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Motivating residents to conserve energy without financial incentives

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Abstract:

Given the aim to motivate people to conserve energy in their homes, we need to understand what drives people's energy use behavior and how it can be influenced. This article describes applied energy-conservation campaigns at two U.S. military installations where residents do not pay their own utility bills. Customized approaches were designed for each installation based on a broad social-psychological model. Before-and-after energy use was measured and residents were surveyed about their end-use behaviors. Residents said they were motivated by the desire to do the right thing, set a good example for their children, and have a comfortable home. For sustained change, respondents recommended continued awareness and education, disincentives, and incentives. Findings show support for some aspects of a social-psychological model, with emphasis on altruistic as well as egoistic motives for behavioral change. These studies may have implications for other situations where residents are not billed for individual energy use, including other government-subsidized facilities, master-metered apartments, and university dormitories.

The Link Between Knowledge, Values, Attitudes, and Behavior

Despite decades of research in energy conservation and other pro-environmental behaviors, considerable uncertainty remains about what motivates people to behave in environmentally responsible

ways. Studies have investigated, for example, the contributions and links between environmental knowledge (e.g., Ostman & Parker, 1987), environmental values (e.g., Kempton, Boster, and Hartley, 1995; Neuman, 1986), attitudes (e.g., Becker, Seligman, Fazio, and Darley, 1981; Geller, 1995), personal characteristics (e.g., Allen & Ferrand, 1999), and behaviors (e.g., Harrigan, 1991; Katzev & Johnson, 1987). Numerous theoretical approaches have been developed to integrate various combinations of these factors. Nevertheless, energy-conservation behavior, as with all behavior, is multifaceted and complex, challenging our attempts to explain and predict it. Research has demonstrated that there is no single and general construct that predicts environmentally friendly behavior (Oskamp et al., 1991). For example, campaigns that rely on information or prompts to behave in an environmentally friendly manner have brought disappointing results (de Young, 1993; Staats, Wit, and Midden, 1996).

In addition, studies have shown an apparent disconnect between people's expressed concern for the environment and their own energy use. In some cases, consumers have expressed strong conservation views and claimed to have taken a wide range of conservation actions, but measurement of energy use data showed these statements to be considerably exaggerated (McDougall, Claxton, Ritchie, and Anderson, 1981).

Social-Psychological Model of Behavior

These theoretical limitations do not mean that behavioral change cannot be influenced through knowledge, values, personal characteristics, or attitudes. A large body of research has demonstrated that all these factors, and others, do contribute in various ways. Nevertheless, a more complex model continues to evolve.

Many researchers have developed and tested various aspects of a broad social-psychological model to describe energy conservation behavior (e.g., Costanzo, Archer, Aronson, and Pettigrew, 1986; Darley & Beninger, 1981). This model integrates societal, group, and individual-level processes. It also provides support systems to aid behavioral change and overcome barriers such as lack of information and everyday life needs.

Studies supporting this model have shown that people were more likely to make permanent changes in their energy behaviors if the new behaviors were easy and convenient to perform, when they had the skills and resources needed to change behaviors, when their neighbors and friends were changing in similar ways, and when they made commitments to change in public settings (Costanzo, Archer, Aronson, and Pettigrew, 1986; Harrigan, 1991; Stern, 1992).

More specifically, people are more likely to adopt energy-efficiency behaviors under the following conditions:

- People view energy efficiency in terms of benefits to themselves rather than curtailment, especially in terms of increased thermal comfort and health (Becker, Seligman, Fazio, and Darley, 1981; Samuelson & Biek, 1991)
- Energy use and savings are made visible, thus providing goals and motives where they did not previously exist (Kempton, Darley, and Stern, 1992; Stern & Aronson, 1984).
- Information is conveyed in a vivid, salient, and personal format (Costanzo et al., 1986; Dennis, Soderstrom, Koncinski, and Cavanaugh, 1990; Stern, 1992; Stern & Aronson, 1984), including visual modeling of specific actions to be taken (Winnett, Leckliter, Chinn, Stahl, and Love, 1985).

