

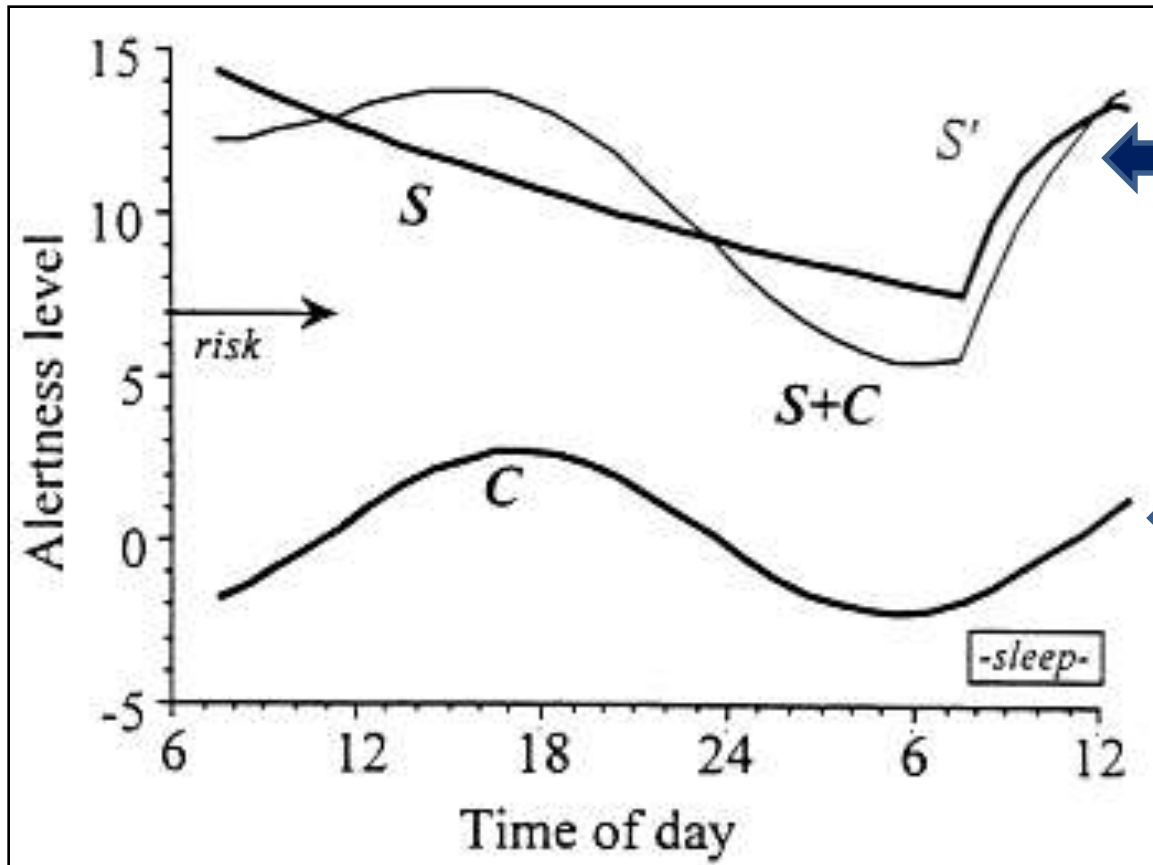
# **Shift-work, psychosocial job characteristics, sleep and health in air traffic controllers and satellite controllers.**

Work & Cognition Laboratory CLLE  
University Toulouse, France

Claudine Mélan,  
Magali Cariou,  
Edith Galy,  
Nadine Cascino

1. Investigation of the 24-hr trends of physiological and psychological variables in Air Traffic Controllers and Satellite Controllers : chronobiological regulation ?
2. Multi-dimensional and integrative approach of these job-situations and their long-term effects on health, job-satisfaction and fatigue ?

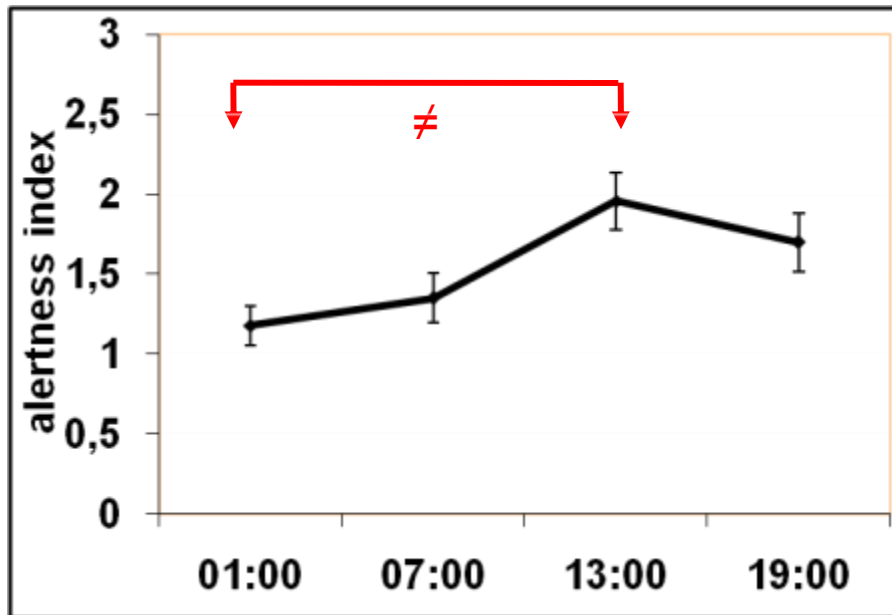
## Chronobiological models of 24-hr trends



