

A UNIVERSAL DESIGN CHARRETTE CONDUCTED IN AN EDUCATIONAL SETTING TO INCREASE PROFESSIONAL SENSITIVITY

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Abstract: This paper describes a design Charrette conducted in a graduate course on Universal Design (UD), in which students, here professional architects, developed a design project for a public-service centre. The goal of the Charrette was to understand the effectiveness of this type of teaching method to increase the designers' sensitivity toward UD issues and gain knowledge on participatory processes. The Charrette involved potential users with various disabilities who evaluated the design proposal using tactile maps and other communication media. The Charrette exercise included Wayfinding as an important topic in the design of buildings and urban spaces. Issues related to this aspect were translated into flowcharts as diagrams and tactile representations. The participation of users with disabilities was evaluated. The results showed that the Charrette, as a teaching method, was successful in making the student group examine questions regarding UD. However, the student group continued to be primarily concerned with the design's formal aesthetic issues, and the process differed little from the traditional "designerly" ways of doing things. An analysis of the participatory phase showed that potential users with visual disabilities had difficulties understanding the design and the wheelchair users criticized various questions of access and barrier-free Wayfinding. Recommendations to improve "design for all" education are presented. To increase the sensitivity of professional designers to issues concerning UD, potential users with

disabilities should participate early in the design process, to provide input as the proposal is developed. Introducing a multidisciplinary design team should also be tested to include a larger variety of viewpoints in design decisions. This approach may strengthen the concern for elements of an architectural and urban design that directly affect person-environment relationships.

Keywords: Universal Design (UD), Architectural Design Process, Design Pedagogy, Wayfinding, Design Charrette, Tactile maps

Introduction

This paper discusses the importance of Universal Design (UD) as a concept to be incorporated into the creative design process of the built environment. The principles of UD should be part of designers' repertoire. To achieve this result, UD should be present in appropriate pedagogies to increase designers' sensitivity towards the needs of others. Responding to different requirements and desires is an essential design attitude that must be learned and acted on in design decisions.

In this study, UD was the subject of a graduate class at the University of Campinas, which included a design Charrette. The students of this graduate class were all practicing design professionals, in this case, licensed architects who were engaged in graduate courses at the above-mentioned university. The topic of the Charrette was a Citizen Service Centre (*Poupatempo*) and the exercise emphasized not only UD, but also organizational issues concerning Wayfinding of this building type.

The creative process is continuously changing in the face of new design requirements. Technological advances and global, social and economic changes have directly influenced the design of the built environment, thereby increasing the complexity and functional requirements of buildings (Nicol & Pilling, 2000; Hadjiyanni, 2008; D'Souza, 2009; Kowaltowski et al., 2010). A new professional posture is required that is capable of a more responsible and sensitive approach to design solutions to address

environmental impact, accessibility and humanization of architecture, among other design factors (Kowaltowski, 1980; Quayle & Paterson, 1989; Salama, 2005; Danko et al., 2006; Ryhl, 2009).

To contribute to the discussion on the preparation of designers to address the concepts of UD in their professional activities, this paper presents a building design educational experiment, as a design Charrette. This exercise followed a study where role-playing and user participation were shown to be significant collaborative factors in design education (Bernardi & Kowaltowski, 2010). The same research also showed that role-playing was insufficient to engage design professionals fully in the needs of users with disabilities, and that further efforts were needed to increase design professionals' sensitivity.

Literature review

Design education with Universal Design in mind

Research continuously forms and refines principles and concepts on which to base decision-making for the design of the built environment. In this context UD has gained importance as a research area and as a subject in design curricula. Various teaching methods have been devised to increase future designers' sensitivity to the issues of UD. To permit a more autonomous use of built spaces for people with a variety of disabilities regulations and laws have been introduced over the last thirty years. These efforts should ensure that the planning, design and construction of buildings and urban places adequately provide for these users. (Duarte & Cohen, 2003, Preiser & Smith, 2010; Barnes, 2011; McGuire, 2011; Nussbaumer, 2011).

Afcan and Erbug (2009) showed that three critical issues challenge the integration of UD in current design practices. The first of these questions is a theory-practice inconsistency, with design professionals showing a lack of UD knowledge. The second issue concerns user needs, as designers are typically not users of their own creations; therefore, eliciting, capturing and

describing diverse user requirements through effective procedures is vitally important. Finally, the third issue is attributed to the interdisciplinary nature of design processes.

To increase the discussions of UD and address these three issues in higher education many strategies have been used. Among such strategies are the following: curricula expansion; faculty training; introduction of innovative new courses and new topics in design assignments. Recommended teaching methods include role-playing and Charrettes within participatory processes (Brent et al., 1993). The literature regarding design education with specific emphasis on UD is rich, presenting successes and some failures from which lessons can be learned (Lifchez, 1986; Quayle & Paterson, 1989; Stiffler, 1990; Welch, 1995; Morrow, 2001; Schermer, 2001; Christophersen, 2002; Duarte & Cohen, 2003; Paulsson, 2005; Salama, 2005; Luck, 2007; Hadjiyanni, 2008; McGuire, 2011; Dorneles & Bins Ely, 2012). These studies point out that students should learn the difference between accessibility and UD because accessibility is more concerned with a barrier free environment and an inclusive design based, in most countries, on legislation. In contrast, UD embraces the spirit of inclusion as a concept of design and, as a study subject, should emphasize the experiential and psycho-social qualities of spaces. Courses should therefore discuss and practice critical interpretive understandings of person-environment interactions (Franz & Lehmann, 2004; Souza, 2008). Cooperative projects between design schools and special user organizations are encouraged and appropriate UD pedagogy should apply methods such as creative problem solving, project-based teaching and evidence-based design (Nussbaumer, 2009).

