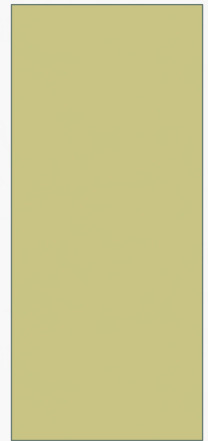


**THE OFFICE USERS' EXPERIENCE
OF MIXED-MODE SYSTEMS:
BEHAVIOURAL THERMOREGULATION**
*ANGELA LM ALESSI, CHRIS HEYWOOD, SCOTT DRAKE
THE UNIVERSITY OF MELBOURNE, AUSTRALIA*

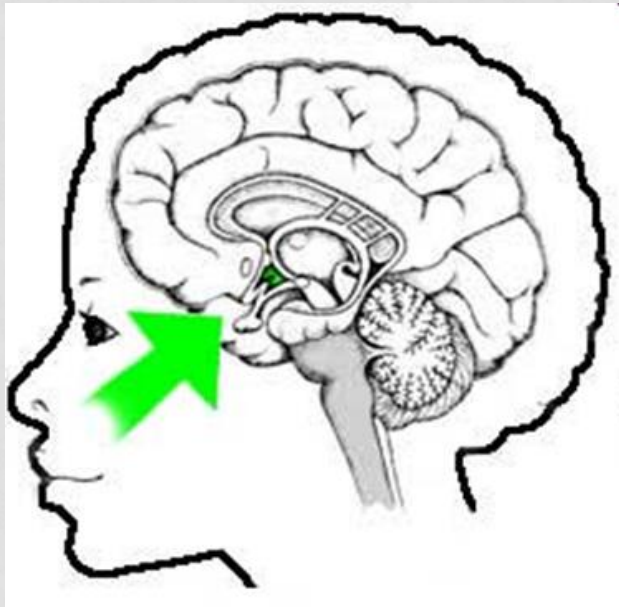
CIB FACILITY MANAGEMENT CONFERENCE
21-23 MAY 2014
TECHNICAL UNIVERSITY OF DENMARK



INTRODUCTION

- **Purpose:** Understanding people's thermoregulatory behaviour in a changeover mixed-mode space.
- **Background:** Adaptive thermal comfort considering people active participant.
- **Methods:** The National Australia Bank (NAB), Melbourne Docklands, north façade: multifunctional spaces where people choose between air-conditioning and natural ventilation.
- **Results:** People felt comfortable in the mixed-mode space, with high level of acceptability of the thermal environment.
- **Implications:** Mixed-mode spaces are essential in office environments for people's comfort.

THERMAL COMFORT



- **The condition of the mind that expresses satisfaction with the thermal environment**
- (ASHRAE 1992/2004,
• ISO, 2005)
- ASHRAE=American Society of Heating, Refrigerating and Air-Conditioning Engineers
- ISO=International Organization for Standardisation

2 APPROACHES TO THERMAL COMFORT

- **Heat Balance Approach**
- Deterministic Engineering model
- Laboratory experiments
- Environment=air-conditioning 22/23 degree Celsius
- People=thermal comfort sensors
- **Adaptive Approach**
- Holistic Architectural person-environment model
- Field studies
- Environment=natural ventilation (+air-conditioning)
- People=user control=occupants can modify the environment

