UC Berkeley
Indoor Environmental Quality (IEQ)

Title
A web-based occupant satisfaction survey for benchmarking building quality

Permalink
https://escholarship.org/uc/item/0hs9x6gm

Authors
Huizenga, Charlie
Laeser, Kathryn
Arens, Edward

Publication Date
2002-06-01

Peer reviewed

eScholarship.org Powered by the California Digital Library
University of California

A WEB-BASED OCCUPANT SATISFACTION SURVEY FOR BENCHMARKING BUILDING QUALITY

Charlie Huizenga, Kathryn Laeser, Edward Arens
Center for the Built Environment (CBE), University of California, Berkeley

ABSTRACT

Occupants remain a largely untapped source of information for facility managers interested in improving the performance of their buildings. An appropriate web-based environmental quality survey offers opportunities to broadly include occupants in a building performance feedback loop. We have developed a survey that can measure occupant satisfaction with indoor environments in a standardized manner while minimizing research costs and inconvenience to the survey participants. A standard set of core questions is used to measure satisfaction with environmental factors such as indoor air quality, thermal comfort, and acoustics. "Branching" questions are used to capture detail for diagnosing causes of perceived problems. The survey has been extensively tested and refined. It has been applied in a variety of research scenarios, three of which are presented in this paper: evaluating the effectiveness of a design intervention, informing the development of design guidelines for a new building, and benchmarking facility performance.

INDEX TERMS

Occupant satisfaction, Perceived performance effects, Web-based surveys, Benchmarking building quality, Online reporting

INTRODUCTION

Historically, building occupants have been underutilized as a source of information on building performance. Prior to web-based surveys, creating, distributing, and analyzing paper questionnaires was a time consuming and expensive process, and diagnostic paper surveys necessarily took a long time for occupants to complete. In addition, surveys have tended to be project-specific and not often repeated. One exception is the Probe study in which a standardized survey was used to benchmark building performance (Leaman et al, 1997). At the Center for the Built Environment (CBE), our approach is similar in that we've created a standardized environmental quality assessment survey that can be applied widely and used to systematically compare the performance of multiple buildings, as well as evaluate the performance of an individual building. The survey grew out of earlier thermal comfort surveys conducted by CBE (Benton, 1994; deDear, 1997; Schiller, 1988), but the focus has now shifted to a new audience – facility managers and building owners involved in acquiring, operating and improving their building portfolio. Working with several of our industry partners, the survey has evolved into a web-based tool that measures employees' satisfaction with their workplace environment quickly and at a low cost.

METHODS

The survey is comprised of a core survey and optional survey modules. Each organization using the survey has the option of employing the core survey or customizing the survey to include additional modules that support their information needs. The core survey includes modules for office layout, office furnishings, thermal comfort, air quality, lighting, acoustics, and building cleanliness and maintenance. Examples of optional modules include wayfinding, safety and security, and air diffusers. Core questions stay consistent from survey to survey to maintain data integrity for the purposes of benchmarking and trend analysis.

https://escholarship.org/uc/item/0hs9x6gm

The survey has been extensively tested and refined, and facility managers and designers to have evaluated the reporting format to determine the utility of various report designs. An established in-depth pre-testing method called cognitive interviewing was used by the Survey Research Center at the University of California, Berkeley to assess how well respondents were able to comprehend and accurately report answers to survey questions (Eisenhower, 2000). Cognitive interviews allow researchers to examine the thought processes that affect the quality of answers provided to survey questions. The primary technique used was the "concurrent think aloud" whereby respondents were asked to comment out loud about anything crossing their mind as they read, interpreted and answered each question. This technique was supplemented by paraphrasing (asking the respondents to put something in their own words) and systematic probing. Seven people participated in this testing. Results were used to refine the survey organization, question text, graphic design of the scales, and the process required to access the survey website.

The time to completion has been monitored, and occupants have evaluated the length of each section of the survey. Approximate time to completion for the core survey is 5-12 minutes; time to completion varies depending on the number of branching questions and comments answered. This length of time has not been regarded as an impediment to completion in most (but not all) of the buildings surveyed to date. Surveys that include several customized modules in addition to the core survey have had completion times of up to 20 minutes. Organizations that choose to implement longer surveys are briefed regarding the potential negative effect that longer time to completion can have on response and completion rates.

