

**Using an Action Research Approach in an Interactive Design Curriculum to Encourage Critical Thinking:**

*The Bus Rapid Transit System (BRT) and Digital Wayfinding in Public*

Adream Blair-Early, University of Wisconsin-Milwaukee, Department of Art and Design,  
2200 E. Kenwood Blvd., P.O. Box 413, Milwaukee, WI 53201

***Abstract***

The project, designing a wayfinding system for the BRT or Bus Rapid Transit System in Cincinnati, immersed pre-junior digital design students in action research in which they were researcher, designer and intended audience. The students, working in multi-disciplinary teams that included digital design, urban planning and industrial design students and faculty, became active users of the existing public transportation system while conducting interviews of neighborhood leaders and patrons of the Cincinnati Metro, the existing bus system for the city.

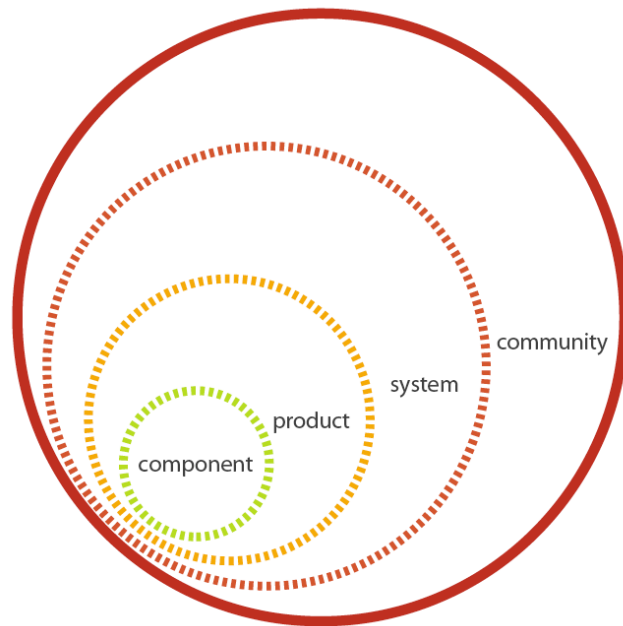
This paper reports on the results of this research project. While the results are not yet fully developed, they represent an on-going attempt to establish a collaborative approach to interactive design and design research methods that can be referenced by educators and practitioners alike.

***Keywords***

Action Research; Participatory Design; Interaction Design; Wayfinding; User-Centered Design.

### **Introduction**

Interactive forms of communication, those that are made up of dynamic and time-based information, require more iterative methods to show the relationships between content and users as well as define a broader context for their work. Often, interactive design curricula are product-centric, their concerns primarily with the creation of a website, kiosk, or cell phone interface. They lend themselves to a more linear design process focused in production that ignores the larger issues of community and the environment in the scope of their solution.



**Figure 1. Inter-related scale of design problems from J. Christopher Jones.**

In his book, *Design Methods*, J. Christopher Jones writes about the scale of design problems within contemporary society. At the smallest scale, design solves a component of a problem. In terms of our public transportation system, students might be asked to redesign a map or schedule for one of the existing bus routes. At the product level, students might be challenged to redesign the entire system of maps for that bus line. Within the component and product levels, design is largely concerned with the production process; in this case, it is responsible for creating a visual system and hierarchy that can be continued through a variety of media but is not as concerned with its life outside of the product. At the system level, students address the role of the bus line as part of the public transportation system in Cincinnati, from automobile traffic to bicycles and pedestrian lanes, as well as its role within it. Finally, at the community level, students must also address the role of transportation and its intersection with the community. Jones tells us that contemporary design problems are most often at the community and systems levels, and not at the levels of products and components where our design curricula are most often centered.

From there, the question becomes “How, as designers, can we begin to see and then solve design problems at a higher level? How do we get students to see interaction design in terms of systems and communities rather than product or even component?”

