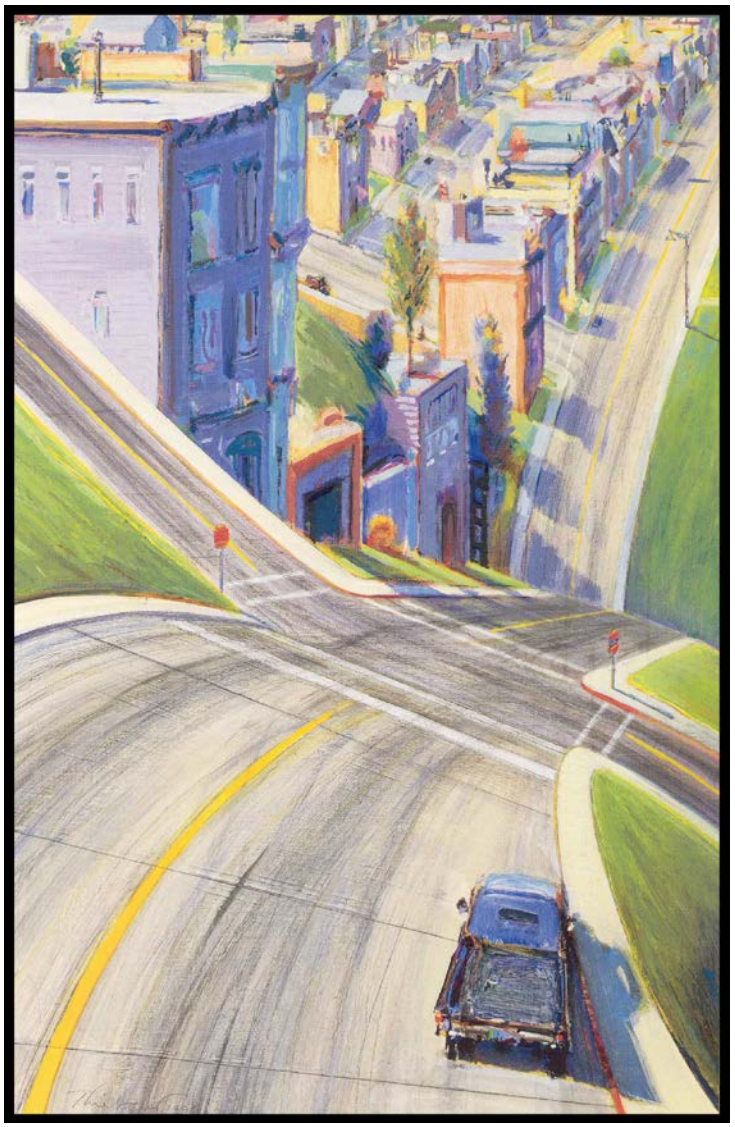
UCDAVIS
PLUG-IN HYBRID & ELECTRIC VEHICLE RESEARCH CENTER
of the Institute of Transportation Studies



Framing Electric-Drive Vehicles

Ken Kurani
Institute of Transportation Studies
University of California, Davis USA
www.its.ucdavis.edu

Asilomar 2011 Conference on Transportation and Energy, 30 August 2011

ITS UCDAVIS

"Nobody has a crystal ball clear enough to see how big the electric car market will be five years from now."

Brad Berman (23 August 2011) Pike Research Forecasts 1 Million Plug-in Cars by 2016.

What are frames?

"…mental structures that shape…

the way we see the world,

the goals we seek,

the plans we make,

the way we act, and

what counts as a good or bad outcome..."[1]

1. Lakoff, G. (2004) *Don't Think of an Elephant! Know Your Values and Frame the Debate*. Chelsea Green Publishing: White River Junction, VT. p. xv.

See also, Goffman, E. (1974) Frame Analysis: An Essay on the Organization of Experience. New York: Harper & Row

Seemingly simple technical fact

Presently, we can store more energy per unit volume, mass, and cost in a gasoline tank than in an electro-chemical battery.

Pre-existing PEV Frame

PEVs' problems are cause for delay

- EVs are different from conventional cars, therefore people will not buy them
  - Asilomar 1995: EVs must be transparent to consumers.
    - Batteries!
      - Driving range limits
      - Long recharge times
    - Recharging network limited
- Before we can have PEVs, we need two things:
  - "advanced" batteries
  - public recharging infrastructure

Statements in this frame about PEVs

"All-electric cars are the Next Big Thing. And they always will be."[1]

"EV Buyers Want More Range Than Offered."[2]

"About 80 percent of Americans … expect a BEV to have a single-charge range greater than the approximately 100-mile range provided by the Mitsubishi and Nissan.