Teaching methods

One of the more frequently used teaching methods in design courses is role-playing, where students will temporarily become users with disabilities. Role-playing was introduced in discussion groups in universities already in the 1980s and was shown to diffuse a student's close proximity to a project and engage him/her in a more objective and creative mode of thinking

(Lifchez, 1986; Radford & Stevens, 1988; Quayle & Paterson 1989; Duarte & Cohen, 2003; Altay & Demirkan, 2014).

The participation of special users in design classes has been a fairly long-standing pedagogical tool as well in architecture schools. Paulsson (2005) recommended this type of inclusion, to enhance empathy exercises in the studio setting, which should be coupled with lectures by experts on various disabilities to increase factual knowledge. Empowering design can then occur through the inclusion of profound knowledge about human capabilities and less on disabilities (Tyler, 2011). Participation of individual users may also bring to the design debates specific life endeavours, experiences and coping techniques. Thus, immersion in reality can stimulate creative solutions. Following people with disabilities on a daily basis is also recommended, to develop intellectual rigor and motivational skills in students who may find inspiration in the everyday lives of ordinary people (Gehl, 2011). After this immersion, innovation no longer tends to be a quest to be different but seeks to respond critically to everyday problems and challenges. Restrictions imposed on design by UD are no longer viewed as stifling creativity but can be instigators for new and fresh ideas (Stiffler, 1990; Morrow, 2001).

Preparing design professionals for interaction design with an emancipatory process, particularly when users with various disabilities are included, touches on several key issues of expertise. Ethics of conduct, representational and ethnographic skill development are necessary (Luck, 2007). Being able to adequately convey ideas, with respect for others and have insights into special needs can no longer be missing in pedagogical goals of colleges of design. Students should develop a questioning attitude, think in alternatives and engage in non-argumentative conversations (e.g., making deals, agreeing to disagree, etc..) (Morton, 2012). The new approach establishes an awareness and appreciation for diversity and design for society as a whole (Tyler, 2011; Christophersen, 2002).

Emancipatory processes occur primarily in professional practice, with users as active members of a design decision-making process (Luck, 2003; 2007;

Sanoff, 2011). In this scenario, the professional designer must learn to act ethically and responsibly in serving the needs of others (Schermer 2001; Woolner, 2009). The introduction of users with disabilities in such processes usually transcends the dialogue between designers and potential users. Reading of a design proposal to obtain a perception of the future built environment occurs essentially through graphic documentation, which may present difficulties. When users with visual impairments participate, one must go beyond the usual two-dimensional drawings or 3D presentation models. Tactile maps are recommended, because they address richer sensorial values (Dischinger, 2000; Howell & Ionides, 2008; Bernardi et al., 2011). For this reason these new communication techniques should be part of the formal education of designers.

Universal Design in a specific context

In a previous teaching experience by the authors involving role-playing and the participation of users with visual impairments, students increased their awareness to accessibility and UD issues (Bernardi & Kowaltowski, 2010). However, this study showed that students often revert back to their normal abilities when difficulties arise and the combination of role-playing and user participation was recommended. This previous example also showed that a gain in real-life experience might come at a cost because frustrations can occur during participatory design. Further studies were recommended to achieve a more inclusive design process in both teaching and practice.

The case study presented below concerns issues of UD education and design practices in a specific context. Because the teaching experience is situated in Brazil, some historical facts on accessibility and UD in design education in this context are presented.

A university undergraduate degree in Architecture and Urban Design is the traditional degree for professional designers in Brazil. The graduates from these courses can work in various areas of design, such as architecture, interior design, product and landscape design and urban planning. To date, most design education in Brazil has only touched on the concepts of UD and Wayfinding, and there is a need to expand the necessary and specific

knowledge of designers (Preiser & Smith, 2010). In the USA design Charrettes, with a focus on UD, were considered important vehicles to discuss vital questions and increase designers' sensibility in their decision-making process soon after the signing of the Americans with Disabilities Act (ADA) (Brent et al., 1993). In Brazil, such concentrated workshops are a more recent introduction to design education (Cohen & Duarte, 2010).

The discussions on the topic of UD increased in the 1960's in Brazil. In the mid-1980s, a long debate culminated in laws, decrees and technical reports that sought to ensure the right of access in the physical environment for disabled persons, with an emphasis given on people with reduced mobility. In 1985, the first Brazilian technical codes were published. In the revised 2004 version, these codes are now a standard, applied throughout the country (Brasil, 2000; ABNT, 2004, Prado et al., 2010). Physical barriers pose problems for a significant number of Brazilians. In developing countries, not only physical barriers but also cultural and economical hurdles affect questions of accessibility. Attitudes play a role, among other important factors, to make a society barrier free in the widest sense (Sasaki, 1997). The 2010 general census in Brazil found that 23.9% of the population possesses at least one kind of disability (IBGE, 2012). This information emphasizes the importance of the topic of UD in a society where the demand for universally accessible spaces exists and is growing.

