

Understanding Conflict Between Landlords and Tenants: Implications for Energy Sensing and Feedback

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ABSTRACT

Energy use in the home is a topic of increasing interest and concern, and one on which technology can have a significant impact. However, existing work typically focuses on moderately affluent homeowners who have relative autonomy with respect to their home, or does not address socio-economic status, class, and other related issues. For the 30% of the U.S. population who rent their homes, many key decisions regarding energy use must be negotiated with a landlord. Because energy use impacts the bottom line of both landlords and tenants, this can be a source of conflict in the landlord/tenant relationship. Ubicomp technologies for reducing energy use in rental units must engage with landlord/tenant conflicts to be successful. Unfortunately, little detailed knowledge is available about the impact of landlord/tenant conflicts on energy use. We present an analysis of a series of qualitative studies with landlords and tenants. We argue that a consideration of multiple stakeholders, and the power imbalances among them, will drive important new research questions and lead to more widely applicable solutions. The main contribution of our work is a set of open research questions and design recommendations for technologies that may affect and be affected by the conflict between stakeholders around energy use.

Author Keywords

Sustainability, energy, domestic computing, inequality

ACM Classification Keywords

H5.m. Information interfaces and presentation: Misc. (e.g., HCI): Miscellaneous.

General Terms

Design, Experimentation

INTRODUCTION

The Ubicomp community is well positioned to address core challenges related to environmental sustainability. Particularly in the domain of home energy consumption, several studies have already identified solutions to aid in energy reduction in homes [1,12], barriers to saving energy

[4,8], availability of “green” products [37], and inefficient habits [8,30,32]. Of these studies, issues of class only surface in [8], which focuses on the 30% of the U.S. population making less than \$30K per year [33]. Despite the fact that approximately 30% of the U.S. population rent their homes [6], and low-income individuals are among those who are more likely to live in rental housing than others [2, 25], few studies in the CHI and Ubicomp communities target renters (exceptions are [4,8,30]). Issues such as tenancy, class and poverty affect the autonomy of individuals with respect to energy use. For example, household members [4,8,30] and landlords [8] may influence energy use. Exactly how the autonomy of tenants, and their relationships with other stakeholders affects their use of energy is not well understood.

This article will argue that by learning more about the other 30% of residential energy consumers (tenants), Ubicomp researchers can create technologies that are relevant to a broader audience. We present three qualitative studies exploring how conflict over energy use plays out in the landlord-tenant relationship. While legal, social, and political factors may affect the landlord/tenant relationship, our studies show that new information can have an influence on landlord/tenant relations. This represents an opportunity for new technologies. Sensors that can gather information, data mining technology that can identify unnecessary energy use across multiple units even without separate meters, mobile technologies that can connect people without steady Internet access to this information, and feedback visualizations, are all examples of information technology which may influence or be influenced by the conflicts between landlords and tenants.

This paper extends prior work exploring the factors influencing energy use among individuals from 26 low-income households [8]. We add a new analysis and two additional studies exploring *how* landlord/tenant relationships impact energy consumption behaviors. Our results demonstrate the importance of understanding the ways in which power differences influence how energy is used (and wasted). This understanding, in turn, has implications for what technology we create and how we design it. We show that sensing and communication technologies can shift three factors that affect power: information, communication, and community actions.

In the next section, we review related work on landlord/tenant relationships. We then present an analysis

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of our photo-elicitation interviews, landlord interviews and role-playing sessions. We provide a set of design recommendations identifying new challenges for sensing and social technologies that may help landlords and tenants discover new resources and improve communication.

BACKGROUND

Much of the research on landlord/tenant relationships emphasizes the power landlords have over their tenants [23, 31, 34]. Based on a one-year ethnography of a low-income, multi-unit dwelling, Vaughan argues that low-income tenants are “relatively powerless” in the landlord/tenant relationship [34, p. 215]. Vaughan observed that tenants showed a lack of trust in landlords and feared exploitation [34]. Despite tenants’ fear of exploitation, when Vaughan asked tenants if they would join others in an organized attempt to improve their units and/or lower their rents, tenants consistently responded yes. However, local volunteers/organizers within the community reported difficulty in mobilizing the community to take action.

In a legal analysis of the relationship between landlords and tenants, Keller concludes that landlords hold the upper hand in the landlord/tenant relationship [23]. Factors affecting the landlord/tenant relationship include the status of the housing market, socio-economic status, and existing laws [23]. For example, since there is a smaller supply of inexpensive apartments than more expensive apartments, Keller argues that those who are paying less may have difficulty moving if they are unhappy with their current housing. For the same reason, landlords renting in low-income markets do not have too many problems filling vacancies. As a result, landlords have more power in this relationship. Further, in some markets, landlords can pick and choose the best, or most suitable tenants from those tenants who are willing to pay, also giving them a slight power advantage over tenants. A landlord may also be able to affect a tenant’s life more than the other way around. For example, a landlord withholding heat may have a greater impact than a tenant withholding rent.