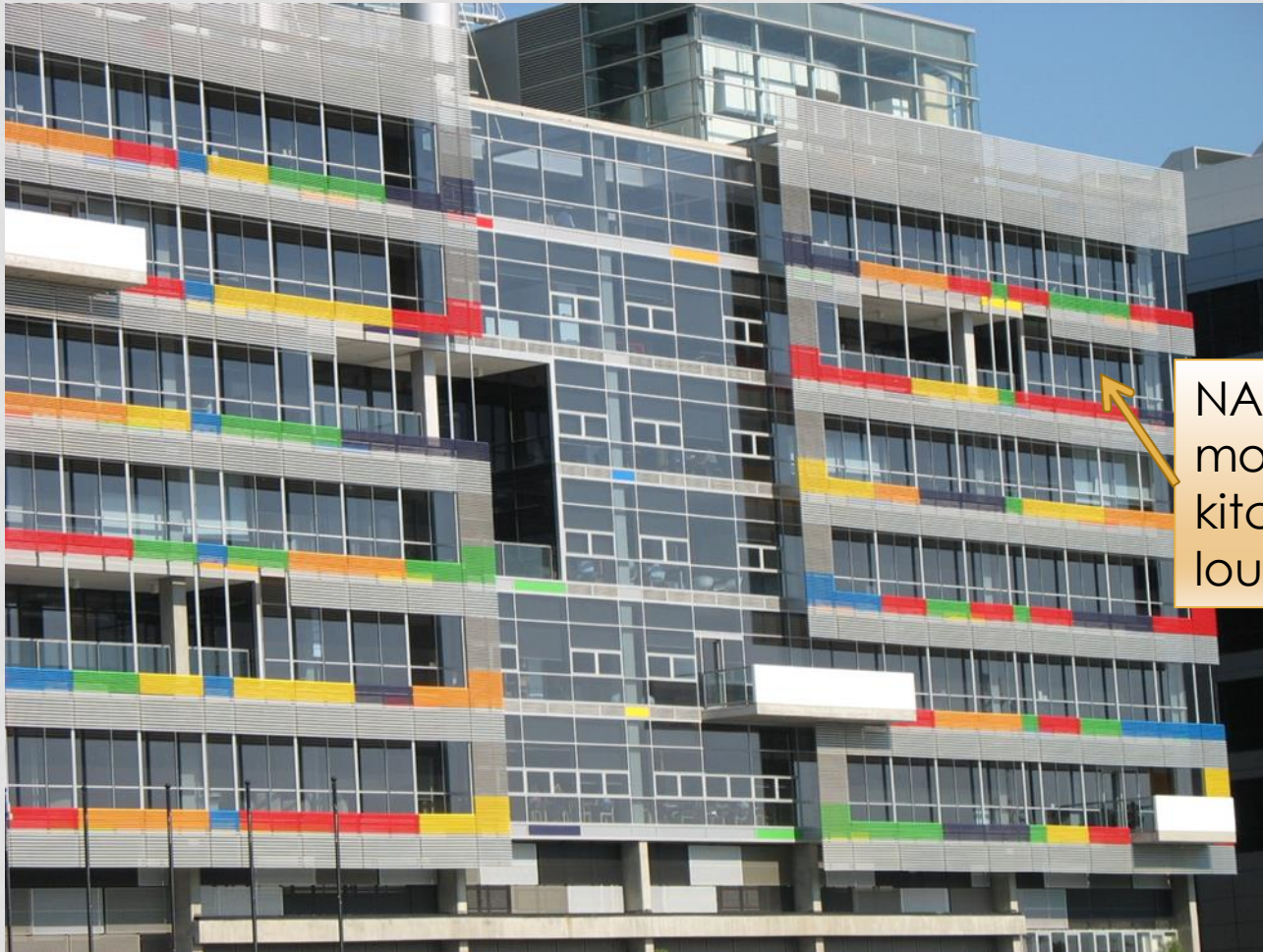
PRINCIPLES OF ADAPTIVE COMFORT

- **COMFORTABLE ADAPATIONS**
- “If a change occurs that produces discomfort, people will tend to act to restore their comfort” (Humphreys, Nicol, 1998)
- Needs, expectations=satisfaction
- **USER CONTROL**
- The design of a space influences enormously people's behaviour - natural ventilated buildings are better for people's control.
- **TOLERANCE**
- People with greater control over the environment are more tolerant of indoor conditions – broader comfort zone (Leaman & Bordass, 1980-2005)
- “Cognitive tolerance” (Baker, 1996)