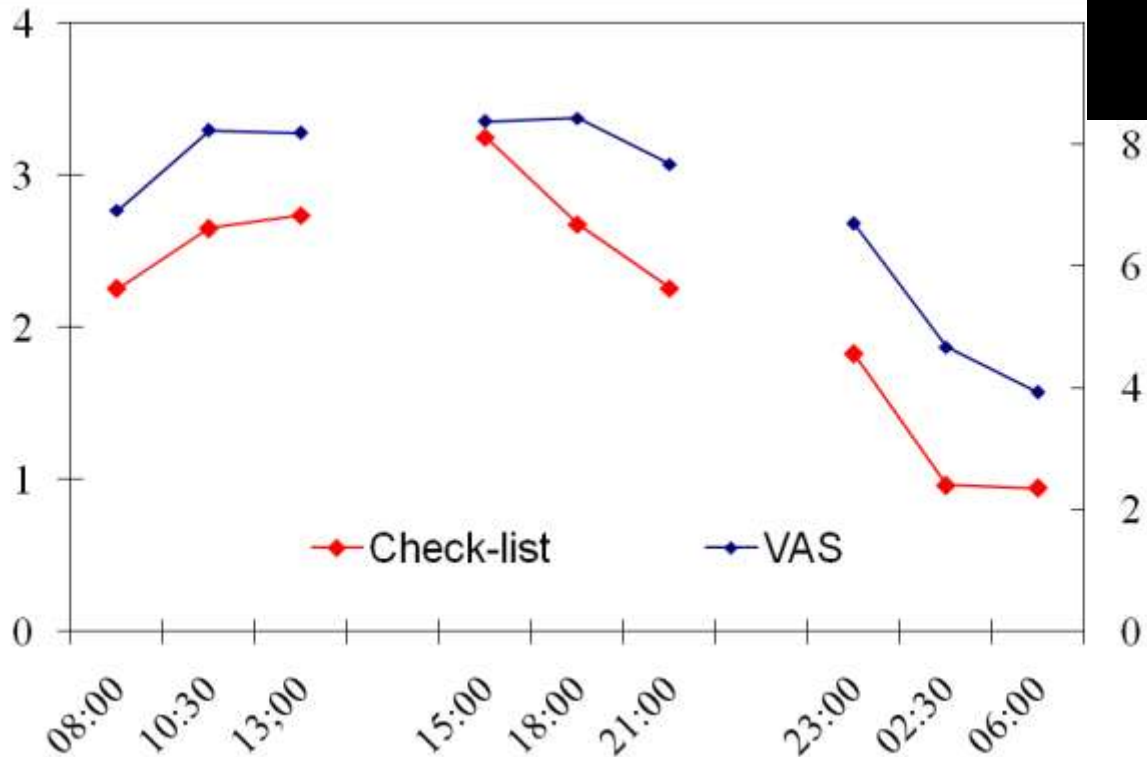
Folkard et al., 1999

## Typical 24-hr trends in Real- Job Situations

Air Traffic Controllers  
(shifts 7-11h, n=17) :  
Self-rated Alertness (check-list)

