visualization, it is highly unlikely that the community would have supported doubling the density, and no less have considered it.

Given the focus on land-use and urban design, GIS simulations and 3D visualizations were vital to the entire project. They were used at Steering Committee meetings and public workshops to validate perceptions, test ideas, understand alternatives, formulate the principles that would become the backbone of the area plan, and to develop recommendations for implementation. The use of a real-time, data-rich interactive 3D environment to explore values and ideas as an integral part of the decision-making process resulted in high confidence that "what they meant is what they will get". The real-time 3D models went beyond abstractions such as FAR (Floor Area Ratio – a poor indicator of density and/or intensity of use, found in most American zoning regulations) and provided the experiential basis to discuss in concrete terms the kind of place the residents and stakeholders wanted.

4. Near Northside, Houston

4.1 Near Northside Economic Revitalization Planning Process

The Near Northside Economic Revitalization Plan was initiated by the City of Houston. A local firm, Webb Architects and Associates (Webb Architects) was selected to prepare the plan that included the work of two parallel efforts: The Houston Neighborhood Market Drill Down conducted by Social Compact Inc. (retail market study of the bargaining power of Houston's inner-city neighborhoods) and "Community Preferences" workshops conducted by the ESC. These efforts led to the implementation of urban design guidelines for the Near Northside community. This case study focuses on work with the Near Northside community, Houston's Department of Planning and Development, and their consultants.

> *The following plan for the Near Northside, like many such plans, has many facts, figures, and maps. But behind these lies a vision for how a neighborhood might grow and develop. A vision not developed by city planners or outside consultants though such individuals played a vital role in development. Rather, it is a vision for a neighborhood developed by that very neighborhood. Through countless steering committee meet-*

ings and public sessions over a year's time, community members developed this plan. It is their plan for their neighborhood.
Gabriel Vasquez, Council Member, District H (*Northside Village Economic Revitalization Plan,* June 2002)

The Near Northside, located adjacent to Houston's Downtown, is a predominantly Latino, yet diverse neighborhood, and is one of two neighborhoods in Houston selected for HUD's Community Technology Initiative in 2001. One of the primary objectives of the Initiative was demonstrating the role simulation and visualization could play in helping communities collaboratively plan and reach consensus on their future. An essential part of making the initiative sustainable was technology transfer. Houston's Planning and Development Department staff was trained in the use of visualization software and most importantly, its application in future community-based visioning and planning workshops (Illus. 20).

4.2 Organizational Structure

A Steering Committee of community stakeholders was established to provide community input, act as a sounding board, share their intimate knowledge of the community with the consultants, and review the work of the consultants. The Steering Committee met frequently over a nine month period; members included neighborhood civic associations, neighborhood service organizations, the school district, business associations, local development corporations, and property owners. A separate Advisory Committee provided input from governmental agencies. In addition, three community-wide workshops were held. All meetings and workshops took place in the Near Northside neighborhood.

4.3 Methodology

The overall plan's methodology/ process was somewhat compromised by a series of factors that made coordination and, at critical moments, collaboration between the three consultants difficult. Because each consultant was funded by a different source, whose objectives and timing were not always consistent with the general goals of the revitalization effort, coordination suffered. For example, the ESC's work focused primarily on the commercial corridors, and in the best of worlds should have reflected the market potential of the neighborhood to attract and support a broader range of services and retail than currently existed. Unfortunately, the market work done by Social Compact, Inc. came too late in the process, focused only on neighborhood buying capacity (to the exclusion of neighborhood demand for goods and services), and was not designed to provide information such as how much additional commercial space the neighborhood could support. As a result it was not particularly useful in formulating the development scenarios, simulations, and visualizations. To complicate matters, the consultants did not begin their work in unison, making coordination, the sharing of information, and the development of an integrated process difficult. Notwithstanding the hurdles, the

collective efforts of the consultants, the Steering Committee, the Advisory Committee, Houston's Planning and Development Department staff, and the Near Northside community led to the adoption and implementation of the vision plan.

Interviews were held by Webb Architects with property owners and other stakeholders rather than groups. The difference between interviews and a group discussion is that with interviews the participants are not engaged in a dialogue. This had the unfortunate result of sustaining often contradictory, mutually exclusive expectations rather than achieving consensus, both in terms of content and process.

Three community-wide workshops were held. Initially, there were to be two, but for reasons to be explained below, an additional workshop was required. The first workshop was held about a month before the ESC's contract with the City of Houston took effect and, as a result, was without input from the ESC. Over 100 people participated in a facilitated process that identified issues, problems, and assets, and a question-and-answer session.

