Creating Environments that Promote Efficiency and Sustainability: Anthropological Applications in the Building/Construction Industry

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ABSTRACT

People are influenced to behave in an energy efficient and sustainable manner when the physical and social/cultural environment they inhabit encourages such behavior. The environments we construct for building occupants must generally meet their varying physical, psychological and social/cultural needs or they'll figure out a way to meet them on their own, often with negative energy and sustainable repercussions. And any messages crafted to promote desired behavior and decision making must be socially/culturally relevant to be effective – both the message content and means of conveyance.

The behavioral sciences can assist in creating, evaluating and maintaining efficiency promoting environments. In particular, anthropology provides methods for collecting the stories of occupants and O&M personnel, understanding human behavior and occupant needs and applying that understanding during programming/planning, design, commissioning and post occupancy evaluations. This paper will present a methodology with case study examples on how to apply anthropology to design, retro-commissioning and post occupancy evaluations.

Why Anthropology?

Anthropology is the comparative study of humans, including our physical form, our societies and cultures and the ways we manipulate our environments, in all their various manifestations across human history. It is commonly thought of as an "academic" discipline and many in the building construction industry question what application it has for them on a daily basis. At least this has been the experience of the author.

However anthropology and other human centered studies, such as sociology and psychology, have applications that range far beyond the halls of academia. Given that anthropology encompasses a vast body of human centered knowledge and understanding that is currently unknown to most in the building construction industry, it has great potential in helping us better understand the humans who live and work in the facilities we design, build and operate. Other industries have already embraced anthropology, including health care, retail, computer chip manufacturing and web-interface design. The question should not be why the building construction industry should apply anthropology on a daily basis, but why it doesn't, and what it costs society as a result?

Three case studies will be used to explore these questions: a 2005/2006 post occupancy evaluation of the Edward Gonzales Elementary School in Albuquerque, N.M. (Human Inquiry 2006), a 2009/2010 retrocommission of the General Services Administration's (GSA) Conrad Duberstein U.S. Courthouse and Post Office in Brooklyn, N.Y. (M.E. GROUP, Inc. 2010) and a 2011/2012 post occupancy evaluation of the V. Sue Cleveland High School in Rio Rancho, N.M. (M.E. GROUP, Inc. 2012). However, first a brief anthropological primer is needed.

Anthropology 101

The four major subfields of anthropology – cultural, physical, linguistic and archaeology – all provide methods and interpretive theoretical frameworks for understanding human behavior and applying that understanding during building design, construction and operation. Out of these four subfields, this article will focus primarily on what cultural anthropology has to offer, particularly regarding social/cultural factors. Such factors typically refer to aspects of behavior and interactions that bind groups of people together - from nuclear families to nations. Several examples are provided in Table 1.

Table 1. Examples of Culture

Examples of Categories	Some Specific Examples
Forms of Communication	language, symbols, body language
Values	conservation, individuality, equality, service, responsibility, accuracy, respect, diversity, sustainability, education
Gender Roles	masculine (male), feminine (female), androgyny (third or neutral); tied to socially appropriate roles (jobs, activities, etc.)
Employee Category Roles	office worker, laborer, engineer, secretary, teacher, politician
Technology / Material "Things"	computers, systems furniture, light fixtures, thermostats, clothing, glazing
Preferences	Music, food, clothing, hobbies, temperature, personal space, privacy
Processes	design phases, work order procedures, formal and informal rules of interaction between occupants and O&M staff

As we learn, or are indoctrinated within a given culture, particularly as we're growing up, our cultural surroundings, or "cultural scripts", train our brains to use the basic psychological machinery we all have in different ways. This influences our perception of the world around us and what we consider normal behavior when interacting with others and performing tasks. Culture provides us with a lens through which we view and interpret the world, helping to generate our specific experiences. Culture helps us tell the difference between being comfortable and uncomfortable, thermally, visually, socially, or otherwise (e.g. Dourish 2007). It is also embedded in the organization and operation of our physically constructed environments.