Before asking students to solve more complex design problems at the system and community levels, we needed a better framework to conduct our research. Traditionally, the digital design curriculum relied on user testing or Human-Computer Interaction as formal research and largely visual sketches and ideation methods as our informal research process. Neither method forced the student to research the role that their design solution might play in the community and in

solving greater problems within Cincinnati. The process of participatory action research allowed students a broader frame of collaboration within the classroom and the community as well as a process of formal self-evaluation that allowed students to better address the issues of community within their designs.

### **Action Research**

Action research is an iterative process that balances collaborative problem solving with data-driven analysis or research (Reason and Bradbury, 2001, 81). Action research has several distinctive features including the following:

- Collaborative enquiry
- Reflective practitioners
- Participatory problem solving
- Self-evaluation

Action research requires that students analyze and develop concepts and theories based on their experiences. Their concepts and theories are self-evaluated at multiple stages in the developmental process. Students involved contribute equally to the enquiry, and collaborate as partners and as those affected by the problem and its solution. Allowing the students to experience a problem as both designer and intended audience gave them a heightened sense of responsibility as well as the sense of being expert at some part of the problem solving process. Action research calls for collaborative enquiry: students went into the community in order to better understand the role of public transportation in community building.



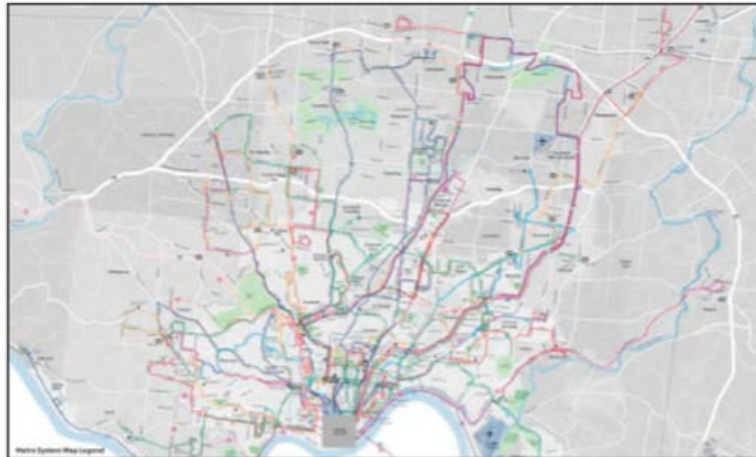
**Figure 2. Example of group collaboration. Students kept record of their brainstorming efforts within their groups and after meeting with community members.**

### **Problem Statement**

During the spring quarters of 2005 and 2006, approximately forty pre-junior digital design students at the University of Cincinnati were asked to research, develop and design digital wayfinding solutions for a proposed Bus Rapid Transit System or BRT in Cincinnati. During the two ten-week quarters, students researched the problem in interdisciplinary teams with input from industrial design and urban planning students and faculty. Students worked with existing public transportation users, members of diverse communities throughout Cincinnati, as well as becoming active users of the current public bus transportation, the Metro, as commuters and students.

### *Transit Problems in Cincinnati*

Like many other cities, Cincinnati has a problem with traffic. Congestion is growing and the number of single occupancy vehicles is higher than ever before. At the same time Cincinnati struggles to support the public transportation needs of its citizens. Parking is expensive and in-demand, and current development patterns rely on automobiles, further limiting the transportation options of Hamilton and Clermont County residents.



**Figure 3. Current bus routes serving the greater Cincinnati area.**

### **Background: Research Process**

#### *Team Composition*

Design teams were made up largely of two to three digital designers, but informally included faculty from urban planning, digital design and industrial design. Industrial design students and graduate urban planning students were also infrequent members of our design teams. Each design team met with existing users of the Metro as well as station workers and bus drivers.

#### *Timeline*

Students met during *Digital Design 2: Interactive Wayfinding* courses for six hours a week. The course was created to allow students to explore both traditional methods of wayfinding as well as interactive devices that aided in wayfinding in both physical and virtual spaces.

