



Understanding Behavioral and Social Impacts on HVAC Energy Efficiency: Beyond the End User

Kristin Heinemeier
Claudia Barriga

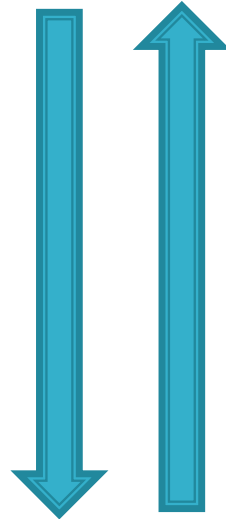
Psychology
Sociology
Physiology

End user



“Middle Men”

Information
Competence
Trust



User Interface
Comfort Conditions

Technology

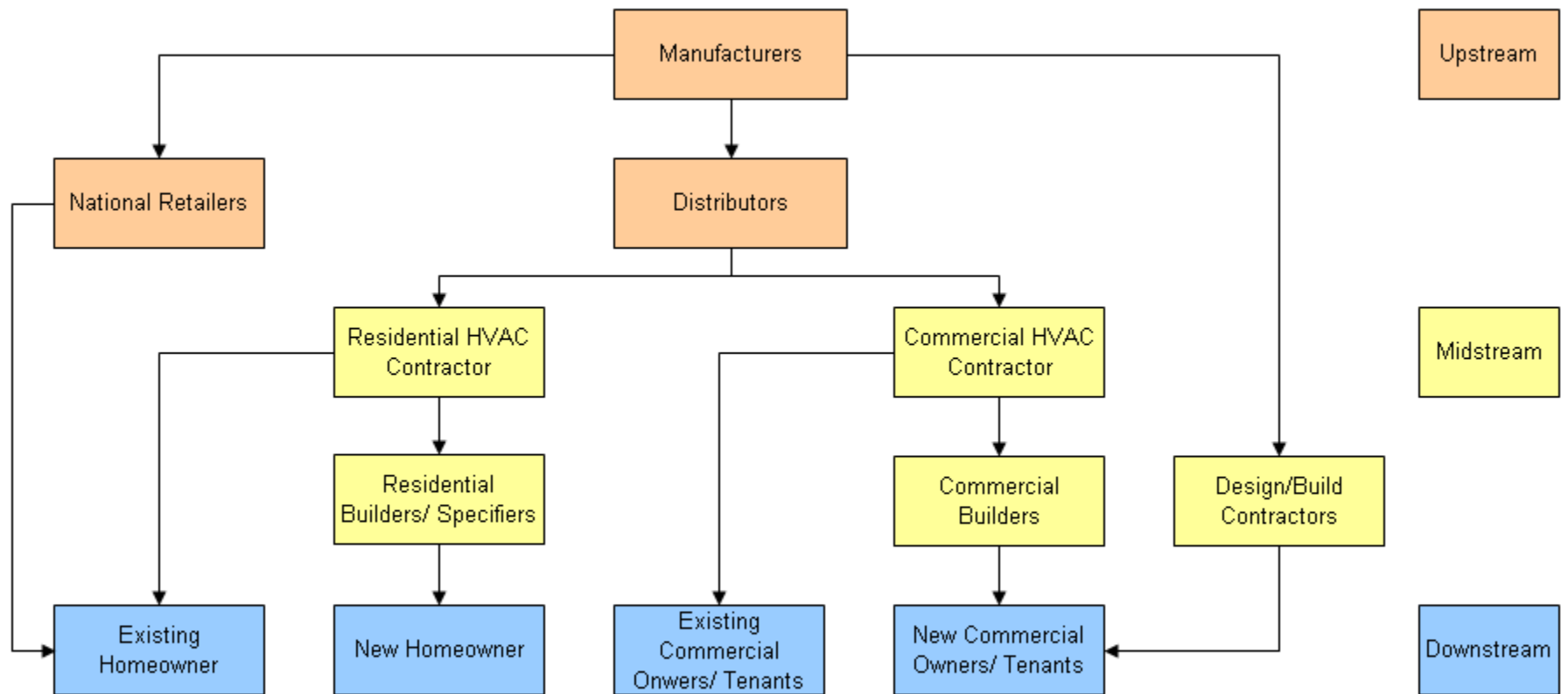


The Power of the Middleman

- That **magic moment** when an HVAC system is not performing well and it should be replaced with something, hopefully something efficient.



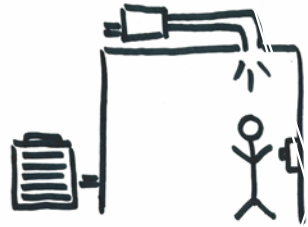
There's More Than One Middle Man



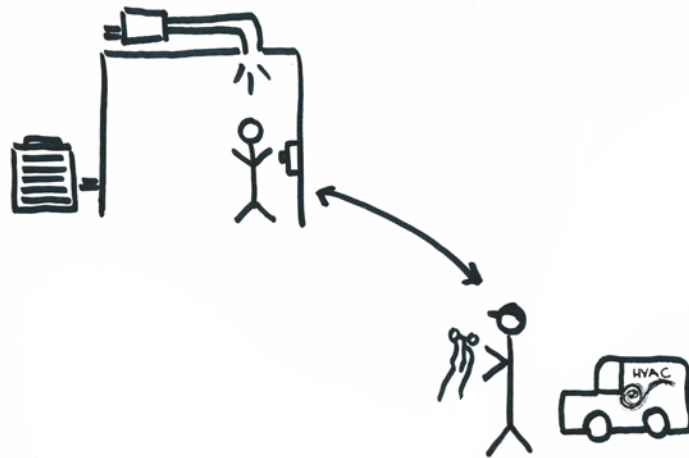
Residential End Users and Their Thermostats



