

BEHAVIORS IN OPEN SPACES

AN ETHOLOGICAL PERSPECTIVE

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OUR ORIGIN

ENVIRONMENT OF EVOLUTIONARY ADAPTEDNESS EEA

- ▶ small groups
- ▶ territorial hunter-gatherers
- ▶ core units are families
- ▶ patrilocality
- ▶ savanna of eastern Africa
 - ▶ open grasslands
 - ▶ scattered trees
 - ▶ water holes
 - ▶ large gregarious animals
 - ▶ predators
 - ▶ seasonality



WHY WE LIKE WHAT WE LIKE

ECOLOGICAL VALIDITY: PHYTOPHILIA

- ▶ positive emotional response to plants
- ▶ plants are resources
- ▶ protection
 - ▶ sun
 - ▶ escape
- ▶ indicators of resources
 - ▶ water
 - ▶ animals
 - ▶ blossoms indicate soil quality



EFFECTS OF PLANTS

- ▶ natural environments reduce stress
- ▶ dentists' patients
- ▶ recovery after surgery
- ▶ prisoners are ill less often
- ▶ cognitive efficiency
 - ▶ driving license exam
 - ▶ open plan offices



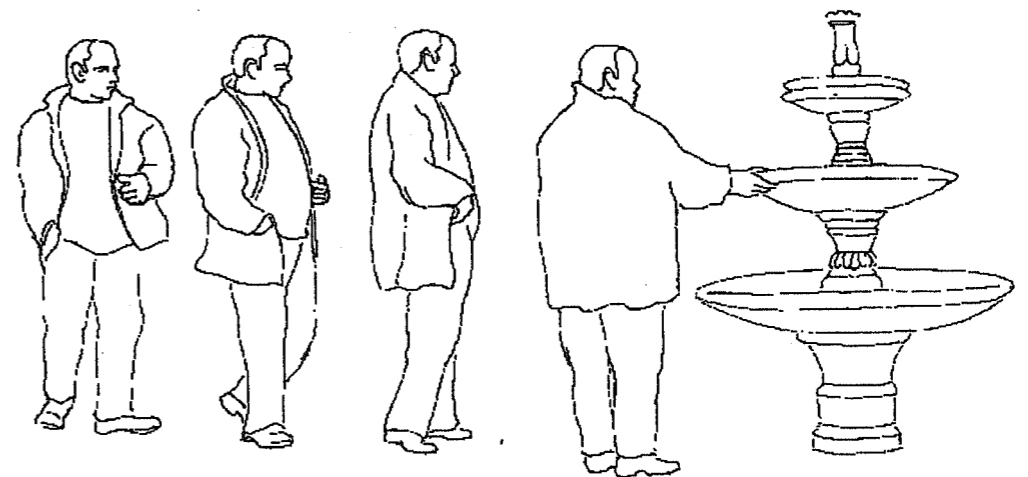
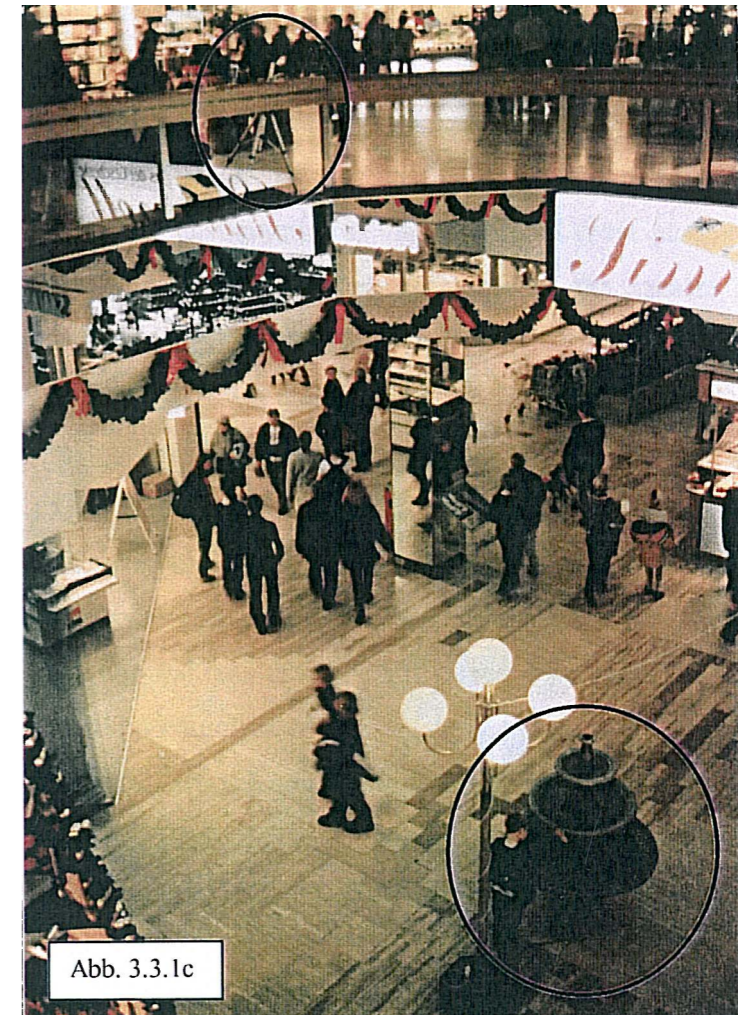
ÉCOLOGICAL VALIDITY: HYDROPHILIA