#### *Design Methodology*

The design methodology of the course can be divided into three major areas; research, design, and testing with the majority of the course focused on the research phase of the project. In the first phase of the course, students conducted research through the interview process as well as surveys and general research into the community, public transportation in Cincinnati and existing BRT systems in use around the world. In the second phase students developed concepts and tested them in the community and the classroom, as well as furthering their work through prototype and content development. The final phase of development required that students invite members of the school and local community into presentations for feedback.

Students were asked to conduct collaborative research using a combination of personal observation and interviews. As potential users of the BRT, students used Metro bus routes at a variety times during the day, including but not limited to; morning rush, afternoon, evening rush and early evening.

Teams collected personal observations in the form of journals, video and photographs as well as collecting route maps and transfer tickets. Student research included interviews conducted in both formal surveys as well as unstructured anecdotal stories from patrons already using public transportation as well as those resistant to using public transportation. Following analysis of the

collected research on public transportation, students began their research into traditional wayfinding methods and new technology being used in wayfinding.



**Figure 4. Students were encouraged to explore new technology such as multi-touch screens in their exploration of wayfinding methods.**

#### *Breakdown of classtime.*

The first two weeks were spent in brainstorming and the development of design teams. Faculty and students groups met and were given background information about the Cincinnati BRT proposal through the urban planning department.

Students spent the following three weeks meeting with community members as well as first hand research into the existing public transportation system. Through self-evaluation students identified existing issues with the Metro.

The following four weeks were spent in concept development, refinement and prototype development. During this time students continued to meet with community members as well as team members. The class culminated in a final critique that involved all levels of their existing design teams.

Although many subjects were discussed during the course, wayfinding and community building were the focus of each design solution. Students were asked to solve spatial and timing issues as well as look at the current system being used. Special areas of interest identified during the course included:

1. Creating a community landmark.
2. The role of town crier or resurgence of the bulletin board
3. Connecting art to the community
4. Memorializing Everyday Heroes

### **Wayfinding**

#### *A Brief Introduction*

Wayfinding can be viewed as one of the earliest human activities due to the inherent mobility of humans. However, wayfinding as a discipline did not gain much development until the early 20th century. The term “wayfinding” was coined in 1960 by city planner Kevin Lynch in his influential book *The Image of the City* and later became “wayfinding” in the mid-1970s. As a dynamic process of “spatial problem solving,” wayfinding is a term introduced “to describe the process of reaching a destination, whether in a familiar or unfamiliar environment” (Passini 1984, 100-110; Arthur and Passini 1992, 40-42).

“Wayfinding difficulties are usually explained by inadequate signage” (Passini 1996, 319-331).

However, wayfinding is more than putting up signage with arrows. A comprehensive wayfinding system requires close collaboration of behavioral and cognitive psychologists, urban planners, landscape architects, architects, interior designers, graphic designers, and most recently, interaction designers. As an integrated part of the users' experience, wayfinding sometimes plays a dominant role during a journey and sometimes a minor one.

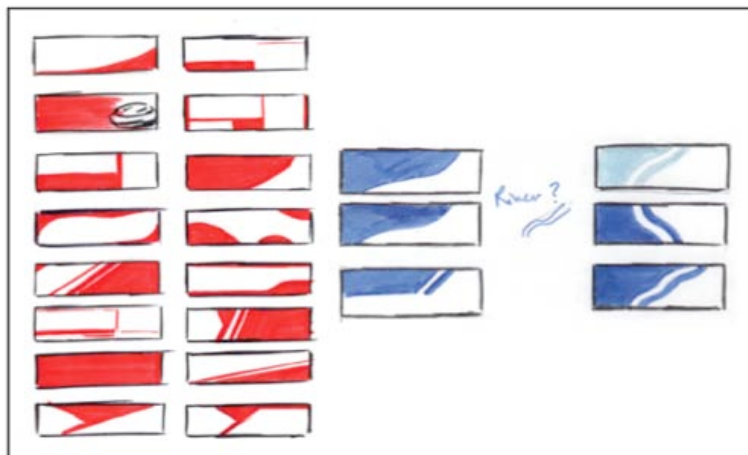
#### *Aesthetics in Wayfinding Design*

According to *Universal Principles of Design* the aesthetic-usability effect states that "aesthetic designs are perceived as being easier to use than less-aesthetic designs." This, in turn, has significant implications when regarding the acceptance, use, and performance of a design or space.