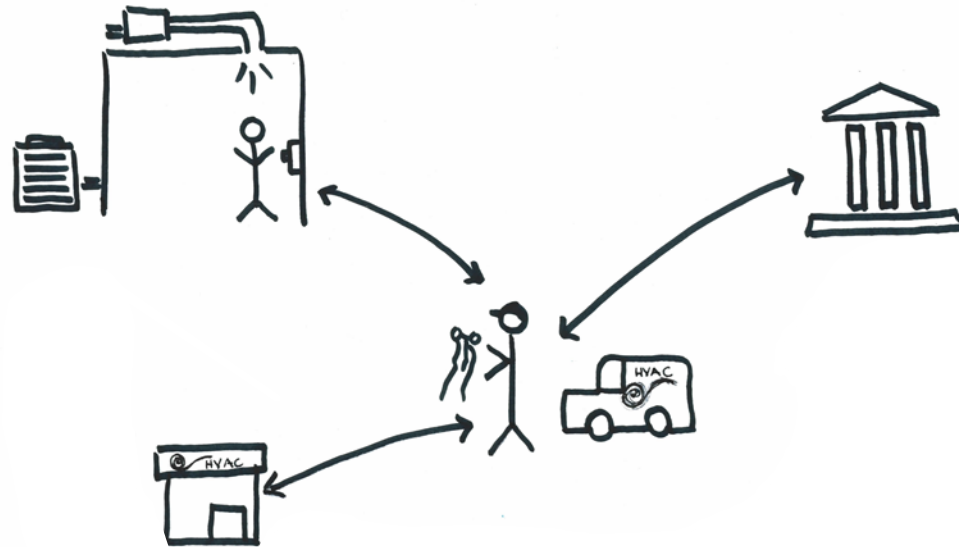
The technicians and their tools



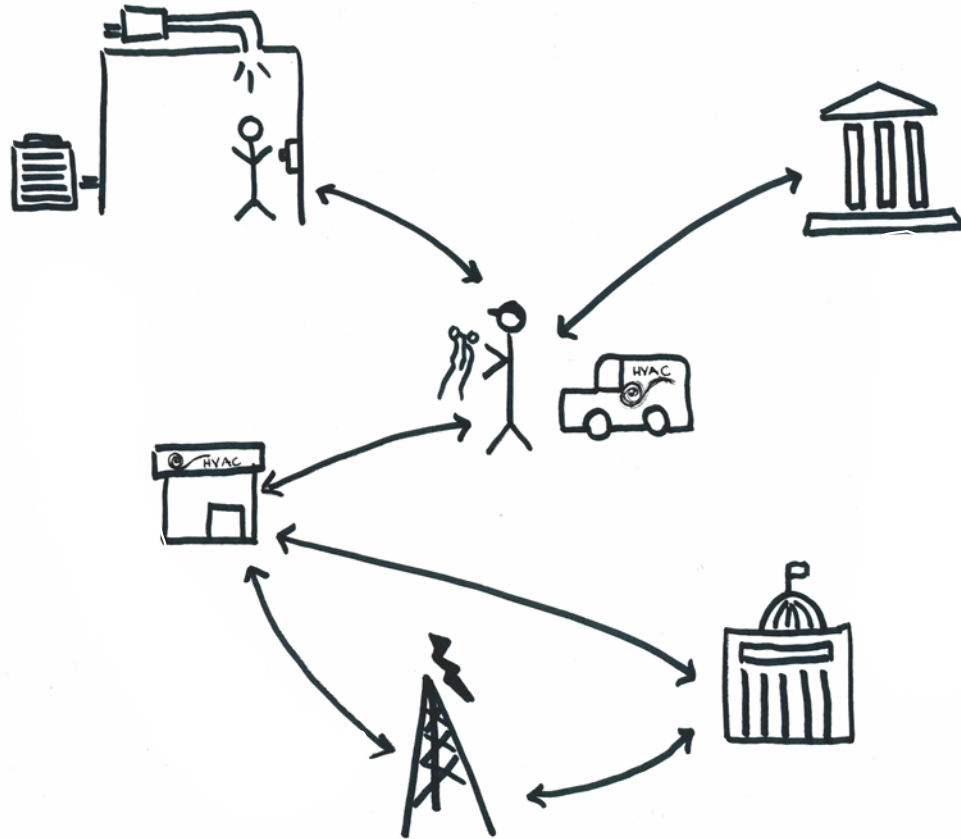
The End User Meets the Technician