LABORATORY EXPERIMENTS



VS FIELD STUDIES

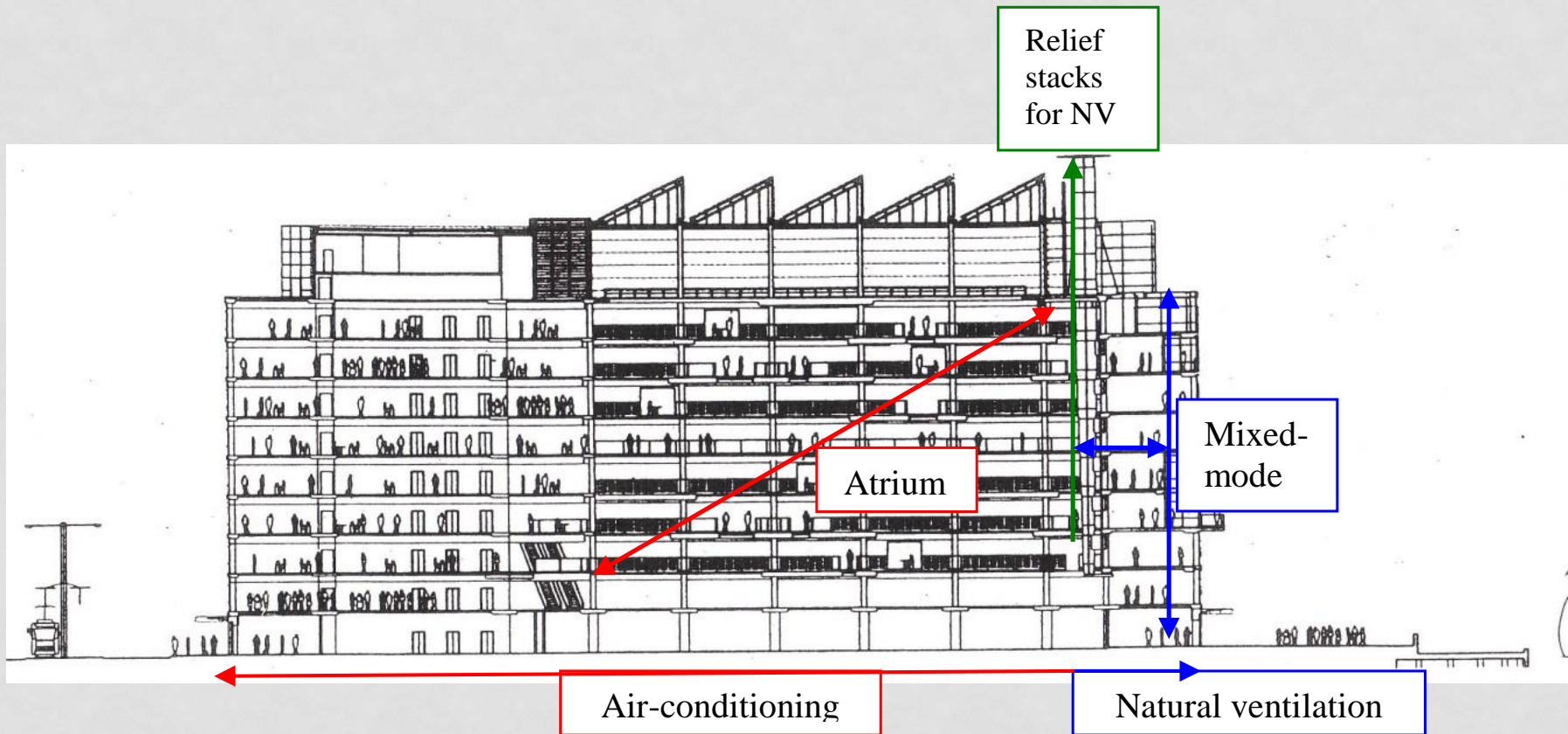


NAB mixed-mode
kitchen-
lounge

METHODS

- Thermal behaviour involves measurable factors and subjective aspects.
- 1- Indoor climatic data collected with instruments positioned in the mixed-mode space+ Bureau of Meteorology outdoor climatic data.
- 2- Two surveys in Autumn and Spring, the two seasons that were thought to be more conducive to behaviour adaptations.
- 3-Four weeks observations conducted in each season of investigation for a total of 200 hours.