One intriguing aspect of the social-psychological model of energy use is in social comparison. The idea is that comparison and even competition with others increases motivation to achieve something perceived as positive. According to social identity theory, people strive for a positive self image, and their membership in a group is itself perceived as part of their identity (Tajfel, 1978; Tajfel & Turner, 1979). According to social comparison theory, comparison with others reduces uncertainty and helps establish standards of personal behavior (Festinger, 1954). These theories, and at least one energy-related workplace study (Siero, Bakker, Dekker, and van den Burg, 1996), suggest that emphasizing a common group identity can lead to more cooperative behavior and improved performance by group members.

The Need to Characterize Specific Populations

Applying social-psychological principles in behavioral interventions gives us more opportunities to understand and refine the model and, ultimately, to help create behavioral change. One important but

neglected aspect of energy conservation interventions, we believe, is tailoring them to the individual environment, in part by involving the targeted energy consumers in preintervention consultation.

Tailoring applied research approaches to a target population has been a common strategy in social interventions, notably health campaigns, for many years (e.g., Rogers & Storey, 1987). Just as health campaigns define and target specific populations (e.g., smokers, pregnant women, people whose behavior puts them at higher risk of HIV infection), residential populations within specific living situations often share certain characteristics that must be understood and woven into any effective intervention effort.

Only recently have energy conservation programs begun to use elements of this tailored approach. Powers, Swan, and Lee (1992), for example, suggest using different strategies to target various kinds of people for home energy audits. Their study identified demographic and psychographic variables that affect the likelihood of people participating in an audit and making corresponding home improvements.

Among the variables that should be investigated in energy-efficiency interventions include type of housing and constraints of residents. The situations in which people live, and their ability to control their environments by taking certain actions, vary from case to case.

Typical energy-saving tips aimed at homeowners often are not applicable to those in apartments or subsidized housing. For example, military residents and apartment dwellers often do not install their own insulation or purchase their own large appliances. Furthermore, it does no good to tell people to close their vents if they have radiators or radiant heat, or to apply heat-blocking films on windows if they are prohibited by the building owner from doing so. In addition, highly mobile populations (military, students) may adopt different energy-use habits than those who stay in their residences for years. Thus, effective intervention efforts should explicitly include the characteristics of the targeted living situation and its residents.

The Military Situation

Under the Energy Policy Act of 1992 and a more recent Presidential executive order (13123, June 1999), all government facilities are required to reduce their energy consumption 35% from 1985 levels. The U.S. Department of Defense is the nation's largest federal energy user, consuming more than 70% of the

energy used by all federal facilities (U.S. Department of Defense, 1999). This consumption makes the Department of Defense a particularly visible target and represents a potential for substantial savings.

Several military installations have shown substantial energy savings in recent years (e.g., Lister, Chalifoux, and Derickson, 1996; Rospond, 1997). Most of these efficiency achievements, however, have resulted from retrofits, new technologies, and purchasing processes. Further, most projects have focused on administrative and operational areas of energy use.

It is not surprising that residential behavior has received little or no study on military installations. Indeed, much of the literature on energy efficiency focuses heavily on equipment and infrastructure changes, with little attention paid to end-use behaviors. It is much easier to install new energy-efficient lights and insulation, for example, and measure the energy output afterward than to try to determine to what extent personal behavior change may have resulted in energy reduction. In addition, self-reporting of pro-environmental behavior limits validity (Barker, Fong, Grossman, Quin, and Reid, 1994) and monitoring can be viewed as intrusive.

Despite these challenges, behavior in military housing represents a potentially significant source of energy conservation. Housing at some military installations accounts for up to 30% of total installation energy costs, according to energy managers (C. Howell, personal communication, June 14, 1999). In addition, technology, upgrades, and even the military's current move toward privatization of housing and utilities (U.S. Department of Defense, 1998) can accomplish only so much.

Military installations in Washington and Arizona were chosen as the two sites for the applied research projects described here. The military environment was chosen because officials already were supporting energy conservation and because the hierarchical, close-knit social system and social structures were considered advantageous for a communitywide intervention effort.

METHODS

Applied research studies were conducted to demonstrate the feasibility of tailored, research-based strategies to promote energy conservation in military family housing. Families who live on base (called on post) do not pay their own energy bills, so motivation must be non-economic. Most residences are not

individually metered. The lack of individual bills also means that residents receive no feedback on their own energy use or any savings that may occur.