The second workshop, held about two months later, was keyed to ensuring that the consultant team was on-target regarding community issues, transportation, strategies for change, and concepts for new development. The ensuing discussion clearly revealed deep flaws in the Webb Architects-led process. Expectations were high and frustrations deep, because the workshop was virtually all presentation with little time for discussion. The ESC was asked to simulate and visualize the development implications of a commercial corridor, with and without the proposed light rail system. The real-time simulations and visualizations were mislabeled and introduced by Webb Architects at the end of a three-hour meeting as the "virtual reality tour" of future corridor development. When confronted with possible development scenarios in real photorealistic 3D, which they had no role in formulating, the participants were outraged. They were frustrated because they felt that they were being asked to choose a development alternative, notwithstanding that the simulations and visualizations raised substantial questions about the values, future, character, and identity of the Near Northside neighborhood.

What became clear in the ensuing confrontation was that the community assumed that the ESC's visual simulations were being used to sell a conclusion rather than inform and engage the citizens in developing *their* vision for the neighborhood. Moreover, while the ESC envisioned the simulation and visualizations as the beginning of a process to stimulate discussion, the community viewed them as a product of a process in which they had no role. The Webb Architects process/ methodology had misinformed the community about the way simulations and visualizations were to be used to help the Near Northside community develop its vision. Once the mismatch was identified, the Steering Committee and Near Northside community decided to start over and hold another workshop. It is this last workshop that is discussed in more detail. One lesson learned is that people take visual simulations literally. The second is how threatening simulations and visualizations can be when presented out-of-context and without a clear explanation of how they will be used in the planning process.

4.4 Focus on Simulation / Visualization

The neighborhood's second public workshop focused on presenting the polices and programs formulated in response to the first workshop, but failed to address the issues of values and identity – the character, look and feel, and sense of place. The Webb Architects process was a traditional planning process of identifying what needed fixing, a litany of policies and programs, and a grab-bag list of everything from a department store to repairing sidewalks. Many of the community-suggested policies and programs were often mutually exclusive or contradicted other community objectives. Moreover, and this is where the community's outrage emerged, there was no attempt to reconcile the inconsistencies and contradictions, nor to give form and reality to these policies by translating them into a 3D representation of the neighborhood using visual simulations.

This is exactly what the ESC did. Taking the policies, words, numbers, and wish-lists, the ESC gave them physical form, illustrating their implications, and asked, "This is what you said, is this what you mean?" For example, in the case of the light rail alternative for the Irvington Commercial Corridor, the recommendations included:

- an intermodal garage for commuters working downtown,
- densities needed to support light rail,
- mixed-use development that included the introduction of new building types into the neighborhood, and
- attracting a large chain store typically found in shopping malls.

The ESC's real-time visual simulations of three light rail development scenarios from moderate to high density – by Houston neighborhood standards) showed radical change. The development scenarios were based on discussions with Webb Architects regarding the results of the first workshop and the level of consensus reached on both program and community identity. Given the response to the simulations and visualizations of the three development scenarios, it was clear there was a considerable gap in perception and expectations between the community and Webb Architects. The jump from the programs and policies to physical design appeared to be a disconnect in the process. First, the simulations and visualizations, by necessity, involved making design decisions, many of which were fundamental, that assumed a value system and (possibly implicit) identity that had not been explicitly discussed with the Near Northside community. Second, poor management of time and lack of clarity of purpose by Webb Architects at the workshop resulted in a limited time to discuss the issues related to each development scenario, and led to the high level of community frustration.

As a result, a Community Preferences Workshop was added. Its purpose was five-fold:

- Reach agreement on the community values and sense of its identity (where it is and where it wants to be);
- Help the community understand the rules of the game such as the City of Houston development regulations;

- Translate the policy and programs presented at the proposed second workshop into a series of principles that would profoundly affect the way the Near Northside neighborhood developed;
- Understand the community's perception of itself as it currently exists; and
- Comprehend the implications of light rail on future development.

In order to both reveal and test the community's perceptions of itself, its common values, and sense of identity, the ESC focused the Near Northside community's workshop on combining a cognitive mapping narrative exercise and 3D simulations and visualizations. The mapping narrative approach was employed rather than a questionnaire, so as not to restrict or channel the residents' responses. Members of the Steering Committee were given a "brief" that was distributed to their constituency. The brief asked each participant to describe through words and images his or her daily experience (Fig. 14). The approach was purposely open-ended, leaving the length, format, and organization to the individual. Themes that had emerged in prior workshops (e.g., walkability, pedestrian-friendly, shopping, housing, landscaping, etc.) were mentioned in the brief, but were not required to be referred to in the narrative (Portugali, 1996).

