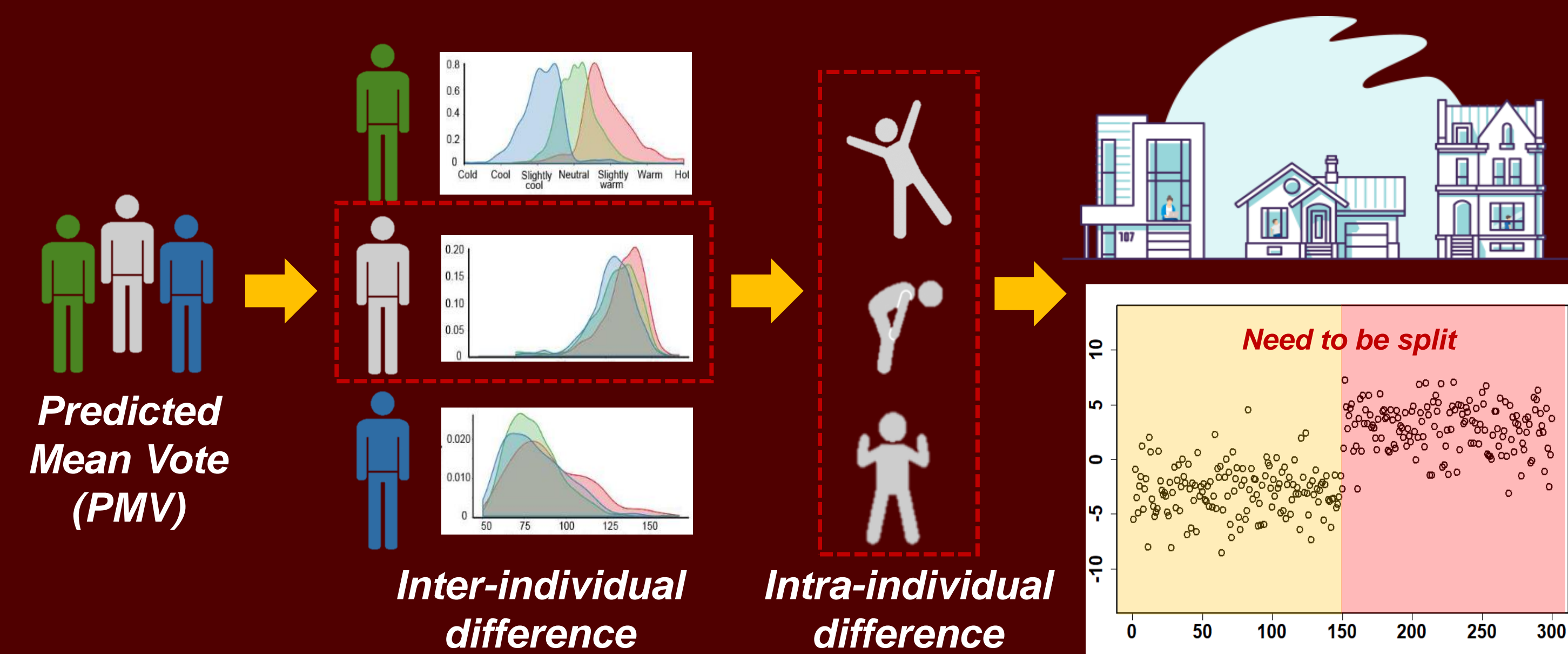


### BACKGROUND

- Importance of a thermally comfortable indoor environment
  - Thermal comfort is the state of mind that reflects an individual's satisfaction with the thermal environment (ANSI/ASHRAE 2013)
- Need to understand the role of intra-individual differences in predicting personal thermal comfort state
  - Intra-individual difference is how an individual feels differently in the same environment on different occasions
  - Understanding sub-personal thermal state based on a single model can lead to biased results