A tenant may legally withhold rent or use it to pay for fixing major problems on a property. However, the landlord may assert the tenant is late with rent and attempt an eviction. Because of this, withholding rent represents a risk for tenants more so than landlords. While laws may empower both landlords and tenants, the existence of “pro-tenant” laws may not have much impact on the overall balance of power [23].

Collective action, such as tenant and rent strikes, can aid tenants in gaining power through strength in numbers [23]. However when landlords maintain personal relationships with tenants, they may render it more difficult for tenants to collectively take action against their landlords [31, 34]. Though conflicts may exist between landlords and tenants, tenants usually bear no hostility toward landlords and feel that the landlord is likely to suffer from tenants’ efforts to create change [34].

In summary, the structure of the relationship between tenants and landlords gives landlords power over tenants. This power is also influenced by personal relationships, knowledge, and other factors affecting the power of individuals. Our analysis highlights the ways in which these forces influence the relative power of tenants and landlords with respect to energy use.

TENANT PERSPECTIVES

In this section, we discuss tenant descriptions of their relationships with landlords, based on a new analysis of our prior work [8]. This prior work focused broadly on energy practices in low-income communities including barriers to and motivations for saving energy. Although landlords were mentioned, the conflicts between landlords and tenants were not explored in depth. For this article, we re-analyzed the subset of data dealing with landlord/tenant conflict and extracted common themes around sources of conflict, resolution of conflict, and so on.

Tenant Method

The data we analyzed came from photo-elicitation interviews with 26 low-income households across two locations: a small town in the Southern U.S. and a metropolitan area in the Northern U.S. Participants were recruited *via* Craigslist, posting flyers, and in-person at community centers located in public housing and low-income communities. Photo-elicitation is a qualitative method where participants take their own photos, which are used to elicit information that may otherwise have been invisible to the interviewer [5]. As described in [8], participants were given a week to “take pictures of objects and/or scenarios that make you think about personal energy use or anything that makes you think about energy.” Following this, participants were interviewed. Discussions of the photos lasted 1-2 hours and were transcribed. Data from one participant, a homeowner, was thrown out, and the remaining data was re-analyzed with a focus on the landlord/tenant relationship.

We used a bottom up approach to analyze our data. We assigned low-level codes to the data based on concepts that were significant such as gripes, overcompensating, responsibility, successful actions, and so on. This resulted in 19 codes, which were then grouped into themes, such as the value of knowledge and the presence of an imbalance in power. We connected the themes to our problem space by exploring how they helped to explain the impact of conflict in the landlord/tenant relationship on energy use. This approach was influenced by the open and axial coding used in *grounded theory* [21]. We did not use prior theory to drive the selection of codes or themes. Instead, the themes that we found led us in an iterative fashion to an exploration of power in interpersonal relationships.

Tenant Results

Most of the 25 participants in this study were African American (21), female (20) and earned less than \$10,000 (18) per year. Because of public subsidies, only four participants paid their entire energy bill. Nine participants

only paid when they exceeded a set allocation of kilowatt-hours *per* month and eight received stipends (for part of the rent and/or utilities). Either independent landlords or publicly run housing authorities paid for the energy bills of five of the tenants. Nine tenants were Section 8 tenants. Section 8 is a form of subsidized housing available to low-income households at a fixed low rate (based on factors such as unit size) and all Section 8 apartments must pass regular inspections. One participant had a free-energy audit to assess her apartment. Next we will describe themes resulting from our data analysis, grouped into sources of conflict and resolution of conflict.

Sources of conflict

Sources of conflict fell into two broad categories – financial responsibility, and overall imbalance of power.

Impact of Financial Responsibilities: As described earlier, some residents paid for their energy bills while others received stipends from the government or were not responsible for paying at all. We saw differences among some of these payment models. For example, landlords were reportedly more proactive when they were responsible for paying energy bills. In one case, a resident was contacted by her landlord for a leak in the bathroom. Her explanation was: *“They pay it. That’s why he was concerned”* (Yasmine). Residents felt that landlords did not address issues when they were not fully responsible for paying energy bills or could not afford to fix things. *“I guess they don’t have funds or whatever”* (Brian). Here, Brian gives the landlord the benefit of the doubt, justifying the unaddressed issue. Brian felt that landlords need to make ends meet too. One resident commented that the *“external element controls my bill more than it should”* in reference to bad structure, and being able to feel outside air. She comments: *“I’m concerned because that’s excess funds out of my budget that I could utilize in another way”* (Catherine). To summarize, residents were concerned about wasted energy, and reported that fixes were dependent in part on who was financially responsible for energy bills.