1.Bryce, R. (2010) Unplugged! Why Electric Cars Are the Next Big Thing…And They Always Will Be. Energy Tribune. Posted August 5. Similar statements are widely attributed and likely to have been used long before appearing in Bryce.

2. King, D. (3 August 2011) http://www.autoobserver.com/2011/08/ev-buyers-want-more-range-than-offered.html

An Alternative Frame

PEVs give access to new values

- Some people will buy PEVs *because* PEVs are different from conventional cars
- Three new systems of benefits
    1. Electric drivetrain
    2. Recharging behaviors
    3. Identity: Environmental, social, and civic
- Create new values, new benefits, new behaviors: new lifestyle sectors
- People learn, adapt, explore, play,…even make mistakes

If experts don't have a clear enough crystal ball, how do households describe their own futures?

- People tell stories—narratives—to connect their pasts through the present to possible futures.
  - Such narratives create coherence and meaning
- Futures can be multifarious, contingent, and uncertain

"The future is already here –
it's just not evenly distributed."[1]

1. Attributed to, and apparently claimed by, William Gibson.

MINI E Drivers: How long to access new systems of PEV benefits?

Drivetrain

- Accelerate from 0 to ~30mph—3 to 4 seconds.
- Turn evaluation of aggressive regenerative braking, from negative to positive—3 to 4 days.

Recharging

- Sense of independence from oil, no trips to gas stations, stable electricity prices vs. fluctuating gasoline prices—3 to 4 weeks

New lifestyle sectors

Initial Household Fleet

A hypothetical household owns two cars to which they make routine trip assignments.

Car 1 (ICE)

- Trip **a**
- Trip **b**
- Trip **c**
- Trip **d**

Car 2 (ICE)

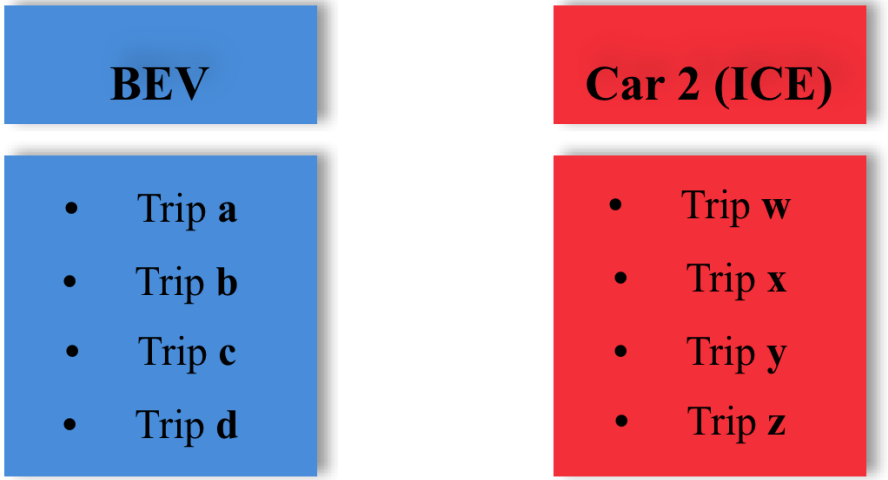
- Trip **w**
- Trip **x**
- Trip **y**
- Trip **z**

At first glance, BEVs may not fit the present

Confronted by the idea of a BEV, this is what people imagine they must do—and few imagine it is a good idea.

A battery EV may not simply substitute into their *present*.