Methodology

Design Charrette

Charrette, meaning "cart" in French, is said to originate from the *Ecole des Beau Arts*, where, after long days and nights designing and drafting, students' projects were collected and placed in carts *en route* to their final review (Sanoff, 2011). The basic idea of the Charrette, putting students under pressure, so to speak to catch the last train, is prominent in design education. Typical Charrette protocols are the following: a short time period, multidisciplinary participants, focus on a single design problem and group isolation in a specific place (Lennertz & Lutzenhiser, 2006).

In current design studios, the term Charrette usually refers to an intensive design exercise developed by groups of students in a short period of time ranging from one day to two weeks. Many subjects, including building safety and security, ADA, community planning and sustainability have used Charrettes (Brent et al., 1993; Onayngo & Noguchi, 2009; McLaughlin, 2013)

The effectiveness of Charrettes can be linked to the fact that interdisciplinary teamwork can be practiced (Clayton et al., 1998). There are authors who question the use of Charrettes because they may involve gruelling workloads for students (Bachman & Bachman, 2009). However, Staub and Lulo (2011) show that Charrettes can be productive in establishing dialogue between designers and user groups. Participating laypersons may provide initial design information and help define the parameters for the further exploration of solutions.

Case Study

In the case study described in this paper the design Charrette did not have all the protocol elements. The Charrette group was not isolated for a specific short time period in a single space. Users only participated in specific phases of the process, namely during the presentation and design “crits”.

The focus of the Charrette was to design a building for a particular purpose and to test whether students are able to include UD as a principal design-guiding element. The seven principles of UD and Wayfinding, as an aspect of design, were considered the focus of the exercise (Connell et al., 1997). The Charrette also paid attention to presentation and communication techniques to improve the design process, considering users with various disabilities. Motivating students to imagine more conceptual solutions that follow UD principles was a primary goal of the case study. The proposed building, its relation to the urban tissue, architectural forms and details, interior spaces and their organization should be naturally inclusive.

The topic of the Charrette was the design of a municipal Citizen Service Centre building, called “*Poupatempo*” (“Save Time” in Portuguese). In the

State of São Paulo, these centres exist in all medium and large cities, where the State Government offers essential services to the population. The centres have the following goals: concentrate public services in a single physical space; provide fast, efficient citizen services and apply advanced information and communication technology (Painelli, 2008). The most sought-after *Poupatempo* services include ID cards, work permits, unemployment insurance and driver's licenses, which are all important documents that people need in everyday life. The site for the design proposal was located close to the main university of the city of Campinas and local residents were considered the target population.

The challenge of designing a *Poupatempo* considering UD was assigned to eight graduate students of the School of Civil Engineering, Architecture and Urban Design, of the University of Campinas. All students were professional architects with several years of experience. The exercise was part of a course given on UD in the master's and doctoral program of the School. The course was structured as a design Charrette and as a participatory process. The student group was given instructions to include users with a variety of disabilities in the design phases. The actual organization of these stages was transferred to the students, and they were asked to document their specific means of achieving a participatory goal. Students were also invited to observe difficulties and gains.

Theoretical discussions on accessibility and UD in the design process were a component of the course work. The following four topics were part of the syllabus: Universal Design; UD and its impact on design quality; Post Occupancy Evaluation (POE); and Wayfinding. The required reading included manuals and POE studies of *Poupatempos*, references on UD principles (Connell, 1997) and Wayfinding as a guiding aspect for the organization and legibility of architectural spaces. The primary reading included the following: Luck et al., 2001; Preiser & Smith, 2010 and Welch, 1995. Additional supplementary readings were required for each topic. Design analysis exercises occurred prior to engaging in the design Charrette.

The Charrette group included eight architects and two instructors, who were also professional architects. Five female and three male designers participated, each with more than five years of professional practice, and all were enrolled in the architecture graduate program of the School of Civil Engineering, Architecture and Urban Design of the University of Campinas.

Five design stages were present in the exercise: briefing, preliminary design, design development, participatory design presentation and evaluation. The Charrette was developed in the four-hour weekly course meetings, and the students met off-campus and on-line between classes. Students prepared pre-design material and drawings individually at home or in their offices. The group divided these activities in two parts: urban access to the site and the building design proposal. The activities lasted six weeks. After the participatory presentation, the group met for a feedback debate. A report was made, and a conference paper was presented and published.

While concentrating on the principles of UD (equitable use; flexibility in use; simple and intuitive use; perceptible information; tolerance for error; low physical efforts and size and space for approach and use (Connell, 1997)), the Charrette group gave special attention to the task scenarios as presented in Afacan and Erbug (2009). The scenarios were used to structure the design process as a whole and to pay attention to detail. Elements were specified as presented by Afacan and Erbug (2009): entering and exiting; the circulation system as a whole; Wayfinding; obtaining services; and the location and design of the public amenities. In a *Poupatempo* building, spatial orientation is essential. A coherent layout, referential elements, clear zoning and the placement of objects with obvious functions are important (Ribeiro, 2004). To enable people with disabilities to use such spaces, the path leading to all areas should be accessible (Dischinger et al., 2012). This path should be free of obstacles from origin to destination and display a range of access possibilities. Orientation should also be enhanced through maps and their tactile versions, located in strategic places (Cohen & Duarte, 2010; Bernardi et al., 2011).

