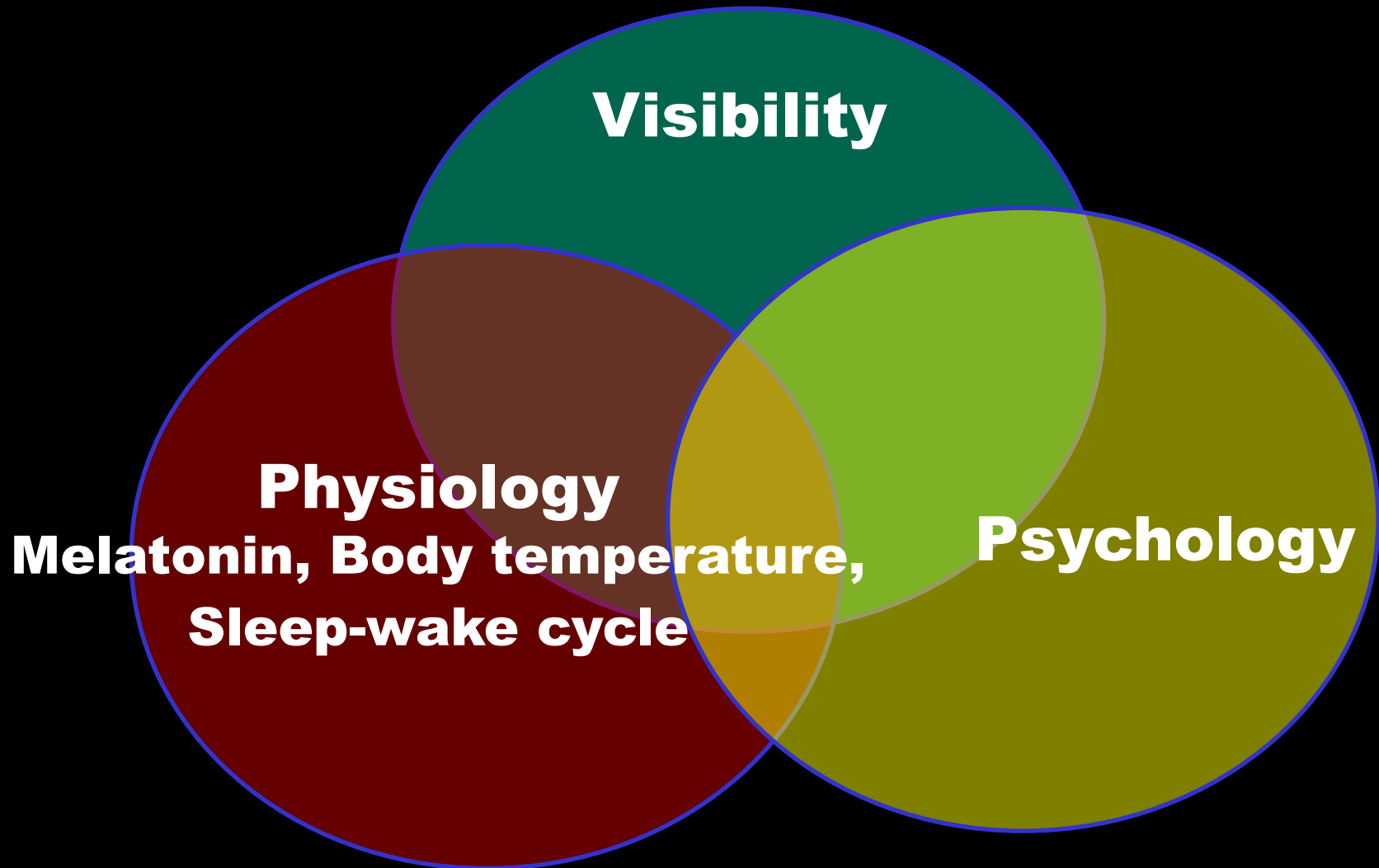


# Lighting effects on unconscious human behaviors

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# Lighting Effects on Human Beings



# Light and circadian system

- **Light can alleviate seasonal depression.**
- **Light can increase the length and quality of sleep.**
- **Light can improve performance of night-shift workers.**
- **Light can consolidate sleep/activity patterns in Alzheimer's Disease patients.**
- **Light can improve weight gain in premature infants.**
- **Light regulates melatonin.**
- **Light has a direct impact on cortical brain activity.**



*Nature Made*

**Melatonin**

3 mg

DIETARY SUPPLEMENT  
60 TABLETS

Helps  
Promote  
Sleep!

# Light therapy room



Patients were exposed to at least 3,000 lx at their eye levels to adjust their sleeping patterns.

**National Institute of Mental Health:  
National Center of Neurology and Psychiatry**

# **Deluxe Bio-brite Light Visor**

**\$279.00 ( reg. \$299)**



**Bio-Brite light visor helps fight against seasonal depression.  
Great for jet lag.  
Try the sunrise alarm and wake up naturally.**

**The Bio-Brite light visor is a breakthrough in convenience, efficiency and utility of bright light therapy. Wearable - this bright light source that is light weight, adjusts to fit comfortably around your head and is powered by a rechargeable battery pack that leaves you free to move about. Delivers safe, gentle glare-free light. Super efficiently because the light is fixed close to the eyes.**



# SPA



## **The Power of Kraft Light Therapy in the Sun Room**

**The sun room is enhanced with high quality, medical light therapy devices that combat stress, prevent seasonal depression (SAD), regulate blood pressure and blood sugar levels, create vitamin D and improve quality and duration of sleep.**

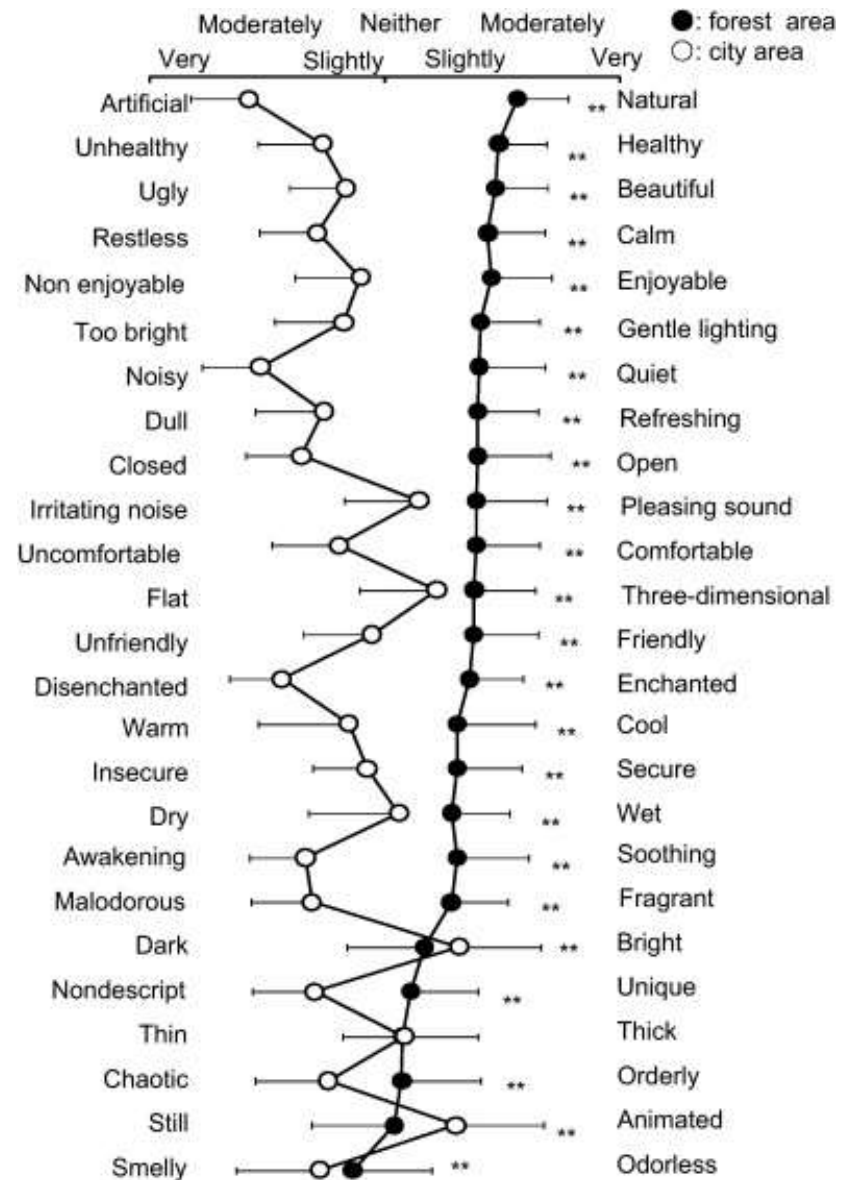
A photograph of a relaxation room. The walls are covered in light-colored wooden slats, creating a warm, textured appearance. Several black lounge chairs are arranged in a row, each with a white towel placed on it. The room is dimly lit, with soft, warm lighting emanating from the walls and floor, creating a relaxing atmosphere. The ceiling is also covered in wooden slats. A doorway is visible on the right side of the frame.