The survey implementation process typically begins with an email informing building occupants of the survey web site address, start date and end date. This email is drafted and sent either by CBE or the sponsoring agency. Subjects can open the survey at their convenience. After linking to the survey, respondents see a welcome screen informing them of the purpose of the survey. The welcome page also advises them of the amount of time it should take to complete the survey, and their rights as a research participant. Participation in the survey is voluntary and anonymous. Upon starting the survey, participants click through a series of questions asking them to evaluate their "satisfaction" with different aspects of their work environment. Satisfaction is rated on a 7-point scale ranging from "very satisfied" to "very dissatisfied". In most cases, respondents who indicate dissatisfaction (the lowest three points on the scale) with a particular aspect of their work environment are branched to a follow-up screen probing them for more information about the nature of their dissatisfaction. Respondents who indicate neutrality or satisfaction (the upper four points on the scale) move directly to the next survey topic. When applicable, respondents are also asked to assess the impact of environmental factors on their effectiveness in getting their job done.

FIGURE 1. Sample occupant satisfaction question (screen shot of web-based survey)

Occupant responses are collected via the Internet and recorded to a secure SQL server database hosted by a third party vendor. A survey typically stays open for 1-2 weeks. The rate of participation is monitored; if it is going slowly, reminder emails may be sent. After the survey is closed, the data is cleaned. Responses of participants who answer less than 15 questions are removed from the final data set. Of the buildings surveyed to date, response rates have ranged from 27%-88%, with the majority of response rates between 45%-65%. Overall, we've found that response rates are higher when the initial message introducing the survey is sent directly from a

person who is well known, respected and a decision maker within the participating organization. The introductory email for the survey with the lowest response rate was poorly executed; it was forwarded three times before it reached the occupant, each time with an additional header attached. By the time it arrived to the intended recipients, the reader needed to scroll to the bottom of the message to read the original text. This diminished the perceived importance of the study and is likely to have resulted in the low response rate. The study with the highest response rate was introduced with an email sent directly from the head of the organization noting an "important survey" for all building occupants. While likely leading to the high response rate, often this type of cooperation and attention from the head of an organization is difficult to orchestrate.

Data is reported using a web-based reporting tool. Satisfaction ratings are tabulated for each point on the scale, and are also summarized into three bins: satisfied (top three points), neutral (middle point) and dissatisfied (bottom 3 points). This summary is particularly useful to managers that need to see a top-level overview of occupant feedback. Comments are also listed in totality for each question. We have learned that reviewers typically scan these comment lists right after looking at the summary page on the front (Baughman, et al, 1995). To protect the confidentiality of participants, the online report contains only aggregated, anonymous results. The tool has tiered security access, allowing participating organizations to view their own results in full but keep detailed comments and building identifier data confidential.

APPLICATIONS & FINDINGS

The survey has been used to evaluate the performance of 22 buildings in the United States including office buildings, laboratories, banks and courthouses. Findings from several of these studies are highlighted below.

CASE ONE: OFFICE SPACE, NEBRASKA USA

In summer 2001, the CBE survey was used to evaluate the effectiveness of a building's under floor air distribution (UFAD) system. The survey response rate was 75%. Results showed that overall, occupants sitting in areas with overhead air distribution were more satisfied with the air quality in their workspace than occupants located in areas with a UFAD system (see Figure 2). This result was unexpected and warranted further analysis. Additional comments provided by respondents suggest two possible reasons for this result: occupants were not using the floor diffusers provided in their workspace because (a) they didn't know that they exist or (b) they were too difficult to adjust. For example, one occupant wrote, "I didn't realize I had any control of the floor vent until I filled out this survey (neither did some of my co-workers)". In addition, when occupants located in the UFAD section were asked if they have ever requested the relocation, removal or addition of a diffuser within the proximity of their workspace, 100% of the occupants responded "no". When asked how often they adjusted the airflow through floor diffusers located within the proximity of their workspace, 53% responded "never". These occupants needed to be informed about how to use the diffusers to control the air quality and thermal environment in their workspace.

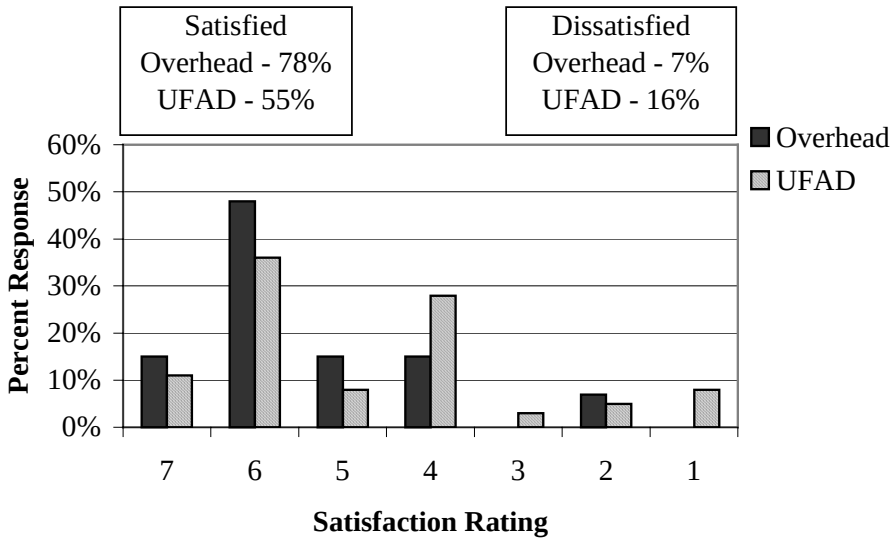

FIGURE 2. Comparison of air quality satisfaction ratings for occupants located in areas with an overhead air distribution systems vs. a UFAD system.