To begin the Charrette, the group of students established an urban access route to the site, coming from the local bus terminal and ending at the

proposed building site. This route was translated into a tactile map (Figure 1).

Figure 1. Tactile map of route from bus terminal to proposed Citizens Service Centre



In the programming phase, the Charrette group structured design information and created a checklist according to the Problem-Seeking method (Peña & Parshall, 2012). Facts were collected and a wish list of goals was created, with specific design requirements that included UD and spatial orientation. The feasibility of the project was studied and users were characterized. Semi-public and private spaces were defined. Main access points and circulation flows for Wayfinding were outlined, and local codes were analysed. Design requirements included good indoor-outdoor connections and a project with aesthetic impact. The proposal's design principles were the following: good organization of services and integration of spaces; environments appropriate for employees and users; accessibility to all areas and finally comprehensible and attractive spaces that promote social inclusion. Providing users with humanized spaces, which include views

of gardens, were concepts discussed during design development (Kowaltowski, 1980; Danko et al., 2006).

Each member of the design group prepared an individual interior space-zoning proposal that considered spatial orientation and the legibility of circulation flows. After extensive design debates, a preliminary flowchart was agreed on and translated into a tactile map, as shown in Figures 2 and 3. The special tactile legend of this map defined the services offered, where information can be found and the choices users have to reach their destinations. The waiting area gained special design attention. The flowchart map played an important role during presentation of the design proposal to potential users with disabilities.

Figure 2. Flowchart of services for the design of a Citizens Service Centre (Poupatempo) with numbers indicating: 1 - information panel, 2 - information and service desk, 3 - non-official services (food, copying, public toilets, etc.), 4 - waiting area, 5 - specific services offered by the centre

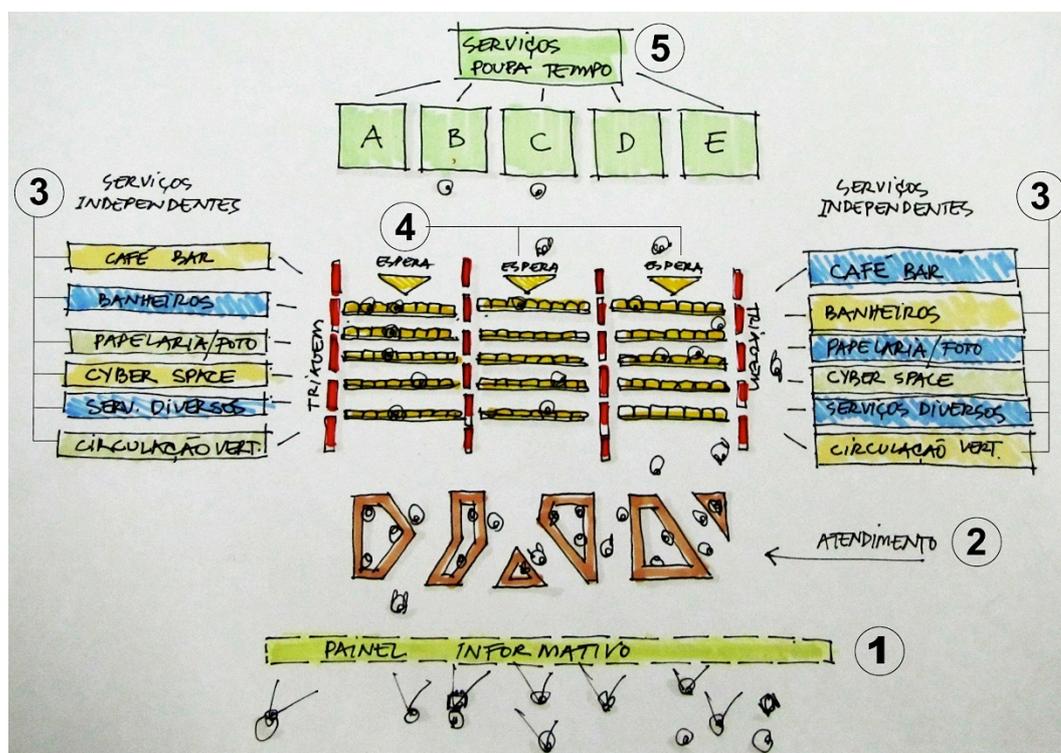
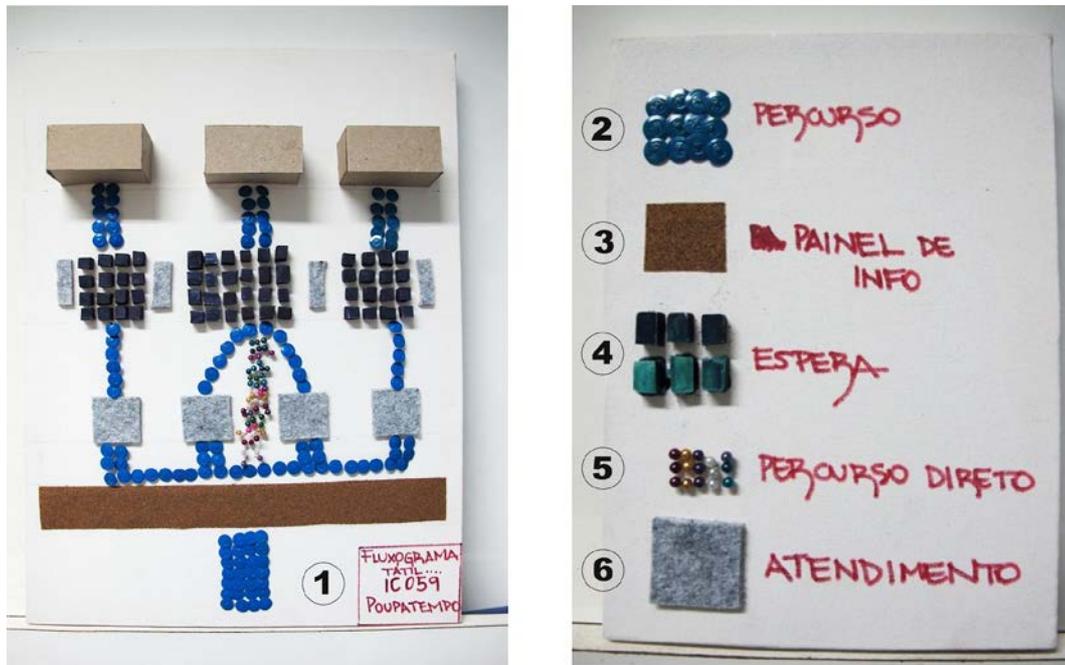