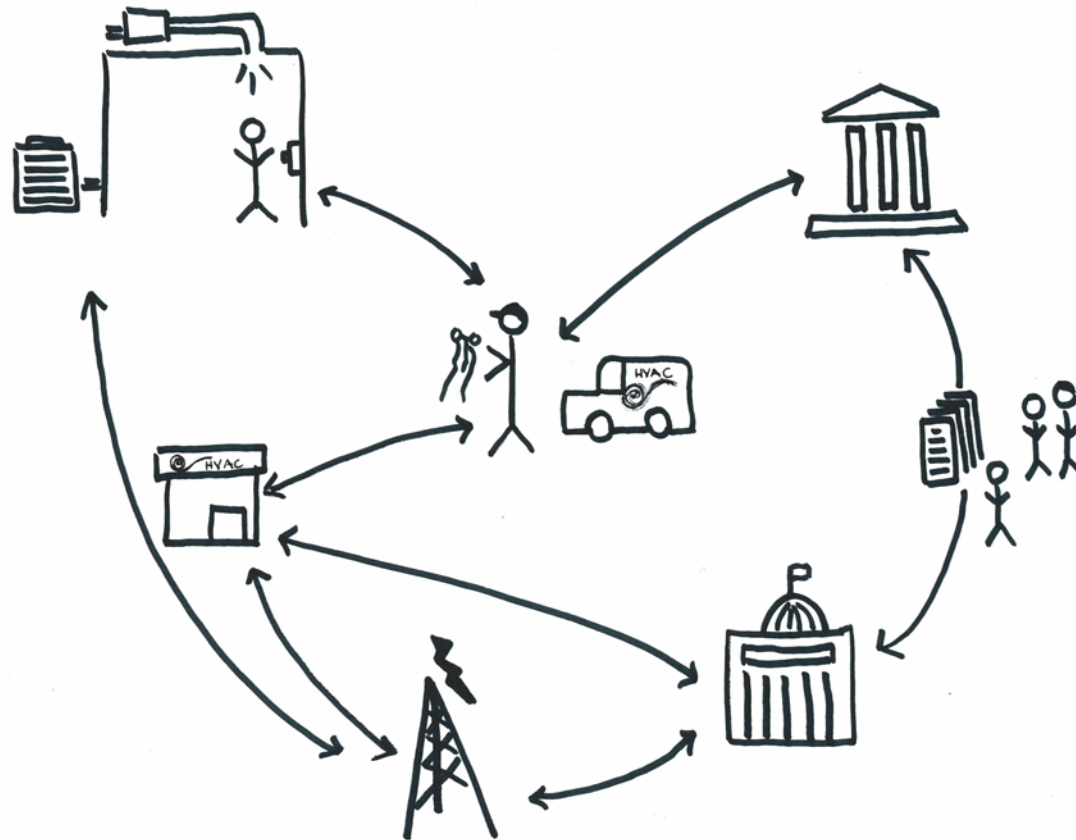
Technician brings in influences from diverse institutions



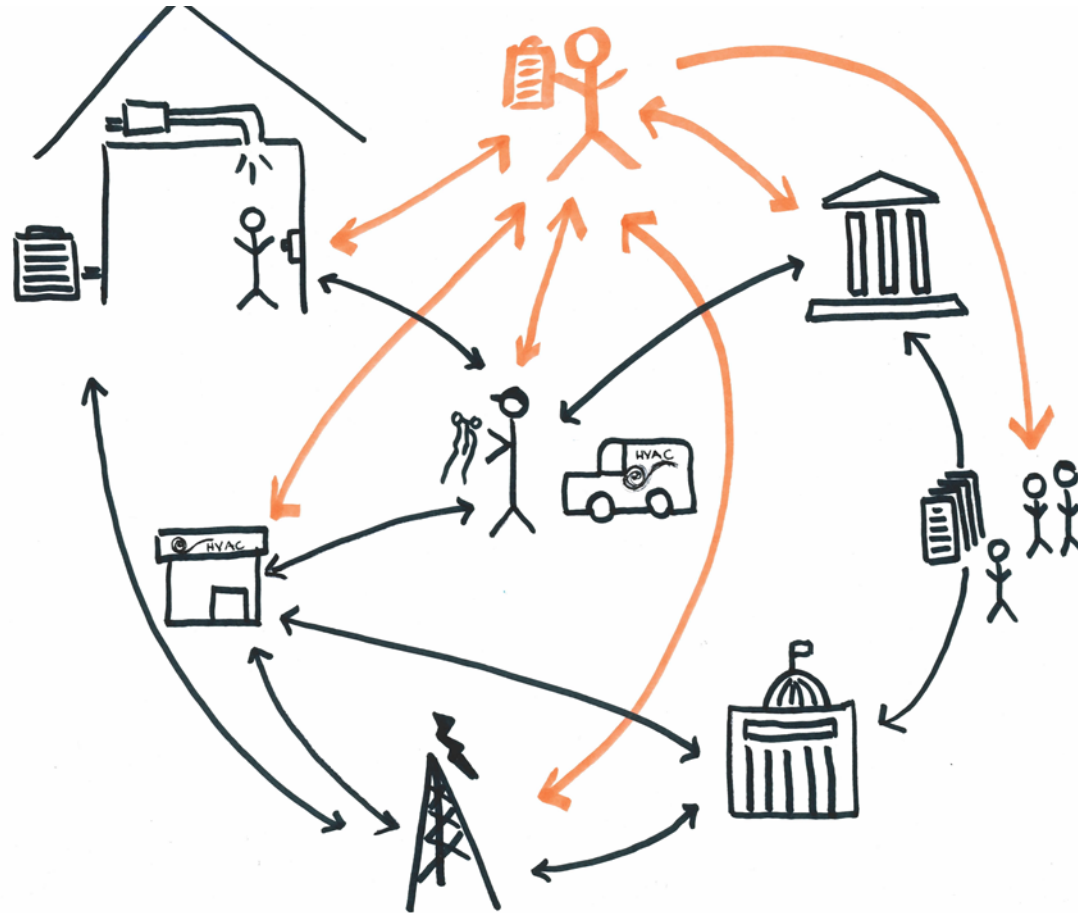
Who are under other influences themselves...