THE NAB MIXED-MODE SPACE



NAB: THE VILLAGE OFFICE



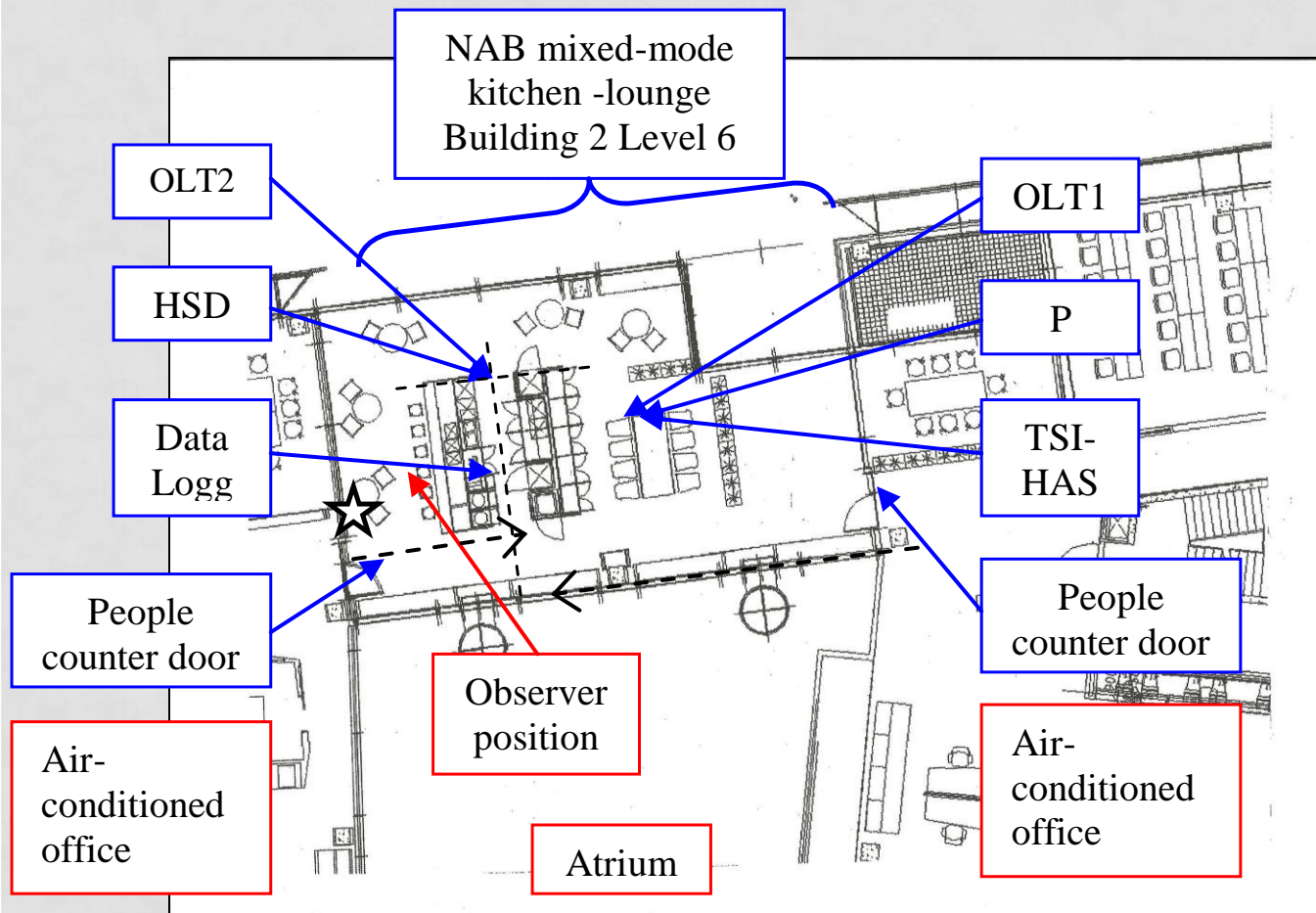
NAB: NEW CORPORATE STRATEGY



NAB MIXED-MODE SPACE



INDOOR CLIMATIC DATA MEASUREMENTS: POSITION OF THE INSTRUMENTS



OLT1=Omega Linear termistor for mean temperature
OLT2=Omega linear termistor for radiant temperature
HSD=Hygrometer-hycal solid devise for relative himidity
P=Pyranometer for radiation
TSI-HAS=Heated sphere anemometer for air velocity

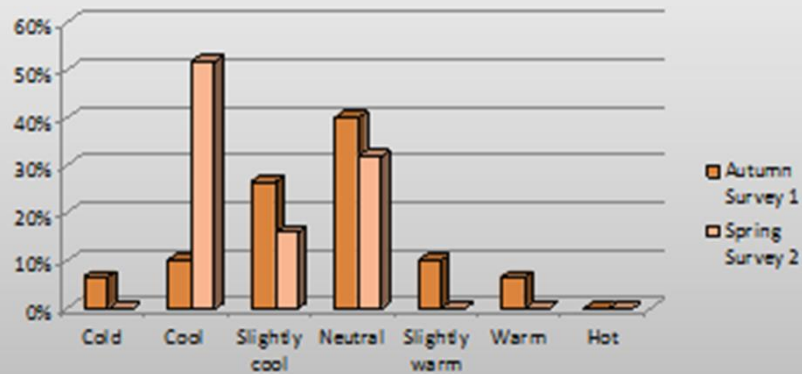
CLIMATIC CONDITIONS AFFECTING THE MIXED-MODE SPACE

Outdoor conditions	NAB mixed-mode kitchen lounge	Air-conditioned office