**Just relax in a dark room**



- ✓ **Certainly, body temperature or secretion of melatonin is measured.**
- ✓ **However, can you recognize how much you relaxed correctly?**
- ✓ **The physiology response is generally too fundamental.**
- ✓ **There is a certain distance in our physiology response and emotion.**
- ✓ **Delicate emotion is recognized sensuously.**

**Osgood's Semantic Differential** was an application to measure the semantics or meaning of words, particularly adjectives, and their referent concepts.



**Finds out about a subject's idea through an interview**



**Comfortable**



**Soothing**



**Calm**



**Enjoyable**







**Come to the surface:  
They can be expressed in language  
Sometimes stereotypical way of thinking**

**behavior observation**

**Unconscious:  
They cannot be expressed in language**



- ✓ **They never went to sleep intentionally.**
- ✓ **A difficult topic, darkness, and a slow lecture invited them to sleep.**
- ✓ **The effect of light appears in behavior.**

# Interpersonal Communication

- **Interpersonal relationship**
- **Sex**
- **Personality**

- **Surrounding Environment**



**Lighting**

- **Speaking volume**
- **Personal distance**
- **Facing direction**
- **Eye contact**

# **Lighting Effects on Speaking Volume**



**Loud**



**Quiet**



## General lighting

Table: 800 lx Ambient: 500 lx



## Spotlighting

Table: 50 lx Ambient: 1 lx



## Table candle

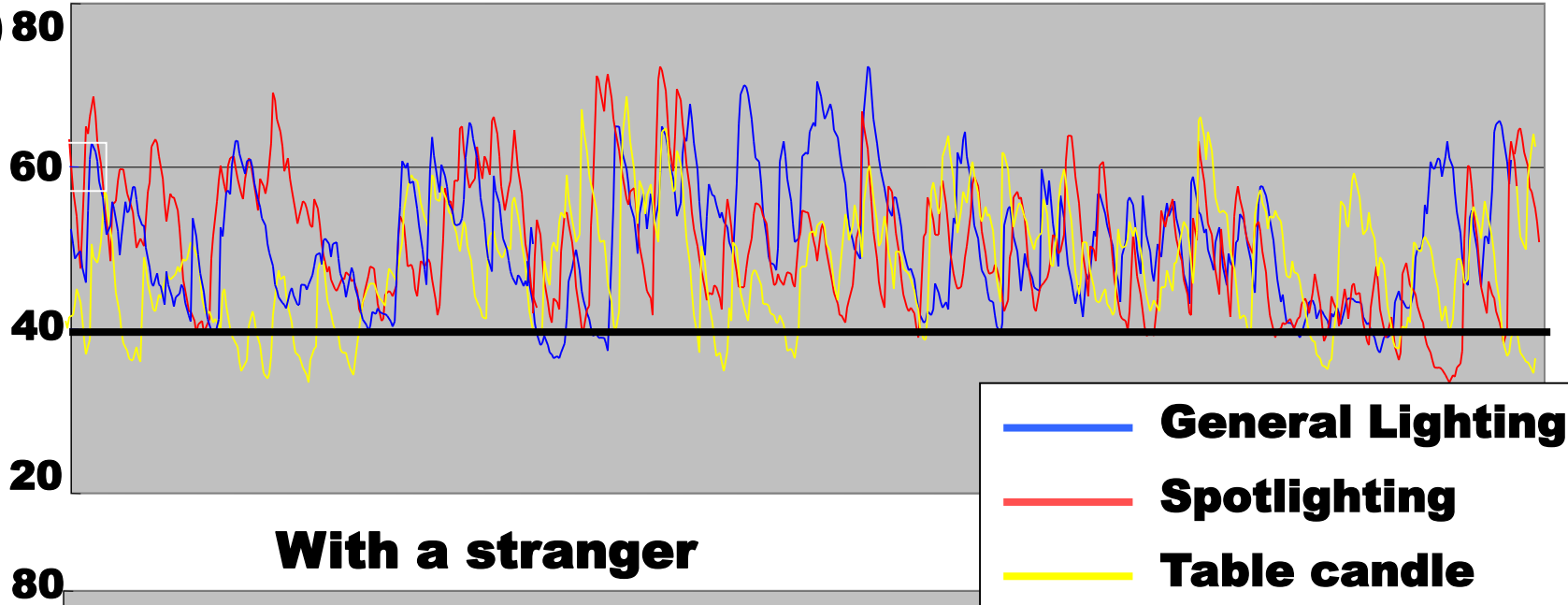
Table: 3 lx Ambient: 0.1 lx

Subjects: 20 pairs, 40 people

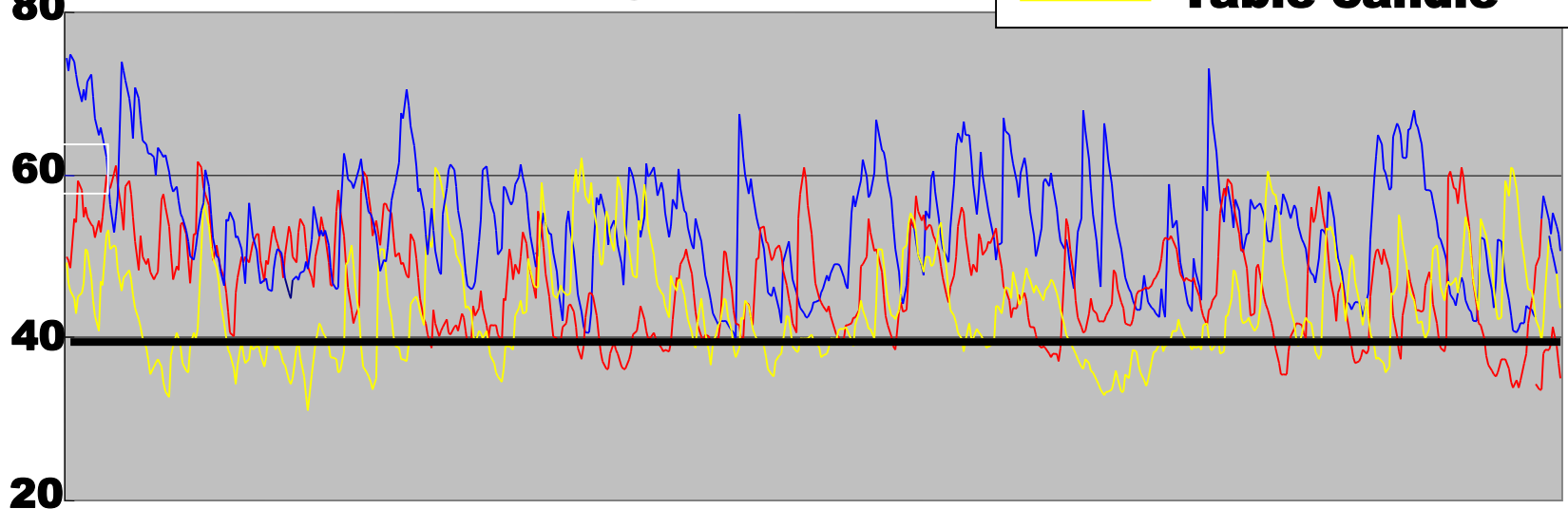


# Speaking volume (one minute example)

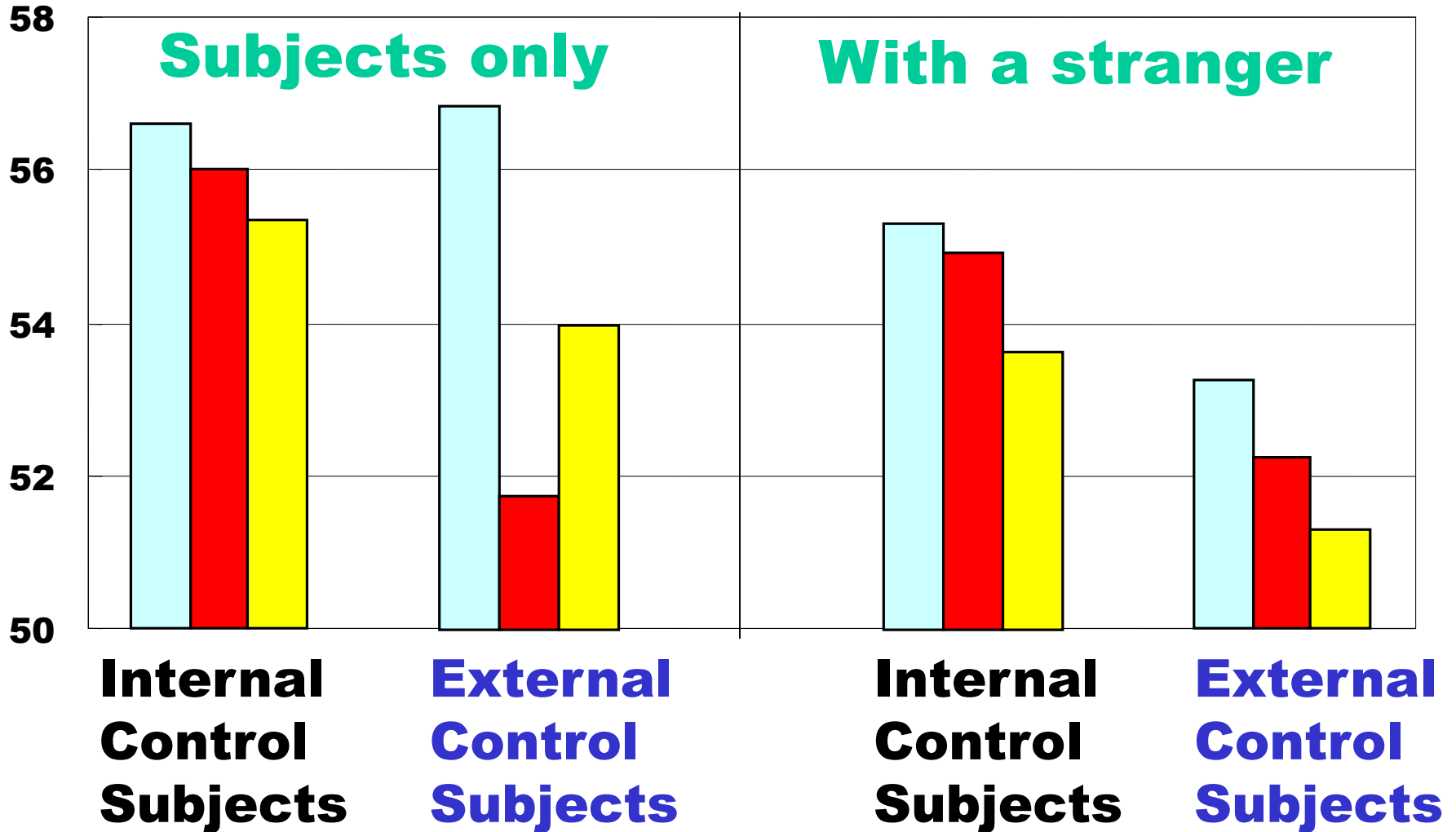
**dB**  
**(A)** **Subjects only**



**dB**  
**(A)** **With a stranger**



# Average Speaking volume dB(A)



# Locus of Control

**Locus of Control refers to an individual's perception of what are the main causes of events in life. More simply put, do you believe that you control your destiny or that it is controlled by others or fate? "A locus of control orientation is a belief about whether the outcomes of our actions are contingent on what we do (internal control orientation) or on events outside our personal control (external control orientation)." (Zimbardo, 1985)**

## **External Locus of Control**

**Individual believes that his/her behavior is guided by fate, luck, or other external circumstances**

## **Internal Locus of Control**

**Individual believes that his/her behavior is guided by his/her personal decisions and efforts.**

# Speaking Volume

- **Generally, people speak loudly in bright environment and speak quietly in dark environment.**
- **In extremely non-uniform lighting, speaking volume vary depending on speaker's personality.**
- **People speak somewhat quietly, when sharing a space with unfamiliar person.**

**Lighting Effects  
on personal distance  
and facing position**



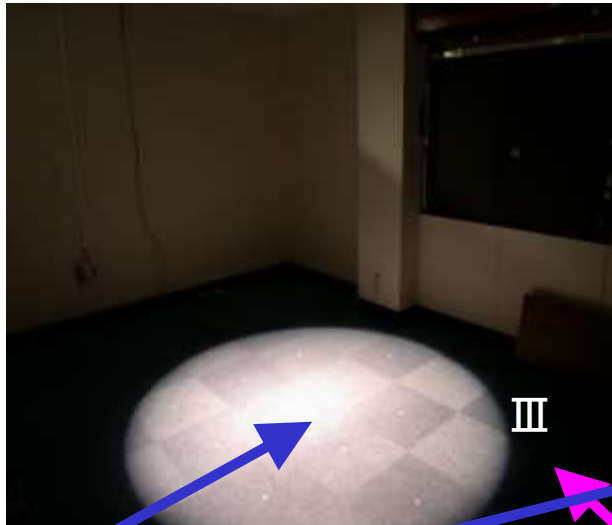
**Where do people stay under non-uniform lighting?**