A successfully designed space can evoke feelings of happiness, serenity, loyalty and patience. In today's complex environments these feelings are significant factors in the usability and success of a designed environment. Emotional responses can effectively help an audience interact with a designed space. "Positive relationships with a design result in an interaction that helps catalyze creative thinking and problem solving. Negative relationships result in an interaction that narrows thinking and stifles creativity. This is especially important in stressful environments, since stress increases fatigue and reduces cognitive performance" (Lidwell 2003, 184). Often in environment design, aesthetics are treated as a separate entity to the wayfinding experience. Art displays that might help direct travelers in an airport or define a terminal are treated as part of the building or space and not as usable information.

New technology allows for more interactive and user responsive digital displays to become part of the space's aesthetics. Still, aesthetics as a source of positive feedback in wayfinding remains an overlooked opportunity.

Students were encouraged to integrate the use of aesthetics into their wayfinding solutions as a way to reinforce community identity, increase effectiveness and integrate technology and community art. Students were encouraged to evaluate existing bus shelters as well as airports and train stations as community landmarks and meeting spaces beyond their immediate functional purposes.



**Figure 5. Early concept sketches and color studies.**

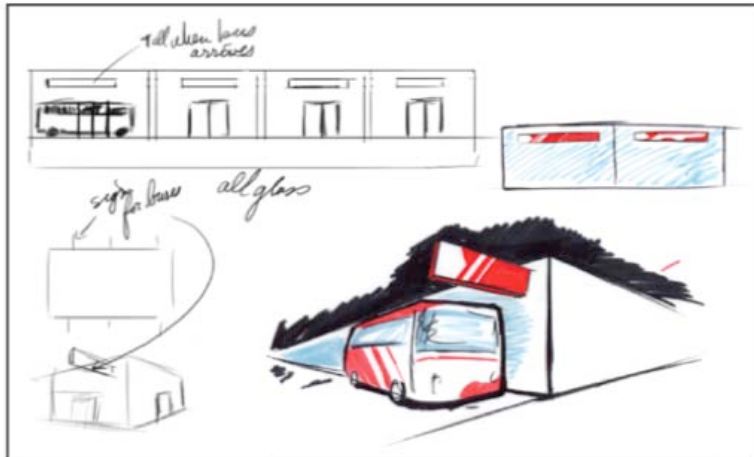


Figure 6. Concept sketches of color system applied to buildings and buses.

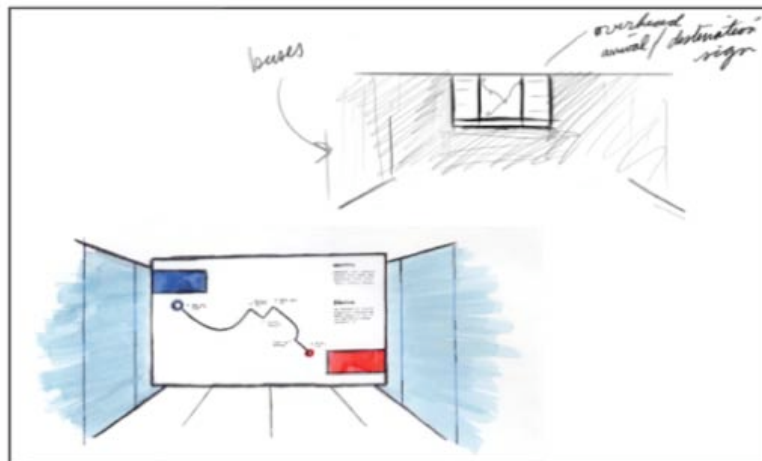


Figure 7. Early sketch of route maps and bus shelter.



Figure 8. Icon and route study.