For example, thermal comfort — that state of mind resulting from our ability to maintain thermal equilibrium with the surrounding environment — is dependent primarily on the following six factors: air temperature, mean radiant temperature, air movement/velocity, relative humidity, activity levels, and the insulative properties of clothing (ANSI/ASHRAE 2010). The socially/culturally acceptable clothing styles that we grow up with are part of what generate the experience of being thermally comfortable in a given situation. They are part of the norms we learn from our family, peers, schooling, company policies and the mass media, and they vary by such things as job type, gender, age and class. The perception of thermal comfort is therefore tied not only to our physiological and psychological reactions to the above six factors, but also to our ideas of "social comfort" related to conforming to one's social/cultural clothing norms. This creates many potential settings for thermal comfort conflicts among different demographic groups possessing different clothing norms, and therefore different insulative values of dress (M.E. GROUP, Inc. and Gallup Consulting 2009).

Taking the Duberstein facility as an example, the tenants were surveyed by the General Services Administration (GSA) in May/June 2009 (255 responses; 60% response rate). The author ran a student's t-test (2 tail, type 3) comparing the responses of men vs. women for each

question. While the differences in the responses were not found to be statistically significant (p-value < 0.05) for any of the questions, the p-values were very close to significant for the temperature rating questions. Physiological differences relative to thermal comfort between men and women (Karjalalainen 2007) contributed to this, but it is also true that insulative values of clothing and the amount of skin coverage often differ between men and women (Morgan and Dear 2003). In subsequent interviews conducted by the author over two days in November of 2009 with 193 of the building occupants, such differences in dress and skin coverage between the men and women were observed, particularly on the lower half of the body with women sometimes wearing skirts or skirt suits. This likely contributed to the differences in their temperature rating responses.

The interviews also indicated that women were more likely to be cold as a result of the facility's HVAC zoning and operational problems, due in part to the differences in skin coverage and clothing insulative values. Women were also more likely to use space heaters; a practice officially discouraged by the GSA yet allowed to make work bearable for a demographic whose discomfort was exacerbated by social/cultural factors influencing dress.

Applying Anthropology to the Built Environment

Anthropologists and other behavioral experts employ a number of data gathering techniques in the field and subsequent analytical techniques for use on the resulting data to understand the influences of social/cultural factors in any given setting. In the case of the built environment, a primary goal of such efforts is to discover patterns in the data that will provide insight into a) the relevant social/cultural norms in play, b) what occupant needs are and aren't being met and why, c) the resulting impacts on occupant productivity and health as well as building performance and d) what action items could be taken to improve the situation.

Programming, Planning and Design

In general, programmers and designers can employ anthropologists or other behavioral experts to participate in design charrettes and review master plans, design narratives and other design documentation during programming/planning and design phases. They can provide their input on whether or not the contextual needs of occupants and O&M staff are being met and look for opportunities to nudge behavior in desired directions (e.g. Bin 2012). For example, does it look like building occupants will be furnished with adequate local control over their immediate work environment? If not, what are the reasons? Are cost constraints limiting the number of HVAC zones or the purchase of task lighting? Are building operators strongly averse to giving occupants any local control? What are the costs for not providing it? In the Conrad Duberstein facility, the lack of individual control of the overhead lighting in a large number of the individual offices was conservatively estimated to be costing the tenants almost $1.06 million dollars annually in lost productivity.[1]

[1] On the courthouse side of the Duberstein facility, a large percentage of the 550 occupants' individual office overhead lighting was controlled by occupancy sensors only. Many interviewed stated they had wanted individual control for a long time. Multiple lab and field studies referenced in the Duberstein case study, exemplified by studies such as Boyce et al. (2006), found increases in performance ranging from 2% - 42% correlated with increased individual lighting control. Those most similar to the Duberstein setting averaged an increase of 6.9%, though

If messaging is used to nudge behavior, anthropologists can apply their understanding of the building occupants to assist in crafting such messages to portray the desired behavior as normative. However, the effectiveness of the message will depend on how well it "speaks" to the building population. The more variable the population, the more varied the social cultural norms regarding sustainable/energy conserving behaviors. This makes it harder to craft a message that inspires all of the building occupants. Multiple messages or message formats may be required. In the case of the V. Sue Cleveland High School, there were many comments made about trash and recyclables not always making it into the receptacles; this was also observed. Many thought that the receptacles were not as noticeable as they could be. To increase their visual interest among the student body, different grades, classes or clubs could "adopt" the receptacles across campus and be in charge of refurbishing them. These refurbishing activities could be captured in photos and video, along with students using the receptacles as intended, and made into posters displayed across campus. The videos could be played on the TVs across campus as well. In general this would help establish more student ownership of the receptacles, as well as the process of recycling and keeping the campus clean. Using the students themselves, preferably from multiple grades, both genders and multiple "cliques," in the posters and videos would also help establish the portrayed behavior as normative.