Temperature (average) 12.27°C	Temperature (average) 24.74 °C	Temperature (average) 22.6°C
Humidity (average) 66.5%	Humidity (average) 29.85%	Humidity (average) 40%
Wind speed (average) 24 Km/h (6.65 m/s)	Air velocity (average) 0.013 m/s	Air velocity Not available

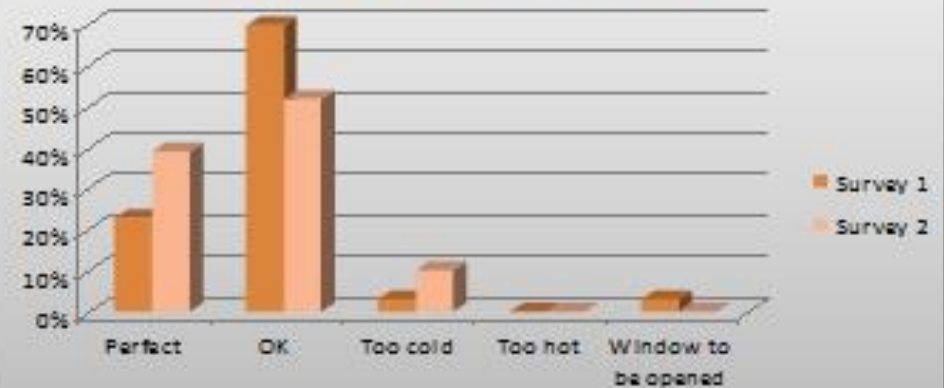
Outdoor conditions	NAB mixed-mode kitchen lounge	Air-conditioned office
Temperature (average) 34.56 °C	Temperature (average) 23.03 °C	Temperature (average) 22.6°C
Humidity (average) 35%	Humidity (average) 49.05%	Humidity (average) 40%
Wind speed (average) 24 km/h (96.65 m/s)	Air velocity (average) 0.021 m/s	Air velocity Not available