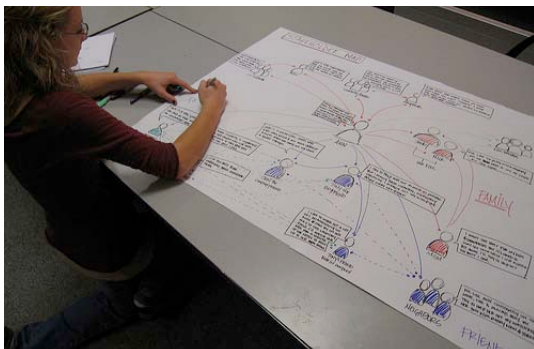


**Figure 9. 3D rendering of bus and shelter integration.**

#### **Action Research: A Three-Person Framework**

Participatory action research is a diverse approach to research. In recognition of diversity within this type of research, Reason and Torbert formulated a three-person framework. These three separate, yet integrated pathways are described as first-, second-, and thirdperson action research. First-person action research fosters self-inquiry and increasing awareness of the researcher's own everyday life as the process unfolds. Second-person action research focuses on interpersonal encounters, and the researcher's ability to collaborate with others in their community of inquiry. Third-person research activities extend the inquiry within a wider community with intent to transform the politics of the issue.

Bradbury and Reason differentiated first-person practice as 'work for oneself', second-person as 'work for partners', and third-person as 'work for people in the wider context' (Bradbury and Reason 2001, 449). For the purpose of our class, students were encouraged to differentiate their research into this framework. For example, students doing first-person action research might examine their place with Cincinnati's public transportation system and as community members of Clifton. As third-person action research they might work within the community to determine differences between their use and a single mother of three and what impact does each design solution have for both members of society?



**Figure 10. Student examines connection in community of users of public transportation.**



## **Public Transportation in Cincinnati**

The problem is twofold. Cincinnati is made of several culturally diverse neighborhoods known for their architecture and ethnic makeup. Students were asked to analyze two Cincinnati neighborhoods as well as their own, that of Clifton and Clifton Heights and Over-the Rhine, a largely poor, African-American neighborhood situated near downtown and known for the diversity of its architecture as well as its poverty.

The second part of this problem is that Cincinnati is geographically spread out and traditionally resistant to use of public transportation. Several attempts have been made throughout its history, most notably the Cincinnati Subway, a mass-transit system that was partially built and abandoned in 1925. More recently, the city had considered adopting a rapid transit system called the BRT that utilized dedicated lanes, community transit centers and eco-friendly buses.

Through their research, students were able to identify several design issues facing the current public transportation system. These issues included the following challenges:

1. Public perception of existing transportation system as ineffective, dirty, and dangerous.
2. Access to underserved communities in Cincinnati, most prominently Over-the-Rhine.
3. Building community identity through public spaces and providing community information.

### ***Transit in Cincinnati:***

#### ***The Subway***

Cincinnati is the site of the country's largest abandoned subway tunnel. But "abandoned" is not quite the word, as construction slowed to a stop in 1925 before even half of the sixteen-mile line was completed. Seven miles between Cincinnati's central business district and the industrial suburb of Norwood were tunneled, bridged, or graded, but no track was laid and no subway cars were ordered. No passengers ever rode between the six stations that were built. The mute two-mile tunnel that remains under Central Parkway is unknown to many Cincinnati natives, and what most who do know of it consists largely of hearsay and speculation.

#### ***Cincinnati Metro:***

The Cincinnati Metro is the only existing public transportation system to Cincinnati and its surrounding communities. Often overcrowded and subject to delays due to traffic congestion and poor weather, the Cincinnati Metro is often criticized for its inability to serve all sections of the community equally.

#### ***The Bus Rapid Transit System:***

In dense metro and urban environments, dependence on the use of private automobile for personal mobility, has negative consequences including traffic congestion, environment pollution, energy consumption and destructive land use development.