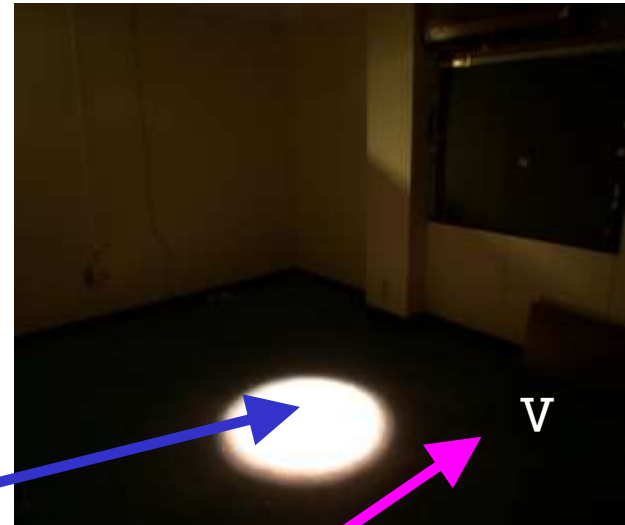
**Almost uniform**



**Wide angle spotlight**

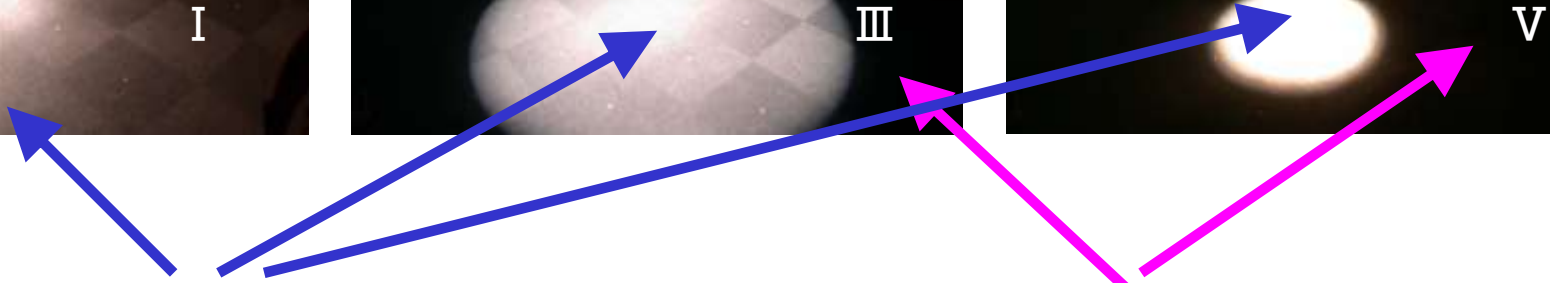


**Narrow angle spotlight**



**400 lx**

**30 lx**

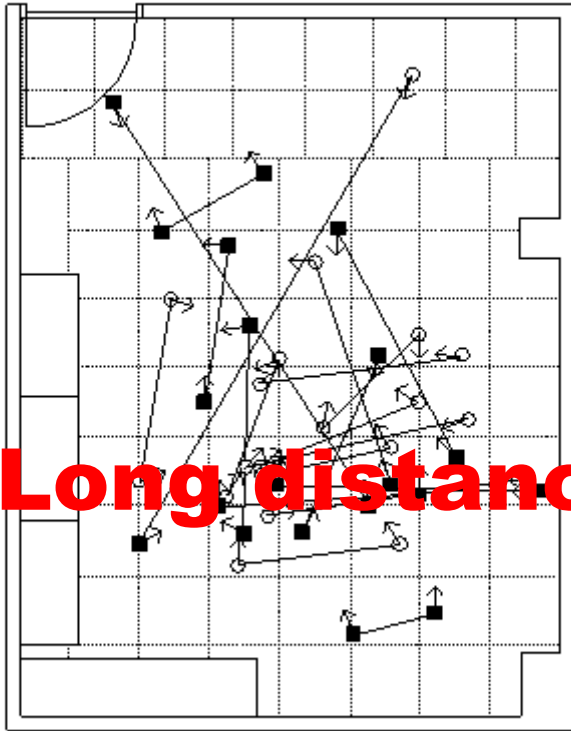


# Personal distance and facing position

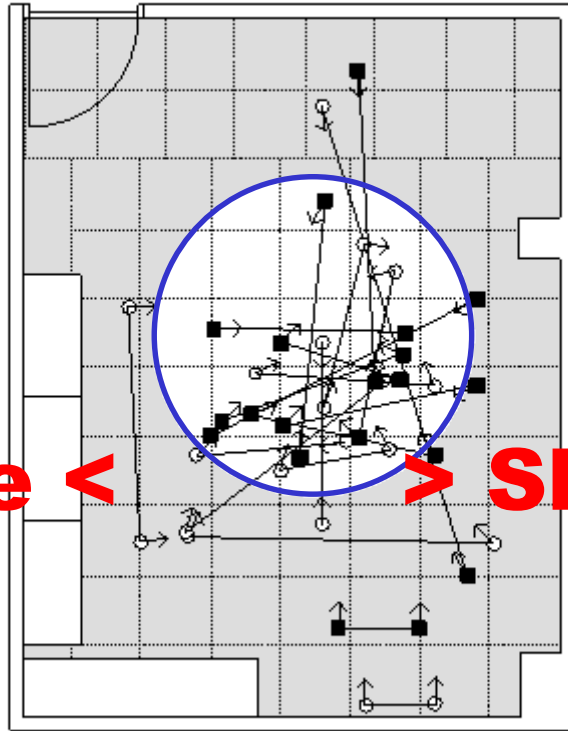
Monitoring subjects' behaviors by an infrared video camera