Imbalance of Power: Seven tenants described situations where they did not advocate their needs to their landlord. Many examples involved residents who did not report issues primarily because of their expectations as a result of their income and status. For example, one resident stated, *“I think I have a hole in the wall and that’s where air is coming from but they’re not going to do anything about it...It’s public housing. If it was a house, they sure will find anywhere the air is coming from”* (Claudia). Another resident stated, *“We have some older appliances in the building, but they’re owned by the landlady, and she wasn’t high up on the idea of buying all new for a Section 8”* (Eve). When residents did advocate for their needs, they did so for several reasons: knowing tenant rights, negotiation with their landlords, education about energy efficiency, and the results of energy audits.

Resolution of Conflict

Some tenant actions led to successful conflict resolution and infrastructure improvements to save energy. Conflict resolution, as described by tenants, was driven by two primary factors: increasing knowledge and strengthening communities.

The Value of Knowledge: One participant spoke up regularly because she knew her rights as a tenant. She said, *“I’m perceived as a trouble maker because I’m always questioning...I’m demanding because I know I have the right to have it...It’s like they hate to see me coming but I notice with my complaints, they’re starting to do things sometime a little different”* (Catherine). In this case, Catherine had previously lived in a better public housing facility; she knew her current conditions were unacceptable and she had success when voicing her concerns. In many cases, residents of low-income communities do not have experience living outside of low-income housing to compare to. Our results showed that energy audits could increase tenant knowledge and even provide advocacy support. For example, Eve said that as a result of an energy audit, *“they talked the manager into finally cleaning out some of the appliances,”* and she estimated that she saves an additional \$60 per month as a result: *“especially the furnace, because all that dust in there, the heat wasn’t getting in. The filters were dirty”*. In this case, the landlord did not have to purchase new appliances and the resident saved money.

Strengthening Communities and Community Action: Our results show that strengthening communities and group action may have been successful for tenants that required new windows for their apartments. One resident stated, *“I know there was one time when it got real cold and everybody’s electric bill was over 200 something dollars and everybody was freaking out....’Hold up, that’s more than my rent’, you know...they did make adjustments because they replaced the windows...”* (Geraldine). It can be implied that since *everyone’s* electric bill was expensive, the landlord took action despite the expense of doing so. It is possible that tenants brought the issue to the landlords because they feared they would not be able to pay their rent. It is also possible that the landlord took action for fear of mass vacancies. Overall, it is unclear why the situation was resolved. Our related work suggests that collective action may not always be so successful [31, 34].

Conclusions from Tenant Perspectives

While conflicts existed in landlord/tenant relationships, we found that several tenants felt that complaints would be ineffective though a few found effective ways to influence landlords: knowing their rights, seeking new information and advocacy support from organizations that provide energy audits, and collective pressure from many tenants.

LANDLORD PERSPECTIVES

At this point, our data on landlord/tenant relationships was based entirely on tenants’ perspectives. To complement this we held semi-structured interviews with seven landlords.

Landlord Method

We interviewed a total of seven landlords for 30 minutes to 2 hours each (the more experience and tenants a landlord had, the longer the interview). We recruited five landlords from metropolitan areas in the Northern U.S., *via* a website used by Section 8 landlords and tenants to find housing and two *via* Craigslist and word of mouth.

Our interview questions centered around landlord responsibilities including who pays for utilities, yearly cost of updates, what type of maintenance and/or updates are required each year, information regarding the cost of monthly rent and how participants determined prices, and aspects of the job landlords enjoyed the most and the least. Landlords were not directly asked about conflict with tenants because we wanted equivalent data to the tenant study. Indeed, we let the issue of conflict arise on its own.

We took detailed notes during the interviews and wrote a memo about each interview shortly after it ended. Our goal was to identify common landlord responsibilities and points of conflict between tenants and landlords. We also compared the landlord and tenant findings and noted similarities and differences.

Landlord Results

Five of the seven landlords were male and the landlords ranged in age from 30 to over 60. Landlords had one to 25 years of experience and owned one to over 200 units. Five landlords owned Section 8 housing. Since rent is paid directly by the government, landlords who participate in Section 8 gain increased financial security. In return, the housing must pass regular inspections to be eligible to rent to Section 8 tenants. Though tenants cannot withhold rent from the landlords directly, they can report issues to the Department of Urban Housing (HUD). HUD can withhold rent from landlords and also prevent landlords from further renting to Section 8 households.

