The kinetic paradox of objects: a working theory for designing architectural fabric

by

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ABSTRACT

If all architectural form could be simplistically grouped into only two categories, these might be "object" and "partial enclosure," where objects are in dialogue with the space around them while partial enclosures articulate the space within them. In contemporary architectural discourse, "object" is in disfavor. Particularly in the sphere of urban planning, and in reaction to city-hating International-style buildings, architectural objects are to be avoided in favor of continuing the weave of existing urban fabric. Such objection is based on a figure-ground understanding of urbanism that values the figure of public space over that of architectural element. This white-and-black construct has been used in architectural theory to sometimes prefer space and sometimes object, but this paper takes the position that hierarchy is not necessarily the appropriate relationship.

This paper describes an object-space dialogue that is not based on figure-ground. It starts from the assumption that space is potential movement. By studying existing masterworks, the relationship between object and movement space that was discovered is interesting because it is paradoxical: objects articulate space to suggest movement often while simultaneously acting as obstructions. Architecture that takes advantage of such ambiguities, such as Michelangelo's reconstruction of the Capitoline Hill, "...force[s] the observer into a personal solution of [the] paradox [thus endowing] movement...with aesthetic overtones." [Ackerman 1970, 156.] This paper called this object-space relationship the kinetic paradox, and used it as the basis for a design method to resolve a problematic innercity site.

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I am grateful for the support I received from the many fine people at RTKL Associates, Inc.
# Table of contents

Object, fabric, and ideas of space........................................7
Spatiality of the Object....................................................9
  The kinetic paradox of objects........................................11
  The concave/convex paradox...........................................21
Analysis: Spatiality of multiple objects..............................27
  Wayfinding systems.....................................................29
  Landscape systems....................................................33
Conclusion.............................................................................39

Appendix
  The community and the site.............................................41
  Project program............................................................47

Bibliography...........................................................................49
Object, fabric, and ideas of space

In contemporary architectural discourse the concept of "object" is in disfavor. Particularly in the sphere of urban planning, and in reaction to city-hating International-style buildings, architectural objects are to be avoided in favor of continuing the weave of existing urban fabric. In the 1986 essay collection, On Streets, one author admonished:

"In the street as a series of pavilions...the street space is negative in that it does not seem to have been intended as a configuration produced by the flanking buildings. Because of the discontinuity of the street facade, the buildings read as autonomous objects--pavilions--each generated around some supposed center, standing free of each other, displacing more than forming space. "[Italics added. Ellis 1986, 126.]

Such objection to "object" is based on a figure-ground understanding of urbanism that values the figure of public space over that of architectural element. The figure-ground phenomenon is hierarchical: it assumes a pattern of two fields in which one is figure and the other interstice [see Arnheim 1974, 227-233]. This white-and-black construct has been used in architectural theory to sometimes prefer space and sometimes object, but this paper takes the position that hierarchy is not necessarily the appropriate relationship.

In his history of ideas of space in architectural theory van de Ven concluded,

"Instead of the former negation of space, or antagonistically the negation of mass, architectural theorists have recognized that perhaps the only correct answer to the dilemma could be found in the favorable balance of the two aspects [1977, 244]."

This paper seeks to answer a two-part question: can a model of the symbiotic relationship between object and space be proposed from precedent analysis, and if so, can that understanding be the basis for a working theory of design?

Fig. 1. The figure-ground relationship about the Pantheon. Detail from the Map of Giambattista Nolli, 1748. Source: Ellis 1986, 116.
Fig. 2. Existing conditions of test design site. Drawing by author. See the Appendix for additional information.
Spatiality of the Object

To resurrect a positive essence for the concept of object in architecture, it was helpful to look to writings on sculpture. Substituting the word "object" for the words "sculpture" and "figure" in Langer's description of sculptural volume, it becomes a working description of the palpable relationship to space that architectural objects can have:

"[Object]...is essentially volume.... The volume is not a cubic measure, like the space in a box. It is more than the bulk of the [object]; it is a space made visible, and is more than the area which the [object] occupies. The tangible form has a complement of empty space that it absolutely commands, that is given with it and only with it, and is, in fact, part of the sculptural volume. The [object] itself seems to have a sort of continuity with the emptiness around it, however much its solid masses may assert themselves as such. The void envolds it, and the enfolding space has vital form as a continuation of the [object]." [1953, 96.]