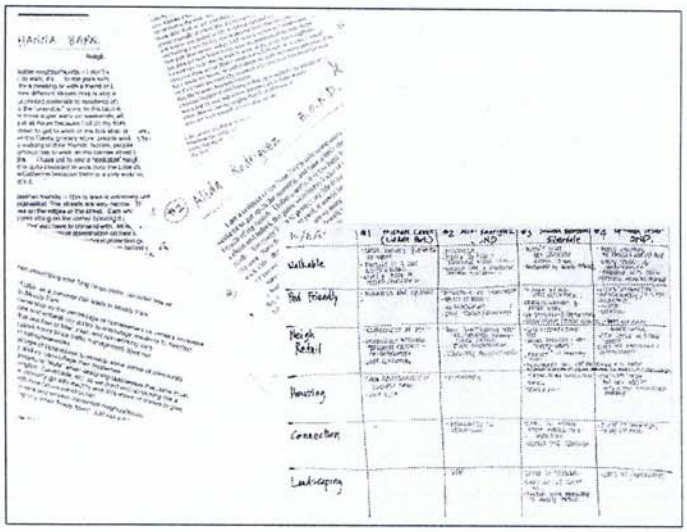


Fig. 14. "Narratives" describing a participant's daily experience and their interpretation.

The narratives were then interpreted for environmental images. Not surprisingly, the environmental images of the residential areas were generally positive while those of the daily shopping experience were uniformly negative. The narratives revealed that shopping was generally done on foot rather than by automobile,

in part because of the Latino culture and economics (where most families had one car that was used to get to work in Houston's decentralized environment). As a result, in the Near Northside neighborhood, walking to reach destinations within the community is a way of life. While the narratives identified many strong service and retail destinations, they are dispersed, making them difficult to access on foot. Furthermore, the character of existing development is suburban and based on the automobile. The narratives noted the unpleasantness of negotiating curb cuts, parking lots, and discontinuous sidewalks. They also discussed the lack of shade (e.g., from trees), security (e.g., from lighting), and a place to sit (e.g., from street furniture). Implicit in the narratives was a desire to concentrate and connect compatible activities. How these objectives would be achieved, given form, and agreed upon was the goal of the Near Northside Community Preferences Workshop.

In addition to interpreting the narratives, the ESC produced a set of graphics, to explain the relationship between Houston's parking requirements for specified land-uses, and a photo-realistic real-time 3D digital model to simulate and visualize potential development in the commercial/residential areas, with and without the introduction of the light rail (Figs. 15 a,b). The 3D model was disaggregated into its constituent components (buildings, parking, streetscape, etc.) creating a set of building blocks that could easily be assembled and re-assembled to represent alternatives. The photo-realistic 3D models of retail, office, restaurants, and housing used typical Houston building types, for purposes of familiarity and local context to the participants. The buildings used represented an array of types, sizes, uses, and densities. Photographs of the buildings were texture mapped on the 3D massing model of the building. The use of familiar buildings avoided the issue of architectural design, since the workshop was focused on urban design and the siting and configuration of open/ public spaces and the location of parking. The workshop was concerned with principles leading to the formulation of urban design guidelines, rather than a particular design solution (which in any case is virtually impossible in Houston's regulatory and development culture). As a result, a representative section of blocks, including residential blocks, were selected for simulation and visualization.

The choice of a real-time environment allowed the ESC to simulate a pedestrian's experience of walking from a house to the commercial corridor. It also served the additional purpose of building confidence in the openness of the workshop process, since a participant could locate themselves anywhere in the 3D model rather than be limited to either static images or animations, where the viewers' path and focus are predetermined. It was important that the participants saw the 3D digital model as support for decision-making rather than as a means to manipulate decision-making.

At the workshop, the ESC presented its interpretation of the narratives and how they informed the design of the workshop, and the issues to be discussed and acted upon. The validation of the ESC's interpretation interpretation of the narratives, and their translation into a series of issues dealing with connectivity, continuity, and compatibility was critical to the workshop progress. Without validation by the community, the workshop would have been redirected to better understand the meaning of the narratives. As a methodology for understanding environmental im-

ages, the narratives proved to be, according to the participants, a non-threatening and non-manipulative means of inquiry.

The visualization of Houston's parking requirements proved to be an eye-opener for the participants. By visualizing the area of a typical block in the Near Northside neighborhood, consumed by a single land-use and that use's required parking, it became instantly clear what the implications of the parking requirements meant in terms of compact, walkable commercial district. While the development rules were done in the abstract, a single use at a time, the rules were used in the simulations and visualizations to accurately reflect the reality of the regulations.