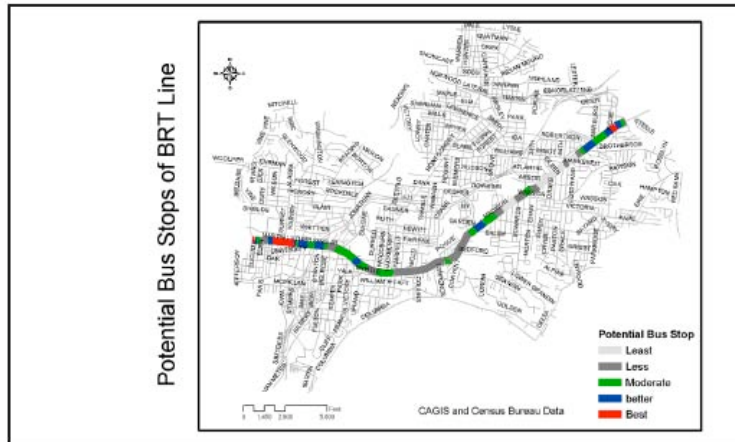


Figure 11. Proposed BRT route connecting the Clifton and Over-the-Rhine neighborhoods.

### ***Connecting Neighborhoods:***

#### ***Over-the-Rhine***

**Over-the-Rhine** is a neighborhood located just north of downtown Cincinnati. A historic district known for its architecture, it is equally known as the site of the 2001 Cincinnati riots lasting three days over the police shooting death of an unarmed 19 year-old African-American boy wanted on several outstanding warrants.

Historically a blue-collar German neighborhood, the neighborhood has changed dramatically in recent years. Today, Over-the-Rhine has a vibrant African-American community, despite problems with crime and poverty.

#### ***The Results***

Students were asked to work in teams to address the issues surrounding the implementation of a rapid-transit bus system in Cincinnati's underused public transportation system. Students were challenged with making a new mass transit system, the BRT, an iconic part of Cincinnati by connecting neighborhoods and communities through wayfinding, digital signage and accessible community information.

The performance criteria for the designs were as follows:

##### ***1 Usability and Ease of Use***

Is the design asking to be explored or experienced? Is the information necessary to the user and speed and efficiency important?

##### ***2 Community Pride***

BRT Stations were expected to symbolize and define communities. Cincinnati has a long history of divided communities, both racially and socio-economic. Therefore, students were expected to develop designs that not only enhanced wayfinding but also increased community awareness and pride.

##### ***3 Scale/Structure***

Can the design be scaled up? Scaled down? Is the site structure, rules, and information easily understood to the public?

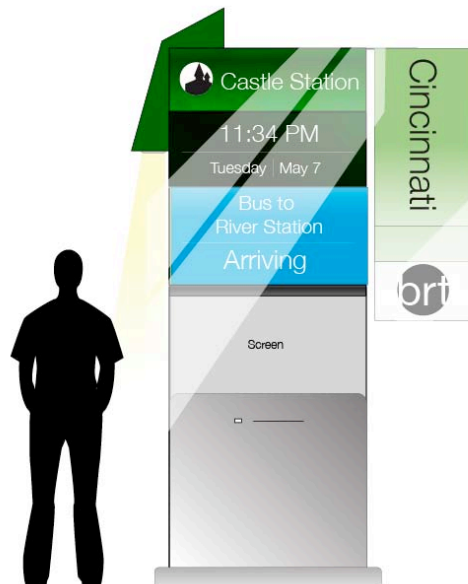
Although the course resulted in several interesting proposals, of particular interest were the bulletin board kiosk and community memorial wall. Both solutions focused on connecting the community in high traffic spaces as well as serving as wayfinding landmarks within Cincinnati.

### *The Bulletin Board*

The bulletin board has long been a posting place for the community and way to gain visibility about events, people, and places. Traditionally informal in nature, this design looks at providing a public posting place available to all members within the community. The kiosk style bus stop would offer a clock, route information, waiting times between buses, community information and events and a safety light. It was designed to be small and would need little space other than a sidewalk.