Figure 3. Tactile map of flowchart of services for the design of a Citizens Service Centre (Poupatempo) and legends read: 1 - flowchart for the service centre, 2 - path to obtain information, 3 - information panel, 4 - waiting area, 5 - direct path on return visits, 6 - customer service desk

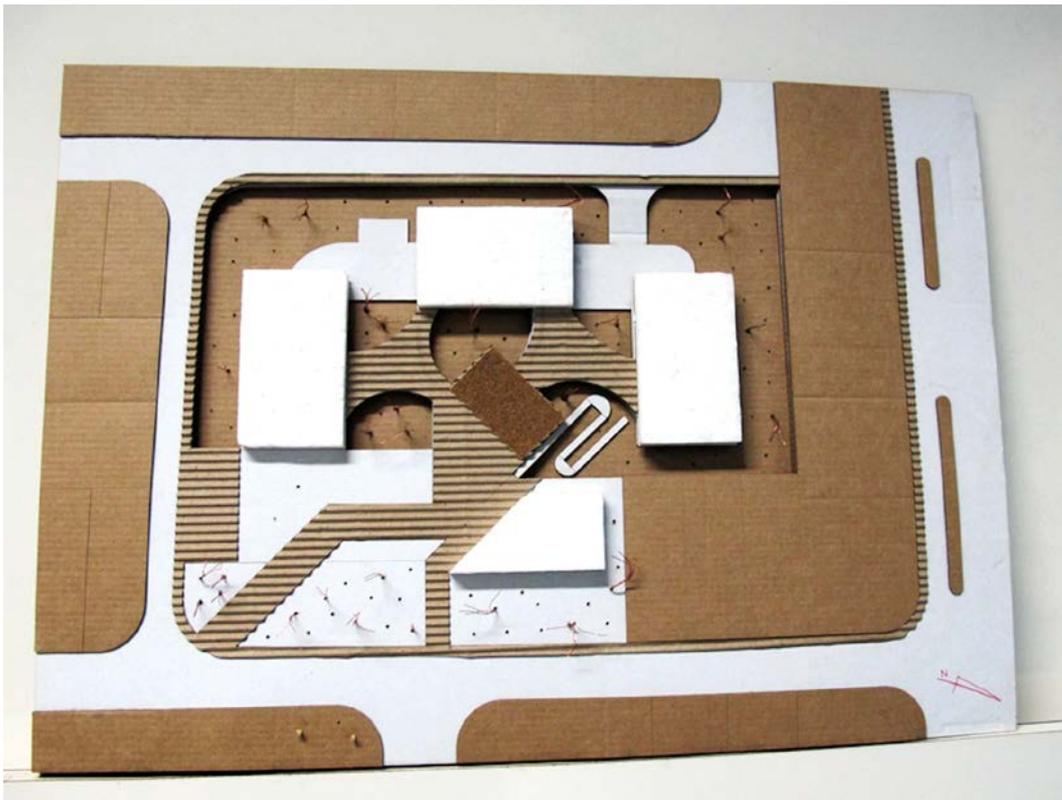


Design sessions began with intense discussions and “crits” by the two instructors (Figure 4). The final design proposal (Figures 5) was in the form of four simple buildings, joined by a marquise. These buildings formally represented the major internal uses and services offered. Because the site has a topographical level difference of three meters between the front and back streets, parking could be accommodated underground. Stairs, ramps and elevators connect the two levels vertically.