What is the nature of this "vital form" commanded by an object, specifically an architectural object? Through an analysis of masterworks, a symbiotic object-space relationship more exciting than figure-ground was discovered: paradox. That is, architectural objects can make visible double-meaning in the surrounding space. For example, objects can articulate space to suggest movement while simultaneously acting as obstructions. Ambiguity in architecture can be desirable, for it immerses users into a richer participation with the architectural setting.

In the following pages, paradoxic object-space relationships are described through the presentation of case studies, and they are tested as design tools by applying them to the resolution of a small urban design. The site and circumstances of the design problem are presented in the Appendix and are summarized in figure 2.

Fig. 3. Capitoline Hill. Perspective, 1569, after Michelangelo. Source: Ackerman 1970, 149.
The kinetic paradox of objects

Both Lynch [1960, 78-83] and Passini [1984, 130] have discussed the symbiotic landmarking relationship between object and path that enhances wayfinding. A paradox can be built into such a relationship, however, when the landmark not only marks the path but obstructs it: is it then moving the user forward or not? This double-reading is called here a kinetic paradox, because it is rendered in movement space. Ackerman discovered this paradox in Michelangelo's redesign of the Capitoline Hill. His description, below, is diagrammed in figure 6.

"While the visitor enters the piazza, and later the Senators' palace, on axis, his direct progress is barred first by the statue, and then by the entrances to the double-ramped stairway. He is not only forced to choose between two equally efficient routes, but is distracted by an emphatic stellate pavement that suggests movement of a different sort, along curvilinear paths towards and away from the center. He thereby becomes intensely involved in the architectural setting to a degree never demanded by earlier Renaissance planning. By forcing the observer into a personal solution of this paradox, Michelangelo endowed movement, which usually is just a way of getting from one place to another, with aesthetic overtones." [Ackerman 1970, 156.]

Fig. 4. Michelangelo's reconstruction of the Capitoline Hill begun 1536, Rome. Redrawn by author from Ackerman 1970, 150-151.
Without the object (below), movement is direct and axial and received by the Senator's Palace facade.

With the objects (right), forward movement is visually stopped and physically slowed through six devices:

1. After climbing stairs to enter plaza, visitor is immediately confronted with a descent.
2. If visitor chooses to circumvent the recessed oval, there are four

Fig 5. Capitoline Hill reconstruction with central statue, plaza, stairways and tower removed. Diagram by the author.
3. Forward movement is also blocked by the central statue.

4. Leaving the central oval requires a change in direction to the right or left.

5. Stairs to piano nobile of the Senators' palace are 90-degrees to main axis. Also, these stairways form a triangle pointing up.

6. Forward motion is also visually stopped by tower.

choices: to travel either to the right or left and either along or within one of the flanking arcades.

Fig 6. Capitoline Hill reconstruction. Diagram by the author.
In the test design, lessons learned from Michelangelo's composition were applied to create a central outdoor place for the high school campus that balances the geometries of the site and resolves the three-foot change in elevation between Federal Street and the area behind the brewhouse.

1. Students entering from Federal Street are confronted by a statue on a plinth beyond which is a central lawn.

2. Students can either move along a building's edge towards its entrance, (4). As at the Capitoline Hill, choices to the right and left are fairly symmetrical.

Fig 7. Diagram by the author of entrance to campus from Federal Street.
3. which also brings them towards outdoor seating areas.

4. Students can enter the central lawn which terminates in a seat wall.

5. or move down a ramp towards other campus areas.

Fig 8. Plan detail of test design. Drawing by the author.
Another object composition that was studied was the reading table designed by Herman Herzberger for his Montessori School at Delft (see fig. 9). It is placed in a jog in a corridor between classrooms. Drenched in sunlight, which is a powerful attractor, the person moving down the hall might well be drawn to the table. Beyond the table the corridor continues, but visually the table and its masonry column are in the way of direct progress.