**Figure 12. Traditional community bulletin board found on the campus.**



**Figure 13. Student rendering of the bulletin kiosk design.**

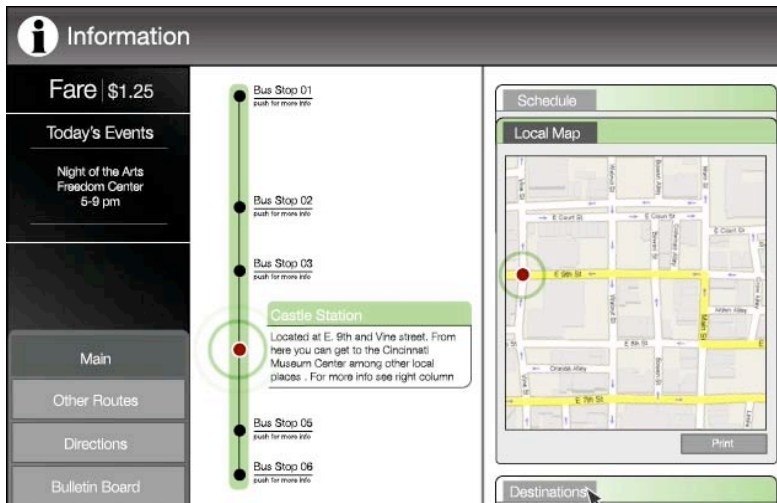


Figure 14. Through the kiosk, users would be able to access information about their bus schedule, route and the surrounding area.



Figure 15. Users would also have access to community events, want ads, and job postings.

### *Community Memorial Wall.*

Another design solution to come out of the course looked at establishing or reinforcing community spirit through the creation of a memorial wall. This design focused on remembering community members, particularly in Over-the-Rhine, lost to violence, or to highlight "everyday heroes," local teachers and community leaders who were making a difference in the community every day. Additionally, the space allowed artists in the community to showcase their work on digital displays. The stations boasted community stages in order to provide additional space for community events and artists.

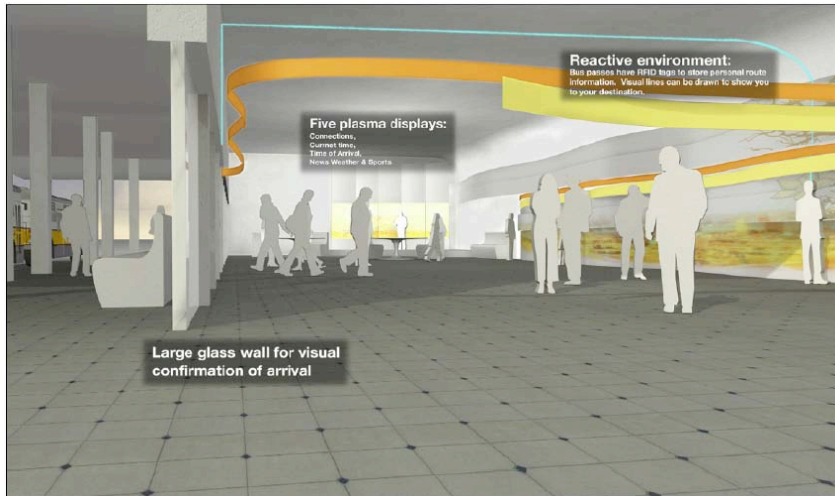


Figure 16. Space boasted a large video wall that could highlight local artists as well as local heroes.