With regard to energy use, we found that landlords who paid tenant utilities often felt that tenants were taking advantage of them. This stands in contrast to the tenant study, where tenants often gave landlords the benefit of the doubt. Landlords we spoke with did not describe themselves as taking advantage of tenants though they were cognizant that tenants might feel disempowered. Several offered a landlord's perspective on how tenants could increase their success in requesting improvements.

Landlord Responsibilities and Goals

An understanding of landlord/tenant conflicts is only possible when overall landlord responsibilities are clear. This may vary a great deal, but ultimately a landlord is running a business with the goal of making money. In contrast, the goals of most tenants are to have a comfortable, safe, and affordable living environment. These goals may not always align.

Landlords we interviewed put a lot of time and money into managing and maintaining their apartments. However, the environment and saving energy were not major factors in

decisions about updates, fixes, and purchases. Instead, they were viewed as a responsibility, necessary to maintain the properties and keep tenants. Energy reduction was a secondary benefit. As a result, landlords did not target energy efficient appliances such as washers and dryers and landlords reported cutting corners to save money. For example, landlords discussed purchasing used appliances, or purchasing carpet with no padding. Some justified cutting corners because of damage that had been done in the past due to tenant negligence.

All the landlords we interviewed were responsible for at least some utility bills, primarily because some buildings were master-metered (*i.e.*, one common meter for a building with several apartments). Additional landlord responsibilities included repairs, ensuring the plumbing and electrical were operating at all times, keeping the grass cut in the summer and removing snow if needed in the winter.

Sources of conflict

The key source of conflict as seen from the landlord's perspective was tenant neglect or wastefulness. Research suggests that residences deteriorate due to landlord negligence more often than they are destroyed by tenant harm [23], despite the fact that "landlords are convinced that tenants don't take care of property" [34, p. 216].

Despite this trend, with regard to energy use, most (5/7) landlords we spoke with reported that tenants at times took advantage of them. Landlords especially felt taken advantage of when they saw resources wasted that tenants did not pay for. For example, James described a situation where a tenant waited to notify him about a broken thermostat and instead opened his windows in the winter because he was too hot. This delay in notification meant paying for extra heat (until the tenant reported the issue, and then until James found someone to address the issue). James came across as a fair landlord; he seemed to be concerned about issues such as safety and ensuring his property was well maintained. However, he felt tenants should understand the consequences of not paying their bills on time and that some issues may go unaddressed as it takes money to fix issues. James said, "*I'll keep a pair of socks on or a sweatshirt and since they aren't paying for it, they're in shorts,*" implying that tenants care less about saving energy if landlords are responsible for the bill. Landlords were also sensitive about tenant behavior that affected safety or required extra work. For example, Pedro was upset that residents remove batteries from smoke detectors to put in their children's toys. Removing smoke detector batteries presents a safety hazard and extra work for landlords to ensure smoke detectors are working at all times. Pedro wished the tenants were aware of these safety risks and landlord responsibilities.

Perhaps because of the perceived wastefulness of tenants, most of the landlords we spoke with were fairly critical of tenants and their actions with regard to energy use. However, many of the landlords we interviewed seemed to want a reason why tenants were wasteful. Explanations

landlords produced included that “[residents] don’t care because they are not paying utilities...there’s no way to force them to be energy efficient when they don’t care.” (Gerald), “people feel uncomfortable [in regards to raising issues], they don’t want to be viewed as a complainer.” (James) and “maybe just because they don’t have much and feel like, ‘what’s the use?’ Or maybe it’s their upbringing.” (Pedro). These explanations demonstrate a range of assumptions about tenants (lack of caring, fear of retribution, and resignation).

Resolution of Conflict

Though landlords felt they were being taken advantage of, those not renting to Section 8 tenants can increase the rent to address this. One landlord mentioned communication oriented strategies for encouraging tenants to conserve energy (such as suggesting that a tenant wear warmer clothing before turning up the thermostat, and sending a letter to his residents encouraging them to help keep costs down in the winter by reporting issues as soon as they arise). It is not clear that either strategy (raising the rent, or asking tenants to change their behavior) is effective in increasing conservation.