**Without the object** (opposite near right), movement is on the diagonal and does not bring traffic to classroom edges.

**With the object** (opposite far right), traffic is brought to classroom edges and is slowed down. The object defines a place—a reading area—between the classrooms.

*Fig 9. Object is viewed in front of a void: this enhances sense of depth, but the object blocks direct movement. Photo source: Luchinger 1987, 57.*
Fig 10. Diagrams of plan detail from Hertzberger's Montessori School at Delft. Adapted by author from Luchinger 1987, 51.
In the test design, the idea of layering an object before a void was explored at the renovation of the existing warehouse. A free-standing outdoor stairway was added to the existing terrace of the old brick carriage house. A glass curtain wall was inset into the warehouse wall, behind which is a lobby and vertical circulation core.

Fig. 11. The warehouse was added to the rear of this old carriage house. Photo by the author.

Fig. 12. Sketch by the author of the test design renovation of the warehouse block.
Fig. 13. Bernini’s San Andrea, Rome. Front elevation and plan poche. Both the interior and the exterior front are concave. Source: Giedion 1967, 125.

The concave/convex paradox

Ven traces the development of the concave/convex paradox in architectural theory from Sitte in 1888 through Schmarsow, Brinckmann, Frankl, Sorgel, then Giedion in 1941:

"Sorgel's architectural aesthetic culminates in the pronouncement of architecture as 'interior and exterior concavity of space.' Thus he attempts to solve the dual notion of concavity-convexity, brought to the fore by Sitte thirty years earlier.... [H]e comes to the seeming paradox that architecture has to follow the law of interior and exterior concavity, since urban spaces are equal in idea to architectural spaces."

[1978, 115].

As has been pointed out by Venturi [1966, 156], Baroque architects used poche to develop concave interiors simultaneous with concave exteriors [see fig. 13]. But, from a study of sculpture, another technique applicable to the use of objects, was found.

In Krauss' history of modern sculpture [1977, 56-58], she described a Russian Constructivist method for generating form that is concave to multiple directions. Naum Gabo's diagram of this is below, and a sculpture using the principle, are shown on the preceeding page. Gabo called this method stereometry, but a better name would be, simply, intersection. As can be seen from the examples, multiple concavities are generated by the intersection of silhouettes.

Fig. 15. Naum Gabo. Diagram showing stereometric cube. Source: Krauss 1977, 56.
In the test design, the central plaza created in the previous section resulted in a convex corner jutting towards the brewhouse axis previously described. But the importance of this axis begs for coalition not collision. A traditional Japanese solution for merging axis and convex corner is the same idea as the Constructivist's intersection, as shown in the photo at right. The slab's corner became an intersection between stone edge and slab edge. This idea was therefore also used to solve the test design.

Fig. 16. Traditional Japanese resolution of a corner jutting into an axis turns the corner into an intersection between the edge of the slab and the edge of a stone. Source: Engel 1964, 328.
Fig. 17. The Constructivist Lipchitz's stereometric sculpture is here borrowed to resolve the same condition in the test design. Drawing by the author.
Fig 18. Aerial view of central campus. Drawing by the author.
Analysis: Spatiality of multiple objects

To complete the design, presented in the previous, required some thought about designing with multiple objects. Le Corbusier's urban designs for mass housing represent the problem of composing with multiple centric forms: there is no dialogue between the pieces.

What, then, is the spatiality of multiple objects?

Fig. 20. Plan for a City of 3 Million Inhabitants. Le Corbusier, 1922. Source: Besiger and Girsberger 1967, 317.
Wayfinding and landscape systems

Two categories of composition systems for objects to articulate kinetic space have been found in the literature. These are wayfinding systems and landscape systems. Wayfinding systems deploy objects in relationship to a path network while landscape systems attempt to find rules to imitate from natural landscapes. Design rules for these two types of systems are summarized below.

Wayfinding systems.

An excellent source of ideas for designing a wayfinding system is MacDonald’s catalogue and celebration of the objects associated with the street system of Imperial Roman cities. His aesthetic for the relationship between object and street is in contrast to Ellis’ remark of the same year quoted earlier in this paper.