RESULTS

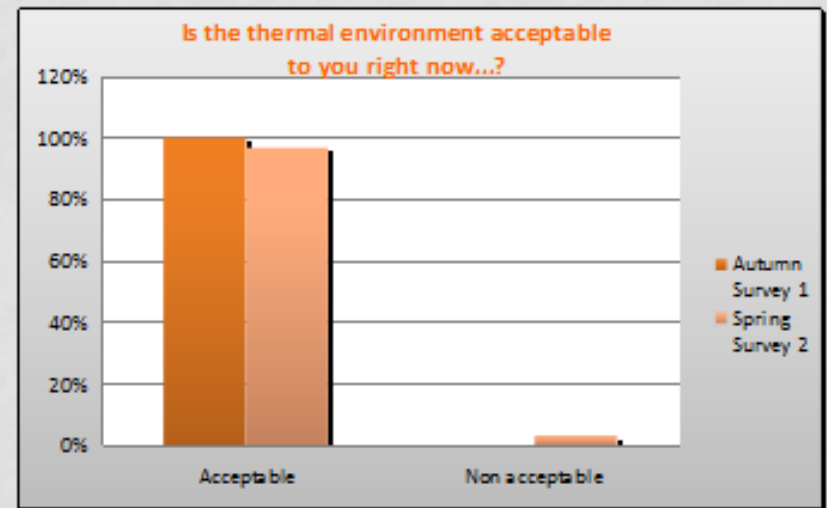
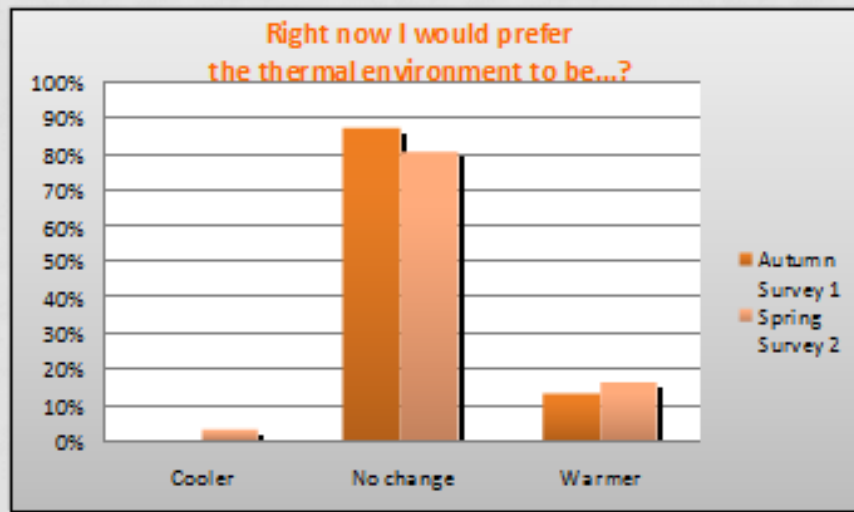
How do you feel right now in this room?