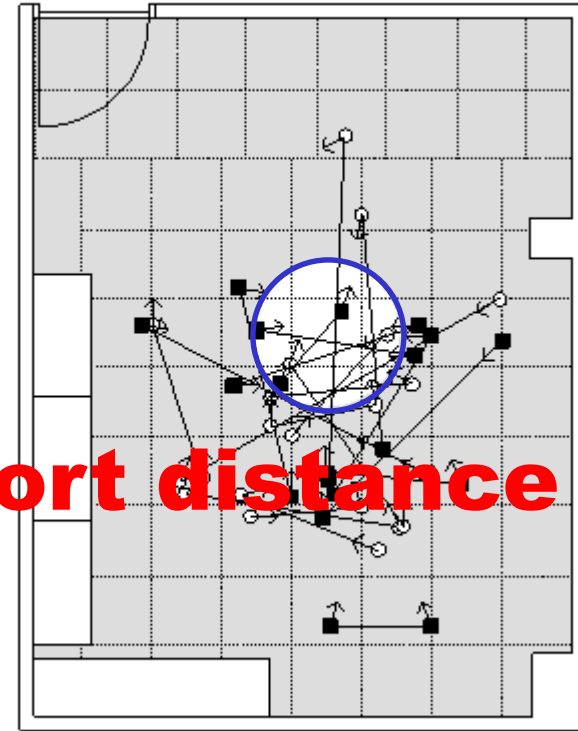
I **General lighting**



III **Wide Spotlighting**



V **Narrow Spotlighting**



**Long distance < > Short distance**

**Subject ■ Male 20 people  
○ Female 20 people**

**Positions of conversation  
and direction of their faces**

**Wide Spotlighting => Changes darkly**

**Facing angle**

**180°**

**120**

**60**

**0**

**0**

**1**

**2**

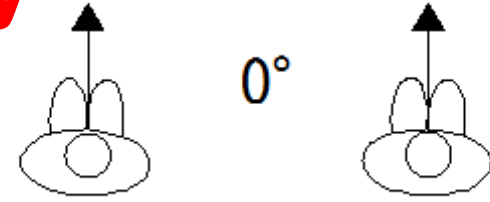
**3**

**4**

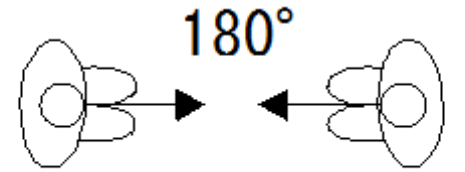
**m**

**Personal distance**

**Facing angle**



0°

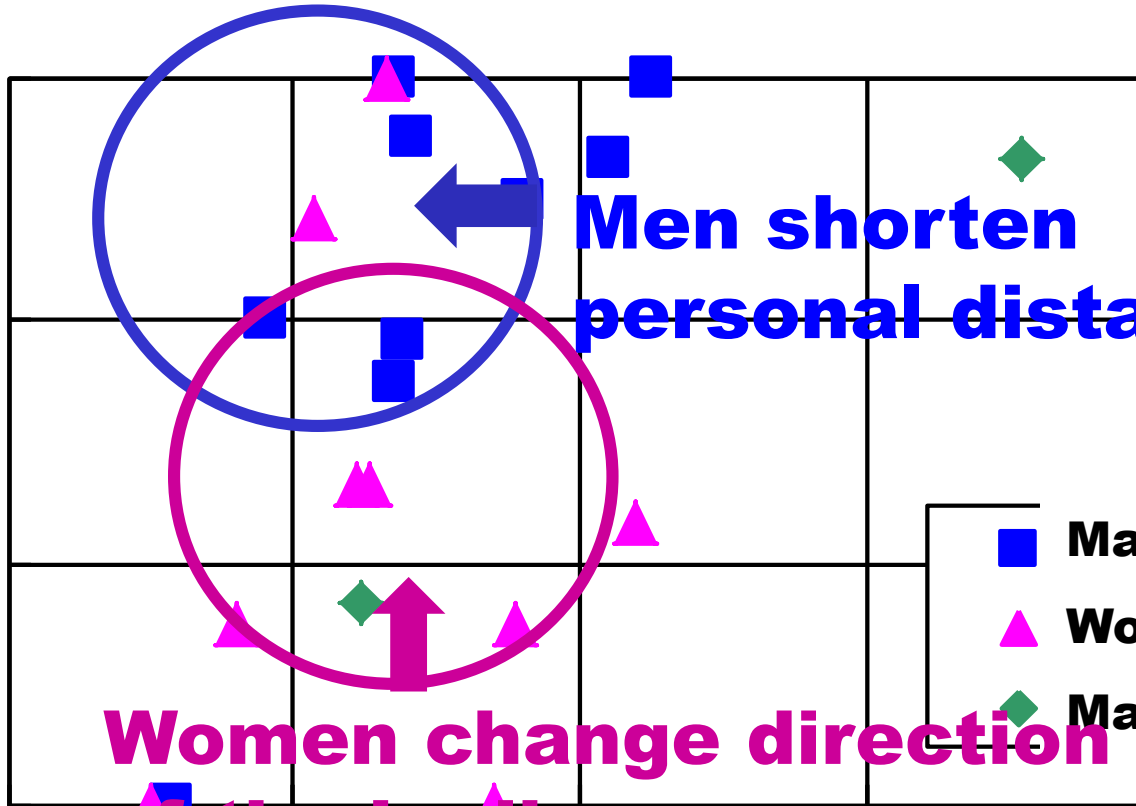


180°

**Men shorten personal distance**

**Women change direction of the bodies**

- Man-man**
- Woman-woman**
- Man-woman**