"Since the primacy of interior space in imperial architecture has been emphasized so often, it is important to call attention to the open, exterior quality of passage [objects]....They say a lot about the expressive power of half-formed architectural space, about its potential for suggesting the existence of shapes and places that in physical fact are not there. It is this openness, inconclusive with respect to boundaries but unambiguous regarding position and its implications, that as much as anything explains why passage architecture so effectively articulated Roman [streets]." [Italics added. MacDonald, 1986, 109.]

A path-object diagram of the Roman city Djemila is shown on the next page, followed by the path-object diagram that organizes the test site. Note that:

1. Objects are used in sequence along the main axial direction.
2. Objects are used at intersections and shifts in geometry, calling out a change in direction.
3. Intervals between objects quicken toward the central public place.
4. Objects flank public outdoor spaces or are central in them.

Fig 22. Roman conoidal fountain at Djemila. Freestanding fountains and arches were part of the passage architecture of imperial Roman cities. Source: MacDonald 1986, 13.
Fig 23. Djemila, founded 96-98 A.D. Plan diagram showing path-object relationships in a wayfinding system. From MacDonald 1986, 6, and annotated by the author.
Fig 24. Diagram of the object-path relationships organizing the test site. Diagram by the author.
Fig 25. Pages from a Japanese gardening manual showing stone groupings and their symbolic meanings. Source: Engel 1964, 269.
**Landscape systems.**

This paper uses the name "landscape systems" to refer to design approaches that attempt to find compositional rules to imitate from natural landscapes. A highly developed example of such a system is Japanese garden design. The ultimate aim of the traditional Japanese garden is to reveal nature [see Engel 1964, 257]. The rules of composing garden relationships are contrived from an understanding of natural landscapes. But the Japanese garden...

"...is not even a miniature copy of real nature, but rather a symbolic abstraction that requires a certain knowledge of its terminology to be understood." [Engel 1964, 259]

Three types of elements form the traditional garden. These are stones, plants, and water.

"The most important feature of the Japanese garden is the stone....the stone is the dominant and scale-providing element in the garden...."[Engel 1964, 268.]

This was expressed poetically by Noguchi,

"Stones are the bones of the garden." [quoted in Ashton 1992, 270.]

Thus, this paper looked at the rules for arranging standing stones in traditional Japanese gardens. Unlike stepping stone arrangement, and the wayfinding systems defined previously, standing stones do not form object-path relationships as much as object-field relationships.
An object-field relationship of a Japanese stone garden is shown on the next page, followed by an object-place diagram used to organize the test design. Note that, where the wayfinding system was used to organize two of the three street geometries forming the site, the landscape rules were used to address the orientation of the existing warehouse building.

Japanese standing stone composition rules included [see Engel 1964 and Takakuwa 1973]:

1. Each individual stone should never appear unstable to the force of gravity. Stones may be grouped on top of each other.

2. The importance of interval, which is, after all, a kinetic measurement. Stones are placed at "exquisite intervals, of which a popular one is the "seven-five-three" grouping. This is fourteen stones arranged in three groupings of seven, five, and three, such that, from whatever location they are viewed only 14 are ever visible. This is a kinetic motif because revelation is only achieved through a viewer's change in position.

3. Aesthetic appreciation of poverty or economy of means.
Fig 27. Diagram of the contrived landscape of a Japanese rock garden. Diagram by the author.
Fig 28. Diagram of the object-field relationship used to reform the warehouse and some public spaces in the test design. Diagram by the author.
Conclusion

If all architectural form could be simplistically grouped into only two categories, these might be "object" and "partial enclosure," where objects are in dialogue with the space around them while partial enclosures articulate the space within them. This paper has looked at one of these categories, the object, because it has been underexplored and depreciated in contemporary architectural theory. The paper sought to describe the object-space dialogue in terms other than figure-ground.

The focus of this model was an idea of space as potential movement, an idea previously explored by Hildebrand and others, including Scott:

"Space, in fact, is liberty of movement. That is its value to us, and as such it enters our physical consciousness. We adapt ourselves instinctively to the spaces in which we stand, project ourselves into them, fill them ideally with our movements....Even if we stand still....the space has suggested a movement." [1914, 169.]