Commissioning and Building Operations

Commissioning agents can employ anthropologists to essentially do the same reviews discussed above as part of the enhanced commissioning effort. Anthropologists can also assist commissioning agents develop owner operational requirements, training processes and equipment manuals that best meet the needs of the specific O&M staff in question. In addition, anthropologists can help commissioning agents communicate the differing perspectives in place among the key stakeholders. This facilitates understanding and two-way communication of occupant vs. O&M needs and project constraints (Harmon 2011a). Building operators themselves can employ anthropologists to assist them in improving the quality of their interactions with the building occupants, whether that's via the work order process, service calls or building scheduling. In each of the three cases studies focused on in this article, the evaluation process inherently facilitated this two-way communication. Each stakeholder groups' concerns, needs and constraints that were learned were passed along to the others during the fieldwork and subsequent report presentations.

In the case of the Edward Gonzales Elementary school, a twice-daily school-wide light sweep or "flicker" was implemented to remind teachers and staff to take advantage of the daylighting and turn off lights when not needed. Though well intended, this decision created a backlash because of the resulting several minutes of disruption in student focus with every flicker. The anger and frustration were so great among some teachers that lights were deliberately left on as way to regain some sense of personal control over their own spaces, reducing the intended energy savings. As a result of the collected narratives and survey results, several set point modifications were made to address complaints while still maintaining the sweep's original function of minimizing unnecessary use of the light fixtures. By engaging

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excluding an outlier brought this down to 2.6%. Starting with this and adjusting based on findings from the facility's evaluation; then using an average salary of $120,000 (including benefits) from the 2009 Federal Government General Schedule Base Pay Rates for the employee categories present, the above productivity impact was estimated.

teachers, staff and students in an evaluation of the facility, their stories, needs and input were taken into account in developing a solution that had their buy-in, increasing their own satisfaction and performance, as well as that of their students, and the energy efficiency of the school (i.e., not deliberately keeping the lights on out of frustration). At the same time, this provided an opportunity for the administrators, O&M staff and designers to educate the teachers and staff on the specifics of both the how and why of the building's lighting control system. As a result, teachers and staff were more cognizant of keeping the lights off when adequate daylight was present, and they were more willing to accept a modified version of the light sweep.

Post Occupancy Evaluations

Whether instigated by building owners, designers or commissioning agents (for retrocommissioning related work), post occupancy evaluations, as the case study examples demonstrate, are greatly enhanced when anthropologists and other behavioral experts are involved. The level of involvement does not have to be extensive for anthropologists to provide valuable insight, but it is far more effective when they are able to engage the building occupants and make observations first hand using the ethnographic methods discussed below. However, some may question the cost of these efforts, and this is a fair question.

Financial Justification of Incorporating Anthropological Services

Table 2 provides the estimated cost[2] of the anthropological focused services provided for the Duberstein facility, along with the total cost, projected energy and productivity savings and simple payback of all of the behaviorally focused energy conservation measures (ECMs). These included a) the implementation of one-way messages, b) increasing actual and perceived local environmental control, c) involving the occupants in formulating solutions and d) adding point of use, real time, recordable energy meters at each workstation. The goals of these ECMS were to increase energy conserving behavior, productivity and the acceptance of all ECMs. The estimated total implementation costs included both the facility improvement costs and additional efforts at occupant engagement. Accounting for the estimated energy savings only, the simple payback was 1.92 years; including the estimated productivity savings dropped the payback to 0.30 years.