The campaigns focused on promoting behavior changes by residents themselves, emphasizing no-cost and low-cost actions. At Fort Lewis, Washington (near Seattle), the campaign ran from September 1998 through August 1999, focusing on heating-related energy in the cool Pacific Northwest climate. At Yuma Marine Corps Air Station (MCAS), Arizona, the campaign ran from July 1999 through October 1999, focusing on opportunities during the cooling season, especially efficient air conditioning use.

The two studies applied various aspects of the social-psychological model, customized for each site. Focus groups and interviews were conducted at each site to identify feasible, appropriate, localized strategies that were adapted to the military culture.

Focus groups were held with neighborhood groups, Boy and Girl Scout leaders, and child care providers. Focus groups were used to obtain information directly from residents about potential campaign messages and images, behaviors to be targeted, resident views on energy conservation, and ideas for community involvement, incentives, and information dissemination.

Interviews were held with officials responsible for housing, energy efficiency, and housing maintenance. Interviews were designed to ensure that officials were made aware of initial campaign plans, to better understand housing energy use and conservation issues, and to solicit ideas for the campaign.

Campaign messages, themes, visuals, approaches, and targeted conservation actions were identified using feedback from the focus groups and interviews. The discussions were tremendously helpful in eliminating non-workable approaches and identifying the most effective ones for each site. For example, people at Fort Lewis did not want energy auditors coming to their homes, but they were interested in involving their children in efficiency activities. Residents were not asked to turn down the temperature on their own water heaters because it involved working around high-voltage wires. At MCAS Yuma, it was not feasible to use the air-dry option for dishwashers because local hard water leaves a residue.

The campaigns were aimed at raising awareness, providing links between energy-efficient behaviors and lifestyle benefits, and appealing to existing values of patriotism and environmentalism.

Activities and information emphasized the inclusive nature of the effort (all housing families were expected to participate, as endorsed by high-ranking military officials), health and comfort benefits of

taking action (vs. deprivation), the ease and convenience of making changes (personal control and efficacy), and the availability of on-site resources to support residents through activities such as repairing degraded weatherstripping (social support).

Tactics included site-specific video programs with residents modeling the desired behaviors, print materials showing progressive energy savings, cartoons with conservation story lines, electronic readerboards, diffusion through military chains of command, and display booths at on-post fairs. The MCAS Yuma campaign also included children's games and activities, as well as tickets given to residences where observed violations occurred. The Fort Lewis campaign included involvement of housing mayors, emphasizing competition among the ten on-post neighborhoods.

Campaign effectiveness was measured in two ways at both sites. First, energy use was compared with data from the previous year to determine savings incurred after the campaigns began. At both sites, energy savings were adjusted to account for differences in weather between the two time periods being compared. This process ensured that weather differences were ruled out as contributors to energy savings.

A multivariate regression analysis, described here, was used to account for the differences in weather conditions between the pre- and post-campaign periods. The baseline statistical model was constructed by regressing the daily energy consumption against the daily average temperature for the billing period to determine the baseline energy performance model. Once the appropriate baseline model was determined, the post-campaign energy use was estimated by running the baseline model using post-campaign daily temperature and operating conditions as model input. Energy savings were calculated by comparing the differences between the actual energy use and the energy use predicted by the model for the same time period.

The second method for evaluating campaign effectiveness was surveying residents to determine to what extent the campaign influenced behavioral changes that led to the savings. At Fort Lewis, surveys were mailed to all on-post households with a 37% return (n = 1,231). At MCAS Yuma, surveys were hand-delivered to all households with a 21% return (n = 175). Sixty-eight off-post military residents also responded; they had picked up the questionnaires from an on-post energy fair that was used in part to distribute questionnaires. Responses from on-post and off-post MCAS Yuma residents were tallied separately and compared.

Data from the questionnaires were entered manually into a computerized survey analysis program that generated descriptive statistics for the responses to each question. Narrative responses from open-ended questions were recorded verbatim. For the Fort Lewis survey, which generated a large number of responses, answers to the open-ended questions were coded so that patterns could emerge.

RESULTS

Measured Energy Use

Table 1 summarizes energy savings in Fort Lewis family housing at the end of the campaign. Fort Lewis uses gas and electricity for residential energy.

Weather-corrected savings were substantial when compared with the previous year before the campaign began: 10% savings, the equivalent of more than $130,000 saved.