The relationship between object and movement space that was discovered was interesting because it is paradoxical: objects articulate space to suggest movement often while simultaneously acting as obstructions. This object-space relationship was used as the basis for a working design theory in the design of a cooperative high school for a problematic innercity site. It is now obvious that such a difficult site should not have been used for the first pass of a developing design theory. For the next test, a much simpler site, for which multiple variations can be quickly generated, will be chosen.

The exploration did not result in a rich substitute for the figure-ground construct criticized at the beginning of this paper, but it brought the author closer to understanding the three-way relationship of object-space-user and the goal of inviting greater participation between the user and the architectural setting.

In the end, the test design remained diagrammatic. Decisions were made about composing object-space relationships, but the architectural form of the objects was not thoroughly explored. For the next test, a kit-of-parts of objects: building parts, site furniture, and the like, will be more rigorously defined.

The use of case studies of masterworks was extremely helpful, and over time a much larger canon will need to be explored. It is from this, and from more design trials that a successful working theory will eventually be distilled.
Fig. 29. The American Brewery circa 1905. Source: The Baltimore City Life Museum.
The community and the site

In innercity Baltimore there is a problematic landmark. A massive five-story brick structure with ocular windows and strongly characterized roofscapes of pagoda and challet follies looms abandoned over rows of beleagured houses. A 13-foot-deep jog cleaves the site behind the structure, the scar of outbuildings razed. To the surrounding community, the landmark status and idelness of this 2,500-acre site is a luxury: why cannot this city-owned property be adapted for sorely need community economic renewal?

The idleness of his building proves the marriage of form and function: its highly specialized form has thus far resisted being matched to a postindustrial function. The building is an 1887 gravity brewery: three fused towers through which grain and liquid were hoisted, pumped, boiled, and cooled: a vertical beer kitchen that operated until 1973. Its campus has been idle since.

"Old breweries are, in fact, almost totally neglected by community leaders and planners, who appear unwilling to devise adaptive-use schemes to preserve them. They argue that such buildings are too specialized, too large (or too small) and inevitably the structures are condemned as being in the wrong part of town." [Newell 1975, 26.]

While generously sized in plan for an urban infill site, the existing building forms and severe site section have been daunting to city planners [see unpublished memos to the Mayor]. The American Brewery site is in Baltimore's East Broadway community, one of the city's older, poorer areas. Two-story row-houses line most of the streets. At intersections the first floors bloom as Mom-and-Pop commercial spaces, often with homemade signage. A visual survey indicates that one-fourth to one-half the houses may be vacant.

The residential pattern is occasionally interrupted by an industrial building, often abandoned, or a church.

Fig. 30. The American Brewery looms over its community. Photo by the author.
Fig. 31. The American Brewery site and surrounding neighborhood pattern. Drawing by the author.
The American Brewery property is an urban infill site with existing structures on three parcels:

1. 1636 North Gay Street, known as the Old Fitzsimmons mansion. A multi-level townhouse shell building, completely gutted. The lot is 87' by 111' or 9,657 square foot.

2. 1700 North Gay Street. A multi-story shell building of unknown original use (brewery offices?) is at the front of the site. Behind this is a two-story carriage house shell, from the time when beer was delivered by horse and carriage. This lot is 183' by 111', or 20,313 square foot.

3. 1701 North Gay Street. A large but irregularly shaped infill site with major frontage on three streets. The lot is 2,489 acres. This site includes the brewhouse which is a five-story brick structure of three internal towers in which floors were little more than balconies around multi-story processing vats. Due to arson and age, it is likely that all floors and roofs will need to be replaced. Thus, it can be treated as a skin into which new spaces and modern mechanical, electrical, and plumbing services will be inserted.

On the Lanvale Street side of the site is a hybrid building: the 19th century three-story stables had a 20th-century warehouse-and-new bottling plant attached to it. Although architecturally unremarkable, its floors do not need replacing. Each floor is about 20,000 square feet and the steel column grid is roughly 40' square.

Other buildings had existed when the brewery thrived (see fig. 32). The demolition of these structures has left a terraced section to the site so that the vacant acreage is 8'-13' below the small yard between the brewhouse and bottling plant.