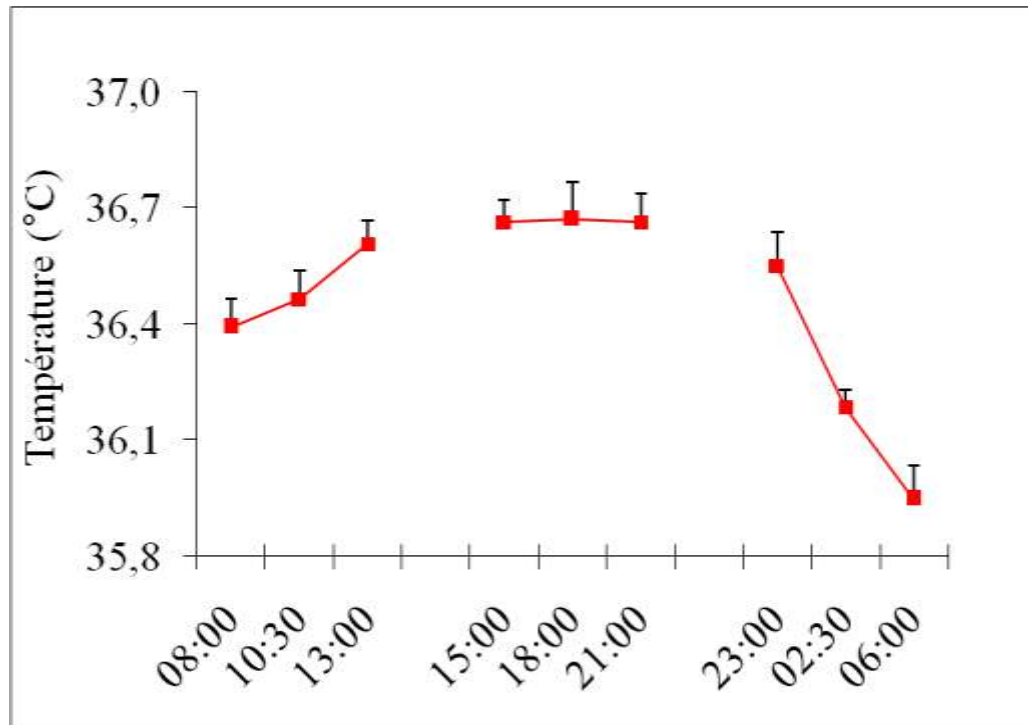


Satellite Controllers  
(3x8, n=15):  
Self-rated Alertness (check-list and VAS)



## Satellite Controllers

Physiological measure : body temperature, sub-lingual



- ✓ Body temperature and alertness highly correlated
- ✓ Similar 24-hr trend than in controlled laboratory conditions
- ✓ Overall independently of the job-situation and shift-schedule system

**→ Strong dependency on endogenous regulation systems**

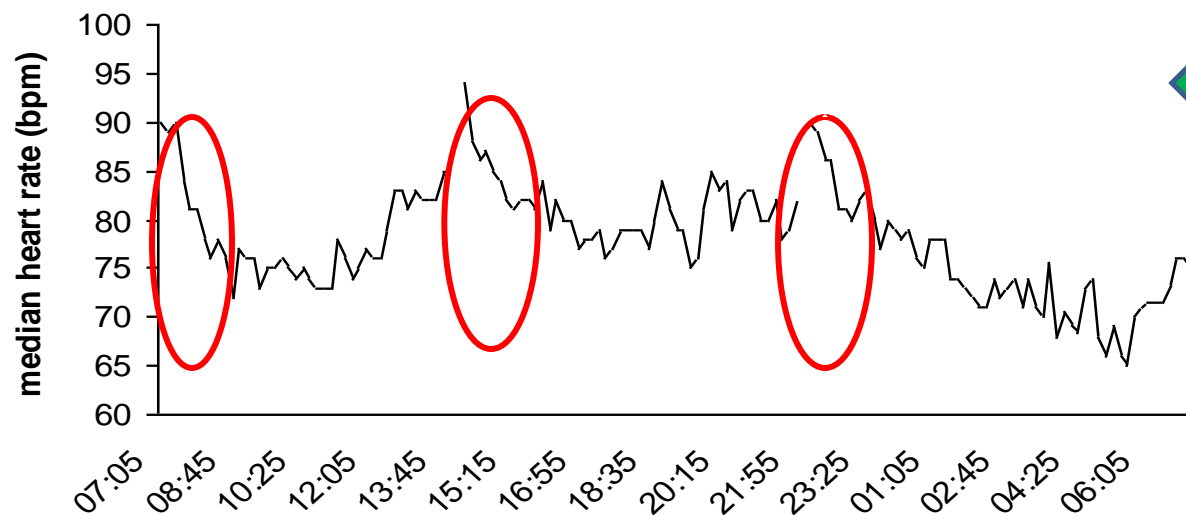
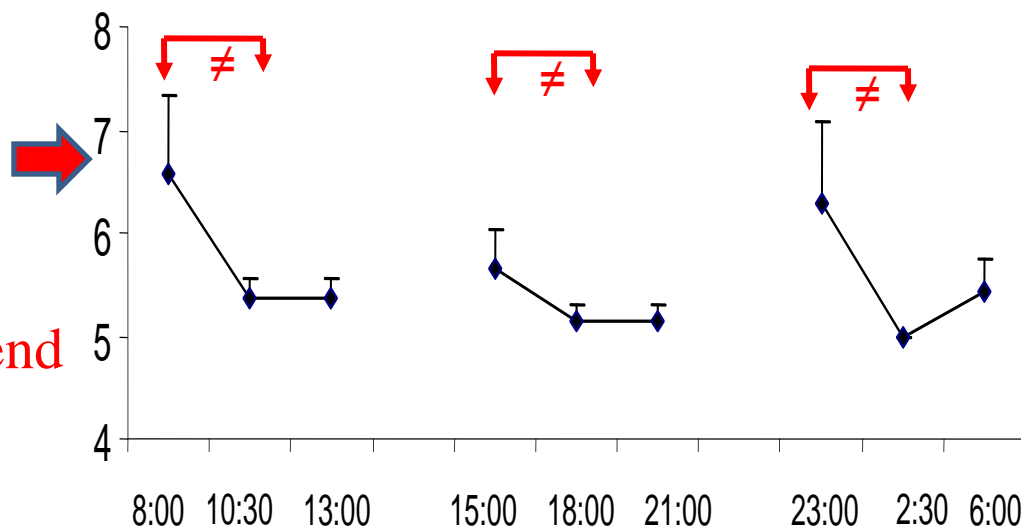
# Inhabitual 24-hr trends in real-job situations