Table 1. Weather-Adjusted Energy Savings for Fort Lewis Family Housing (compares the period September 1998 through August 1999 with the previous period, September 1997 through August 1998)

	Units Saved	**Percent Saved**	**Dollars Saved**
Gas	83,376 therms (8,338 mBtu)	3%	$41,685
Electricity	4,233,000 kWh (13,605 mBtu)	7%	$88,702
TOTAL	21,943 mBtu	10%	$130,387

KWh = kilowatt hour; mBtu = millions of British thermal units

Table 2 shows energy use results at MCAS Yuma. Electricity is the primary energy source in residential housing there; electricity powers air conditioning, the most significant contributor to hot-weather energy use.

In the final month of the campaign, October, energy use declined 12.7%, though net energy use increased slightly when measurements from all four campaign months were tallied. The short duration of the campaign did not allow a more extensive effort. However, the steep drop in the last month of the campaign suggested that the effects of the campaign were beginning to be felt.

Comparing utilities costs at MCAS Yuma from 1998 to 1999 is problematic because rates varied frequently during both years. However, the utilities account for Family Housing at MCAS Yuma had a positive balance of $50,000 at the end of the fiscal year, a surplus the Housing Manager attributed to the campaign.

Table 2. Weather-Adjusted Electricity Use at MCAS Yuma (compares the period July 1999 through October 1999 with the previous period, July 1998 through October 1998)

Month, 1999	**Difference in Electricity Use When Compared with Same Months in 1998, kWh**	**Difference, Percent Electricity Used**
July	+74	4.8%
August	+125	7.8%
September	+30	2.1%
October	-120	-12.7%
Net Use	**+2kWh**	**+2%**

KWh = kilowatt hour

Resident Behavior as a Contributing Factor to Energy Use

Surveys of Fort Lewis and MCAS Yuma residents were conducted to evaluate campaign effectiveness in terms of awareness, behavior change, motivation, and other issues surrounding energy use.

Results showed that the campaigns were moderately effective in promoting behavior change. Table 3 summarizes the results.

Table 3. Summarized Post-Campaign Survey Responses (some total more than 100% because some questions allowed more than one response)

Question	**Fort Lewis Responses**	**MCAS Yuma Responses**
Have you heard about the campaign to use energy more efficiently in family housing?	Yes, 40% No, 56% Not sure, 4%	Yes, 66%
Check the things you started doing after the energy campaign began in September (Fort Lewis) / July (MCAS Yuma)	No change, 8% Turned down thermostat at night or when gone, 47%; closed windows when heat was on, 23%; cleaned or changed furnace filters, 14%; turned off outside lights, 19%; cleaned the lint trap in the dryer, 14%; ran full loads in dishwasher, 12%; used cold water for washing clothes, 13%; adjusted refrigerator temp, 13%	Turned off air conditioner when not at home, 22%; cleaned air conditioning filters, 18%; kept air conditioner at 80 degrees, 17%; watered early and late for short periods, 17%; used heat-blocking materials on windows, 13%. Already did one or more of these things, 40-94%.
What caused you to start doing those things?	Right thing to do, 34% Set a good example for kids, 24% Other (raised that way, etc.), 13% Wanted more comfortable conditions, 10%	Right thing to do, 83% Wanted more comfortable conditions, 48% Set a good example for kids, 42% Other (raised that way, etc.), 27% Wanted MCAS Yuma to be the best, 23%
Does anything make it impractical	My house wastes energy, 45%	My house wastes energy, 28%

to save energy?	Other (problems with repairs, already saving, etc.), 26%	Other (family members waste energy, etc.), 26%
What will it take to motivate residents to keep using energy wisely?	Most commonly mentioned: information/awareness, 40%; disincentives, 27%; incentives, 20%; housing upgrades and other improvements, 16%	Most commonly mentioned: monitor/meter each household and compare with, or impose, a set standard or limit, 15%; disincentives, 15%; reminders, 13%; incentives, 12%; housing upgrades, 6%

DISCUSSION

Both campaigns were moderately effective in promoting behavior change. At Fort Lewis, 92% of respondents said they had taken at least one new action to become more energy efficient. At MCAS Yuma, up to 94% of respondents said they had already been practicing one or more of the targeted behaviors before the campaign began, but up to 22% said they had added one or more new ones. The top-reported behaviors of those who had changed were the top-targeted campaign behaviors (thermostat turndown at Fort Lewis and air conditioning-related efficiency at MCAS Yuma). This suggests that people made behavioral changes as a result of the campaign that, at Fort Lewis and toward the end of the campaign at MCAS Yuma, translated into a measurable reduction in energy use.