Fig. 32. Drawing from the Baltimore American Year Book, 1905. Source: Kelley 1965.
Fig. 33. Existing conditions at the site. Photos by the author.
How to describe the 1990s community within which these 1890s buildings exist today except as innercity: the Baltimore City Planning Department 1990 Census maps show the population of the area includes many children and a large percentage of households receive public assistance (see fig. 34). School attendance rates are relatively poor. the majority of the residents are of African-American descent and 20%-30% of the 16-to-19-year olds have withdrawn from school.

Percent of Population Under Age 18 by Census Tract

Percent of Households Receiving Public Assistance by Census Tract

Fig. 34. Baltimore city census maps. White dot marks location of American Brewery site. Source: Baltimore City Planning Department.
<table>
<thead>
<tr>
<th>Project Program</th>
<th>Rehab Construction</th>
<th>New Construction</th>
</tr>
</thead>
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<tr>
<td>Light manufacturing</td>
<td>60,000</td>
<td></td>
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<tr>
<td>3 floors @ 20,000</td>
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<td></td>
</tr>
<tr>
<td>Manufacturing/school coop</td>
<td></td>
<td></td>
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<tr>
<td>Shop classrooms, 10 @ 1,920</td>
<td>3,840</td>
<td>15,360</td>
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<tr>
<td>Offices, administration</td>
<td></td>
<td>2,000</td>
</tr>
<tr>
<td>CAD stations/studios (second floor of brewhouse)</td>
<td>4,100</td>
<td></td>
</tr>
<tr>
<td>School</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classrooms, 8 @ 1,920</td>
<td></td>
<td>15,360</td>
</tr>
<tr>
<td>Office, administration</td>
<td></td>
<td>2,000</td>
</tr>
<tr>
<td>Community/school center</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cafeteria (brewhouse ground floor)</td>
<td>2,080</td>
<td></td>
</tr>
<tr>
<td>Offices (brewhouse ground floor)</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>Library (brewhouse fifth floor)</td>
<td>4,100</td>
<td>5,500</td>
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<td>Gymnasium/multipurpose</td>
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<td></td>
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<td>Unassigned (two floors of brewhouse)</td>
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<td>Totals</td>
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<td>Plus 40% circulation, outdoor space, etc.</td>
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</table>
Project program

In June 1993, a team comprised of Baltimore's Council for Economic and Business Opportunity, the Southern Baptist Church, the Housing Assistance Corp., the French Co., Justin Development Corp., and Kelly, Clayton & Mojzisek announced a plan to renovate the Brewery property in a four-stage project [Gunts 1993]:

1. **Light manufacturing.** Conversion of the Lanvale Avenue warehouse/bottling plant into manufacturing spaces. A machine shop and a manufacturer of electronic components have been described as first tenants.

2. **Retail.** One or more stores would be built next to the old brewhouse, the former brewhouse, at the N. Gay Street and N. Patterson Park intersection.

3. **Housing and day care.** Across the street from the old brewhouse, the former brewer's mansion, old bottling works, and wagon house would be incorporated into about 40 senior-citizen apartments and a daycare center for children and infirm adults.

4. **Job-training and brewery museum.** A $4-million rehabilitation of the 1887 brewhouse into offices, job training space, and possibly a brewery museum would be the fourth stage of the project.

This paper would like to propose an alternative but related scenario. What if the entire program had a job-training agenda? That is, could the manufacturing, retail, housing, and daycare projects somehow also themselves be school-like? Could the vocational facilities be used by youth during school hours and for adult education in the evenings and weekends? These sorts of question imply a revised reuse program with a job-training emphasis. The new proposal, then is for a cooperative, hands-on education institution. The components of this institution would include a light manufacturing/educational co-op and a community-services/school center. Conversion of the North side of North Gay Street into housing and day care could also include a parenting/home-health aid training program, but this part of the design will not be addressed in this paper.

The revised program is shown on the preceding page.
Bibliography


Site and Community references


Baltimore City Planning Department. 1990 Census.


Unpublished memos from the Mayor's office in the files of the City Museum, Baltimore. (Photocopied.)