Each actor or group of actors brings in different sets of knowledge, motivations and beliefs about each other



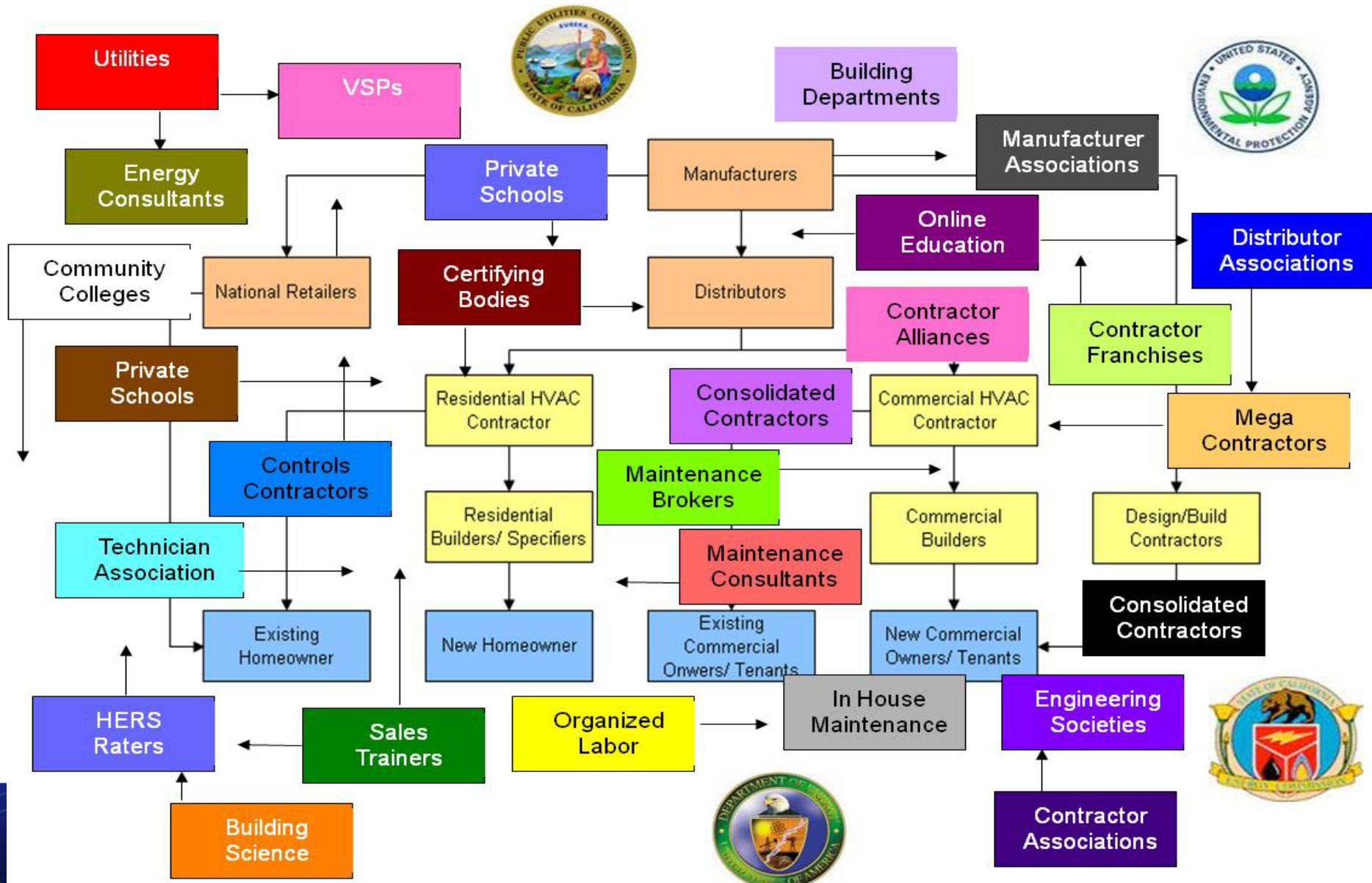
Researchers need to understand these

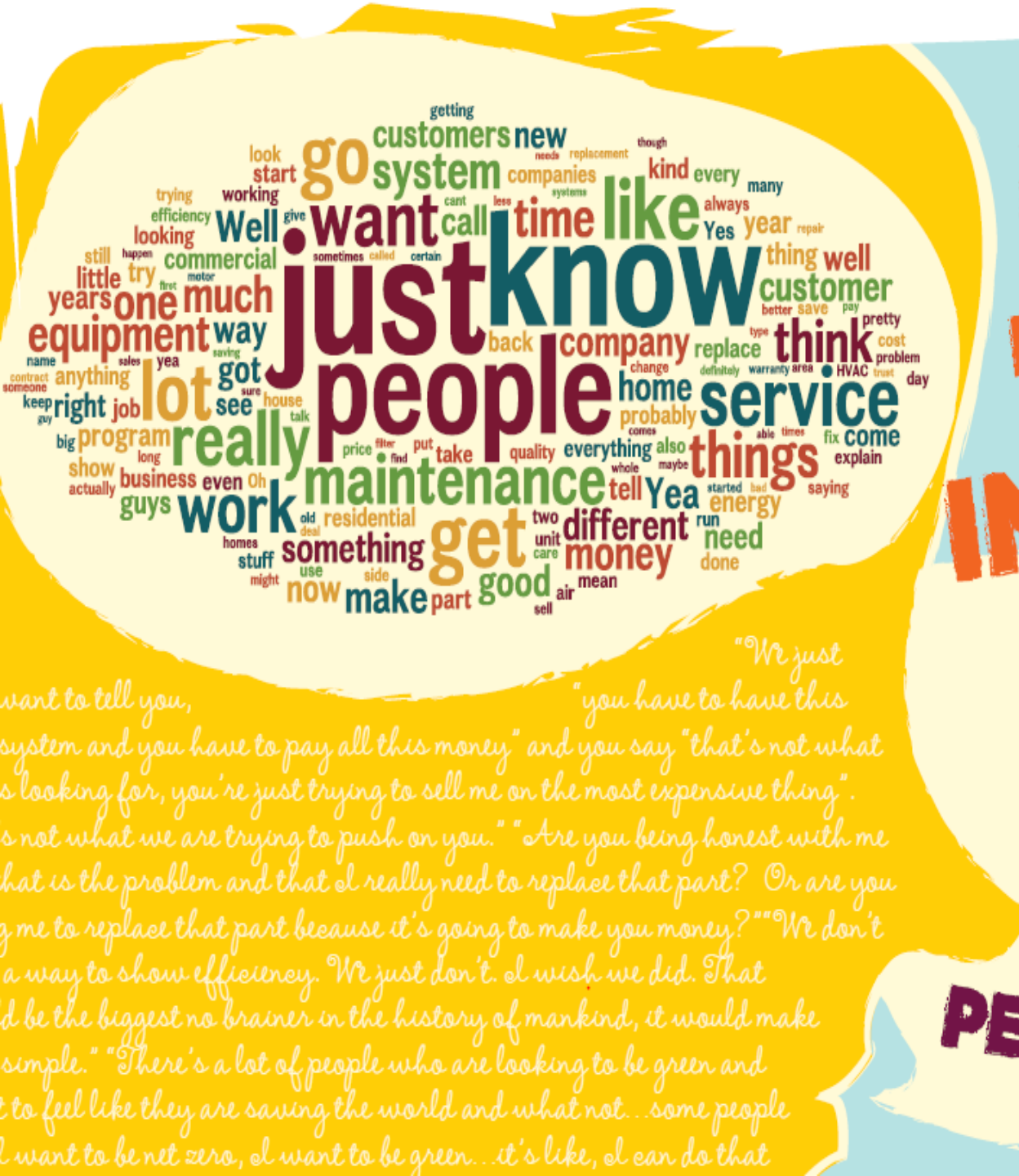


Researchers also need to understand how these affect each other



It gets better!





getting customers new
look start go system companies
trying efficiency Well want call time like
still happen commercial motor
years one much just know
equipment way got lot see house talk
contract someone keep right job big program really work
show actually business even Oh
guys stuff something get
homes use side now make part good
old deal
residential
two unit care
different money
run need
done

"We just want to tell you, 'you have to have this system and you have to pay all this money' and you say 'that's not what I'm looking for, you're just trying to sell me on the most expensive thing'. 'That's not what we are trying to push on you.' 'Are you being honest with me? What is the problem and that I really need to replace that part? Or are you just trying to get me to replace that part because it's going to make you money?' 'We don't have a way to show efficiency. We just don't. I wish we did. That would be the biggest no brainer in the history of mankind, it would make it so simple.' 'There's a lot of people who are looking to be green and want to feel like they are saving the world and what not... some people want to be net zero, I want to be green... it's like, I can do that