The results also revealed that occupants located in the UFAD section were more dissatisfied with the temperature in their workspace (50% dissatisfied in UFAD area, compared to 40% dissatisfied in Overhead area). When probed with branching questions as to the reason for their dissatisfaction, occupants responded that their workspace was often too hot or too cold. The most common descriptions of the source of the discomfort were "air coming out of the vents is too hot or too cold", "thermostat is inaccessible" and "my area is hotter/colder than others". This suggests that the supply plenum temperature and pressure settings were not adjusted appropriately in the UFAD system.

CASE TWO: LABORATORY SPACE, CALIFORNIA USA

In November 2001, the survey was used to evaluate the pros and cons of an organization's existing lab space in order to aid the development of design guidelines for a new lab. The survey response rate was 88%. Results highlighted characteristics of the current space that should be retained in the new space, as well as problems that need to be changed. The results also pointed out several opportunities for improving the current space that will immediately solve problems existing there.

The two categories with the highest level of dissatisfaction were general cleanliness (86%) and sound privacy (86%). The drill-down questions for cleanliness indicated problems with dust, spills and debris, mold on the walls and dirty floors. Occupant comments emphasized a problem of inadequate storage that results in files and books being stacked in the hallways. These findings show several opportunities to modify the existing space that can improve the current work environment at a relatively low cost. The cleaning service can be expanded to include dusting work surfaces and cleaning floors on a regular basis. Walls can be cleaned and repainted in problem areas. Vertical storage can be investigated as a possible short-term solution for making existing storage areas more effective. And a space can be designated for private telephone calls and discussion. The survey revealed positive results for lighting and ease of interaction with co-workers; over 75% of occupants are either satisfied or neutral about the lighting and ease of interaction with co-workers in their current workspace. This informs designers to maintain the quality of these characteristics in the new space.

Overall, however, many of the other environmental factors were rated low; over 50% of occupants reported dissatisfaction with cleanliness and maintenance, noise level, office layout, furnishings, air quality and thermal comfort factors. Since the new laboratory space is to be built to suit, its facilities management has an opportunity to make significant improvements in the design of the new work environment.

CASE THREE: OFFICE SPACE, CALIFORNIA, NEBRASKA, PENNSYLVANIA, FLORIDA USA

Case three shows how the occupant satisfaction survey can be used as a benchmarking tool. One CBE partner organization has used the survey to elicit feedback on how successful each newly constructed building is in meeting its design goals. By viewing the survey results for each building side by side, they can gauge the overall performance of their real estate portfolio and identify anomalies within it.

The survey was used to measure occupant satisfaction six months after construction was complete and occupants had moved into the space. Response rates ranged from 27%-48%. The graph above compares the performance of four buildings, summarizing results from each of the survey's major categories and grouping responses in each category into a single, un-weighted ranking (see Figure 3). Overall, results show that the buildings are performing well across all categories. By calculating and charting a mean score for each category, building managers can assess whether their building is performing above or below the company average. For example, the Pennsylvania facility is performing nearly one point below the mean score in the category of air quality, suggesting that this facility ought to be inspected for potential air quality problems.