Figure 4. Design “crit” with students and instructors, of the case study Charrette



Figure 5. 3D physical model, with some tactile elements, of Citizen Service Centre design proposal



After follow-up research, the design group was convinced that traditional design presentation techniques would be insufficient to adequately communicate the design proposal to potential users with disabilities. Some questions emerged on how to present the project to potential users. These questions were debated by the student group, in relation to Heller's observations on haptic perception of blind people (Heller, 2000; Herssens & Heylighen, 2008). The design group asked themselves several questions. Do blind people think about objects in the same way as people without visual disabilities? Are images created from tactile experiences? Are mental images necessary for spatial understanding? The type of materials to be used for models and tactile maps also raised questions concerning safety of touch and the legibility of maps. These types of questions are part of research on UD. In this case study they were raised during design "crits" and demonstrate that the student group became aware of such fundamental questions. To answer some of the more specific queries, the literature on design communication in a multi-sensory environment was studied (Howell & Ionides, 2008). After this, the Charrette student group made a concerned effort to rethink their design communication, to adequately include users with visual impairments.

For the final design stage, a participatory strategy was adopted in which designers and potential users discussed and evaluated the proposal. During this phase, a slideshow, containing graphs, charts and a virtual model of the design proposal was presented. The history of *Poupatempos* was briefly outlined. Tactile tools, included in the design presentation, were a physical 3D model with some tactile elements (Figure 6) and the organizational chart of the proposal (Figures 2 and 3).

Figure 6. Presentation of Citizen Service Centre design proposal with the participation of potential users with disabilities, using the tactile flowchart



A small group of five potential users participated in the presentation and evaluation phases of the Charrette. This group consisted of individuals with some degree of disabilities, such as being confined to a wheelchair or having visual impairments. These users were students enrolled in a course of the School of Physical Education given at the University of Campinas, therefore not all types of users with disabilities participated in this phase. For example, users with cognitive problems were absent.

During the initial slideshow, the user-participants with visual impairments asked to touch the tactile material to be able to follow the rationale of the talk (Figures 7). After the formal presentation, many questions were asked. Where in relation to the university is the new building going to be? How do I get there by bus? Why is there a level change between the parking garage and the main functional spaces of the proposed building? The ramp seems to be long with of a complicated shape; is it sufficiently low in grade to allow autonomous wheelchair use? Can I park in front of the building and avoid the ramp? Can I, as a blind person, easily find the main information desk? Where

will I be sent if I want to obtain my work permit? None of the potential users asked questions regarding the formal aspects of the design, its attractiveness and the site plan or landscaping features.

Figure 7. Presentation of Citizen Service Centre design proposal with the participation of potential users with disabilities, with students helping to explain the 3D physical model



Following the slideshow, all users had access to the models, tactile maps and drawings. The urban map (Figure 1) was presented first, followed by the organizational chart (Figure 6) and finally the 3D model of the building complex (Figure 7). During this session, the students of the Charrette were actively explaining design elements, their goals and answered questions. They also helped blind users to touch specific places on the tactile maps, when doubts arose (Figures 9 and 10). The potential user group made polite remarks on the design, considering the proposal inviting and attractive. However, these users noted that functional concerns are more important to them than formal issues. For example, users with restricted mobility consider distances a prime concern. The Charrette group debated these concerns and concluded that compact solutions need generous circulation

spaces, and to enhance Wayfinding simplicity in the organizational structure of a building is recommended.

Discussion and recommendations

The Charrette exercise presented in this paper demonstrated that the design of an accessible building could surpass UD standards established by local codes. Additionally, design proposals with UD in mind must consider functional layouts and the clarity of circulation flows in buildings, which in this case reflected the organizational chart of *Poupatempos*.

The feedback phase of the Charrette showed that the graduate students considered the experience a rich exercise in design with UD in mind. The course and its Charrette convinced them that UD should be a guiding concept in the first stages of design and that the appropriate introduction of UD principles in the design process is not a simple prescription of code requirements. The student group was unanimous in their positive evaluation of the graduate course as a whole, and the Charrette as a productive exercise for a practical application of concepts and principles. For several students, this was the first time that UD was considered a more comprehensive design goal than accessibility. The design theme, *Poupatempo*, was found appropriate for the exercise, because it is a building offering services to all citizens, regardless of their needs or capabilities.

The development of a group project united students around common goals, such as: spatial organization based on function; perception of architectural space by users; Wayfinding and accessible routes. Using the Charrette model made the division of labour possible, according to individual talents and abilities and increased productivity. Most students were impressed by the capacity of participating users with visual impairments to comprehend essentials of the design proposal. However, a certain frustration was expressed regarding the lack of anticipation of many of the communication problems that occurred. The Charrette group considered that an exercise of this type should allocate more time to develop the design proposal and the fabrication of tactile maps and models. For the most part, this Charrette was

the students' first contact with these tools. More time was also considered important to better understand a specific user group so that students could be better prepared to answer to typical questions raised.