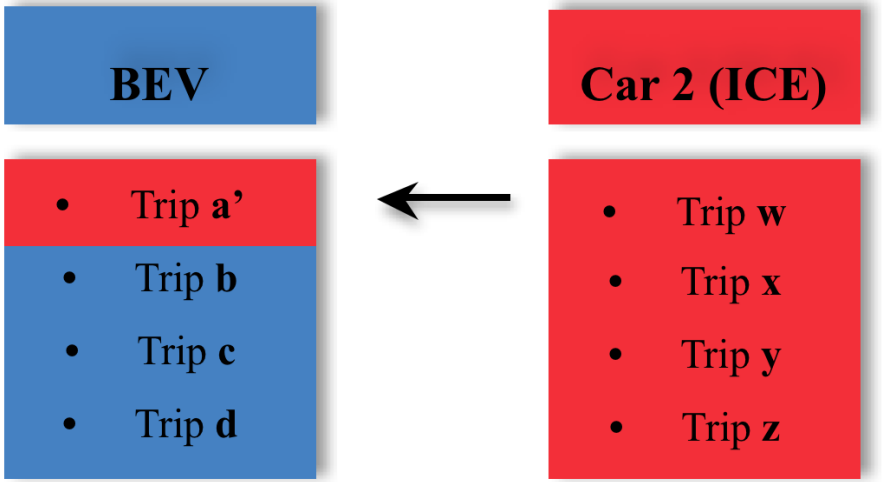
This is also not what happens in households that drive BEVs.



Initial Adaptation

Car 1 replaced with a BEV. Trip **a'** originally performed in Car 1 cannot be done in the BEV, e.g., MINI E, due to cargo, seating, or range limitations.

Common adaptation: reassign trip/activity to Car 2.

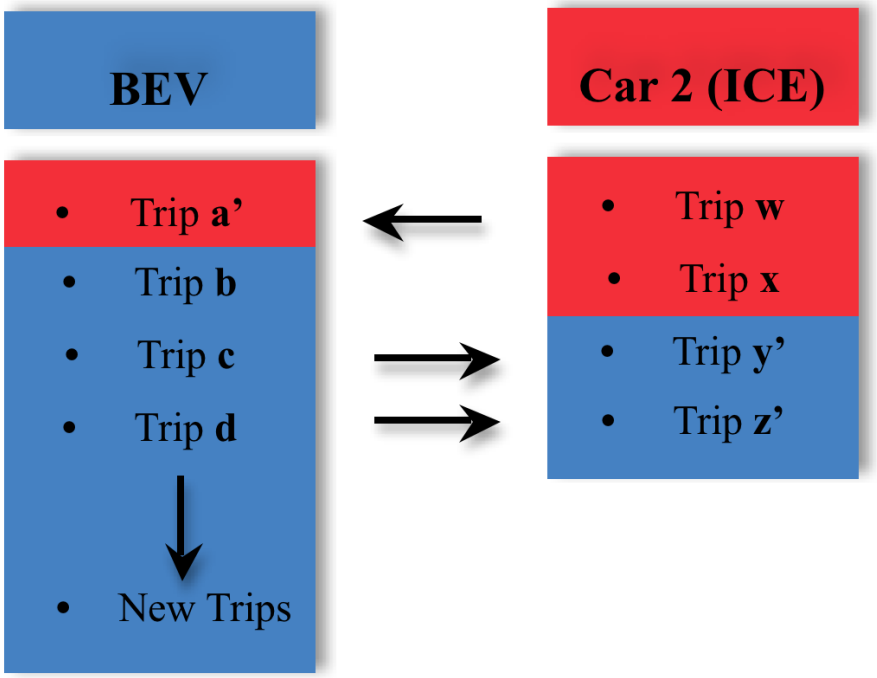


Adaptation and Exploration

Household may reassign other vehicle's trips (**y'** and **z'**) to EV for a variety of reasons:

- EV driving performance (fun to drive)
- Lower fuel/operating costs
- Less polluting

Some may change destinations and create new trips.



Learning Process

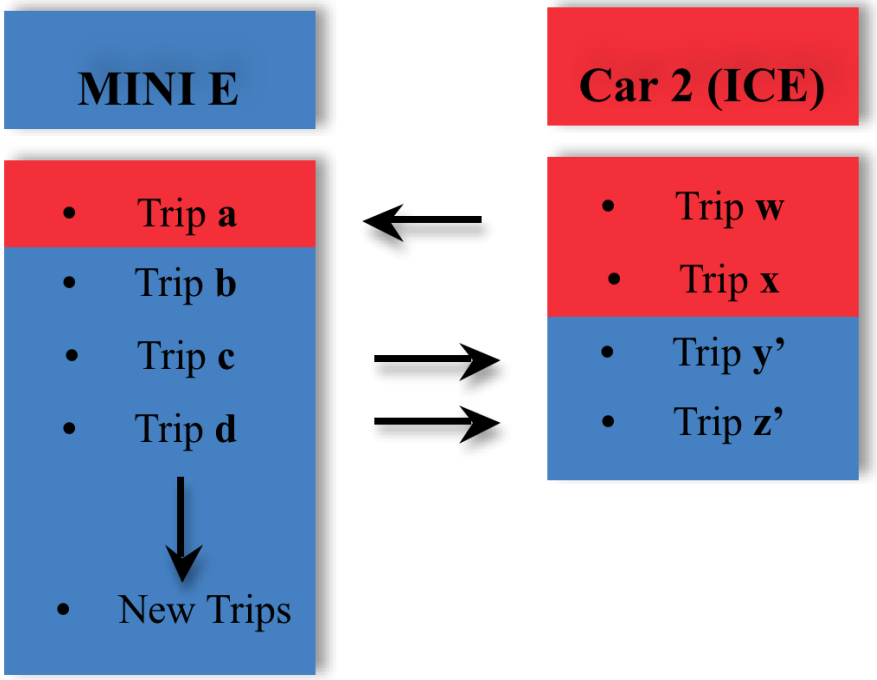
EV lifestyle sector can expand and change as drivers get comfortable with the car, learn distances to destinations and daily totals, (and possibly as infrastructure develops).