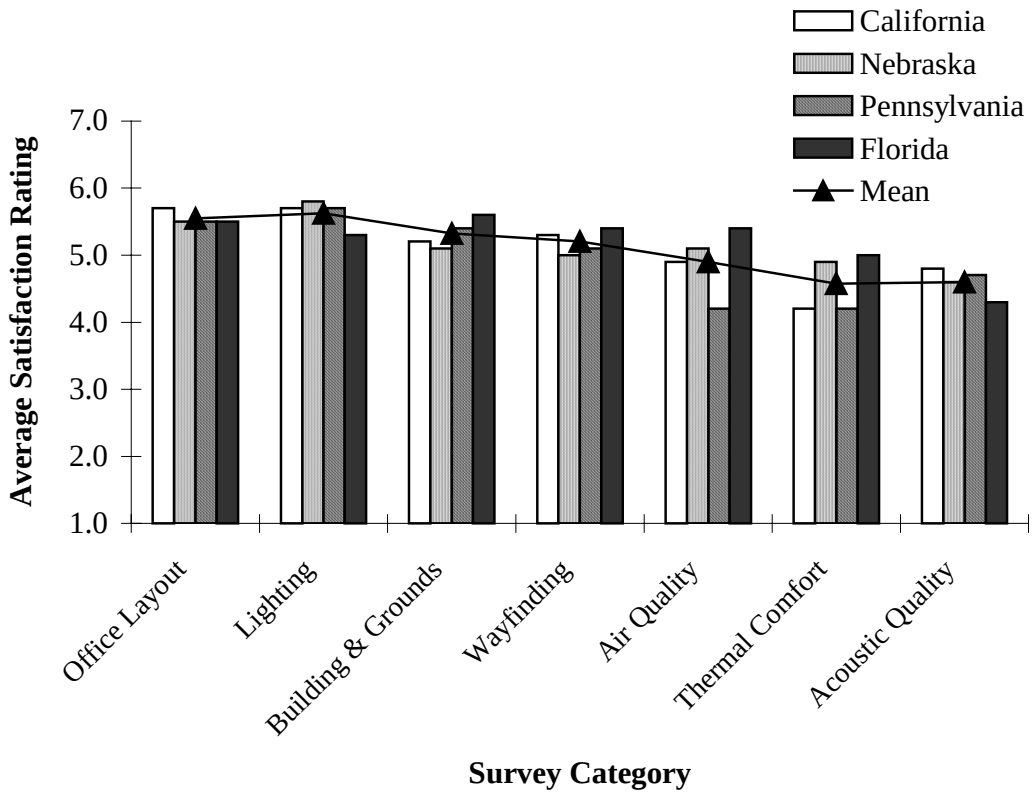

FIGURE 3. Benchmark comparison of average satisfaction ratings by survey category of four office buildings owned by the same organization.

CONCLUSION

With each implementation, facilities professionals have found the occupant satisfaction survey to be useful. The results provide valuable information for evaluating facility investments. In the three case studies presented, the survey was used to evaluate the effectiveness of a design and the way it is operated, inform the design guidelines for a new building and benchmark facility performance. The survey can also be used to identify environmental factors that need improvement, diagnose causes of occupant dissatisfaction and monitor occupant perception of building service contractors' performance. The survey time to completion is short, allowing it to be repeated, perhaps as often as twice a year. This could be used to observe trends in ongoing building performance, to evaluate the effectiveness of service contractors, and to correct problems with the building's operation.

The survey's automated reporting and analysis features are currently being enhanced with a new graphic interface offering an executive level view and the ability to drill down to detailed comments. Benchmark analysis is also being automated, allowing aggregate data for a collection of buildings to be sorted and viewed by specific attributes such as building type, region, year constructed and square footage. This sorting feature will facilitate the mining of the overall database to investigate a wide variety of building performance trends.

ACKNOWLEDGEMENTS

CBE's industry partners have supported the development of the survey and reporting tool, particularly the International Facility Management Association (IFMA), the United States General Services Administration (GSA), the California Department of General Services (DGS), and the architecture firm Skidmore, Owings and Merrill (SOM).

REFERENCES

Baughman, A., E. Arens, F. Bauman, and C. Huizenga. 1995. "Indoor Environmental Quality (IEQ) Assessment System: Development of IEQ Method and Field Demonstration at UC Davis Medical Center." Report to Johnson Controls, Inc., Center for Environmental Design Research, University of California, Berkeley, CA, 150pp.

Benton, C.C., and G.S. Brager. 1994. "Sunset Building: Final Report -- A Study of Occupant Thermal Comfort in Support of PG&E's Advanced Customer Technology Test (ACT^2) for Maximum Energy Efficiency." Center for Environmental Design Research, University of California, Berkeley, June 8, 76 pp.

de Dear, R., Brager, G., and D. Cooper. 1997. "Developing an Adaptive Model of Thermal Comfort and Preference." Final Report on ASHRAE Research Project 884. Macquarie University-Sydney, 296 pp.

Eisenhower, D. 2000. "Documentation of the Results of the Cognitive Testing for the CBE Post Occupancy Evaluation Survey." Report to the Center for the Built Environment, Survey Research Center, University of California, Berkeley, CA.

Leaman, A., W. Bordass, R. Cohen, and M. Standeven. 1997. "The Probe Occupant Surveys, Buildings in Use '97: how buildings really work." London Commonwealth Institute.

Schiller, G., E. Arens, and C. Benton. 1988. "A Field Study of Thermal Environments and Comfort in Office Buildings." ASHRAE Transactions, Vol. 94, Part 2, 27pp.