The graduate students of the Charrette were sufficiently mature and interested in environmental psychology and its application to design practice. User-centred investigations are well known, through POE studies. However, the final design proposal (*Poupatempo*) was mainly based on the formal aspects of design. Each part of the building represented a particular function, as a formal volume, and emphasis was given to the aesthetic composition of these volumes. These aspects had little or no impact on the participating users, and the Charrette students had to rely on verbal communication to explain the more psycho-social qualities of the proposal. Form and dimensions of spaces, views of outdoor areas, effects of light and shade, as well as colour are some elements designers address. How to explain physical space qualities to individuals with sight impairment brought doubt to the minds of the Charrette group, and many problems identified by the potential users with disabilities were not fully anticipated.

Potential users with disabilities mentioned several problems they face in everyday tasks, which reflect expectations of new designs. Because this Charrette example did not include all types of users with disabilities, such insights could not be completely compared to results of other studies. The observations of Afacan and Erbug (2009) are important however, as representing typical problems found in user accounts. These accounts include the following: unnecessary complexity of circulation systems; non-legibility of location of elevators, extensive distances of stairs and ramps from entrances; indirect access to important amenities; unclear paths to travel through buildings; long distances; difficulty of finding information desks; insufficient daylight to guide and direct users; inconsistencies caused by identical colour and decoration schemes; symmetrical layouts causing Wayfinding problems and insufficient distribution of restrooms for disabled persons. Other problems mentioned in Afacan and Erbug (2009) are the following: lack of smooth minor level changes (e.g.. small steps at entrances); too few maps, lack of information directories, signs and displays;

total lack of tactile and sonorous maps and no auditory systems in elevators; difficulties in Wayfinding in car parks; fear of Wayfinding in case of emergencies (e.g.. fire, bomb threat); unusable door handles; insufficient seating in customer service centres; bad finishing and inappropriate material selection in restrooms and lack of tactile information in restrooms. This collection of problems must be transformed or translated into qualitative design data and must be made readily available to professionals and design students. Interpretation should be minimized and designers should be free to find creative solutions. The integration of theories and guidelines in design practice can then be achieved (Ostrom et al., 2010).

Further studies are necessary. Some research should be related to the way designers communicate with a variety of users and their diverse needs. Symbols used in design communication are not necessarily understood by participating users. The question of Wayfinding and the legibility of the functional organization and accessibility are also not directly visible or perceived through an analysis of drawings and models (Hunter, 2010). Experiences of the real world are absent and must be represented or discussed by other than graphic means. Full-scale mock-ups may help, and virtual reality coupled with visits to similar places could be tested.

To increase the sensitivity of professional designers to UD issues, potential users with disabilities should participate in the design process from the beginning as active, equal partners in design decision-making. Introducing a multidisciplinary design team, as recommended by Afacan and Erbug (2009), should be tested as well, to increase the variety of viewpoints. This may strengthen the concern for elements of a building design that directly affect users and their person-environment relationships.

In the teaching studio, establishing the meaning of space is mostly hypothetically discussed and unconnected to realities in use. Specific indicators are needed to test the abstract concepts recommended for briefing, such as the hierarchy and character of spaces, communications and relationships, indoor/outdoor connections, internal and external views, flows of people and goods, spatial organization and orientation, finishing materials, texture and colour, layouts of furniture, facility and flexibility of

use, fixtures and fittings, safety and security, and feelings of comfort (e.g., glare, light and shade, drafts, reverberation of sound, etc..) (Hunter, 2010; Peña & Parshall, 2012). Typically, design education may introduce these concepts to students but often unconnected to specific design problems. Design “crits” will mostly debate spatial aspects such as dimensions, proportions, light, shade and sound, form and volume and the composition of facades, to mention only a few aspects. Discussions that question the perception of a proposed space by users with varied disabilities are still rare in the design studio.

To ensure that a designer can increase his/her observational abilities, think outside the box, test ideas and propose more consistent indicators for the subjective aspects of architecture, design pedagogy must include issues raised in this paper. As a result of the Charrette case study, diverse and dispersed information on “design for all” was organized and structured. Thus, concepts must be introduced and discussed in context. Methods must be applied and refined, and guidelines should be used during design development. Design concepts should include UD and Wayfinding, and a participatory process should be conducted in the design studio (professional and educational). Students must have contact with a multidisciplinary team and users with specific psycho-social requirements. The varying needs and desires of users may then enrich design “crits”. In order to encourage design pedagogy and practice to become more inclusive, the value of multiple skill-sets could also be explored (McGuire, 2011). For example, the framework of Gardner’s (1990) multiple intelligences could have a place in design education. This framework consists of the following eight skills: spatial, interpersonal, intrapersonal, logical, verbal, natural, kinesthetic (tactile learning) and musical (D`Souza, 2009).

To improve orientation (especially for users with impaired vision) organizational issues in indoor spaces also need guidelines. Solving Wayfinding issues in the interior of buildings is related to the absence of wider views and landmarks, where other elements must come into play to enable and enhance the legibility of the built environment.

A summary of recommendations for UD and Wayfinding pedagogy is outlined below. In the first place, **Concepts** must be established on three topics: Design, UD and Wayfinding. In relation to Design different phases demand specific attention:

- At the programming stage designers must address: User needs (physical, social and cultural); Qualification and Quantification of needs; Desires; Performance Indicators; Personal Interests and Ambitions; Design for society as a whole and Ethnographic concerns.
- Data collection should include: Goals; Facts; Concepts; Necessities and Location of Problems, therefore conditions that affect a design project.
- Analysis of repertoire is essential and includes: Theory - practice consistency evaluation and research results from Environmental psychology
- First design ideas need to concentrate on: Established Design Concept, Goals and Principles.