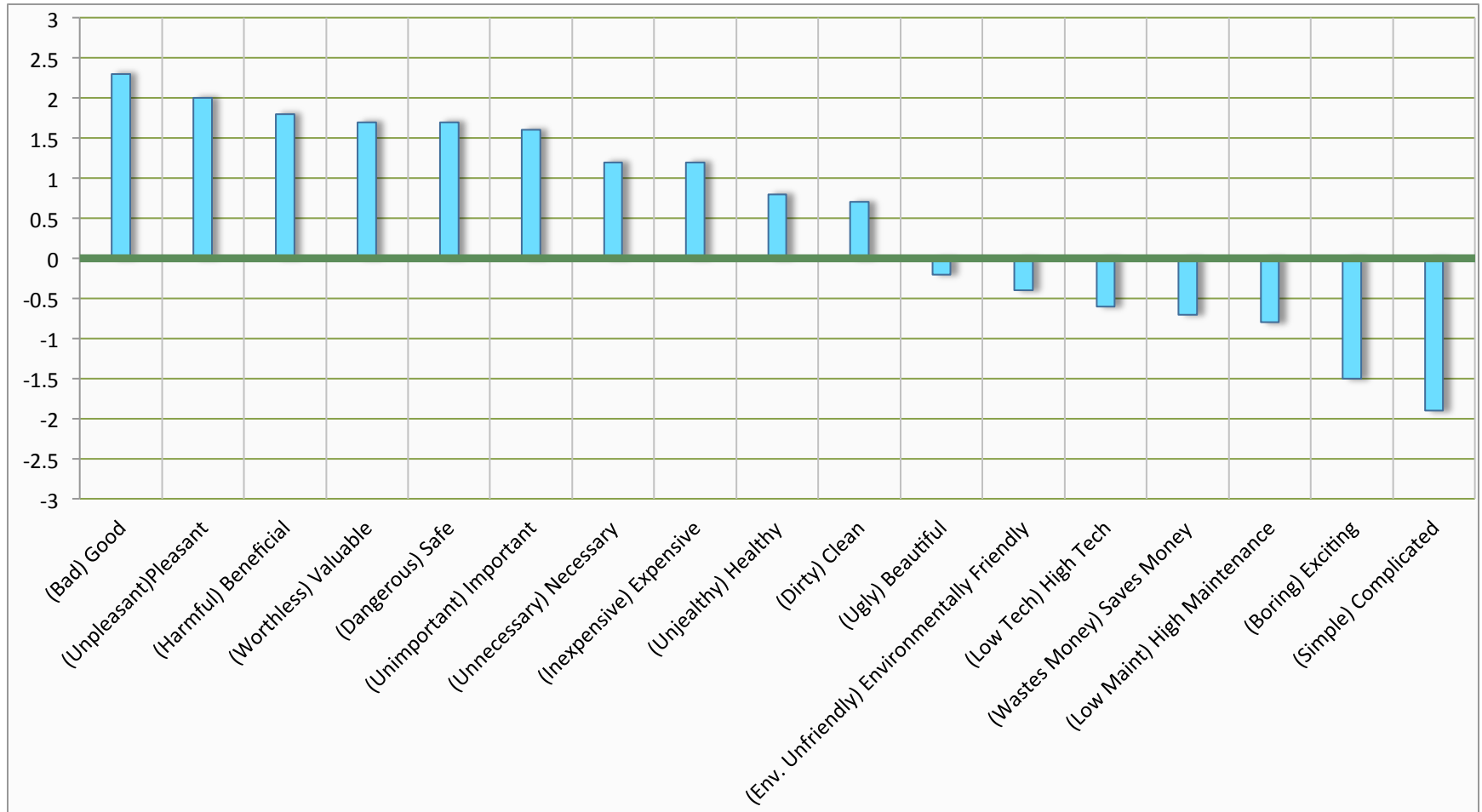
**HVAC
BEHAVIORAL
RESEARCH
INITIATIVE**

**BECAUSE
PEOPLE
MATTER
IN HVAC
PERFORMANCE**

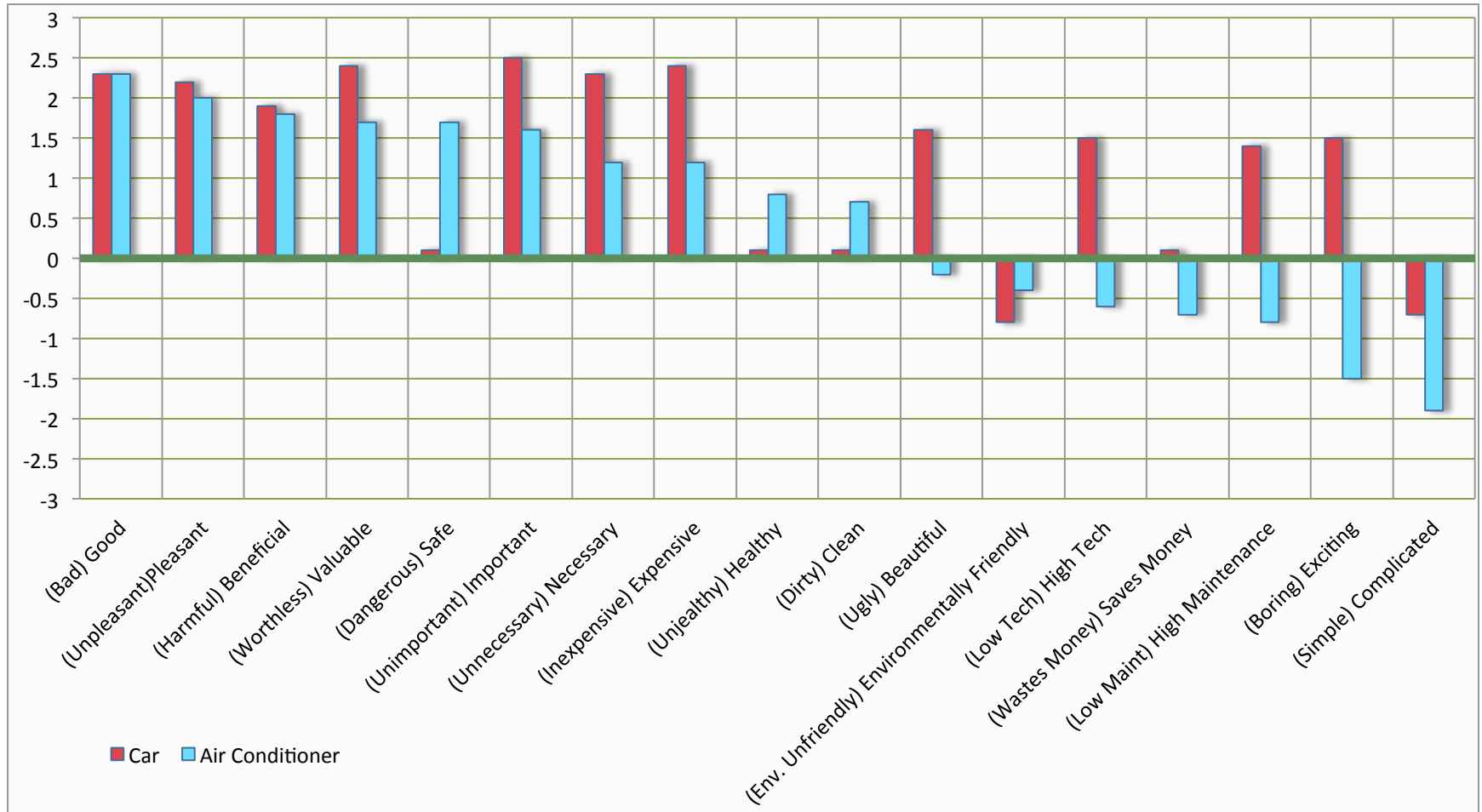
Customer Maintenance Behavior Study

- On-Line Random Survey of 268 residential SCE customers