An additional "reality test" was the simulation and visualization of what are called "big box" uses such as mall-style department stores. While many residents articulated a desire to have one or two in the neighborhood, their sheer size, the amount of parking, and the servicing requirements raised issues regarding pedestrian access, traffic and conflicts with the bordering residential use. Moreover, there were only one or two blocks within the neighborhood commercial areas that could accommodated a big box store. The simulations and visualizations added clarity and substance to the discussion.

Each of the objectives were simulated and visualized using the same set of building blocks, allowing the residents to better understand that, all things being equal, the location of buildings and parking lots on a block greatly affect the pedestrian's experience. In addition, the possible introduction of light rail in the area also raised substantive issues, such as whether or not to "hold the corner" with a pedestrian-oriented building activity, or allowing parking lots to be located at the corners. Typically, a business-as-usual scheme (i.e., automobile-oriented, with parking lots in front of buildings) was contrasted with one that was pedestrian-oriented (i.e., parking lots behind or next to buildings), all other things being equal (Figs. 15 a,b).

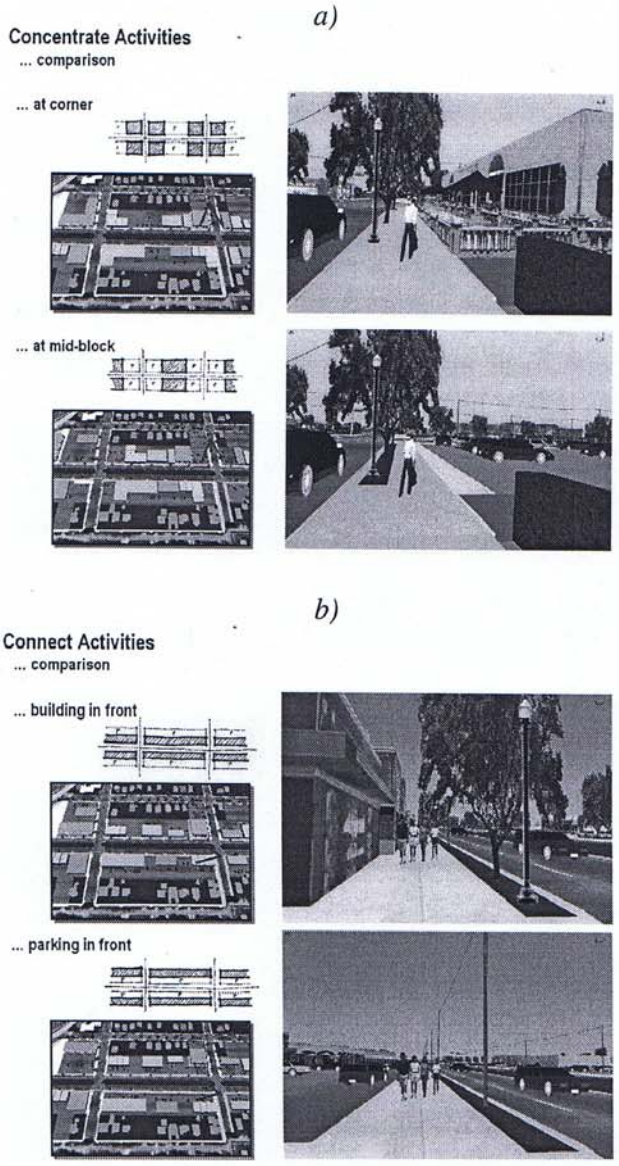


Fig. 15. Snapshots of 'apples to apples" 3D visual simulation of equivalent development along the Irvington Corridor indicating pedestrian friendly versus automobile friendly development patterns as experienced by a pedestrian.

Each of the objectives was presented in side-by-side comparisons as well as in synthesized virtual reality walk-throughs. Interestingly, the side-by-side comparison allowed for a sophisticated discussion of urban design principles and aesthetics based on the participants' analysis of their alternatives relative to whether and why they were auto-centric versus pedestrian-centric. What became clear as the workshop progressed was that, all other things being equal, the siting of buildings and parking lots either favored the driver or the pedestrian. This became a fundamental choice that participants were asked to vote on. The question was posed as an "either-or" or "both-and" set of choices. The final vote unanimously favored a neighborhood whose identity was shaped by the pedestrian experience and the potential of light rail.

The next step for the consultant team and Houston's Planning and Development Department was the translation of the workshop findings/points of consensus into design guidelines to implement the vision. Participants emphasized the power of three dimensional computer images of the place, both static and dynamic, to effectively guide the discussion and lead to future development that is consistent with the communities' values and identity.