**Lighting Effects  
on Seating posture, eye  
contact and conversational  
frequency**








# Observation of Behavior in Public Space



**Targeted space : Open air café in Tokyo  
Daytime and Nighttime in Summer**

# Posture

	1	2	3	4	5
Angle of the backbone	20 degrees back				20 degrees forward
					
	Lean back		Vertical		Lean forward

# Eye contact

Eye contact time	1	2	3	4	5
	~20%	20%~40%	40%~60%	60%~80%	80%~



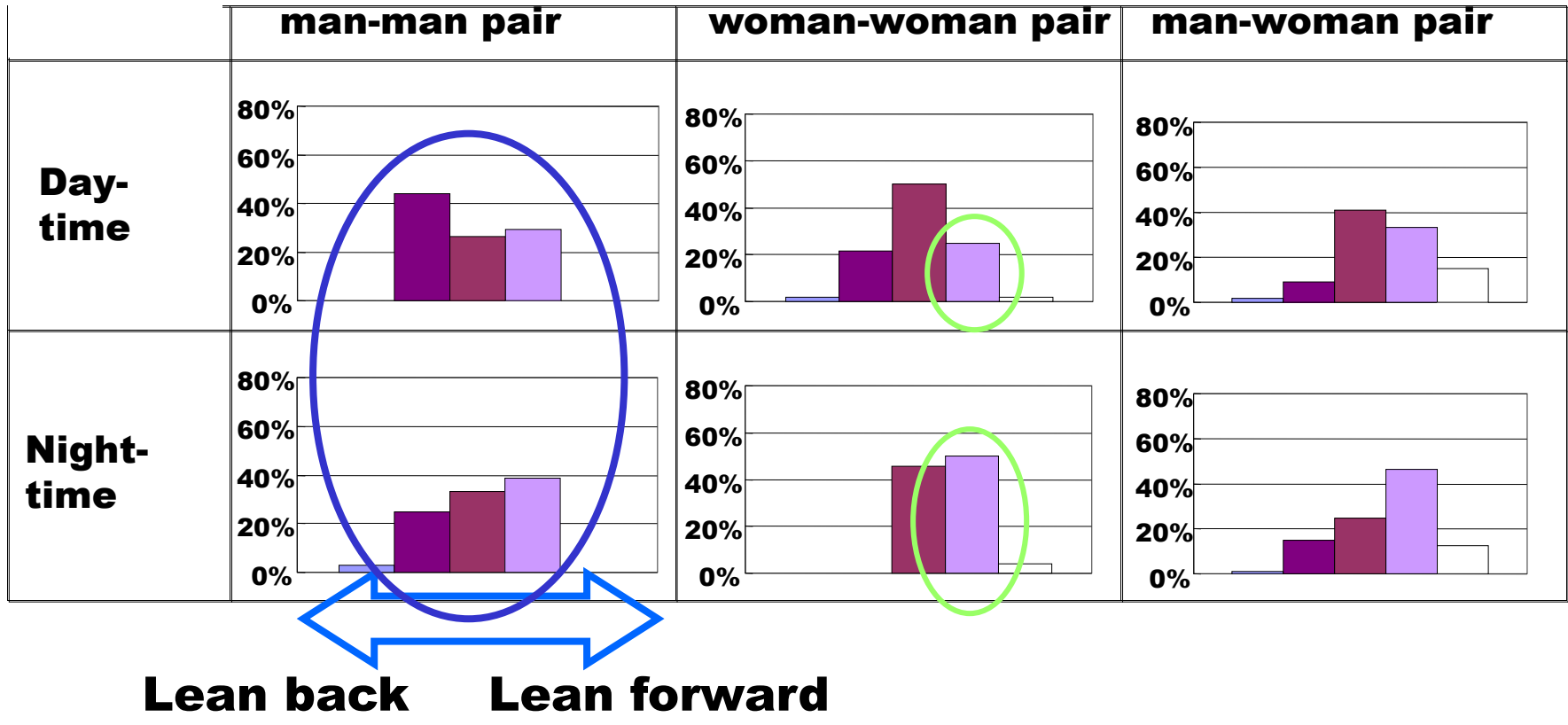
**Daytime (Man-man pair)**



**Nighttime  
(Man-woman pair)**

**Example of subjects  
Total 288 people**

# Posture



● **Man-man pair: Lean back in their chairs**

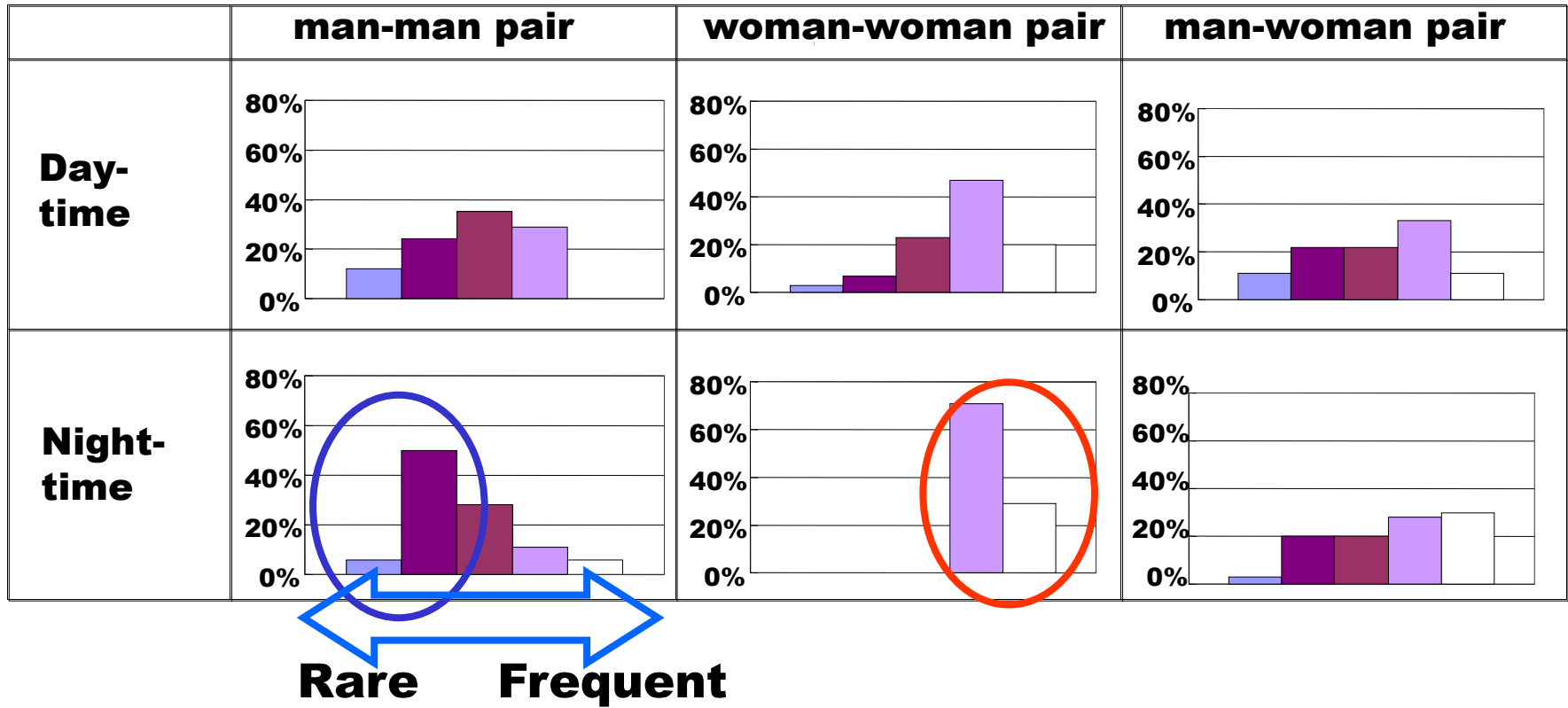
● **Woman-woman pair: Lean forward in night-time**