The landlords we spoke with also had suggestions for how tenants could work to resolve or avoid conflict. For example, James suggested tenants avoid potential problems by investigating a landlord’s maintenance habits before they sign a lease. Cheryl rents part of her home to one tenant, and was open to tenants notifying their landlords if they could fix an issue themselves. She suggested that landlords could reduce tenants’ rent payment to cover the cost of fixing unaddressed issues. James also stressed the importance of tenants “knowing what their rights are.” He felt that landlords and tenants “need to work together for a win-win.” Each of these strategies involves communication or negotiation. All of the landlords felt that keeping their places occupied was a priority that they (and other landlords) would be willing to negotiate and address landlord/tenant issues to keep tenants from moving out.

Conclusions from Landlord Perspectives

As with tenants, a primary reason for conflict was financial responsibility. From the landlord perspective, tenants seemed wasteful of resources they did not pay for, while from the tenant perspective, landlords avoid repairs when it is tenants’ money that is at stake. Landlords seemed to take tenant behavior personally, were aggravated by their wastefulness, were likely to directly ask them to change (or raise the rent), and spent time trying to explain why they would waste. In contrast, tenants tended to give landlords the benefit of the doubt, and to avoid confrontation over issues they thought of as impossible to solve.

ROLE-PLAYING SCENARIOS

To find out more about how tenants might approach conflict resolution with landlords and how they viewed landlords, we ran a role-playing session with eight participants. We asked participants to explore landlord/tenant issues in concrete scenarios so they could

consider both landlord and tenant perspectives and work toward a solution. The use of scenarios is a technique to elicit problems and focus on solutions [3]. Scenarios work well for encouraging reflection and discussion between individuals.

Role-Playing Method

We sought participants (tenants or home owners who had been tenants in the past) earning less than \$30K per year hereby, referred to as “residents.” We recruited from Craigslist and a community center located in a local public housing community. To include a range of opinions, flyers were not specific to energy consumption, stating, “you will participate in a collaborative exercise to brainstorm ideas on how to improve certain areas in the home with technology.” There were a total of eight participants in the role-playing session. Our data included extensive notes taken at each session and demographic information collected via surveys.

We started off with two 5-minute brainstorming sessions. We first asked tenants to brainstorm about what causes them to take action so we could learn about their values. Since this was a brainstorming activity, we left the question open to interpretation, i.e., participants were not told a specific event to think about. Instead, we prompted them by asking questions such as, what caused you to: “come to today’s session” or to “vote or not vote in the most recent election.” We then asked tenants to brainstorm about what causes their landlords to take action to understand how residents perceived their landlords’ values.

After the brainstorming, residents broke into two groups of 4 for role-playing. Participants in each group were randomly assigned to one of three roles: landlord (1), tenant association (1) and tenant (1 or 2). The tenant association was included to explore the impact of a community group on conflict resolution. Each role also included a list of priorities based on what we found in our studies (shown in Table 1).

Both groups were given two problems: an uncooperative

Table 1 - Roles and Priorities used in Role-Play Activity

Roles	Priorities
Landlord	<ul style="list-style-type: none"> - Keeping apartment units filled with residents - Not spending any more than what I’m spending already - Willing to invest in something if it pays off in the next 5 years.
Residents	<ul style="list-style-type: none"> - Safety (“I’m afraid to turn off the lights at night for fear of destructive community members”) - Comfort (“I like to feel cold in the summer”) - Saving Money - Ethics/Spirituality/Religious reasons
Tenant Association	<ul style="list-style-type: none"> - Improving tenant-landlord relationships, building conditions, and services for tenants under a “strength in numbers” model. - Encouraging regular communication and community awareness among tenants

community member and a randomly drawn structural inefficiency. One group drew inefficient appliances and the other group drew a drafty apartment. Participants were instructed to discuss and negotiate the problems within their group until they reached a solution. The “tenant association” group member was instructed to serve as a mediator. In one group, the landlord was responsible for paying electricity and in the other group, the tenants were responsible for paying electricity.

We took extensive notes during these sessions and documented points of contention, questions, frustrations, and what solutions were successful or unsuccessful during the session. We compiled all notes, pictures taken during the role-playing session and debriefing sessions and searched for commonalities between groups (e.g., questions, frustrations, solutions). We used audio recordings to verify specific quotes.

Role-Playing Results

Six of the eight participants were women. Ages ranged from 18 to over 60 and the majority earned less than \$20,000 a year. We found that residents’ reasons for taking action: money, safety, health, personal beliefs, family, and likelihood of success. Residents felt that landlords took action because of costs (e.g., insurance, taxes, water, and maintenance), their reputations, the law, safety, and inoperable facilities such as broken heat or electricity. Note that residents’ values and the values they perceived their landlords have are relatively similar.