If MINI E drivers ever had range anxiety (a pre-existing frame idea), now many have range aspiration (an alternative frame idea)

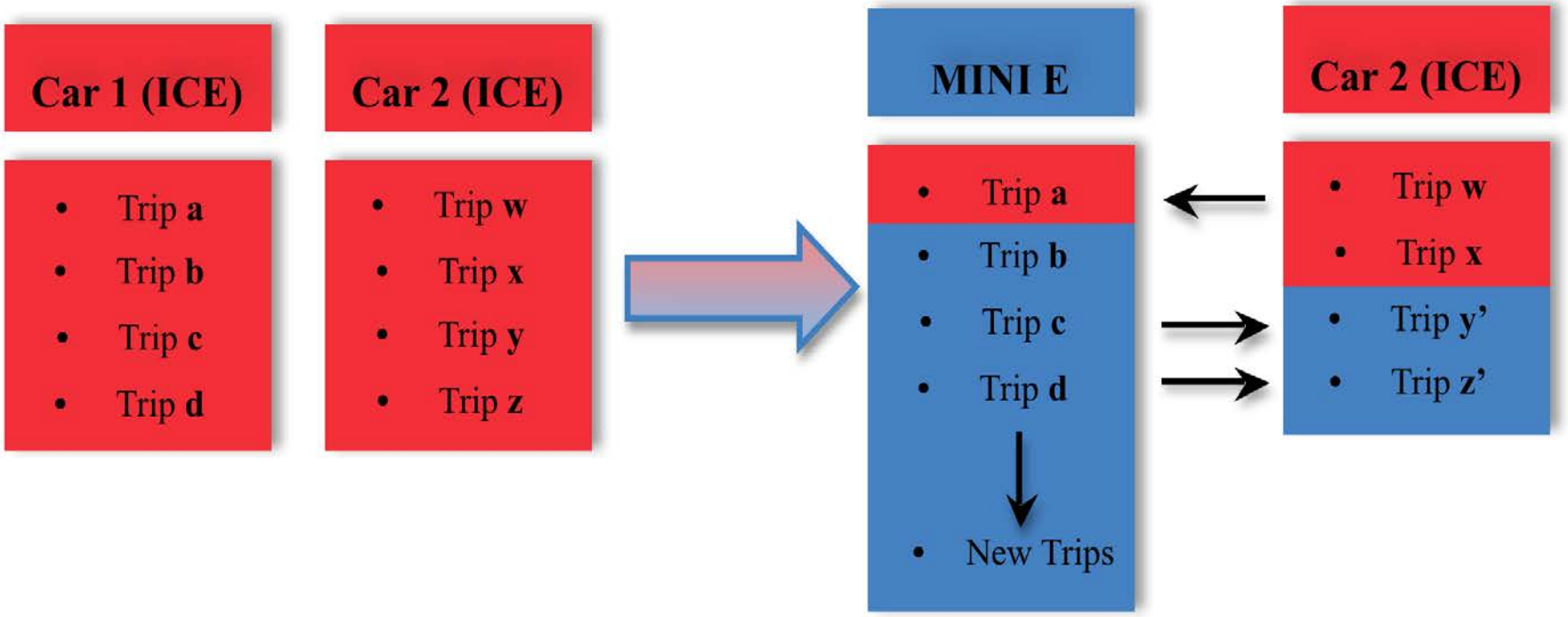
They don't want more range because they are anxious about reaching a destination.

