Hit Run to Go Back to the Schedule!

Evaluation of Behavioral Strategies for Effective Use of Programmable Thermostats

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INTRODUCTION

Framing the problem

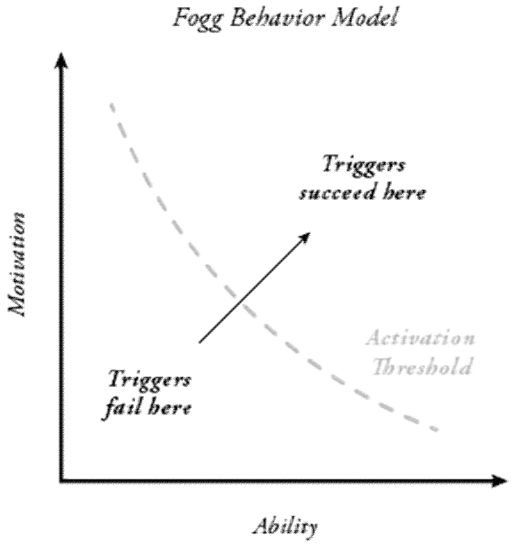
- Occupants who can control their household temperature, using thermostats, should be able to save energy, and avoid wasteful spending
- By turning down the temperature during the night and when no one is home
- Programmable thermostats could make those habits easy to achieve
- Research shows (Sachs *et* al. 2013, Meiers 2011) that having access to a high usability programmable thermostat is not sufficient to promote energy saving behaviors

Overview of the case study

We hypothesize that

At least three factors (Fogg, 2009) are necessary for occupants to keep using thermostat schedules during the Winter:

- We maximize the ability to use thermostats for energy savings
- We ask occupants to commit to keep the schedules and hypothesize that will increase motivation
- And we provide a "trigger" that nudges occupants into performing the behavior even when they deviate and override the programmed schedules



Overview of the case study

- **Target units**
  - 160 individually metered units, Albany
  - Occupants control their home temperature via a programmable thermostat Honeywell Focus Pro 6000
  - Multifamily buildings
  - Units ranged from 1 to 4 bedrooms

ALBANY HOUSING AUTHORITY

- **Randomized controlled trial experiment**
- **Duration: Between December 2014 and March 2015**

- **Detailed evaluation is still underway**

- **In this presentation I discuss**
  - How the feedback from the focus group help determine the message of the prompt
  - if the treatment had a measurable effect over the number of days the occupants used schedules
  - The differences between average daytime and nighttime household temperature between groups

FOCUS GROUP

What would justify programming the thermostat to keep the temperature of the house cooler at night and during the day when no one's home?

Advantages / Enjoy

- Being smart "No need for heat if no one is there…"
- To save money (5)
- To be more comfortable and healthier (5)
- "Not to have to worry about controlling the temperature" / Do it once and forget about it (3)

Disadvantages / Do not enjoy

- Wait time: "having to wait for the house to cool down or heat up" (3) It's also a noisy process (1)
- Different family members have different temperature preferences (3)
- "It is irritating to have to remember to change the temperatures" (in the thermostat) (2)
- Programming the thermostat is too complicated and too time consuming (2)

Study of the messaging for the prompt that reminds occupants to keep the schedules

First Choice

This sticker is about keeping the house warm when people are home. Smart choice

Like: Straight to the point. The House. Doing the smart choice.

Dislike: Message not very clear

Second Choice

This sticker is about saving money by programming thermostats

Like: Message is Straight to the Point

Dislike: The Pig

Third Choice

This sticker is about not wasting money

Like: Putting money back to the bank

Dislike: The Pig

Message is not very clear

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EXPERIMENTAL DESIGN

Conditions that were common to the whole group of participants

- **Before the intervention & *with the support of the Albany Housing Authority***
  - Non-programmable thermostats were replaced by new Honeywell Focus Pro 6000 units
  - Temperature sensors were placed on the wall beside the thermostat
  - Tenants were informed of each interview campaign by the landlords – 3 campaigns

Group 1 - Control

- Interview about family schedules and temperature preferences
- Instructions to program the thermostat + explanation about the “hit run” function