Sources of conflict

Overall, there was relatively little discussion of how landlords or residents might take advantage of each other. This may be because the exercise was so focused on communication, a key element that may be missing in attempts to solve the landlord-tenant problems brought up in our interviews. However, one resident had a concern about raising issues with the tenant association. She felt that if residents went to the tenant association, or above the landlords’ head, the landlord would do his best to mistreat the resident filing the report.

Resolution of conflict

Residents acting out the role of tenants wanted to know *how* to prove to the landlord and tenant association that issues existed. They brainstormed and began to think of different types of information that might help such as comparing their electricity bills with those from past months, and comparing their bills with other residents to show appliances were inefficient. In addition, residents suggested sending letters to the landlord to make the issue known. This caused tenants to realize that they could also ask the landlord for information such as when the last time the county inspected apartments. They wanted to create ways to find out if the appliances were working efficiently when they first moved in. Residents also wanted a way to directly forward their energy bills to landlords and highlight differences. Another idea was to enable everyone in the community to share their bills with others, including

landlords if they desired. Those residents responsible for paying energy initiated this idea.

Participants who played the role of landlord would negotiate with the other participants to find a solution. One “landlord” was unwilling to replace the windows in the scenario of the drafty apartment; however, she and the tenants negotiated caulking windows as an effective solution. The “landlord” made her decision based on the costs of replacing windows. The other “landlord” agreed to purchase a camera to monitor his apartments as a result of uncooperative community members. He felt that purchasing the cameras was the best option, as they would pay for themselves in the next 3-5 years. Some tenants disagreed with this solution because of privacy concerns. In fact, this interaction resulted in tenants suggesting the formation of a community “watchdog group” – a solution cheaper for the landlords but potentially beneficial for the community. Perhaps effective communication between landlords and tenants provides opportunities for both parties to negotiate and make compromised decisions.

DISCUSSION

We have presented three qualitative studies that explore conflicts between landlords and tenants with respect to energy use. Here, we highlight key sources of conflict, which leads us to explore the impact of power in interpersonal relationships on energy use.

Conflicts in our study arose when one party failed to meet the expectations or needs of the other. In many cases, material issues (money, dwelling temperature, *etc.*) were at stake. For example, some tenants failed to report issues to landlords when tenants were not paying the bill, leading to extra costs for landlords. Similarly, a common complaint was that landlords did not fix air leaks, which affected the comfort and utility bills of residents.

At the surface, structural problems such as a lack of common interest between stakeholders seem to drive conflict. But our results point to a deeper problem in the landlord/tenant relationship. Although we have been talking about *conflict* throughout this paper, from a theoretical perspective, it is *power* that determines who will “win” when conflict is present.

Many forces affect the power of different parties in a conflict. These include resources (money, information, education, powerful friends, *etc.* [17]), existing hierarchies and cultural norms such as respect for elders [11], and the connections among groups of people (e.g., those engaged in collective action) [17, 19, 36]. The material reality in which tenants live, combined with the social structure in which they operate have a concrete impact on the resolution of conflict. In this sense, conflict is not just about a specific tenant and landlord, but also the broader context in which they live. For example, a tenant’s relationship with other service providers (such as welfare), a landlord’s ability to leverage a utility company’s customer support, and the existence of tenant organizations or other mediators may all affect the possibility of conflict and its outcome.

To some theorists, the forces described above can be captured in a structural view of power (e.g., [17, 19, 27, 36]). In this structural view, power is visible and has the potential to be shifted by changes in resources, connections, and so on. An example is the impact that a landlord's financial responsibility for a utility bill increases the likelihood that a problem will be fixed at a tenant's request.

An alternate view of power focuses more implicit interpersonal relationships without assuming the presence of conflict. For example, conflict may be avoided (as in the case of residents who feared the consequences of reporting issues) [24]. Vaughan's work suggests that tenants may even worry about the burden their requests may have on landlords [34]. Power may also be internalized as with Foucault's "governmentality" [13], to the point that "perceptions, cognitions and preferences [are shaped] in such a way that they accept their role in the existing order of things..." [24, p. 24]. For instance, some tenants did not expect issues to be addressed because of their low income and status.