### PHYSIOLOGICAL DATA ANALYSIS

- Testing the following hypotheses via a novel computational approach
  - Individual occupant's thermal comfort state cannot be appropriately predicted based on a single model
  - Current personal comfort model based on a single model is not enough to predict one's thermal state and understand entire individual data

#### Physiological sensing data collection through field experiments

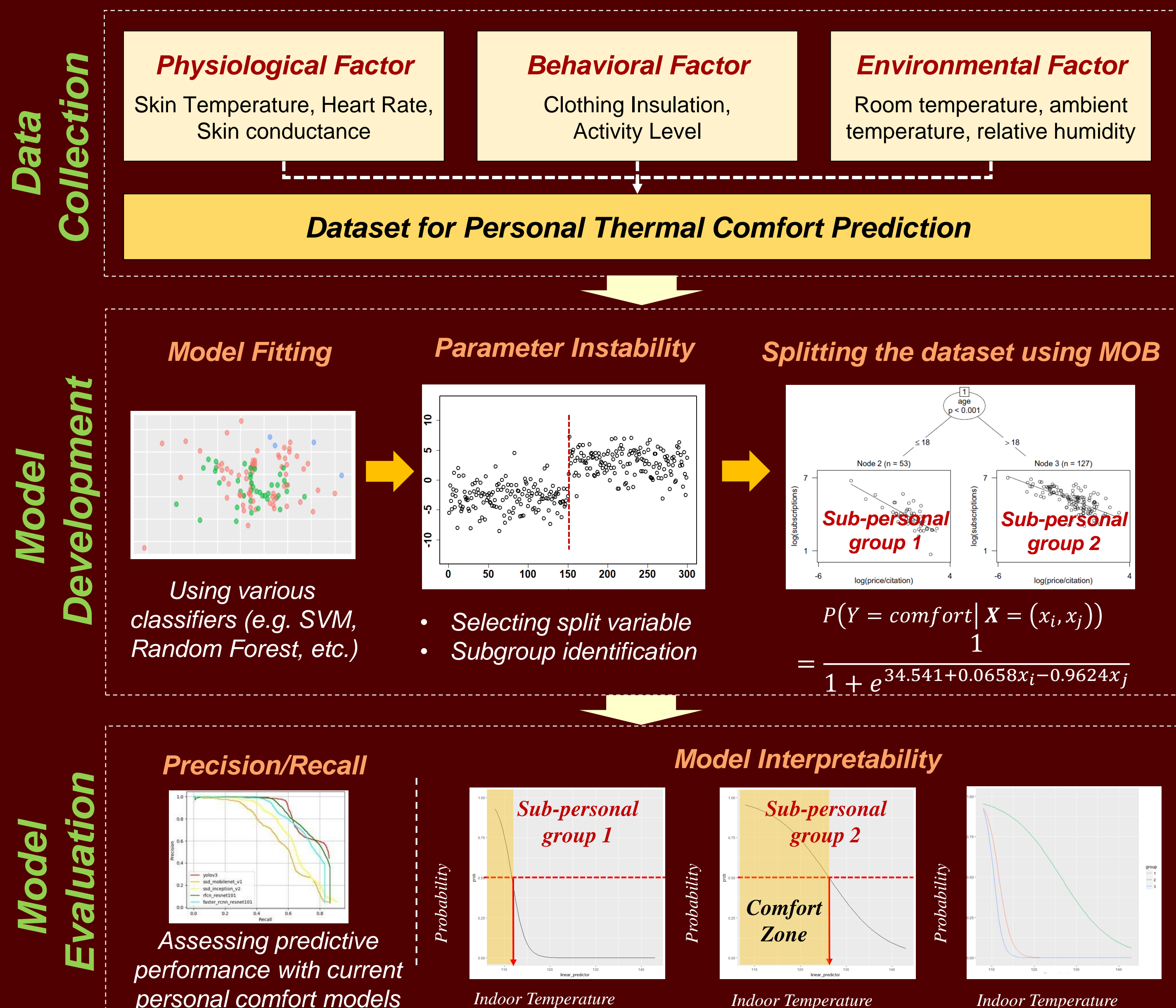


No.	Skin Temperature	Skin Conductance	Heart Rate	# of data
Subject 1	34.03 (33.29, 34.37) *	1.724 (0.969, 1.809)	84.73 (80.3, 88.08)	115
Subject 2	33.34 (32.35, 33.84)	0.5928 (0.4098, 1.165)	72.46 (67.86, 74.84)	105
Subject 3	35.31 (35.09, 35.45)	0.161 (0.122, 0.195)	67.88 (63.97, 71.88)	108
Subject 4	33.41 (33.21, 33.57)	5.188 (3.6, 10.256)	75.78 (71.2, 81.97)	88
Subject 5	34.29 (34.09, 34.53)	0.734 (0.473, 2.783)	72.03 (67.07, 82.1)	102
Subject 6	34.43 (34.33, 34.57)	0.259 (0.162, 0.368)	72.17 (69.98, 75.5)	63
Subject 7	34.34 (34.05, 34.61)	0.466 (0.359, 1.941)	80.52 (74.08, 88.54)	95
Subject 8	32.43 (31.91, 33.25)	0.568 (0.417, 0.989)	79.82 (74.12/ 87.73)	88
Subject 9	32.93 (31.97, 33.77)	0.372 (0.248, 0.427)	59.55 (57.63, 63.07)	99
Subject 10	33.99 (33.18, 34.73)	0.715 (0.567, 1.15)	77.72 (76.4, 80.12)	90
Total data collected				953