In architectural programming discussions the participants of this phase of the design process must reflect on a number of UD questions as outlined: 7 principals of UD; Human capabilities; Generosity; Empathy; Humanization; Equity; Cognitive abilities; Human senses and sensory experiences (Ryhl, 2009); Coping techniques; Psycho-social qualities; Person-environment interaction; Haptic perception; Ethics; Diversity as well as Serving the needs of others. Data collection in relation to UD must include Codes and Legislation according to location, Public policies and Technological developments. A thorough analysis of existing repertoire can also foster the introduction of UD as a design principle.

Where Wayfinding is concerned the design process must pay special attention to questions of Articulation of spaces (Zoning with coherent grouping of functional relationships); Routes; Circulation of users and goods; Legible circulation systems (paths, markers, nodes, intersections, edges, links and approach from street); Parking; Connection to mass transportation and Intuitively perceptible paths. Furthermore the legibility of spaces must

take priority in design proposals through: Ease of users in organizing visual information; Defining boundaries; Clear separation between indoor and outdoor spaces; Clear articulation; Clear routes and Markers. Wayfinding necessarily depends as well on an Integrated Signing System, Integrated Communication Systems, Maps and Models as well as Audible Visual Information.

Once concepts are established the design process needs support from **Methods and Tools**, especially when the process is participatory and includes a multidisciplinary team and users. To establish user requirements the following can be used: Observations; Questionnaires; Case studies; POEs; Cognitive maps; Testimonies; Walkthroughs; Focus groups; Eliciting, capturing and describing user needs; Problem Seeking (Peña & Prashall, 2012) and Codes and Regulations. To make sure that Psycho-social qualities are present in the design proposal such tools as Immersion in reality; Role playing; User participation; Narratives (Danko et al., 2006); Lectures of experts; Observation on a daily basis and Non-argumentative conversations are useful.

To proceed in the development of a proposal architects can be helped at the synthesis stage through problem solving methods such as: Thinking in alternatives; Holistic thinking; Evidence based design, Application of specific results from POEs; Checklists; Charrettes; Collaborations; a Multi-disciplinary team; DQI (Design Quality Indicator) (Gann et al., 2003) and CFA (Comparative Floor Plan Analysis) (Voord et al., 1997). Some common practices should also be present to further design ideas. Thus, models and tactile maps are important and students should be encouraged to develop their visual communication and motivational skills to convey their ideas. Design methods should be tested in the studio setting, to provide students with a sense of security in tackling their decision-making process.

Finally, **Guidelines** for design decisions are important. Hunter (2010) divides these in two parts: the building proximity and the interior. For the surroundings questions such as an Accessible route, Urban mobility and Barrier free urban design must be addressed. The building also needs

identification through: Building form, Volumes, Physical separation, Clustering of components, Roof design, Location of openings, Cladding, Textures, Materials and Colours as well as Ornamentation. Site planning must pay special attention to shaping of the site and the buildings setting through Landscaping, Berms, Roadways, Pedestrian paths and the placing and detailing of Entrances and Exits. When the design is completed Hunter (2010) recommends the use of GPS to check the proposal in detail.

In relation to the building interior Hunter (2010) gives special attention to: Indoor outdoor connections; the placing of Orientation tactile maps; Identifiable circulation spaces (paths, markers, nodes intersection, edges, links entrances and exits, elevators, staircases, escalators); Mobility aids (people movers, fixed rail systems); Ramp and elevator location; Ramp design; Visual identities (environmental graphics, sign systems, orientation devices, “you are here” maps, real-time information devices, colour schemes); Hierarchy of places and spaces; Proxemics; Sensorial perception (sound, smell, touch, ventilation, temperature, light, colour); Layout (Furniture: type, quantity, distribution); Finishing and Furnishing materials; Ergonomic and anthropometrics; Fittings and accessories; Usability and flexibility of space and finally Variability of Wayfinding by building type.

These recommendations are extensive but provide the design instructor with a pallet of ideas and tools to test in the studio setting. Students can also profit from a better-structured design process and develop their attention to detail, when becoming aware of the large number of issues involved in designing with UD and Wayfinding in mind.

Conclusions

The teaching experience, as a Charrette exercise described in this paper, demonstrates that design professionals could increase their UD awareness by considering universal design a challenge beyond the mere incorporation of code requirements. However, the example made clear that a new design process is necessary for professionals to understand more profoundly the

needs of others, question traditional ways of doing things and be humble enough to accept participatory criticism during the design process.

For these changes to occur, design education must also change. The studio must open its doors more frequently to potential users with disabilities. The analytical phase of design must gain structure. Tools to understand various viewpoints, requirements and difficulties of users must be available.

Finally, the results of the teaching experience outlined several recommendations. These ideas provide guidance for a “design for all”, which should be tested in innovative practices both at the professional and educational levels. Collective learning can then be achieved through the sharing of experiences and the addition of insights to a more inclusive design process.

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