Power is a complex concept, and many theories exist that attempt to explain power from political, economic, and social perspectives. Our discussion has focused two forces that help to describe power in landlord/tenant relationship: Structural forces and implicit forces. Structural context including financial responsibility for energy, income, and the broader market can affect the outcome of conflict between landlords and tenants. When conflict arises, changing the distribution of resources can shift the outcome. With respect to tenants and landlords, this most often means a change in the information asymmetry between landlords and tenants or the additive change in resource strength brought on by collective action. However, power is not always connected to conflict [24], and can be internalized to the point that it implicitly shapes behavior, as when tenants self-censor, ignore irritations and speak up only in emergency situations [34]. To the extent that power implicitly shapes behavior, it may do so not only for tenants but also for landlords. For example, the assumption that "*tenants don't care*" reflects a possible misunderstanding of the root causes of behaviors that bypass conflict. In fact, tenants' reported worries demonstrate both caring and awareness of energy wasted even when they do not report it.

Thus, a study of the role that technology may play in this setting must consider two facets of power. First, technology may influence the distribution of resources (such as information) affecting structural power. These resources may in turn influence the outcome of conflict around energy use. Second, technology may interact with implicit forces that shape outcomes even in the absence of conflict. An example is the impact that surveillance technologies may have on behavior. Our next section will explore these ideas in more depth.

DESIGN RECOMMENDATIONS

Our recommendations will focus on two impactful forms of technology: sensing technology and social technology. The former technology produces new information and the latter facilitates the sharing of information, while both may influence action indirectly. For example, our study showed that information, improved communication, and community action can all help to resolve conflicts and change the balance of power. Many other factors that affect the balance of power are not directly amenable to technological intervention, though successful interventions may need to account for them in some way.

Sensing Technologies

Sensing technologies are essential to monitor and provide feedback about energy use. In a review of over twenty studies, it was found that feedback resulted in a 5% to 12% reduction in energy consumption [12]. Clearly, these technologies are powerful and effective. However, eco-feedback studies have primarily focused on individuals or at best multiple individuals within a household. Issues of class, conflict, and power among stakeholders as different as landlords and tenants are rarely surfaced, if at all.

As stated earlier, information represents a resource that structurally impacts the way in which power plays out in conflict situations. In particular, information asymmetry, in which one stakeholder has more information than others, has been shown to affect how conflicts are resolved [26]. Indeed, the potential for information to change outcomes surfaced in all three of our studies. This is not surprising considering that information is a resource that is relatively easy to change, with a corresponding shift in power [14, 19]. Feedback technologies can change who has access to information and manufacture new information.

For example, we found that tenants often do not have access to information about their own energy use (or that of other tenants in their unit). Landlords may have access to this information in limited form (such as monthly utility bills). Eco-feedback may bring information about energy use into the home [15]. New feedback technologies may sense water [16], electricity [28], and gas [7], at the level of individual appliances, producing a very detailed record of personal activity. This information could be used by landlords for surveillance and possibly lead to sanctions against problem tenants, vandalism of technology by tenants trying to protect their privacy, and other forms of conflict. On the contrary, the same technology could be used to identify problematic energy use across many units (or supports exploratory visualization) and could alert landlords, tenants and/or future tenants about problems.

Although we have demonstrated concrete ways in which sensed information ties into structural forms of power, even the straightforward applications we have described must also consider the presence of implicit forces. New information will inevitably shape behavior. For example, information ownership, abuse (such as surveillance of tenants by landlords), and security are all factors in who

has power over whom due to the presence of new information. For example, an application that identifies problematic energy use could be designed to help tenants see the true costs of inefficiencies and thus engender community action. Similarly the mere knowledge that information about energy use is shared with others could affect a tenant's behavior or sense of security even in the absence of abuse or direct conflict.

To summarize, our results challenge many of the assumptions underlying existing eco-feedback systems. Any technology that wishes to reduce energy use needs to be cognizant of the fact that a range of structural and interpersonal factors, both explicit and implicit, affects energy use.

Social Technologies

Landlords we spoke with seemed to feel that improving communication with tenants might help to reduce conflict. For example Pedro felt that tenants might not be aware of the safety risks and landlord responsibilities affected by their decisions to remove smoke detector batteries. James suggested that landlords talk to their tenants more, and discussed the idea of sending a letter to his tenants encouraging them to keep costs down by reporting issues more quickly. The idea of improved communication also came up in role-playing, where participants suggested asking landlords for more information about inspections, or informing them about problems that were common to more than one unit. Strengthening communities (leading to community action) was a final factor that could affect the resolution of conflict.

Technology can support social action by making it easier to communicate, organize, and or discuss common issues [9, 29, 35]. For example, Vieweg, *et al.* show how large-scale distributed problem solving can occur in disaster situations with the aid of social technologies [35]. In another case, DiSalvo *et al.* helped a community to express neighborhood concerns through a participatory design process involving critical engagements with robots, sensors, and other technology [9]. Paulos *et al.*, argue for the role of citizen science in enabling participatory urbanism [29]. This research has shown the potential power of enabling community action. However, little attention has been paid to the role of community action in addressing energy use [10], or to the role of social technology in shifting structural forces or shaping the implicit role of power in how tenants and landlords use energy.