## Satellite controllers

Self-rated tension:

1h after shift-start >

middle of shift and 1h prior shift-end



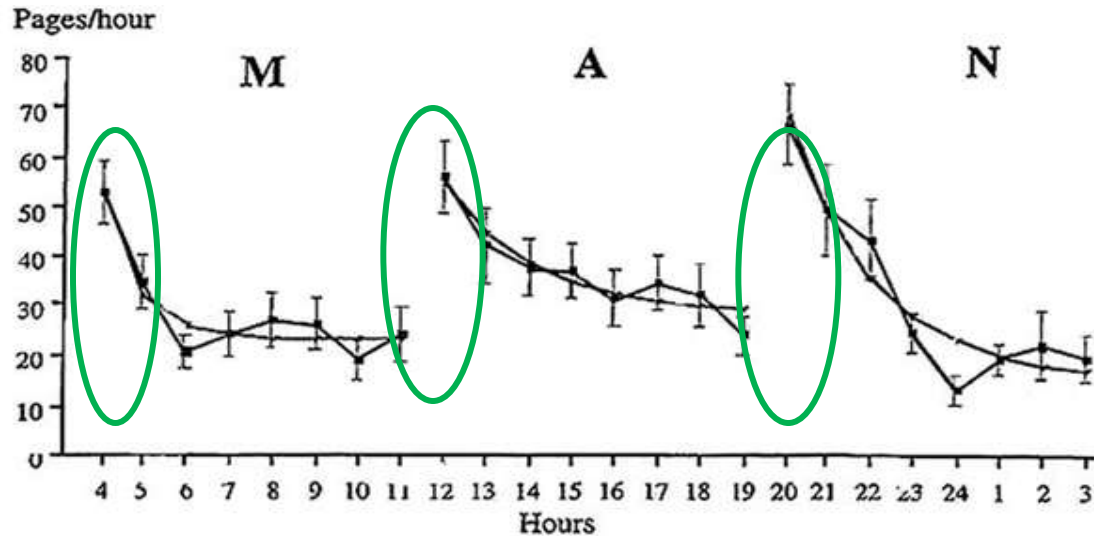
## Heart rate:

First hr > remaining shift



Ambulatory Heart Rate Monitor

## Inhabitual 24-hr trends of job performance



Process Controllers :  
Job Performance  
First hr > remaining shift

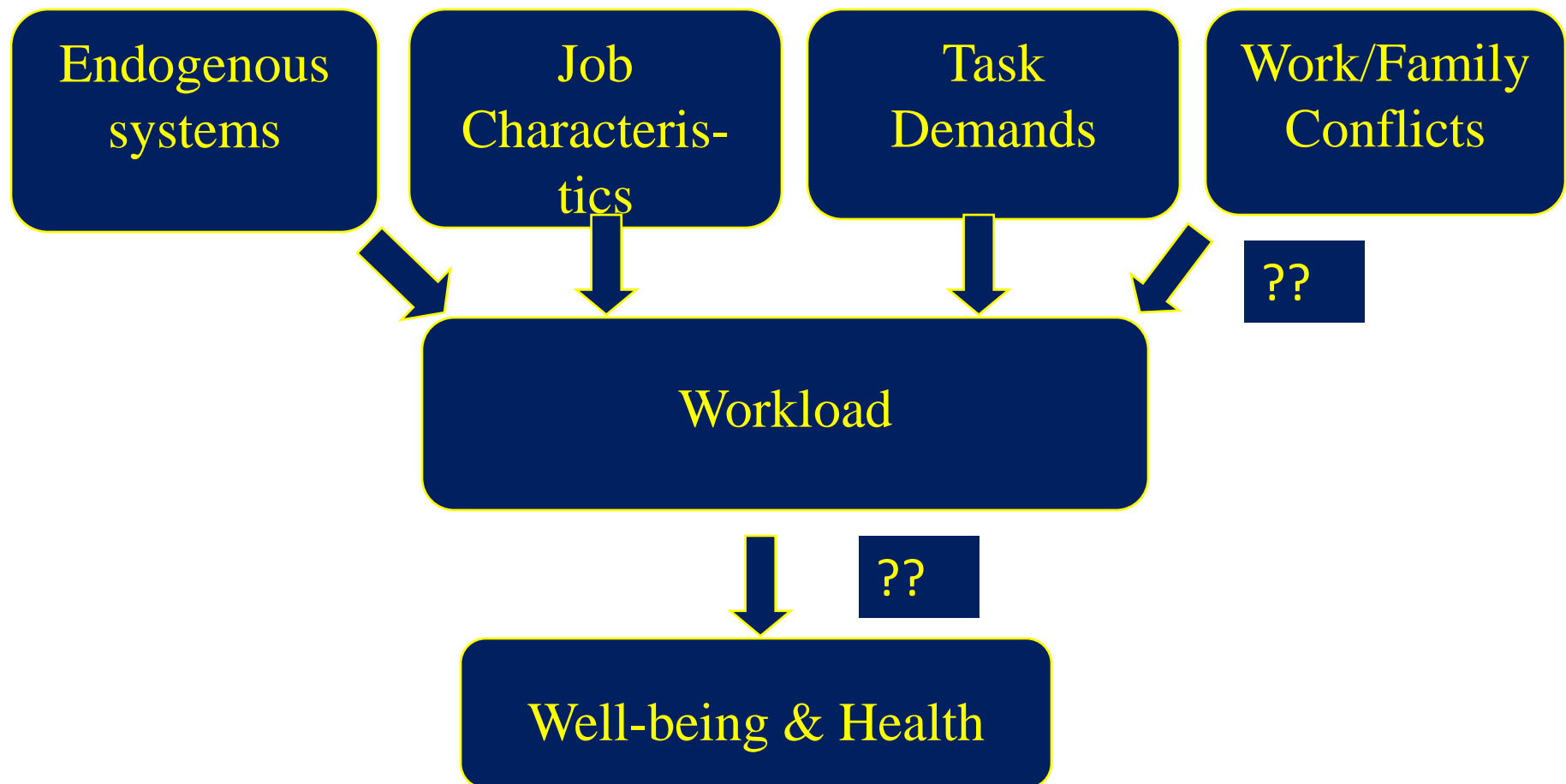
Andorre-Gruet et al., 1998

→ Masking effect by cognitive workload ?



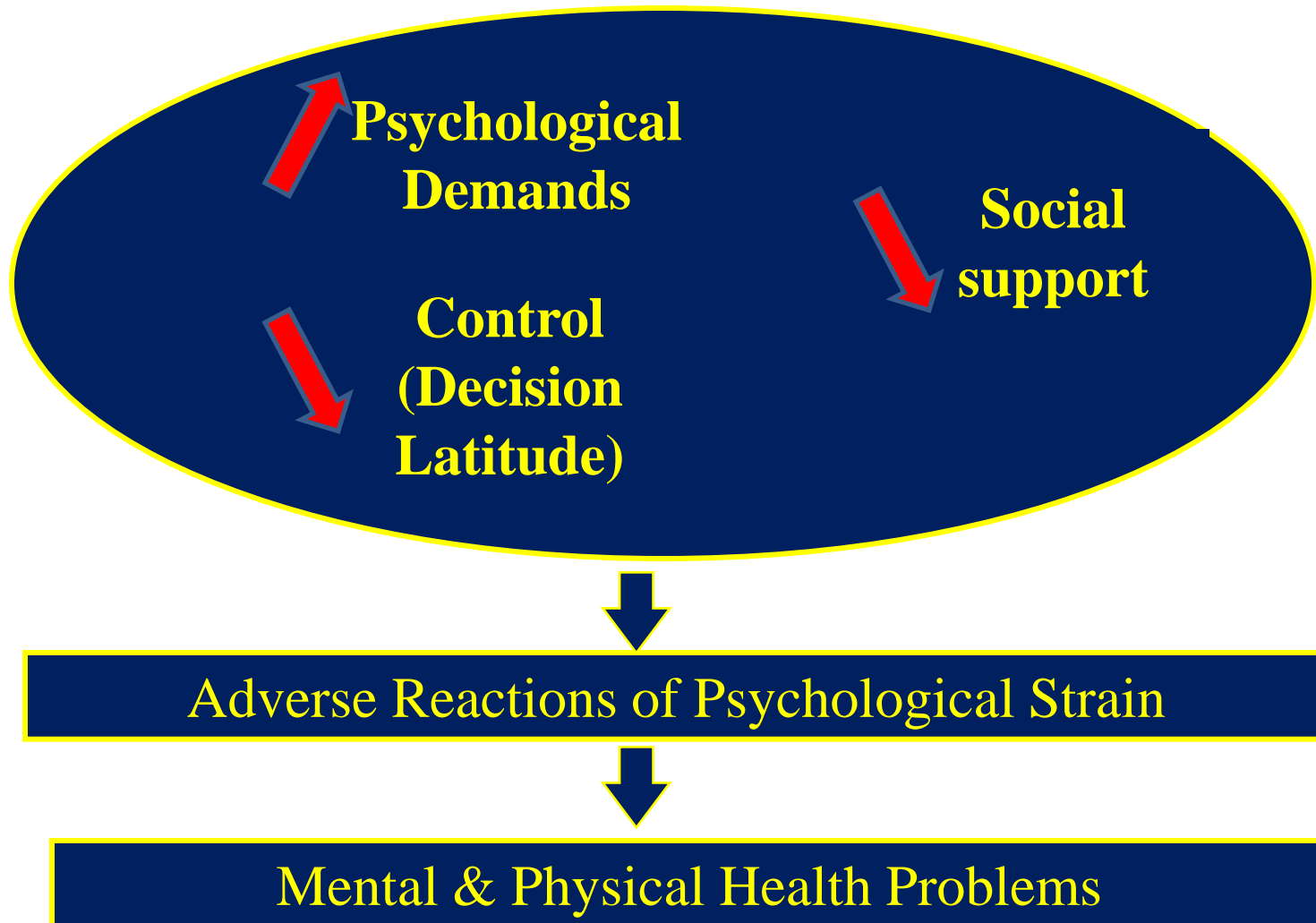
# A multi-dimensional approach of shift-work and job characteristics