Table 2. Conrad Duberstein U.S. Courthouse and Post Office's Behavioral Related Energy Conservation Measure (ECM) Total Cost and Estimated Payback

Estimated cost of Anthropological Related Services	Behavioral Related ECM Estimated Total Implementation Costs	Behavioral Related ECM Estimated Annual Energy Savings	Simple Payback (Energy Only)	Behavioral Related ECM Estimated Annual Productivity Savings	Simple Payback (Energy Plus Productivity)
$10,000.00	$384,777.00	$201,195.00	1.92 yrs	$1,060,000.00	0.37 yrs

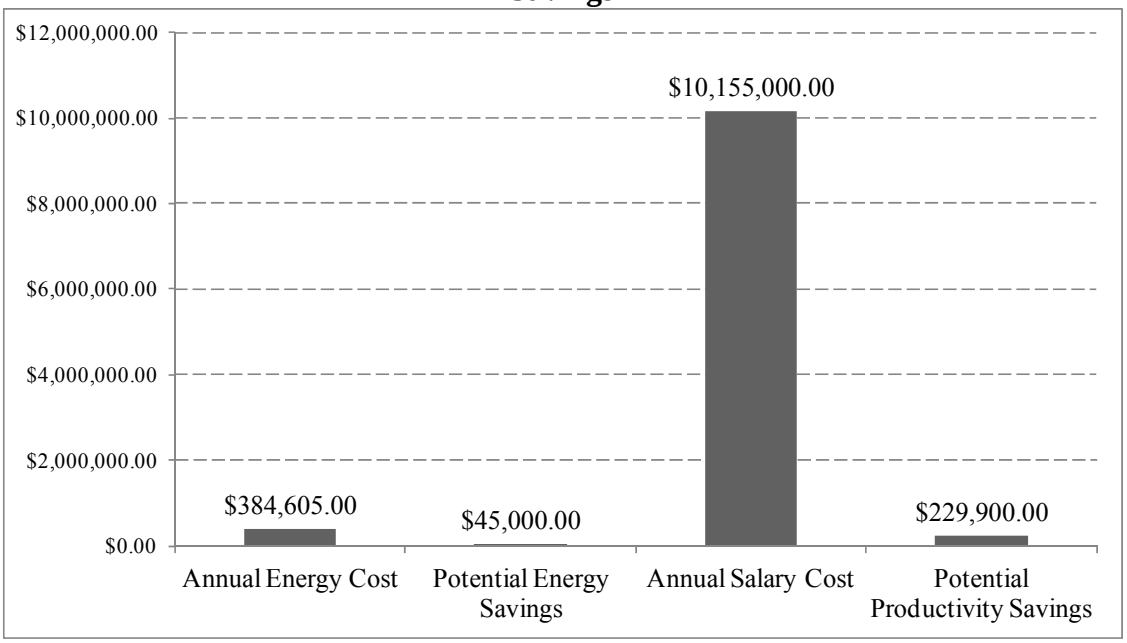
Source: M.E. GROUP, Inc. 2010

[2] These services were provided to the GSA at no additional cost as a pilot study to demonstrate the potential for incorporating such anthropological related services in retrocommissioning projects. As such, this number is an estimate of the fee for the services provided.

In the other two case studies, suggested improvements were also formulated as part of the final deliverables, but the estimated costs and savings were not calculated for each individual item. Figure 1 does provide V. Sue Cleveland High School's a) annual energy costs, b) potential overall energy savings from making the suggested improvements, c) the annual salary costs of all 173 full time equivalent (FTE) teachers and staff and d) some of the potential productivity savings estimated from making the suggested improvements. The fee for the post occupancy evaluation was just shy of $38,000.00 and the total potential annual productivity and energy savings was estimated at $274,900.00. For arguments sake, assume the proposed facility improvements would cost a maximum of $100,000.00. The simple payback for conducting the anthropologically focused post occupancy evaluations would be 0.50 years accounting for both the projected energy and productivity savings.

Perhaps even more important is the potential in improvement of the school facility for learning. The visual contrast and glare issues occurring throughout the school were estimated to be having a negative impact of 1.50% on math test scores and 0.91% on reading test scores, based on past research by the Heschong Mahone Group (2003) applied to this school with the knowledge gained from the POE. These figures should be viewed only as estimates, though every effort was made to calculate these values conservatively. In general, the physical environment will likely have a relatively small impact overall on student test scores because there are so many other variables at play (Heschong Mahoney Group 2003). However, these productivity and performance impacts are constant, will likely get worse over time if not addressed and are in the school district's control to address.[3]

Figure 1: V. Sue Cleveland High School's Energy and Productivity Related Costs and Savings



Source: M.E. GROUP, Inc. 2012

[3] It should be noted that the Rio Rancho School District is taking steps to address the glare and visual contrast problems as well as other issued uncovered during the post occupancy evaluation.