# Man-man



# Eye-contact



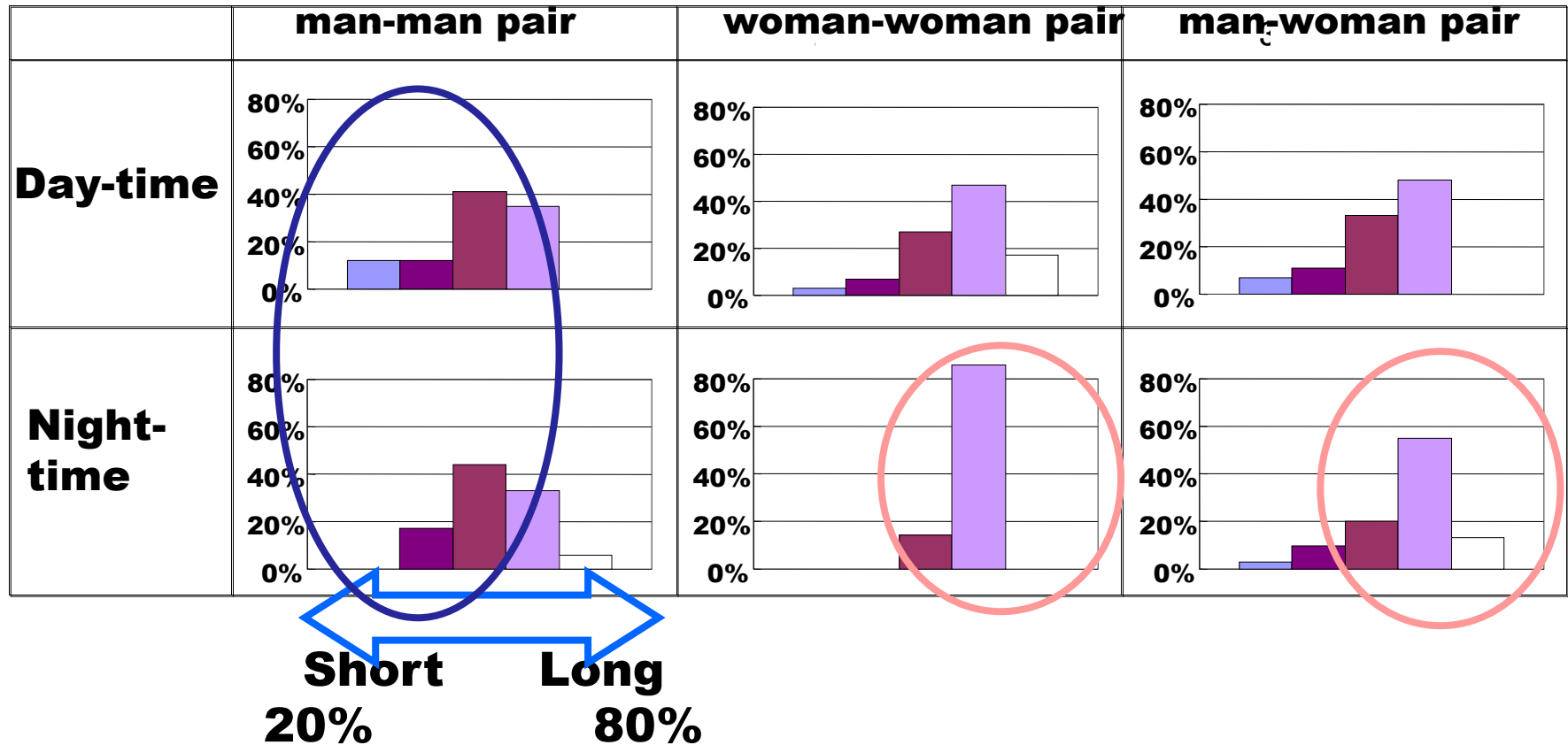
- **Man-man pair: Rare eye-contact especially in night-time**
- **Woman-woman pair: Frequent eye-contact in night-time**



# Woman-woman



# Conversational Time



- **Man-man pair: little conversation**
- **Woman-woman and Man-woman pair: Conversation longer, especially in night-time**

# Man-Woman couples



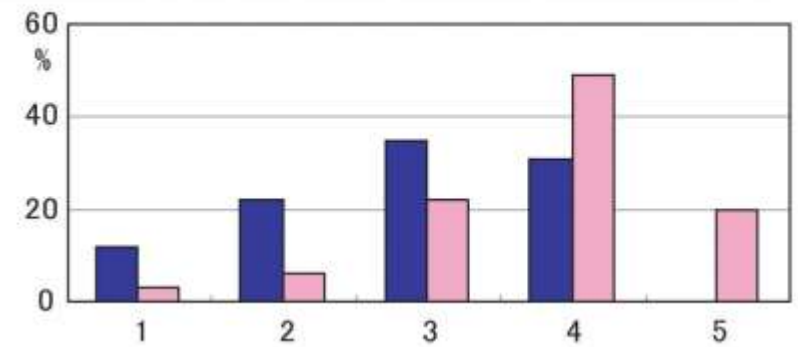
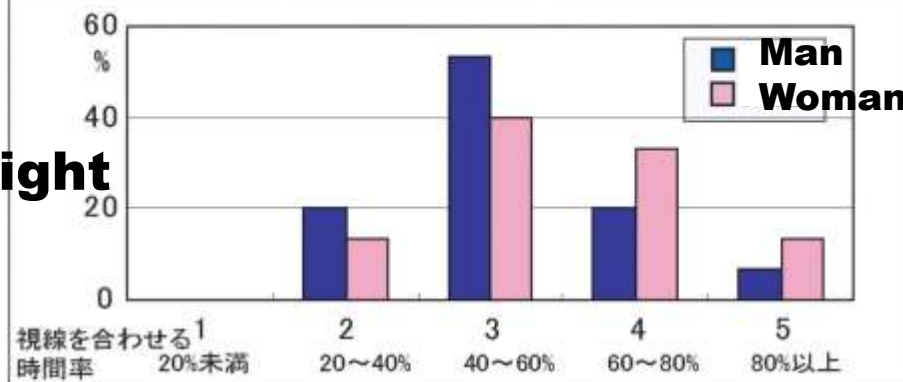
# Cultural difference

## Comparison of the eye contact in Japan and the U.S.

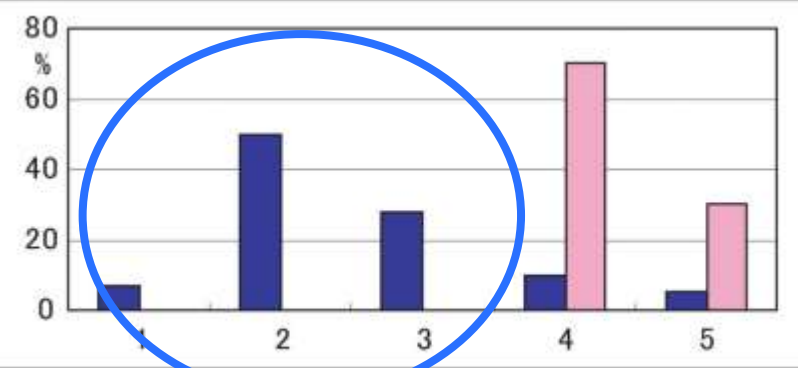
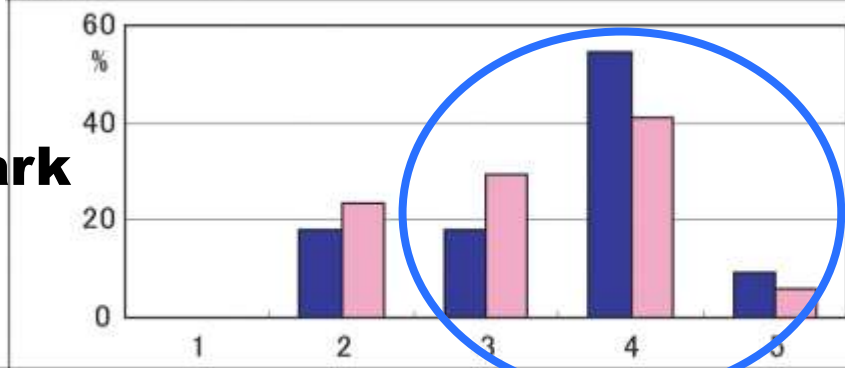
Las Vegas(116 persons)

Tokyo(158 persons)

Bright



Dark





# Investigation in an Active Cafe

Illumination and BGM volume are changed at a 30-minute interval.