They want to access more of their life in their EV: How much of my life can I get into my "MINI E lifestyle sector"?

A fuller electric mobility lifestyle sector should not be confounded with more range.



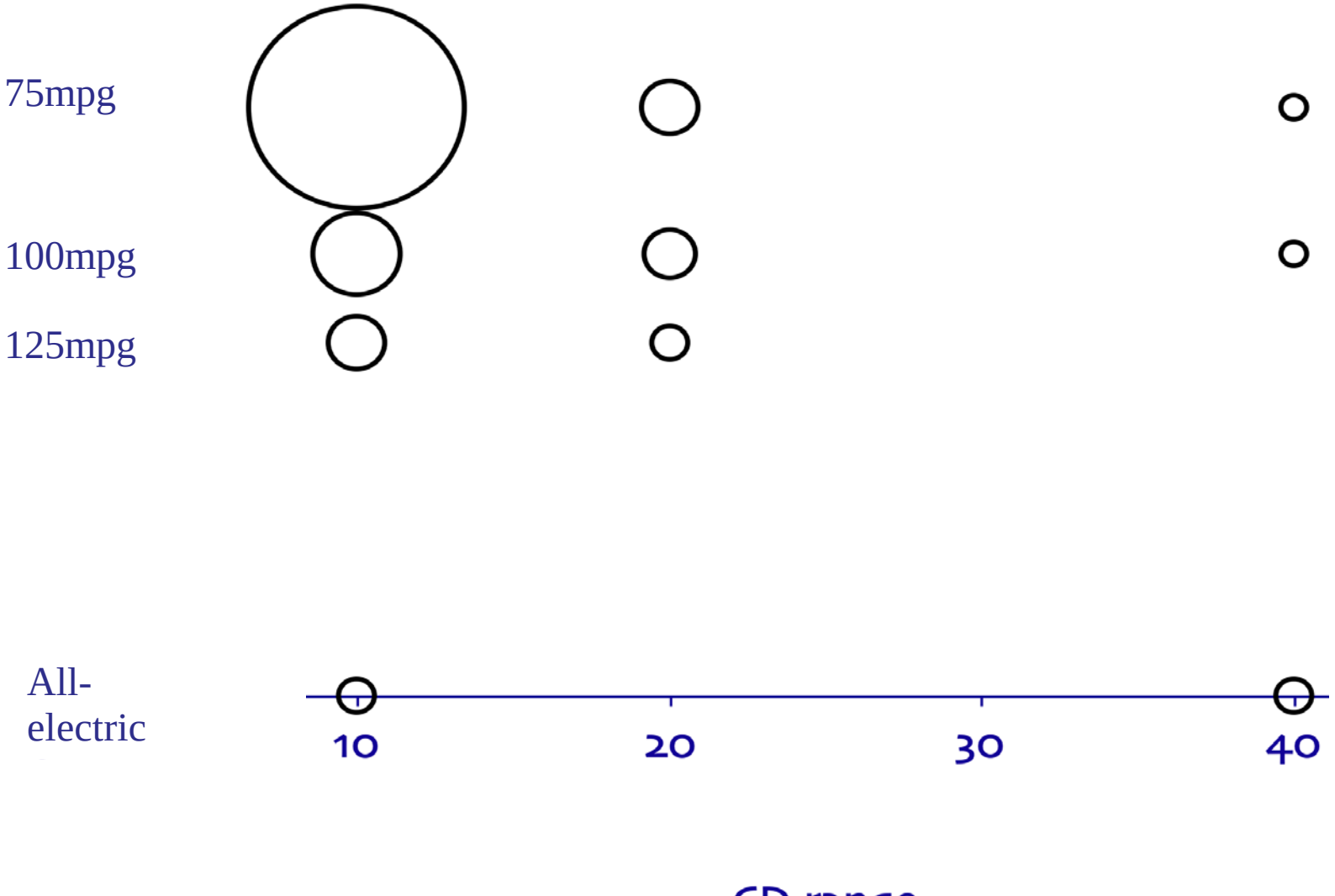
MINI E drivers do not have mystical powers to divine the future