Figure 1 also clearly demonstrates the gross difference in an organization's "people" costs vs. its facility costs, a relatively well known fact pointed out by others previously (Fisk 2002). For Duberstein, the estimated overall annual productivity savings anticipated from implementing all of the ECMs were calculated at almost $3,600,000.00 while the projected annual energy savings was calculated at just under $875,000.00. The costs relative to the anthropological services themselves for the V. Sue Cleveland and Duberstein were only 16.5% and 0.3% of their respective projected annual productivity savings, and for most projects such fees will likely range from $5,000.00 - $45,000.00.

It is true that a percentage of these overall productivity savings presented here were the result of facility and O&M process improvements (and not behavioral focused modifications as presented in Table 2), and therefore could be obtained through traditional evaluation or retrocommissioning efforts, even if unwittingly. However, the anthropological services a) facilitated a focus on productivity that would not have happened otherwise, b) facilitated a more accurate estimation of productivity impacts by using the contextually gathered data to strategically apply previous research on productivity to these specific facilities and c) increased the facility focused and O&M process ECMs' chances for success. This increase was the result of incorporating the additional knowledge gained of the occupant needs and behaviors into the development of the facility improvements and ECMs, as well as the communication facilitated between the key stakeholders.

Finally, though more difficult to quantify financially, the insights gained from incorporating anthropological services (and conducting evaluations in general) can be used for future projects to further ensure their success. In the author's opinion, it is financially foolish to not include anthropological or other behaviorally focused expertise in the design, construction and operation of our built environments. Nor is it ethical in the author's opinion, considering the larger social and environmental consequences to such things as the daily quality of occupant experiences, student learning, patient recovery rates, energy consumption and CO2 emissions. Now that the need has been established, some of the specific anthropological methods will be covered.

Ethnographic Methods

Ethnographies are typically defined as systematic analyses of human interactions in a defined space and time, with a focus on performance, power relationships and ritual, including habits, processes, procedures and events. The concepts apply to all human groups, from Amazonian hunter/gatherers to corporate board members. Ethnographies of the built environment would include examinations of building and occupant performance, and how that performance is impacted by power differentials, occupant and organizational habits, processes and procedures, met and unmet needs and other human factors (Harmon 2011b).

Context. Four key ethnographic concepts (Beyer and Holtzblatt 1998) are important to discuss here, the first one being *context*. This refers to the interrelated conditions within which something occurs or exists – it is where the action occurs and shapes how the action plays out. This means that in order to understand what's going on in any specific built environment, an anthropologist will a) go to the occupants and O&M staff; b) observe daily activities, processes, procedures and interactions where they normally occur; and c) interview occupants and O&M staff while they are working, in their normal context.

This approach allows the anthropologist to discover details and intricacies of occupant behavior, met and unmet needs, social/cultural norms, organizational structure, O&M processes, and interactions among the occupants and O&M staff that may have direct impacts on such things as spatial layouts, system and controls selections, occupancy schedules and needed training and education. Because being in context helps spur occupant and O&M staff memory regarding concerns they may have, or why they take certain actions, and it helps the ethnographer see it from their perspective.

Partnership. The second key concept is the *partnership* that needs to occur between the interviewer (ethnographer) and interviewee (occupant and/or O&M staff). This partnership should be characterized by a) cooperation between both parties; b) a master/apprentice relationship, where the ethnographer is the apprentice, encouraging occupants and O&M staff to share their expertise, experiences and stories; c) recognition that the occupant and O&M staff are the experts – the one person who knows the most about his work is the one doing it; and d) coming into the process expecting to learn.

Interpretation. *Interpretation* is the third key concept, and it refers to the assignment of meaning to observations. The ethnographer will always try to establish meaning in what is discovered, whether analyzing equipment failure or what individuals' postures, positions, and gestures say about the nature of their interactions and the social/cultural norms in play. Interpretation will typically consist of a) observing a fact; b) generating a hypothesis that has an implication for programming, design or operations; and then c) formulating a programming, design or operations idea. The ethnographer can then discuss the interpretations with the occupants or O&M staff, watching and listening for signals whether or not they agree with the interpretation. Table 3 provides an example.