- 4 Focus Groups each with 10 small business owner from SCE territory
- What are customers' knowledge, beliefs, values, intentions related to HVAC Maintenance?

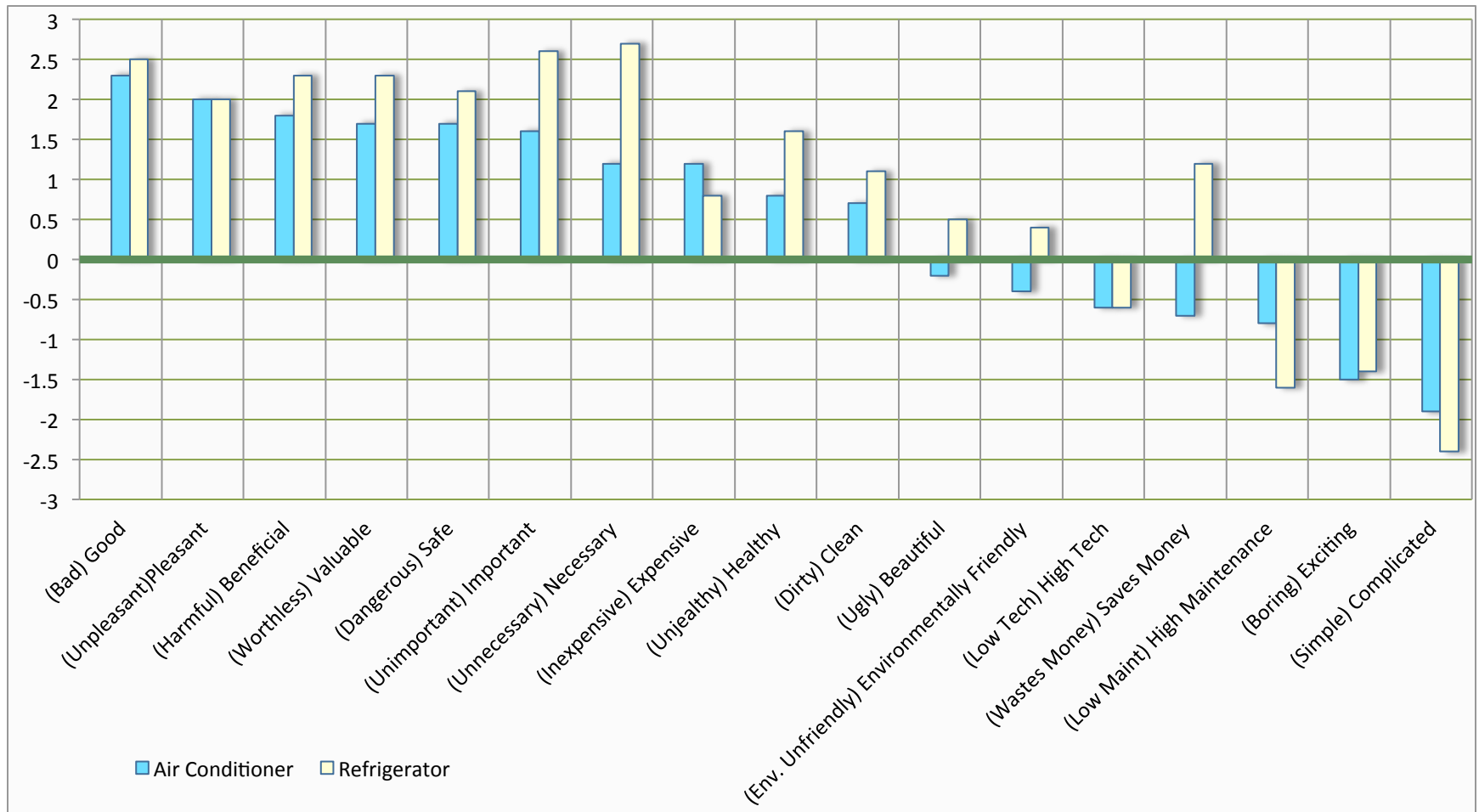
Understanding Maintenance— Residential Survey: Attributes of AC