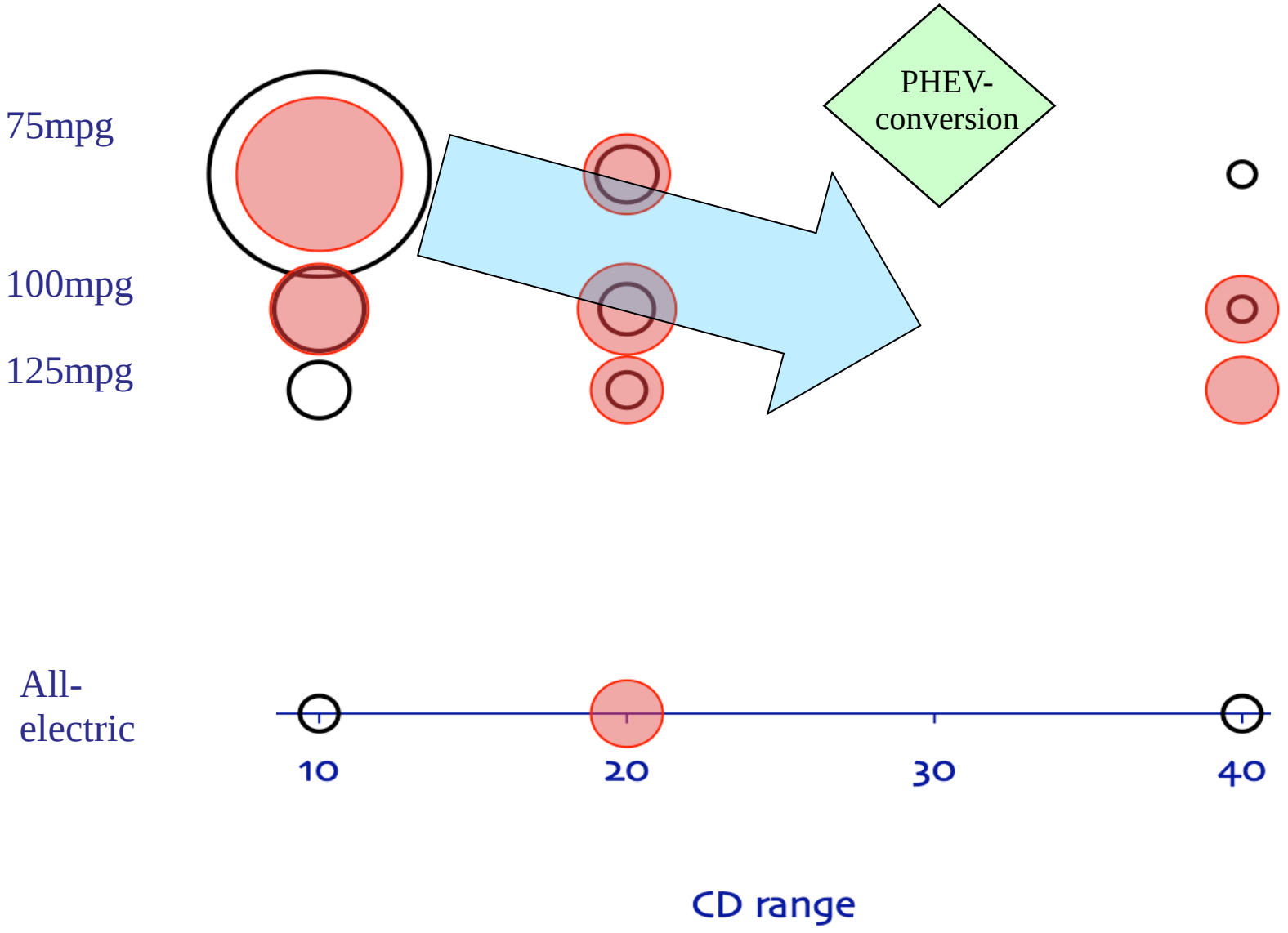
This transition is a contingent construction from one present to another.

A trajectory of “new presents”

PHEV Designs, U.S. New Car Buyers 12/07
National Survey, n = 854



PHEV Designs, add Demonstration Households 8/08 to 8/10, n = 67



To facilitate a trajectory to PEVs:
Abandon delay, pursue new value creation

- Recharging infrastructure? Advanced Batteries?
  - What is recharging infrastructure supposed to do?
    - Bring more people into the PEV market?
    - Enhance the electric mobility lifestyle sectors of those who already have them?
    - Reduce PEV range?
  - So long as range is expensive, PEV markets can be segmented by driving range
    - From small battery PHEVs to big battery PHEVs
    - Offer BEV buyers less range as an option

Fin