Table 3. Example of Interpretation

Fact Discovered in the Field	Hypothesis w/ Design Implications	Design Idea	Feedback
Teachers failing to take advantage of available daylight because they tape papers and posters on the windows due to glare and a lack of adequate wall space for hanging things	Better daylight control plus an alternative location or means to hang things equals more use of daylight	Adding an exterior light shelf plus manual blinds that papers can be also be clipped to, still allowing for adjustment of the blinds.	Discussions with teachers indicate clipping papers to blinds would be an acceptable compromise.

Source: M.E. GROUP, Inc. 2012

Perspective. The last concept is *perspective*, one's personal point of view, consisting of a set of pre-conceived assumptions and beliefs, largely influenced by one's social/cultural background. In addition to recognizing that owners, designers, builders, operators and occupants have their own biases and personal agendas, the ethnographer must also acknowledge his/her own biases. By recognizing the different perspectives in play, and communicating those differing perspectives among the key stakeholders, the ethnographer can help create an understanding of the needs and project constraints among all of the stakeholders. The increased awareness generated will help ensure that a) needs are understood and adequately met, b) occupant and O&M expectations are more in line with what is possible and c) implemented social control measures are congruent with occupant social/cultural norms.

Key Data Gathering Methods

Ethnographies of the built environment as practiced by the author require the use of four key methods that will be briefly discussed here – interviews, observations, surveys and space condition assessments. Traditional ethnography consists of the first two methods. The use of surveys and space condition assessments as described below originate outside anthropology.

Interviews

Interviews should be conducted of all occupant groups to gather information related to the users' perceptions of, and the interactions occurring within, the built environment. As previously discussed, it is imperative that interviews be conducted within the appropriate context where the interviewees perform their daily tasks. Observations of some form are also typically made while conducting interviews in context.

To begin an interview, an ethnographer may ask what the interviewee was doing in this space before the interview started. Ethnographers will search for anecdotes and stories related to the occupants' work as well as the facility, such as "Can you think of an instance where disagreements occurred in the office over control of thermostats or overhead lighting controls?" Anecdotes and stories are effective at illustrating problems or successes in a facility. Ethnographers may also ask more specific questions related to their goals and focus (such as thermal comfort, issues of personal control, effectiveness of occupancy sensors or details of the work order process), but will take care not to lead the interviewee to respond in a certain manner.

Observations

Occupants within the built environment do not always consciously recognize every potential strength and weakness of the environments they inhabit. Nor may they know how to communicate this within an interview setting (particularly if they're not in the appropriate context), and what people say they do on a daily basis often differs from what they actually do. As surveys do not provide a complete picture by themselves, observations, therefore, can be used to help complete the picture. Two common types of observation include:

- Traditional Observation, where one passively observes the actions occurring, such as observing the activities in a single classroom over a period of time.
- Participant Observation, where one actually participates in the actions occurring, such as performing a custodian's duties over the course of a day.

Some things ethnographers look for when conducting formal and impromptu observations include:

- The validation or non-validation of design elements and building operations policies.
- Demographic factors, such as gender, age or attire, interactions, or other social/cultural clues that may inform on occupant perspective(s) and the social/cultural norms in play.

For example, the V. Sue Cleveland High School classrooms incorporate a large amount of glass on the exterior walls for daylighting. Glass on the interior walls also facilitates daylight penetration into the interior spaces and allows teachers to keep an eye on students working in the commons areas. Teachers generally indicated in the surveys and interviews that while they liked the daylighting and views in general, there was not enough wall space to display materials or mount additional whiteboards. In particular, teachers responded that the interior glass could be greatly reduced or perhaps eliminated completely to retrieve valuable wall space.

However, observations indicated that the interior glass facilitated impromptu discussions and collaborations among teachers as one teacher would see another walking by his or her classroom and then exit to the corridor to have a quick discussion. This was not indicated in the surveys or interviews. This unintended benefit of the interior glass that most teachers were not consciously aware of would not have been discovered using only the interviews and surveys.

Surveys

Formal surveys supplement the data gathered through interviews and observations. They can tap into a much larger number of people than interviews within a limited time frame, and also provide informative quantitative data that can be used in a variety of statistical analyses. The specific form that a survey will take and the questions used will depend on the goals and scope as defined with the client.