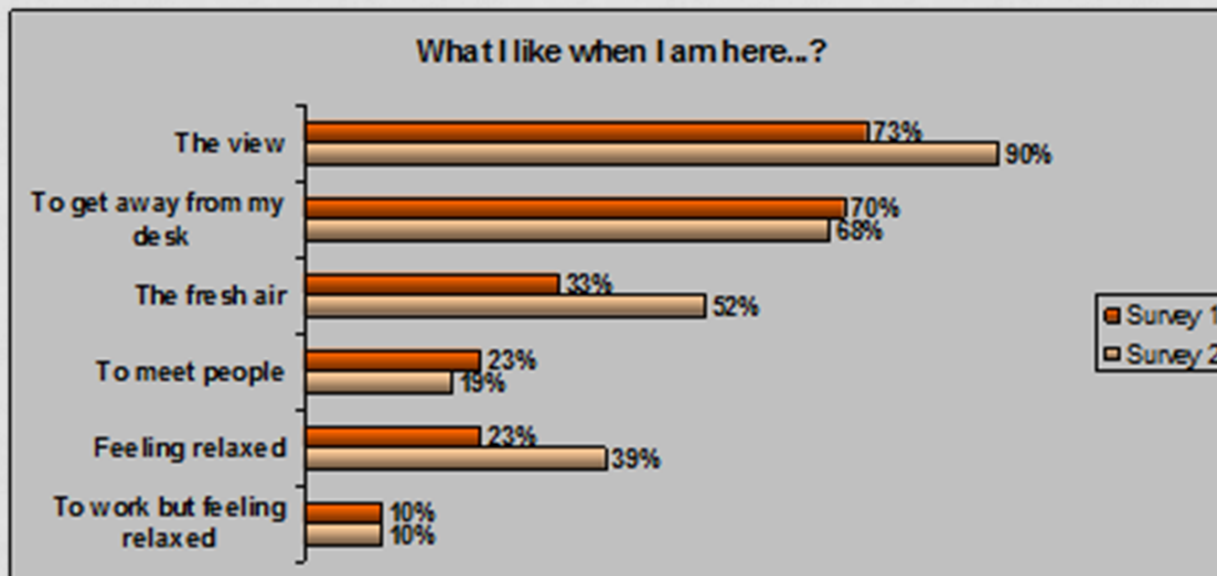
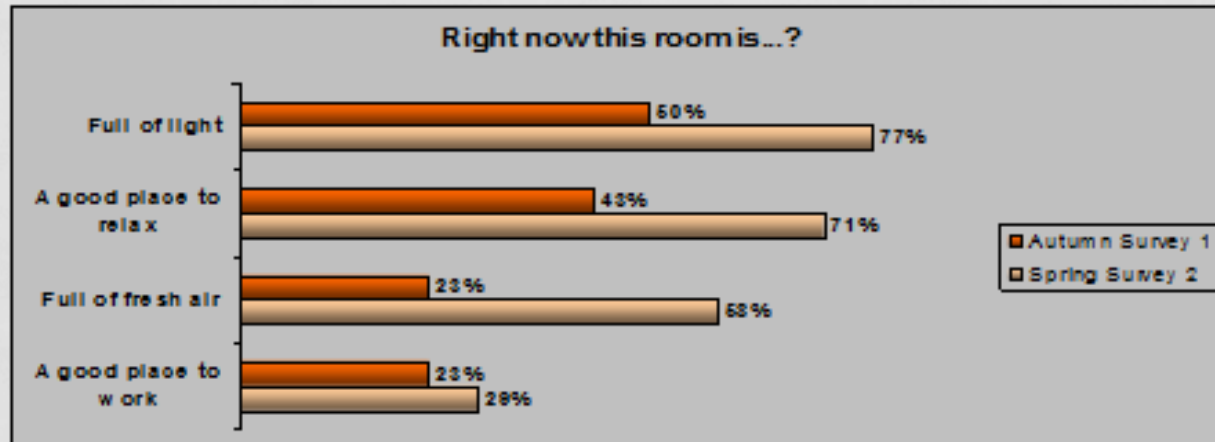
How is the temperature right now?