**Café apartment, Koenji in Tokyo**

**Men** tended to have frequent eye contact only in a dark and loud condition.



**Women** tended to have frequent eye contact under every condition. When dark, it increases further.





# **THE EFFECTS OF ILLUMINANCE AND LOUDNESS OF THE BACKGROUND MUSIC ON CONVERSATIONAL BEHAVIORS IN A CAFE**

- 1. Women** tended to have more **frequent eye contact** than men under every condition, especially in **dark and noisy environment**.
- Men** tended to **talk more under low illumination**, and **women** tended to **talk more under low BGM volume**.
- Men** tended to **bend forward under high illumination**, and **women** tended to **bend forward under low illumination**.
- Specific people and activity were appropriate only in bright and quiet condition.**

# The effect of the color of light on conversational behavior

- ✓ **Colored light does not affect short-time conversational behavior.**
- ✓ **Men cannot talk easily under red light and women cannot talk easily under green light.**

- ✓ **Warm color light is suitable for the conversation accompanied by eating and drinking.**
- ✓ **Slight red lights show food deliciously and excite people's emotion.**

**These researches were applied to the Sharp's new LED lighting which is going to offer "health" using a pale red light.**



さくら色で、料理がおいしそうに見える。



東京都市大学 工学部建築学科 光環境学専門

小林茂雄先生のコメント

昼光色や電球色の蛍光灯やLED照明よりも、赤い光の成分を加えるとともに、黄色い成分をやや抑えているためで、食品の黄ばみを感じさせず、鮮度を高める赤味が際立つのです。



**According to the experimental results, we can be healed and slept deeply by "Sakura Color".**





**Natural white light**



**Incandescent color light**

**Light of the Sakura color**



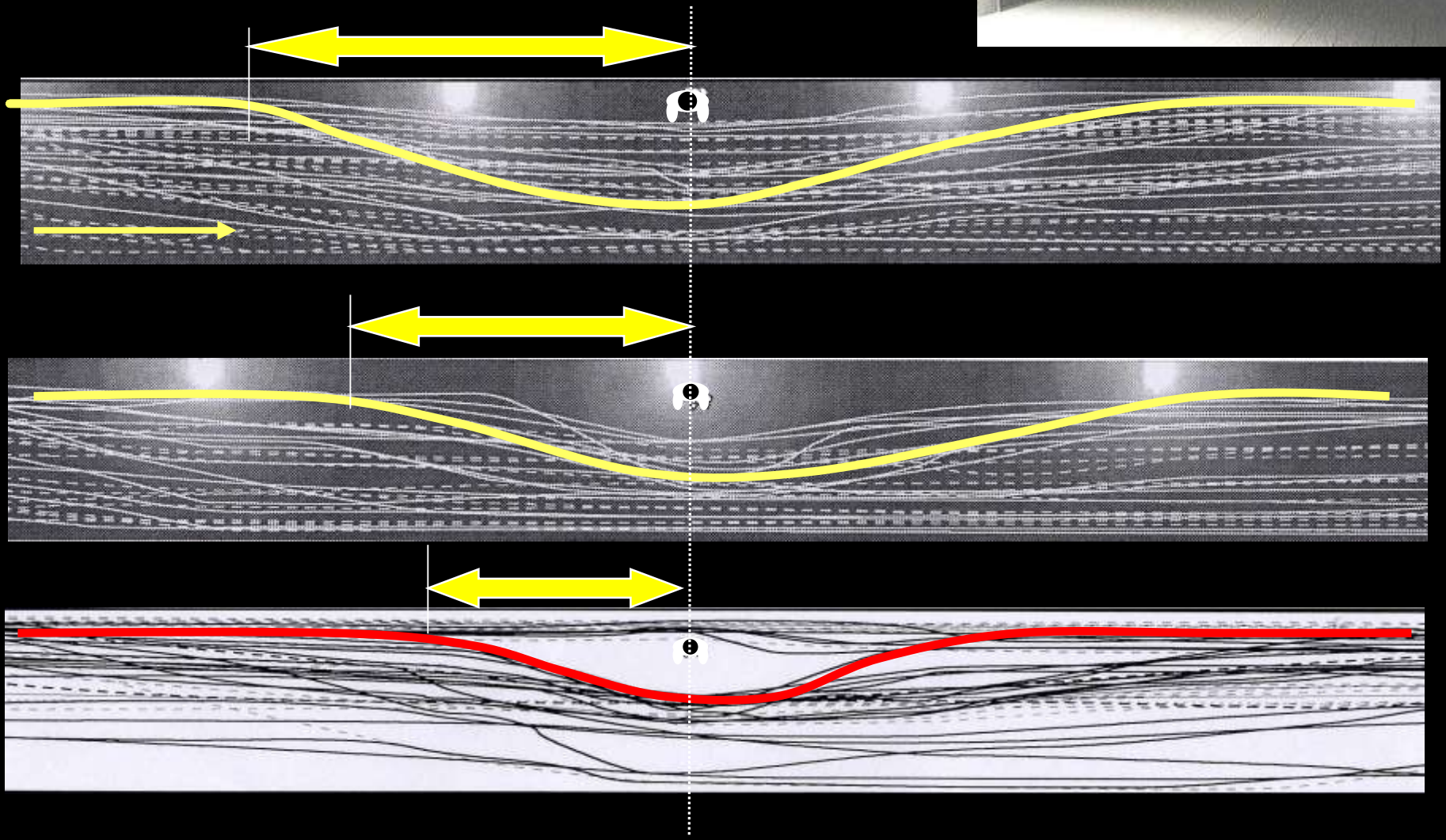
# **Lighting design to promote appropriate communication**

- ✓ **Departure from the visibility and impression by language.**
- ✓ **Consideration with interpersonal relationship, interpersonal conscious and sex difference.**
- ✓ **Lighting design combined with seat configuration.**
- ✓ **What type of communication is desired in the space?**

# **Lighting effects on outdoor behaviors**



# The Pedestrians' Avoidance Behaviors toward a Stranger on the Nighttime Streets



# Hirase onsen, Gifu Pref.

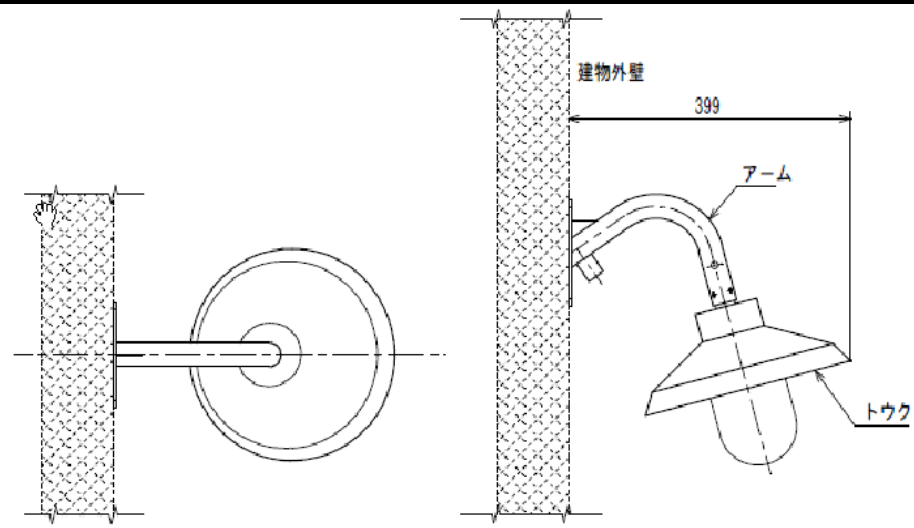
To repair the street lights, pedestrians' routes and uneasy places were investigated.