The effect of social identity and social comparison as motivators was not as powerful as expected. It was thought that the military environment, which emphasizes competition and is more homogeneous than most civilian populations, would be particularly suited for social comparison, leading to improved performance (Midden, Meter, Weenig, and Zieverink, 1983; Siero, Bakker, Dekker, and van den Burg, 1996). Nevertheless, few people said the desire to make their own community look good was a motivator for them. Furthermore, survey comments indicated that some residents were resentful of, and even hostile toward, neighbors they observed wasting electricity and outside water. With up to half the respondents

moving on post within a year, there may be little opportunity to build a group identity and even less motivation to make one's neighborhood perform better than everyone else's.

The potential benefit of social comparison should not be ruled out completely, however. At MCAS Yuma, a substantial 23% of respondents said they were motivated to save energy by wanting their installation to be the best in the (military) service. We speculate that military residents may identify more with their entire installation, or their branch of the service, than with their neighbors on a particular post.

Another way of looking at social comparison in these studies is that it affected parental, rather than group, behavior. In other words, parents modeled energy-efficiency behaviors in the home because they wanted their children to compare themselves with their parents and thus develop good energy-use habits. Social comparison, therefore, occurred inside the home through parent-to-child behavioral modeling. This is consistent with research showing that, in terms of adopting environmentally friendly behaviors, parents were more influenced by their children and spouses than by their neighbors' expectations (Bratt, 1999).

A very interesting finding relates to peripheral negative attitudes that affect energy-use behavior. Geller has hypothesized that people need sufficient personal control, self-efficacy, and other such self-affirmation characteristics before they can actively care enough to take environmentally responsible actions that benefit others (Geller, 1995). This assertion is based on Maslow's classic hierarchy of needs (Maslow, 1971), which suggests that satisfaction of self-needs enables individuals to transcend themselves and emit altruistic behaviors.

These models of altruism were supported in the military housing studies. Many residents returned their questionnaires with extensive narrative comments about structural problems with their homes that made it difficult to save energy. A typical survey response was, "The quarters are very old and what we do doesn't make a difference." The feeling of being at the mercy of the military was another theme. As one resident said, "The last thing a solider is concerned with is whether his house is energy efficient. Our Army is in horrible shape, no money for training or good pay. When we treat our soldiers better, then they will care." Geller's and Maslow's models would suggest that those who design behavior-based energy campaigns must address the conditions leading to feelings of disempowerment and resentment before more altruistic, pro-environmental behavior can occur.

The non-economic nature of the interventions described here raises a broader question: What effect might economic variables have on behavior, in comparison with the social-psychological model that was used as a basis for the studies described here? Intuitively, one might assume that the desire to save money or avoid economic penalties would overwhelmingly drive energy-use behavior, overriding other variables. But clues from the military residents' responses, as well as past behavioral research, indicate that the real answer is much more complex.

First, a serendipitous survey finding gave us some insight about the behaviors of non-bill-paying military residents vs. those who pay their energy bills. Off-post military families at MCAS Yuma are given a housing allowance that pays their utility bills up to a certain pre-determined limit. Those whose usage exceeds the limit must pay the excess themselves. Of the off-post residents who responded to the survey, 46 to 99% said they were already doing one or more of the targeted actions before the campaign began. The rate was lower for on-post residents, from 40 to 94%. In addition, off-post residents frequently commented that the need to save money on energy bills drives their energy-saving behavior.

Secondly, all residents, including those on post, said that financial penalties and incentives would be necessary to make other residents conserve energy. Together, these self-reported behaviors and opinions suggest that economic factors are indeed influential in promoting conservation behavior in military housing.

Research has shown, however, that economics do not fully explain energy-use behavior (Costanzo et al., 1986; Dennis et al., 1990; Harrigan, 1991; Stern & Aronson, 1984). For example, some consumers have ignored significant financial incentives to conserve energy, and others have continued to conserve even when the original financial incentive was greatly reduced (e.g., Hayes & Cone, 1977; Stern, 1992; Stern & Aronson, 1984).