Group 2 - Ability

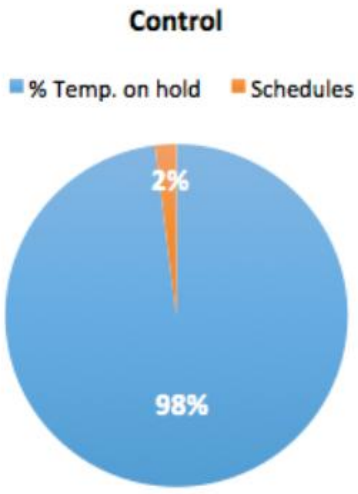
- Interview about family schedules and temperature preferences
- Instructions to program the thermostat + explanation about the “hit run” function
- Schedules and setpoints are programmed for the convenience of the tenants
- Sticker

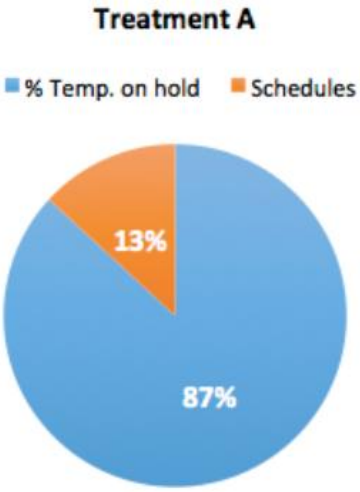
Group 3 - Commitment

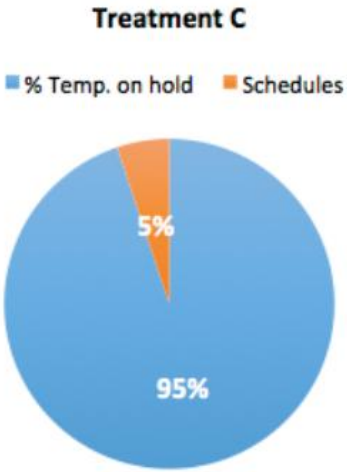
- Interview about family schedules and temperature preferences
- Instructions to program the thermostat + explanation about the “hit run” function
- Schedules and setpoints are programmed for the convenience of the tenants
- Sticker
- Commitment

Recruitment

Groups	Effective recruitment (exc. Opt outs)	Opted out
Group 1 - Control	45	4
Group 2 - Ability	40	4
Group 3 - Commitment	45	4







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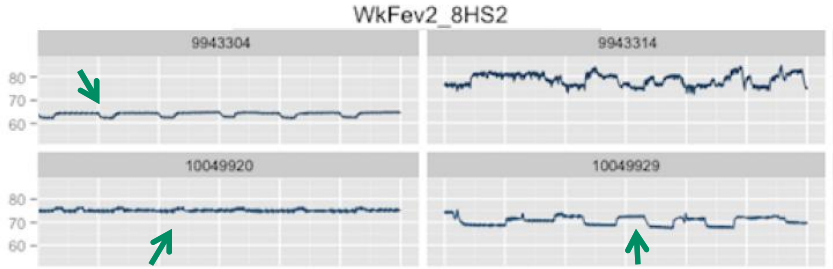
ANALYSIS

Are the households in the treatment groups more likely to keep manual and programmed setpoints in comparison to the control group?

METHOD

- Clustering algorithm to group together days with similar patterns
- Compared the patterns with the schedules previously set or reported
- Coded each day with a pattern with “1” / Day with no pattern “0”
- Counted the number of positives against the negatives and calculated the probability of those positives to happen by chance
- And then compared the positives between groups



