Human Factors in Public Facilities Design

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This article describes research examining people's perception of public facilities to show how consumers' beliefs can be used for environmental design and maintenance. In this study, beliefs about the negative aspects of public restroom environments were investigated. A total of 199 participants rated the level of various elements relevant to safety, design, and security. Cleanliness, better ventilation, and better maintenance were perceived as the greatest problems of public restroom designs. In general, females gave higher ratings. Many of the problem factors can be addressed using HF/E expertise.

INTRODUCTION

Public restrooms, like other public facilities, are frequently designed based on building codes and standards as well as other factors. However, human factors/ergonomics (HF/E) and usability are frequently not considered in the design (Crawford, 1996). Support of public facilities may in part be tied to the extent of enjoyment, productivity and safety resulting from their use. HF/E has tools for evaluating these aspects based on people' beliefs. For example, people's perceptions of parking facilities can influence effort and security which may in turn influence decisions to go to a facility (Mendat & Wogalter, 2003). Recently, Mendat and Wogalter (2003) examined people's perceptions of parking facility issues. Five main problem areas were revealed in their study: (a) compliance and visibility, (b) layout and design, (c) safety and crowding, (d) difficulties at access points and (d) environment and aesthetics. Aspects of each of these areas can be addressed by HF/E professionals. The present study addresses public restroom facilities using similar methods. Previous research has examined people's perceptions of private, home-based restroom facilities and found strong dislikes for particular aspects such as fixture design (Malassigne & Amerson, 1992). In another study, individuals expressed a preference for adjustable sink heights for different members of the household (Mullick, 2001). While research has examined private home-based restrooms, public restrooms have not received much attention. Cai and You (1998) found that participants considered sanitary conditions of public toilets unacceptable in a Taiwan metropolitan city. In a study conducted in England and Sweden (Vernon, Lundblad, & Hellstrom, 2003), found that many children avoided using restrooms at their elementary school because they were perceived to be unpleasant, dirty, smelly, and frightening.

Perceptions of public restroom facilities is a topic which warrants investigation for a number of reasons. First, there has been little research on the topic. Second, it has aspects such as comfort and safety that are areas addressed by HF/E professionals. Third, public restrooms are an evolving system (Bell, Fisher, & Looms, 1978; Soifer, 2000). Public restrooms will likely involve increased use of technology that not only addresses HF/E's core areas of comfort and safety but also the developing areas of sanitation and privacy. Thus, it is important for professionals to address modern concerns and suggest improvements.

The present research sought to investigate variables that may affect: (1) safety – privacy and security; (2) design, and (3) maintenance. The present study asked participants to list a number of potential negative characteristics of public restrooms and then to rate them on a nine-point scale according to the level or extent of being a problem.

METHOD

Participants. A total of 199 individuals participated (109 males and 90 females). The respondents ranged in age from 18 to 78 years (M = 24.5, SD = 9.08). A total of 168 participants were between the ages of 18 and 30 whereas the remaining 31 participants were between the ages 31 and 78. Of the participants, 84% were Caucasian and 72% of the participants were full-time students. Participants were recruited by means of an Ergonomics class research assignment in which students administered the questionnaires to participants visiting various places in the community (e.g., schools, malls, etc.).

Materials and procedure. The items examined were part of a safety and technology questionnaire. Participants were asked to evaluate a list of features according to extent to which they perceived it to be a problem for public restroom use. They made their judgments using a 9-point rating scale with the following numerical and textual anchors: (0) not a problem at all, (2) somewhat of a problem, (4) moderate problem, (6) very much a problem, (8) and extremely a problem.

Table 1. ***Mean (and standard deviations) problem-level ratings of public restroom facilities ordered from most to least problematic***

Feature	*Mean*	*SD*	*Feature*	*Mean*	*SD*
Cleanliness	5.83	2.42	Better drainage	3.20	2.27
Better ventilation	5.15	2.40	Easy access	3.19	2.31
Better maintenance	5.07	2.30	Better trashcans	3.11	2.46
Locking stalls	4.70	2.40	More dividers	3.04	2.61
Filled soap dispensers	4.58	2.36	More sinks	2.92	2.38
Better soap/dispenser	4.54	2.42	Supplies (condoms, tampons, etc.)	2.93	2.58
Stocked with supplies	4.54	2.43	Automatic Flush	2.85	2.52
More restrooms	4.39	2.60	Automatic equipment	2.75	2.40
Better toilet paper	4.39	2.66	Baby changing tables	2.75	2.51
More stalls	4.28	2.73	Restroom design/layout	2.69	2.21
Sanitary toilet liner	4.20	2.71	Foot flush	2.63	2.63
Privacy/security	4.13	2.41	Taller stalls	2.60	2.54
Hot water	3.96	2.64	Doors swing out	2.53	2.40
Larger stalls	3.71	2.55	Features	2.44	1.97
Better hand dryers	3.66	2.58	Purse holder	2.39	2.73
Better paper towels	3.49	2.52	More mirrors	2.13	2.25
Air freshener	3.28	2.67	Seat warmers	1.35	2.28
Better lighting	3.25	2.34			

RESULTS

The ratings for each item were averaged and then placed in order from highest to lowest mean rating. The problem mean and standard deviation for the public restroom features are shown in Table 1. Cleanliness, ventilation, and maintenance were perceived to be the greatest problems associated with public restrooms. The next highest problems were stall locks and supplies. Analyses of variance examining differences in overall ratings of the public restroom items as a function of education, student-status, age, and gender revealed only a significant main effect of gender, $F_{(1,197)} = 9.93$; $p < .001$. There were no significant interactions.

A factor analysis, similar to that performed by Mendat and Wogalter (2003), was conducted on the ratings to determine whether there was any consistent factor structure. A Principle Components Analysis with an orthogonal rotation was carried yielding a factor structure that was too dispersed for interpretation.

DISCUSSION

The current study addressed an area of research, which has not received a great deal of attention in the HF/E literature. Nevertheless, it is a topic important to many, as suggested by the data in this study and that in the study by Kennedy (2001). An interesting aspect of this research is that many of the issues deemed as most problematic by participants are areas of HF/E expertise. Some of the main issues include safety and security, lighting and access which HF/E professionals can readily make suggestions.

In addition to HF/E professionals, other professionals such as architects, security companies and personnel, and maintenance professionals can use the information from the current study to enhance the design of current and future public restrooms. Architects could address a number of issues in their design of public restroom facilities. It may be also beneficial for maintenance organizations to increase the number of rotations through the facilities and perhaps train staff members to be more vigilant regarding supplies and potential safety hazards such as inoperable equipment and/or damaged parts.

State and local governments might incorporate results like those of the present research to indicate minimum standards that must be met. Mullick (1999) suggests that basic core accessibility requirements inadequately address the needs of abled and disabled users. Clearly, architects and maintenance professionals must consider core guidelines and code, as well as economic factors. However, the findings from this research may serve as additional suggestions for public restroom design by incorporating the consumers' perspective. Improved public restroom facilities may help create a better experience, or at least not a negative one, for the consumer and may in turn increase traffic in respective businesses yielding benefits for both consumers and businesses.

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