5. Conclusion

All three vision plans were ultimately about people and placemaking. It is here that simulation and visualization played a significant role by supporting physical design as a form of inquiry. In this modality, design is a means rather than an end in itself. Unlike the traditional planning linear hierarchy, where physical design follows or illustrates policy, physical design *is* policy.

In the three case studies the use of digital simulation and 3D visualization greatly enhanced the public decision-making process and building community consensus when they were an integral part of the planning and visioning process in two fundamental ways. First, the visual simulations were not used to "sell the plan/vision" but as a means to enhance the democratization of planning, by using the technology to inform the plan's creation by the participants throughout the decision-making and consensus-building process. Second, the technology was used to help citizens *create* liveable and sustainable places by making concrete the abstractions of scenarios, public policies, and the like through 3D models that palpably represented the place(s) that would result from their implementation. Unlike maps and physical models, participants could place themselves in the 3D models and randomly walk through them at eye level, as well as query the underlying data. Moreover, the visual simulations were used iteratively, responding to participant's suggestions. The 3D models were quickly modified and new scenarios created, visually simulating policies and scenarios before they are implemented to ensure that -- to quote Dr. Seuss's Horton the elephant -- "I meant what I said and I said what I meant."

The Baltimore Vision 2030 demonstrated that digital simulation and 3D visualization could be applied to help a regional citizenry, living in cities, towns and in rural areas, to determine the future of their region, by evaluating the implications

of a range of agreed-upon growth patterns and scenarios. The Master Planning Initiative in Santa Fe was also faced with a question of "how to grow", but in the much more limited geography of a new district in Santa Fe. There, the visual simulations played a critical role in formulating the development principles that would guide future growth, achieve consensus, and provide the foundation for the design of zoning regulations consonant with the community's vision. The experience of the Near Northside Economic Revitalization Planning Process demonstrated the role simulation played in creating a new neighborhood identity based on enhancing the pedestrian's walking experience and the support of light rail in a city reliant on the automobile. It also showed how the process can go awry when the use of visual simulation has not been carefully integrated in the public participation and decision making process. In each case study physical design, mediated through visual simulation, was employed to assist citizens better understand their own values and sense of individual and group identity, stimulate informed discussion about design and placemaking in concrete terms rather abstractions, and lead to community consensus.

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Notes

The core technology employed by the ESC was ArcViewGIS, a spatial database whose output is typically expressed in maps, charts, and tables, none of which by themselves either resemble the world of everyday experience nor are easily accessible to lay people. It is axiomatic that people experience the world in three-dimensions, in time, and in motion. In response to this need the ESC has devel-

oped software and applications that seamlessly integrate words, numbers, maps, and images in a real-time 3D environment (e.g., CommunityViz™). Further, the tools have been designed to support both deductive reasoning (analysis) and inductive reasoning (design, what ifs).

Vision 2030: Shaping our Region's Future Together Background

Vision 2030: Shaping our Region's Future Together was an initiative of the Baltimore (Maryland) Regional Transportation Board of the Metropolitan Planning Organization for the Baltimore region. Additional support was provided by the Baltimore Metropolitan Council, a private non-profit regional planning agency and the Baltimore Regional Partnership, an alliance of civic and environmental groups that share a common agenda of enhancing quality of life through community revitalization and environmental protection.

ACP –Visioning and Planning (ACP) with its expertise in conducting regional visions was the lead consultant. The ESC was a member of the ACP team of five subconsultants.

Southwest Santa Fe: City/County Master Plan Initiative Background

The study was initiated by the Santa Fe City Council. Subsequently, after discussions with the County and members of the public, the planning area was expanded to coincide with the area undergoing development pressure. The Southwest Santa Fe Planning Area falls within both City and County jurisdictions and, as a result, two entirely different sets of land development regulations. A Steering Group, representative of the Southwest Santa Fe community, provided project oversight and the Planning Department of Santa Fe provided logistical and technical support.

The prime consultants were ACP and the ESC. Local consultants contributed their knowledge of the Santa Fe region and assisted in the implementation of the public outreach and participation program.

Near Northside Economic Revitalization Planning Process Background

The Near Northside Economic Revitalization Planning Process was an initiative of the City of Houston. It was supported by grants from the Federal Highway Administration (FHWA), U.S. Department of Housing and Urban Development (HUD), and the Main Street Revitalization Project, with contributions from Avenue CDC, a local community development corporation. The prime consultant, Webb Architects Associates was selected to prepare the plan. The work also encompassed two other parallel efforts: 1) the "Houston Neighborhood Market Drill Down" by Social Compact Inc, and 2) the Community Preferences Workshops, conducted by the ESC and funded by HUD's Community Technology Initiative grant.