A number of factors have short-term effects on workload and long-term effects on operators health and well-being

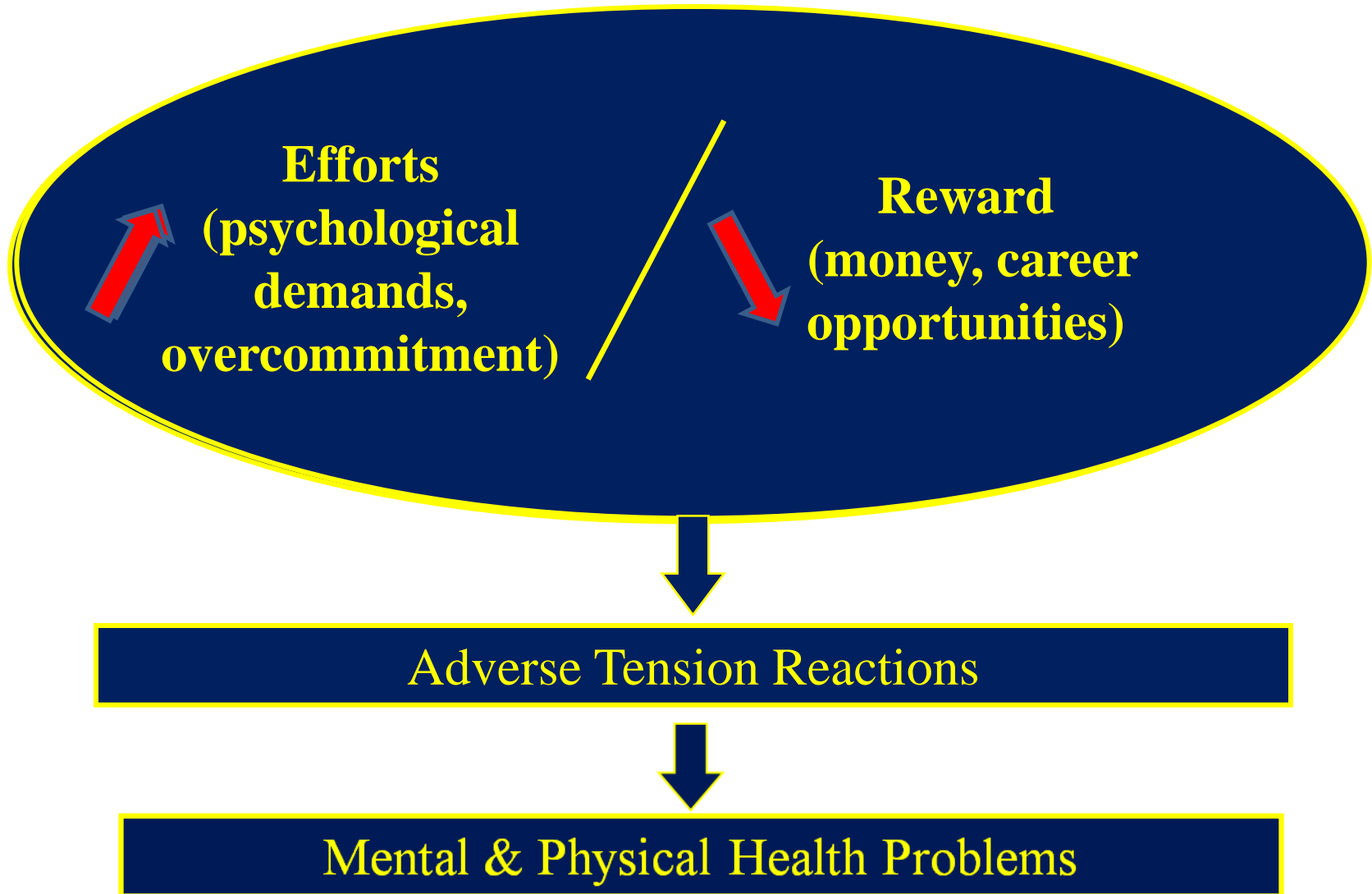


# Models of long-term outcomes of stressful job environments

## **Demand-Control Model, Karasek & Theorell, 1990**



## Effort-Reward Imbalance Model, Siegrist, 1996



# Descriptive analysis of job characteristics and work/family conflicts in **Air Traffic Controllers** and **Satellite Controllers**

Participants and job situation

Differential job requirements

The results obtained so far: descriptive analysis !