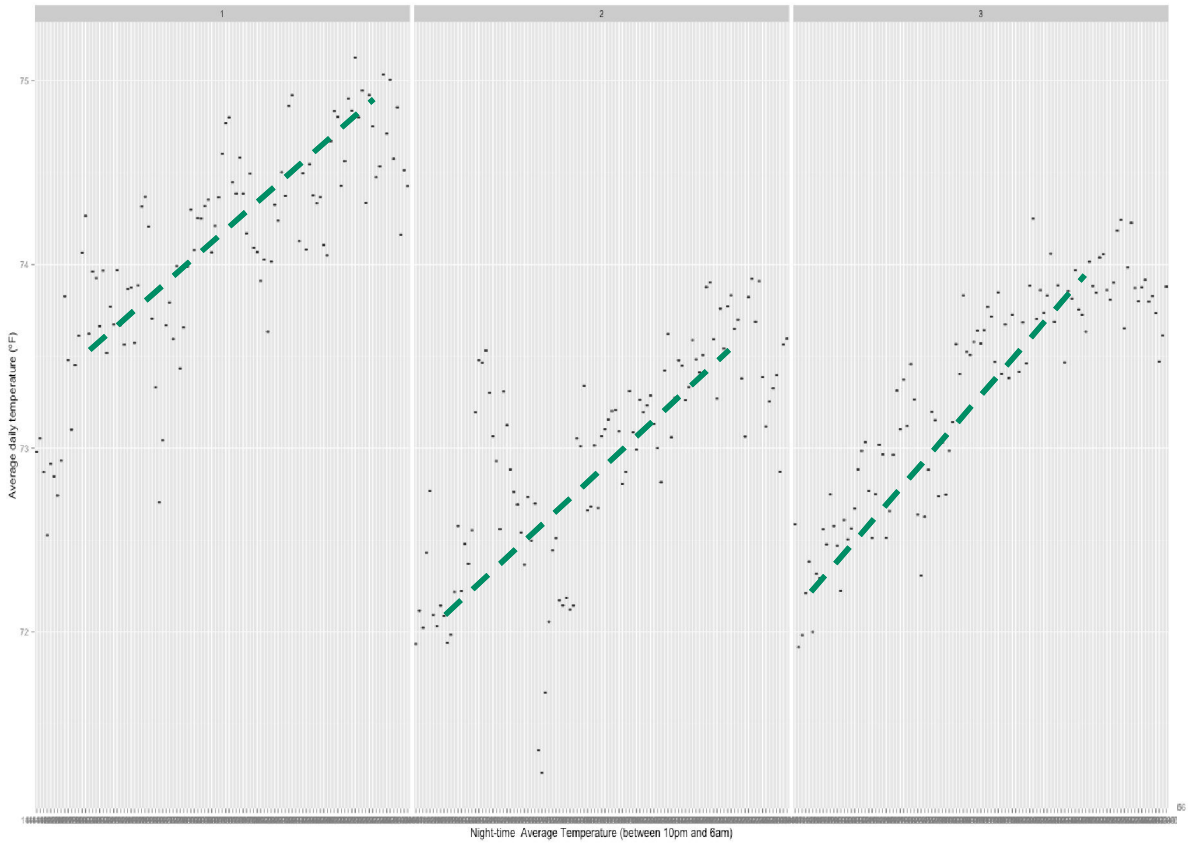
- **PRELIMINARY RESULTS**
- Significant difference between treatments and control but no effect between treatments

Tukey Contrast

	t value	Pr(>|t|)
2 - 1 == 0	3.643	0.00111 **
3 - 1 == 0	3.193	0.00487 **
3 - 2 == 0	-0.335	0.94019

- **The households from the treatment groups used significantly more schedules than the houses that belong to the control group**

Is there a difference between treatments and control for the average temperature of the homes during the experimental period?



PRELIMINARY RESULTS

The control group appears to an average (median) daily temperature trend higher than the treatments but no difference appears to happen between treatments

Overall it seems that the households that belong to the treatment groups keep their homes cooler, when no one is home or overnight

FINAL COMMENTS

Hit Run To Go Back to The Schedule
- smart comfort all winter

- The sticker was designed to take advantage of a feature of the thermostat
- Occupants could override settings but were reminded that they could revert to the schedule just by pushing a button on the thermostat
- It made the behavior easy to do and immediate

- As a consequence, we see a large number of homes returning to the previously set schedules during the heating season
- The majority of those who chose to keep using schedules changed their temperature setpoints but kept the schedules

- The commitment was relatively easy to obtain but promising to keep the schedules seemed to have had no real effect in the experiment

- A rigorous evaluation of the results is still underway
  - Calculation of the of the treatment and energy savings
  - Comparisons with the baseline

Collaboration and acknowledgements

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Questions