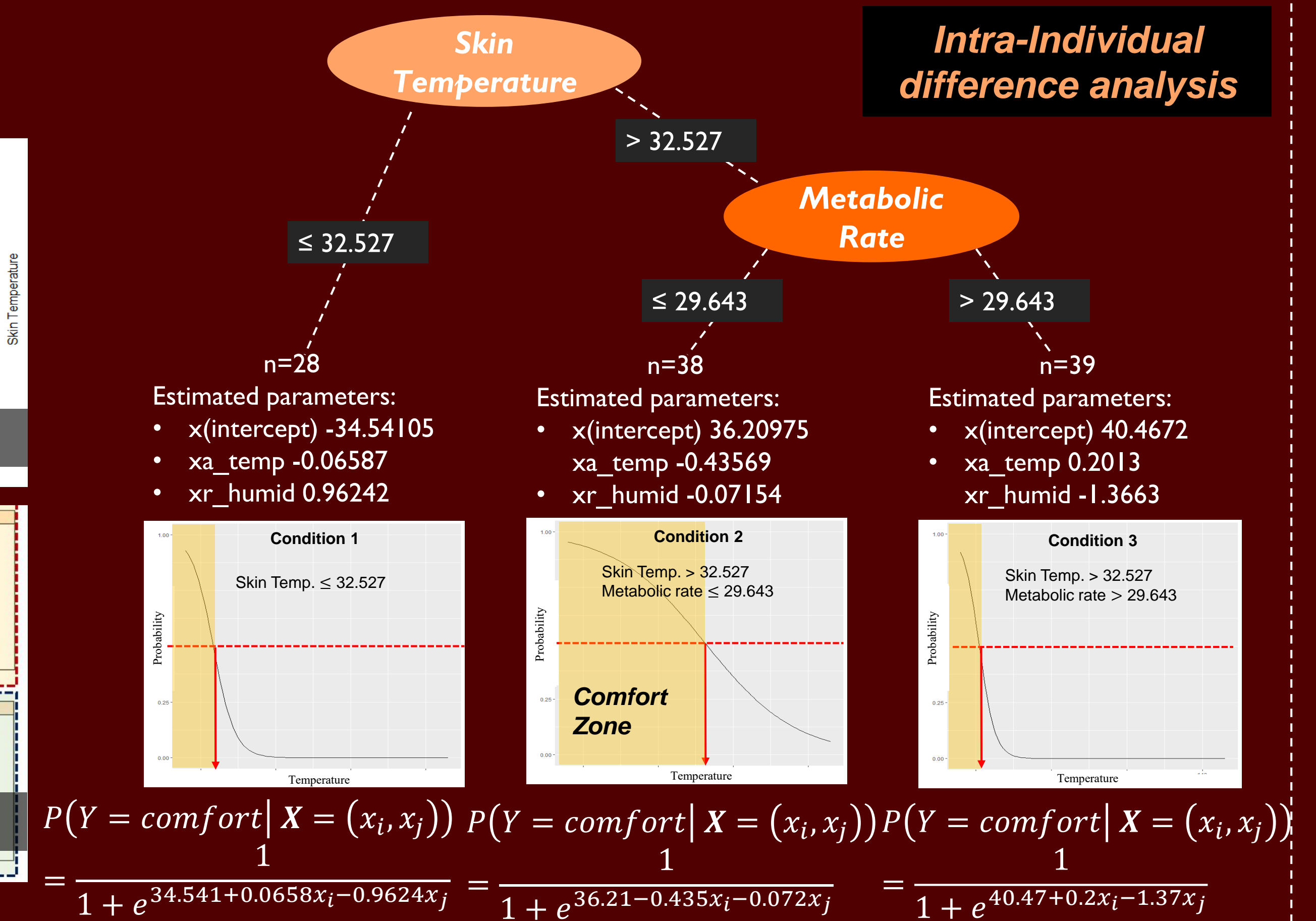
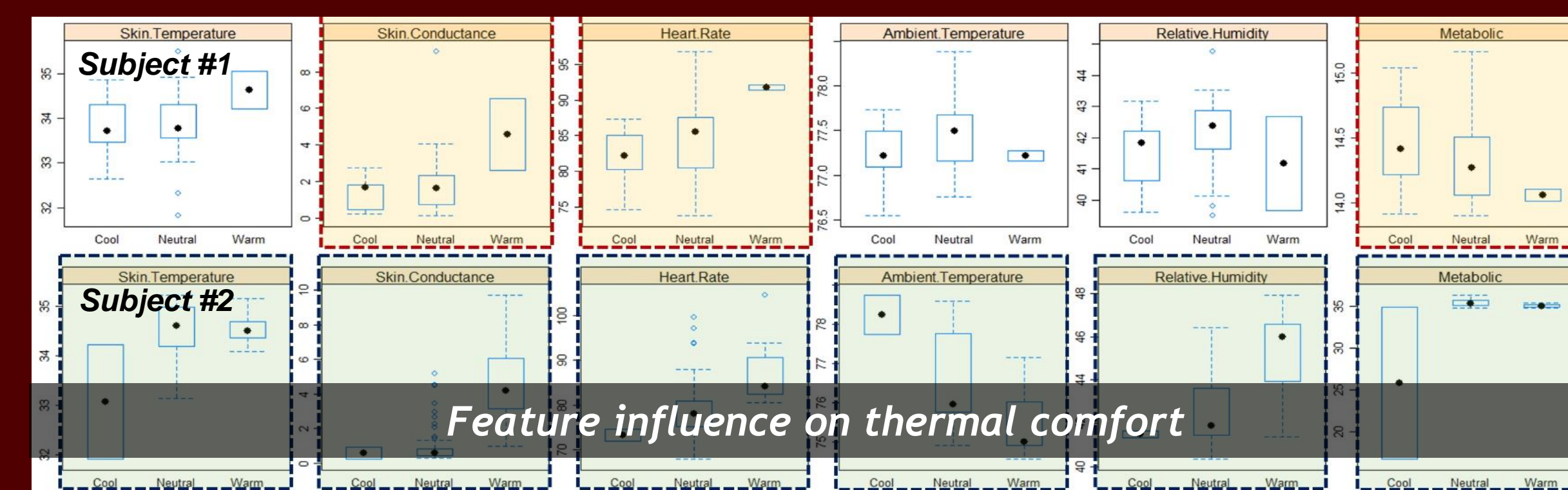
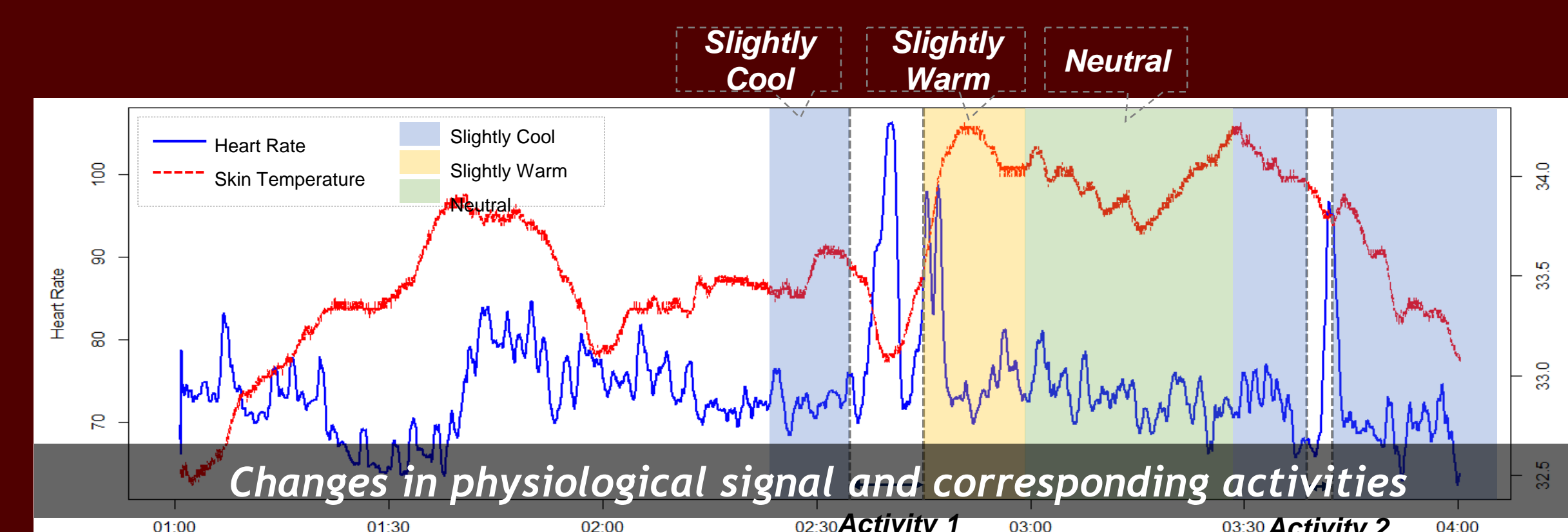
- Electrodermal activity (EDA)**
  - Sampling frequency: 4Hz
- Skin Temperature**
  - Sampling frequency: 4Hz
- Heart Rate**
  - Sampling frequency: 1Hz
- Ambient Temperature**
  - Sampling Rate: 2.5 samples per second
  - Resolution 0.01°C / 0.01 °F
- Relative Humidity**
  - Sampling Rate: 2.5 samples per second
  - Resolution 0.01%RH



### METHODOLOGY



#### Data-driven analysis to predict personal thermal state



### CONCLUSIONS

- Enhanced "personalized" and "interpretable" thermal comfort model
  - Better understand intra-individual differences building on the model-based recursive partitioning
  - Provide appropriate HVAC system control strategies based on individual thermal comfort zone
- Different strong predictors for each individual could be understood through the model-based recursive partitioning
  - Every occupant has different strong input variables in relation to thermal comfort modeling
  - Investigating pairwise correlations between different input variables is required for robust "personalized" thermal comfort modeling