Space Condition Assessments

Space condition data, typically consisting of temperature, humidity, lighting levels, acoustic sound levels, CO2 levels and possibly volatile organic compound (VOC) indicators are recorded over a several week period from individual representative spaces within the building being evaluated using dataloggers. These are often supplemented with trended data recorded by Building Management System (BMS), instantaneous measurements taken by hand and thermal imaging (infrared) measurements of the building envelope. Such data helps to confirm, pinpoint, troubleshoot and illustrate occupant and O&M staff concerns learned during the interviews, observations and surveys.

Putting It All Together

The four ethnographic concepts and field data gathering methods have been demonstrated in previous examples from the three case studies referenced in this article. Here a more comprehensive example from the V. Sue Cleveland High School POE will be provided. Surveys indicated the percentage of teachers, staff and students rating their spaces as thermally comfortable fell short of ASHRAE's 80% threshold for a thermally acceptable environment. The students' ratings of their thermal comfort were also on average lower than that of the adults, as well as wider ranging. By clearly establishing a *partnership* with the teachers, students and staff (including O&M staff/custodians) at the beginning of the evaluation process and conducting interviews and observations with them in the various *contexts* of the school (supplemented with datalogger and instantaneous measurements), the varying thermal comfort ratings and underlying *perspectives* that shape them were better understood.

Beyond HVAC system problems verified in specific areas, the variation between student and adult thermal comfort ratings was *interpreted* to be partially due to the greater variability in student clothing compared to adult clothing (particularly during the warmer months). One's perspective of acceptable clothing is shaped by peers and family, school policy, and society in general, and varies by age, gender, etc. Clothing is also used as a means of establishing "group" identity as well as signaling membership in that "group." For teenagers who are still maturing and experimenting with who they eventually want to be and what "groups" they want to belong to, clothing is part of that experimentation, both in terms of clothing type and the amount worn.

As discussed previously, the varying insulative properties of clothing also affect thermal comfort. So when a large segment of the facility population has a wide range of clothing styles subject to frequent changes, it becomes more difficult to maximize thermal comfort. One of the suggested solutions was to encourage the students and adults to keep layers of clothing available. During the warmer months have sweaters, light jackets, socks, light gloves and perhaps even a cap available if they become cold from the air conditioning, or after cooling off from walking across campus to get to their class. In the cooler months, dress in layers so they can peel off clothing if they start to get too hot. In addition, encourage everyone to dress for the exterior season, such as avoiding long sleeves during warmer months and shorts during colder months. The goal is an occupant population that will add or reduce layers of clothing as individually needed and more uniformly respond to exterior weather conditions in terms of percentage of exposed skin, but still allow expression through clothing choices and styles.

The school's student dress code (according to interviews with the students) does not allow sleeveless shirts to be worn, limiting the potential variability in the amount of skin exposed. But the lack of a similar restriction on the lower body, combined with the dress code's inconsistent enforcement (according to the students), likely means the dress code is doing little to minimize variation in skin coverage or clothing insulative values across the student population.

The next step, if the school chooses to implement this, would be to develop some low cost social control measures that would help turn this into more of the "norm" for students and adults. Something that could be built on is the awareness present among some students interviewed and surveyed that occupants should dress for the exterior conditions and then adjust the building's internal temperature setpoints accordingly. A program could be formulated that spreads this awareness among the teachers, staff, the students and their parents via presentations and messaging located throughout the campus. Incorporating the pride that a large portion of the students, teachers and staff have in their green, sustainable school (verified in the surveys and interviews) as part of this program's implementation would further add weight to it and likely result in some peer pressure to follow the program.

In addition, the dress code should be more consistently enforced and expanded to include keeping additional accessible clothing layers at the school, but more as a policy than a code. Peer pressure and uniformity in behavior could be enhanced by setting goals to keep the school's average classroom temperature setpoints above or below a certain setting for "X" days in a row, tracking this using the school's BMS system. Different areas of the buildings could also compete against each other, though care would need to be taken not to negatively impact thermal comfort and student performance. And the success of the program, messaging, competitions and the like would gain further buy-in by involving the students, teachers and staff in their development.

Conclusion

The potential for applying anthropology in the building construction industry on a daily basis is great. Interviews and observations, which are traditional ethnographic methods, combined with surveys and space condition assessments can cost effectively be applied to understanding occupant needs and behavior in any given facility context. The rewards in terms of energy, CO2 emissions, productivity, performance and health are great, with paybacks potentially under one year. The potential penalties for ignoring anthropology are equally great, with negative individual and societal consequences.

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