## Participants and work organization

	<u><b>Air Traffic Controllers</b></u>	<u><b>Satellite Controllers</b></u>
<b>Gender</b>	<b>4 females – 4 males</b>	<b>8 males</b>
<b>Age</b>	<b>36.6 years</b> (33.25 females, 40 males)	<b>45.7 years</b>
<b>Shift-system</b>	<b>6 shifts variable length</b> (5 day-shifts, range 7.5 to 11h; 1 night-shift, 11h)	<b>3-shift system</b>
<b>Shift-work experience</b>	<b>10 to 15 years , n=7</b> (5 to 10 years, n=1)	<b>Variable</b> (range 1 to 5; > 15 years )

## Differential job requirements....

	<u><b>Air Traffic Controllers</b></u>	<u><b>Satellite Controllers</b></u>
<b>Work content</b>	more or less predictable traffic flow	- shift-start: built up of situation awareness - body of shift: planned operations
<b>Cognitive Workload</b>	high all over the shift, multiple decisions	high on shift-beginning, few decisions
<b>On-duty Recovery</b>	pauses, every 2h	limited

## Results according to Karasec & Theorell's model

### ATCs

« Actif » Job situation (demand+/decision+)	« Passif » Job situation (dem-/dec-)	HighTension (dem+/dec-)	LowTension (dem-dec+)
4 ATCs (2 males, 2 females)	0	2 ATCs (females)	2 ATCs (males)

Positive Emotions

Good Health Outcome

No strain

Good Health Outcome

## SCs

« Actif » Job situation (demand+/decision+)	« Passif » Job situation (dem-/dec-)	HighTension (dem+/dec-)	LowTension (dem-/dec+)
1 SC	6 SCs	1 SC	0

↓ ↓

Psychological Strain

↓

Negative Health Outcome



## According to Siegrist's model

### ATCs

Efforts > Reward	Efforts low, Reward low	Efforts (I or E) < Reward	Efforts (I & E) < Reward
2 ATCs	0 ATC	4 ATCs	2ATCs

75% → No Tension

Good Health Outcome

### SCs

Efforts > Reward	Efforts low, Reward low	Efforts (I or E) < Reward	Efforts (I & E) < Reward
4 SCs	2 SCs	1 SCs	0 SC

50% → Subjective Tension

Negative Health outcome

## Long-term Outcome

	<u>ATCs</u>	<u>SCs</u>
<b>Heath Problems (last 6 months)</b>	Max 4 or 5	Max 8 or 9
<b>Sleeping difficulties</b>	5/8 ATCs	7/8 SCs
<b>Fatigue</b>	7/8 ATCs	7/8 SCs
<b>Self-esteem (Rosenberg, 1969) &gt; Median value</b>	6/8 ATCs	2/8 SCs
<b>Job-satisfaction (Weiss, 1967) &gt; Median value</b>	6/8 ATCs	3/8 SCs