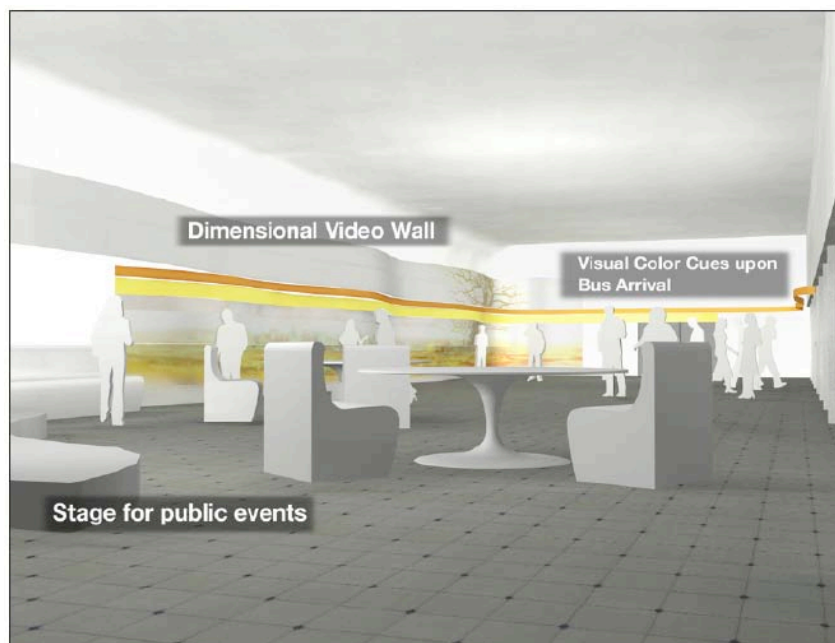


Figure 17. Central to this idea was the inclusion of a public stage that could be used by community for a variety of public events.

### **Conclusion**

Action research is a natural and critical augmentation of interaction design that easily relates to the traditional design process. With constant self-evaluation, refinement, testing and re-evaluation, this type of designer-as-user engagement in the process of idea development is comprehensive. As a result of this study, it is also clear that more precisely defined parameters for action research are needed in order to apply the results in measurable ways.

## Bibliography

- Arthur, Paul, and Romedi Passini. *Wayfinding: People, Signs, and Architecture*. New York: McGraw-Hill Book Companies, 1992.
- Baur, Ruedi. "Programs of visual identity and signage system of the Centre Pompidou." In Ruedi Baur..., Integral..., and Partners, Baden, Switzerland: Lars Muller Publishers, October 2001.
- Dilworth, Leslie Gallery. "Paul Mijksenaar: Wayfinding People." In *SEGDdesign*, (01): 8-11, 2003.
- Heinich, Nathalie. Chapter 9: The Pompidou Centre and its public: the limits of a utopian site. In *The Museum Time Machine: Putting Cultures on Display*, London: Routledge, 1988.
- Lidwell, William, Kristina Holden and Jill Butler. *Universal Principles of Design*. Rockport Publishers, Inc., Massachusetts: 2003.
- Lynch, Kevin. *The Image of the City*. Cambridge, Mass.: The M. I. T. Press, 1960.
- McKee, Bradford. "In Living Color: What passengers need to know and when they need to know it." In *SEGDdesign*, (01): 24-25, 2004. Mijksenaar, Paul. "Wayfinding for Transportation: Airports." SEG D Teleconference, January 23 2003.
- Montiglio, Silvia. "Wandering Philosophers in Classical Greece." In *The Journal of Hellenic Studies*, 120:86-105, 2000.
- Norman, Donald A. "Emotion and Design: Attractive Things Work Better." In *Interactions Magazine*, page 36-42, July-August, 2002. Norman, Donald A. "Introduction to this Special Section on Beauty, Goodness, and Usability." In *Human-Computer Interaction*, 19(4), 2004.
- Passini, Romedi. *Wayfinding in Architecture*. New York: Van Nostrand Reinhold, 1984.
- Passini, Romedi. "Wayfinding design: logic, application and some thoughts on universality." In *Design Studies*, 17:319-331, July 1996.
- Rieser, John J. Chapter 7: Dynamic Spatial Orientation and the Coupling of Representation and Action. In *Wayfinding Behavior: Cognitive Mapping and Other Spatial Processes*, Baltimore: Johns Hopkins University Press, 1999.
- Sandberg, Anders. *Unannounced evacuation of large retail-stores: An evaluation of human behaviour and computer model Simulex*. Department of Fire Safety Engineering, Lund Institute of Technology, Lund University, October 1997.
- Schnetzler-Reising, Jenny. "Signage." In *I. D.*, 50(1):45, February 2003.