ACCEPTABILITY OF THE THERMAL ENVIRONMENT

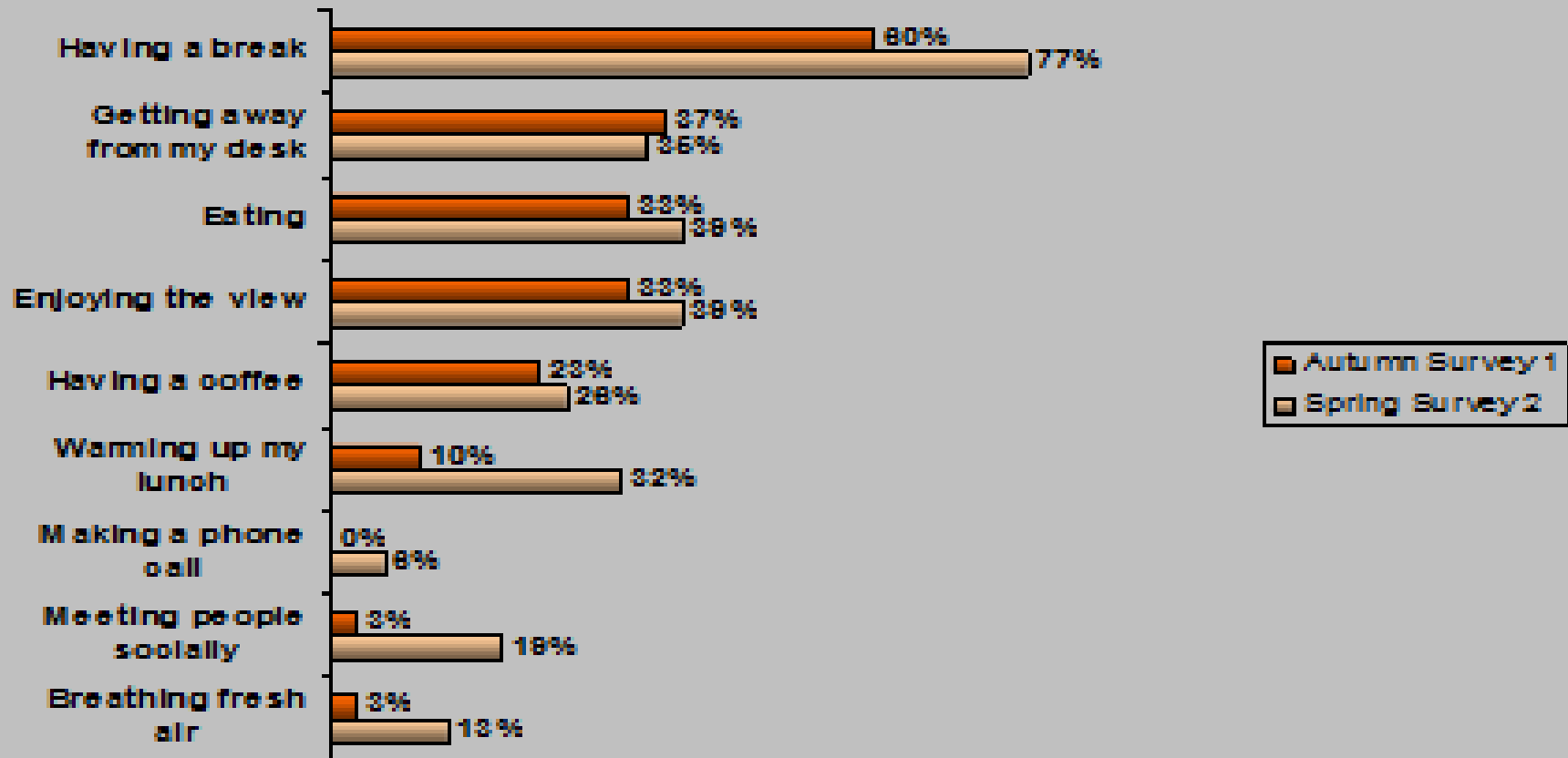


PEOPLE'S PERCEPTION OF THE MIXED-MODE SPACE



BREATHING FRESH AIR

What am I doing here...?



CONCLUSIONS

- People's thermoregulatory behaviour includes physical and psychological aspects.
- The importance of a mixed-mode space within and air-conditioning office environment with its characteristics, where people
 - Enjoy the view;
 - Connect to outdoor climatic conditions;
 - Have a break from the air-conditioned office;
 - Breathe fresh air (even perceived)....
 - TO RAISE THEIR SENSE OF COMFORT AND SATISFACTION.

NEW OFFICE