As with sensing and feedback technologies, social technologies can influence the structural forces affecting conflict resolution. For example one of our tenants described how high building-wide heating bills led a group of tenants to advocate for building improvements. As a group the tenants were successful in achieving their goals, where an individual might have failed. Organized groups can have greater power than individuals [17]. For example, in a sociological model showing the causal logic of how rental housing markets operate in American cities, tenant

movements was the only factor out of several, including home prices, growth, tax policy, interest rates, and the world economy (war, inflation, oil, deindustrialization) to cause rent decrease [20].

Clearly information plays a role in this example, and social technologies naturally support shifts in information asymmetry. For example, the sort of feedback technology proposed in the previous subsection, if they supported communication across tenants, could have facilitated our example by alerting tenants much sooner to the building-wide problems and potentially helping them to organize.

Results from our studies suggest improved communication provides individual community members with access to new information and helps to resolve common problems within a community. Online forums for renters or landlords represent a viable way for social technologies to produce this information (an example is the free legal forum <http://thelaw.com>). For low-income tenants with limited Internet access [18], it could be valuable to bring information that exists on-line into a more accessible medium: mobile text messaging. It would not be hard to create an SMS gateway that could connect tenants to such a forum, or even to a more general social question answering system such as Aardvark [22].

A primary way in which social technologies can structurally affect power and the resolution of conflict is by sharing information among people who can act on it, thus affecting forces such as information asymmetry. Social technology can also structurally affect the relationships among people, as by helping tenants to organize themselves in preparation for a confrontation with their shared landlord.

Yet, tenants may face difficulties in taking collective action against landlords [31, 34]. The roles and relationships that already exist among tenants and between tenants and landlords can implicitly affect tenants' willingness to create conflict. For example, in some communities, tenants are less inclined to share details of their energy use with other tenants [8]. Existing assumptions about what actions are worthwhile may also affect the success of social technologies (*e.g.*, tenants may not agree about whether to act in non-emergency situations). A successful social technology must take these aspects of power into consideration in its design.

To summarize, in addition to well-known issues such as retention and recruitment, social technology design must be based on an understanding of the implicit forces affecting energy use in the landlord-tenant setting. If careful design is able to achieve balance between anonymity, access, and interest, there is great potential for social technologies to support the creation and sharing of information and thus influence the outcome of landlord/tenant relations around energy use.

CONCLUSIONS

As Dourish argues, HCI must consider the political, cultural, social, economic, and historical contexts of the technology it produces to effectively address complex issues such as environmental sustainability [10]. New technologies (sensors, data mining, visualizations, and so on) may be better able to add knowledge, support communication, and enable positive action if designers keep in mind how those contexts affect the use of technology.

We contribute an understanding of the power landlord/tenant relationships in the context of energy consumption. We found that conflicts between landlords and tenants over energy use are driven by the imbalance of power between them. Power is derived from many things, but one of the most fluid is information. In our studies, new information and better communication of information were two of the most salient forces driving conflict resolution. We argue that sensing technology and social computing can play a role in conflict resolution because of their ability to interact with these forces.

We focused our discussion of power on two things: structural issues (including information asymmetry and social hierarchy and other concrete forces affecting the resolution of conflict); and more implicit forms of power such as the internalized forces shaping behavior discussed by Lukes [24] and Foucault [13]. Technology, then, may influence structural forces affecting conflict resolution. At the same time, we argue that designs that fail to consider more implicit forms of power face the possibility of negative outcomes.

Our work has some limitations — Dillahunt *et al.*'s original study was not focused on landlord/tenant conflict and might present an incomplete picture of the issues as a result. It is likely that the landlords we interviewed tended to only describe their most positive interactions with tenants. Additionally, the vast majority of our participants were female, perhaps because many low-income households are led by women. It is possible that there are gender-related issues that also play into the conflicts with landlords. Despite these limitations, our results as a whole seem to be consistent with existing theory in power relations reviewed in this section, and with past work on landlord/tenant relations [22, 34].

Our work challenges the Ubicomp and CHI communities to tackle a new set of research questions on the connection between technology and power. Power is an omnipresent component of human interaction. Technologies that support communication and provide information affect the balance of power in human relationships. Issues such as privacy are in large part important *because* the information being revealed may give one party harmful power over another. It is time to expand our notion of impact to consider the invisible social forces that may be affected by our technologies.

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