Understanding Maintenance— Residential Survey: Attributes of AC



Understanding Maintenance— Residential Survey: Attributes of AC

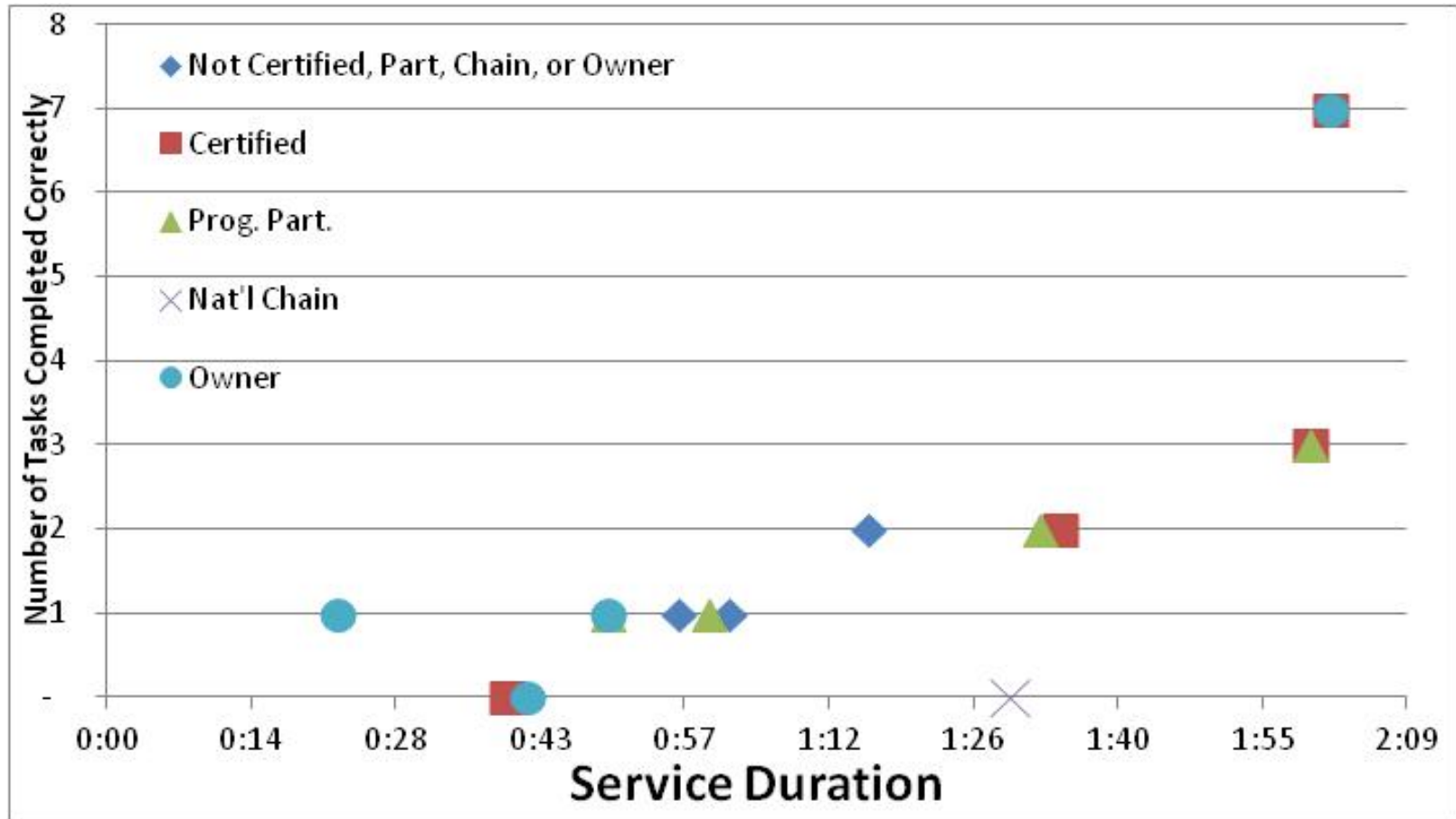


Maintenance Technician Observation Study

- Covertly Observed 13 Maintenance Technicians
- Requested “service,” “maintenance,” and “energy tune-up”.
- Two “faults”:
 - Airflow $< 250 \text{ cfm/ton}$
 - Registers closed
- Post-Observation Interview



Tasks Completed Correctly by Service Duration and Technician Characteristics



A large, white, industrial HVAC unit is mounted on a rooftop. The unit has a prominent, angled metal duct on its side. The background shows a clear blue sky with scattered white clouds. The rooftop surface is visible in the foreground, showing some equipment and structural elements.



New Service Models for a New Service

- Quality Maintenance services will take **over two hours**.
- Adherence to **ACCA Standard 4 & 180** or other industry standards for quality workmanship must be mandatory.
- Accurate and well-documented **measurements and observations** must be the basis for all adjustments and recommendations.
- Technicians must **understand the value** that they are providing so that they will take pride in this new service and enthusiastically offer it to their customers.

The Key is Customer Acceptance

- Gather **solid data** on the energy- and non-energy benefits.
- Focus on potential “**early adopters**” who already value this technical performance.
- Address the “low-tech” perception by making HVAC servicing as **high-tech** as possible by providing:
 - ACCA Standard Checklist
 - Measurements with expected high/low values
 - Charts, eg, duct leakage as ducts are being sealed
 - Measurements and observations that can be tracked over time.

Thank you! Questions, Comments