NB : work-family conflicts overall low; Female ATCs > Male ATCs

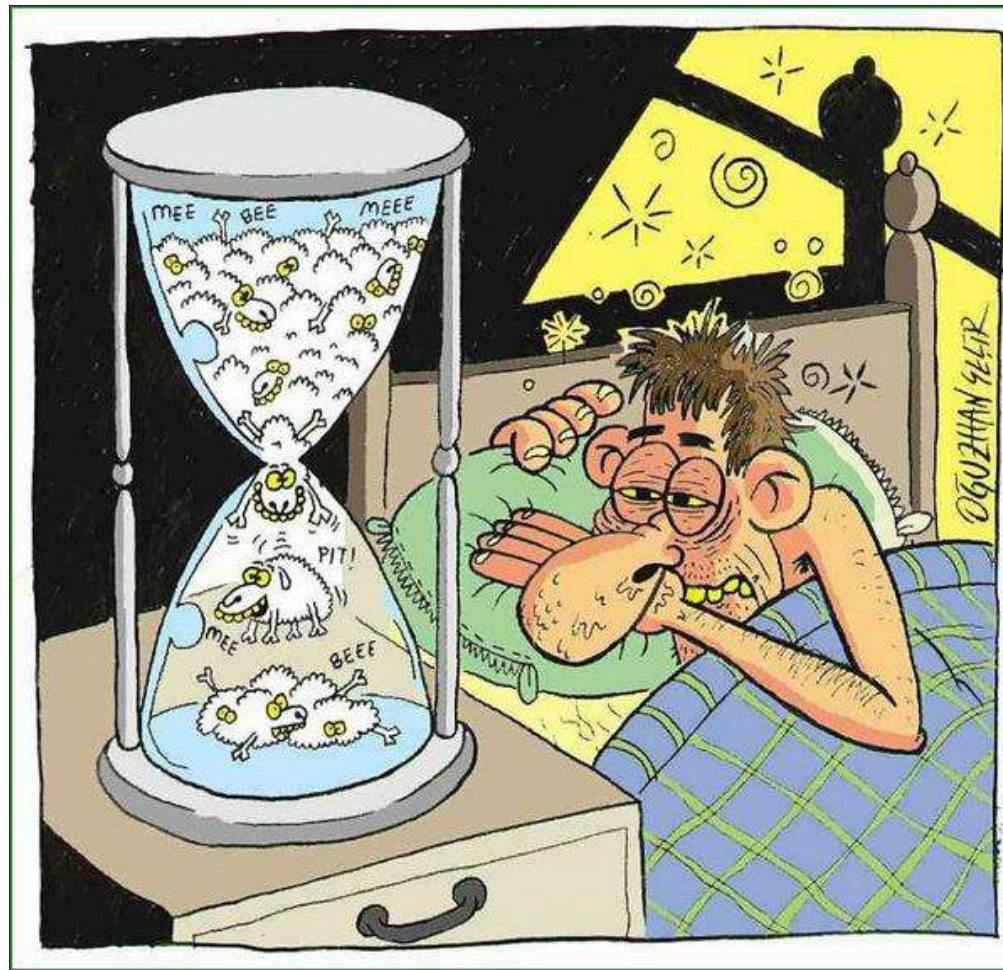
## **To conclude**

The results of the preliminary study favour the hypotheses of a stress-related disease risk in regard with psychosocial work characteristics in shift-workers

This hypothesis needs further confirmation with a larger number of participants and adequate statistical tools.

A large scale study will enable to determine the relationships between the different factors of interest in this study

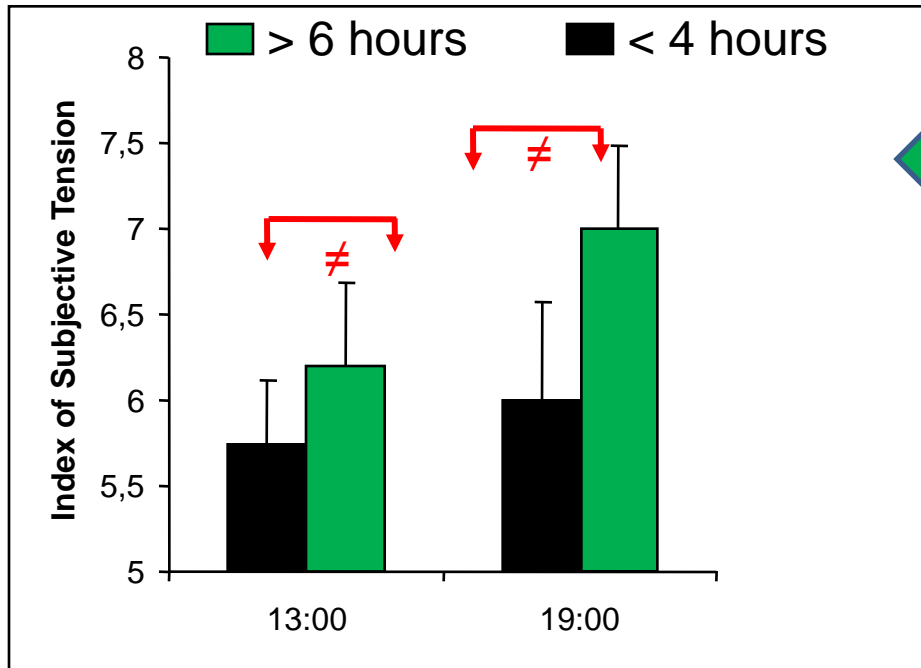
Thank you for your attention



*Pssst! We try to sleep....*

...induce differential long-term outcomes : hypotheses

	<u><b>Air Traffic Controllers</b></u>	<u><b>Satellite Controllers</b></u>
<b>Perceived Job characteristics</b>	High task demands, high decision latitude	low job demands associated with low decision latitude
<b>Effort/Reward</b>	Balance?	Imbalance?
<b>Job Satisfaction</b>	High?	Lower?
<b>Health problems</b>	Few?	More?
<b>Work/Family Conflicts</b>	?	?



Air Traffic Controllers :  
6h at work >4h at work

## Models of Work/Family Conflicts, Greenhaus & Beutell, 1985

**W → F Conflict** : Participation in a **work activity interferes** with participation in a competing family activity

or

**Work stress** has a negative effect on behaviour within the family domain

**F → W Conflict** : Participation in a **family activity interferes** with participation in a competing work activity

or

**Family stress** has a negative effect on performance in the work role

## Typical 24-hr trends in various job situations

Security Agents in a nuclear power plant  
(3x8, n=23) :  
Self-rated Alertness (check-list)