Other comments by residents in our studies support this complexity of motivation. Residents who adopted new energy habits cited a variety of socially responsible and personal motives as the top reasons for their own behavioral change. They said that they were motivated a great deal by the need to do the right thing, to model good habits for their children, and to have a more comfortable home. These responses are consistent with previous research demonstrating that egoistic motives, in addition to altruistic ones, play a role in environment-protective behavior (Stern, Dietz, and Kalof, 1993).

The range and complexity of motivation for energy use demonstrate a key point of this study: An effective intervention must be customized to the population and situation being targeted. This includes pre-intervention consultation to help understand all variables, economic and otherwise, that influence people's behavior in a specific environment.

The concept of customization raises the broader question of this study's generalizability. To what extent can the study findings be extended beyond the military to the general public? The answer lies in identifying the characteristics and attitudes affecting energy use that military residents have in common with other populations. The more similar the characteristics, the stronger the case for applying a similar intervention approach.

Many military base communities are similar to small civilian towns of several thousand people. Families live in apartment buildings and houses, often as part of neighborhoods with schools, stores, recreational facilities, and community services. Military bases are close-knit social systems where communication is diffused through established, hierarchical channels. Demographically, military households are mobile, have a higher-than-average education, larger-than average family size, and spend a large portion of time away from home (Deal, Adams, & Adams, 1996; Lister et al., 1996). In terms of attitudes, military personnel demonstrate a willingness to "do the right thing," possessing a strong sense of justice in service of a greater goal (Lister et al., 1996). Patriotism and competition are ingrained in the military culture. These attributes are balanced with the common human desires for comfortable surroundings and the health and well being of themselves and their children.

Some of these characteristics also may be present in other community-living situations in which residents do not receive utility bills based on individual energy use. Such situations could include government-subsidized housing for low-income residents and seniors, apartments, travel lodging, and student dorms. In addition, some aspects of residential studies may apply to an even larger population – workers who are not personally billed for their company's utilities. Federal office buildings and facilities alone represented $3.5 billion in energy bills in 1998, the most current data available (U.S. Department of Energy, 2000).

A limitation of both military residential studies was their relatively short duration as pilot projects, lasting for one year and four months, respectively. Though both projects showed savings that were

attributable to the interventions, energy management and housing personnel at both bases were unable to continue the intervention and measurement activities at the same levels after the campaigns ended. Furthermore, research limitations made it infeasible to determine to what extent the interventions themselves translated into longer-term behavior. Because of the mobility and turnover of military families, it is unlikely that short-term campaigns lead to sustained behavioral change. What is really needed is to build behavioral research findings into systems to institutionalize change. Organizations need to incorporate energy efficiency as a fundamental value in their policies, regulations, contractual obligations, decision-making, and outreach. This way, energy efficiency becomes a fundamental value for the institution and a habit for residents, rather than being imposed or added on.

CONCLUSIONS

The current studies were innovative in designing customized intervention efforts, measuring subsequent energy use, and attempting to determine the effectiveness of various approaches in influencing measured energy conservation behavior, as described by users themselves.

Some aspects of a social-psychological model appear useful in motivating energy-use behavior change, but others are not as effective, at least in a military housing setting. In terms of institutionalizing behavioral change, it may be best to combine a variety of motivators, including appeal to environmental and parental responsibility, lifestyle benefits, incentives, and disincentives. Behavior motivated by altruism is more likely when residents feel a sufficient degree of personal control.

A mobile population, especially newcomers, requires continual outreach and consistent feedback depicting savings. Empirical study, tailored to each housing situation and population, is imperative for improving our understanding of conservation behavior.

Because of operational and resource constraints, some approaches found effective in other research could not be applied in the current studies. Future energy-conservation studies should more specifically investigate the influence of children on parents (Ekstrom, 1995), the effectiveness of a mock billing approach for feedback, written commitments, in-home visits, comparison with larger social units, addressing knowledge gaps and misperceptions that affect behavior, and longer-term change.

Such applied research could be carried out in a variety of housing situations where residents don't pay their utility bill, don't see their part of the bill, or don't see how their individual actions contribute to the total bill.

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