# The layout of light sources

**Small lights are arranged where pedestrians tended to avoid**



**The new lights were fixed along the street**



**Dark, energy efficient, no light pollution,  
and safe lighting were created.**

# Couples staying along the river

**what affects their romantic behavior?**



**They stay in a line at almost equal intervals.**








- ✓ **Lighting (Brightness)**
- ✓ **Interpersonal distance**
- ✓ **Neighbor's attribution**



**How is their behavior evaluated?**

# Evaluation criteria of a couple's behavior

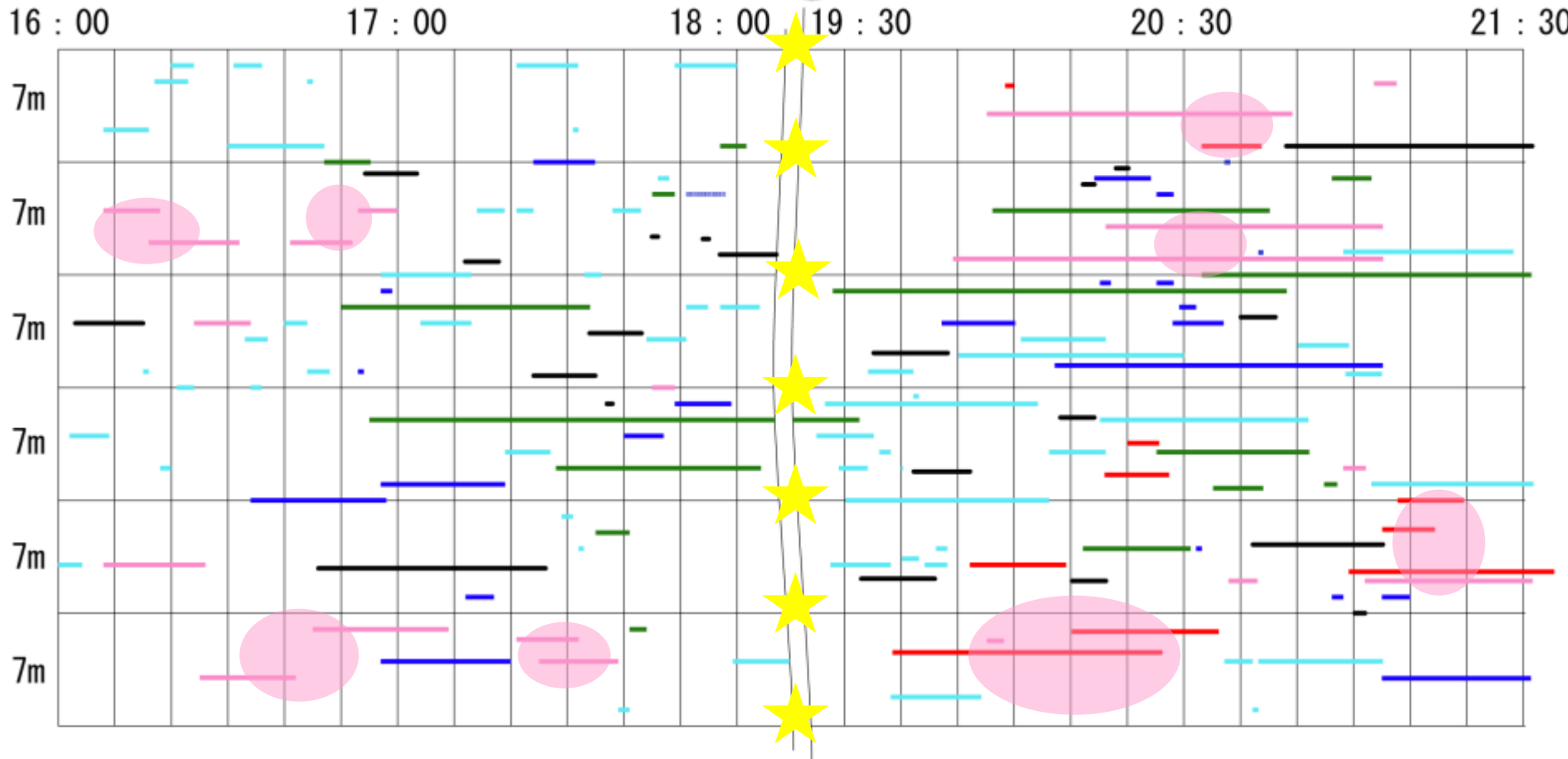
1	2	3
		
<b>separated</b>	<b>gets close</b>	<b>hold hands</b>
4	5	
		

**over the shoulder hold each other**

# Bright

# Light

# Dark



- separated
- gets close
- reach over her shoulder
- People who are not couples

- hold hands
- hold each other

# Landscape, Space, and Lighting Design



Lighting may contribute not only to activate public space, but also to recover from the declining birth rate.



**Conscious**

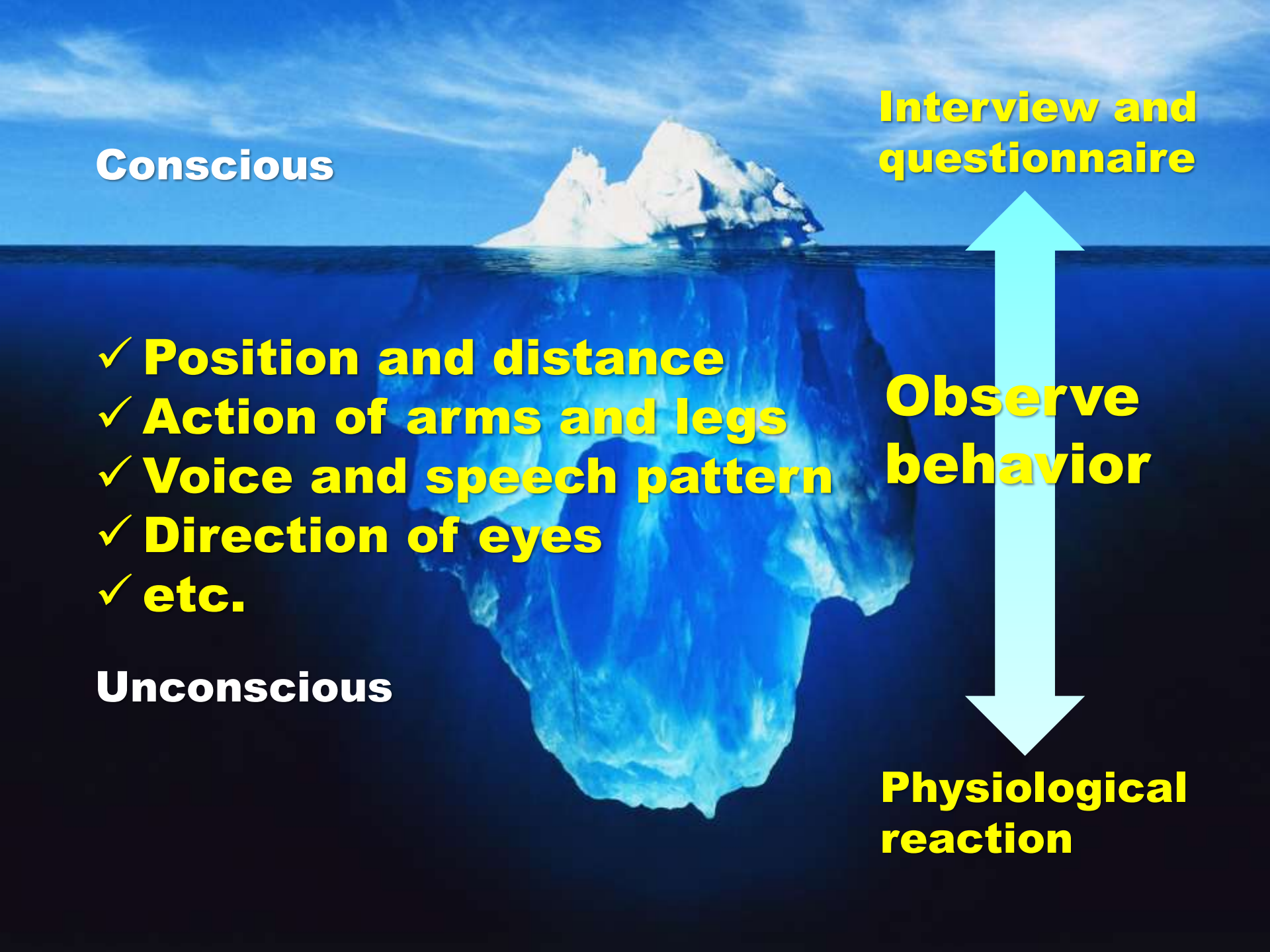
**Interview and  
questionnaire**

- ✓ **Position and distance**
- ✓ **Action of arms and legs**
- ✓ **Voice and speech pattern**
- ✓ **Direction of eyes**
- ✓ **etc.**

**Observe  
behavior**

**Unconscious**

**Physiological  
reaction**





**We should not use strong lighting which moves people's emotion.**

**We should not search for the common effects to all people.**

**The effect of lighting is delicate.**

**The delicate lighting adjusted by delicate individuality should be examined.**

**Lighting can be adjusted at any time,**

**The delicate environmental design  
is going to be  
correspond to the purpose,  
sex and age, interpersonal relations,  
physical condition,  
a season and time, emotion, etc.**

**unconsciously.**