- ▶ positive emotional response to water
- ▶ water is limiting resource
- ▶ moving water has stronger effects
- ▶ water increases social interactions
- ▶ fountains increase the acceptance of squares
- ▶ preference for shiny objects
 - ▶ remind of wetness
 - ▶ children eat more off shiny plates
 - ▶ jewelry

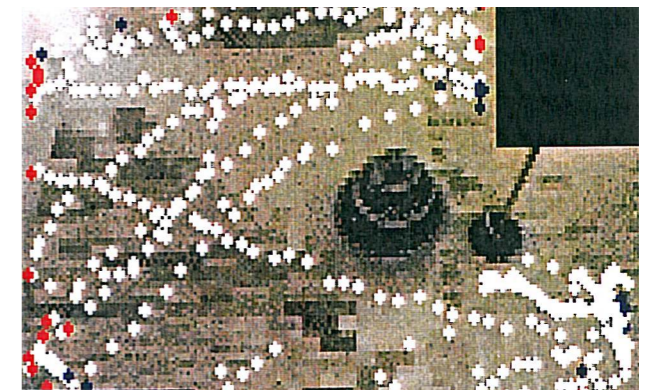
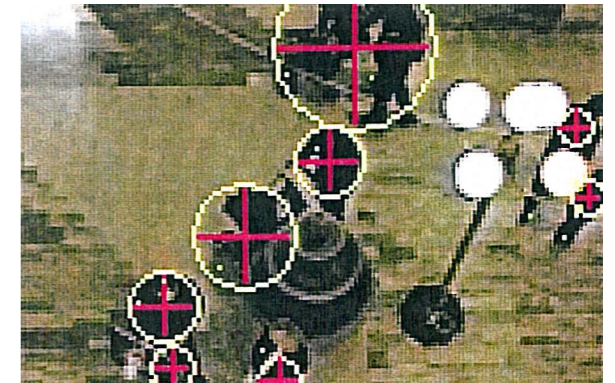
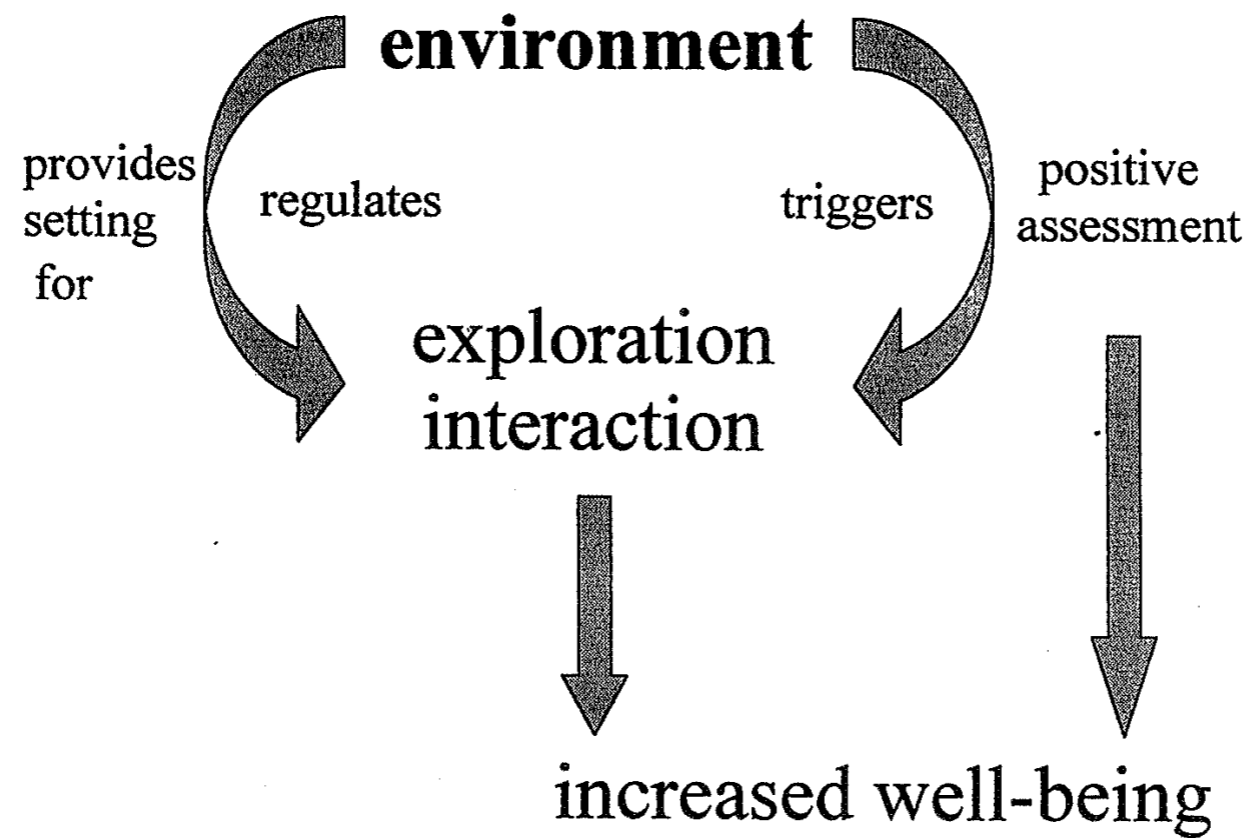


HYDROPHILIA AND BEHAVIOR

- ▶ *SCS*
- ▶ fountain empty - water - moving water
- ▶ exploration
 - ▶ approach
 - ▶ duration of stay
 - ▶ touching
- ▶ social interaction
 - ▶ individual distance
 - ▶ laughter

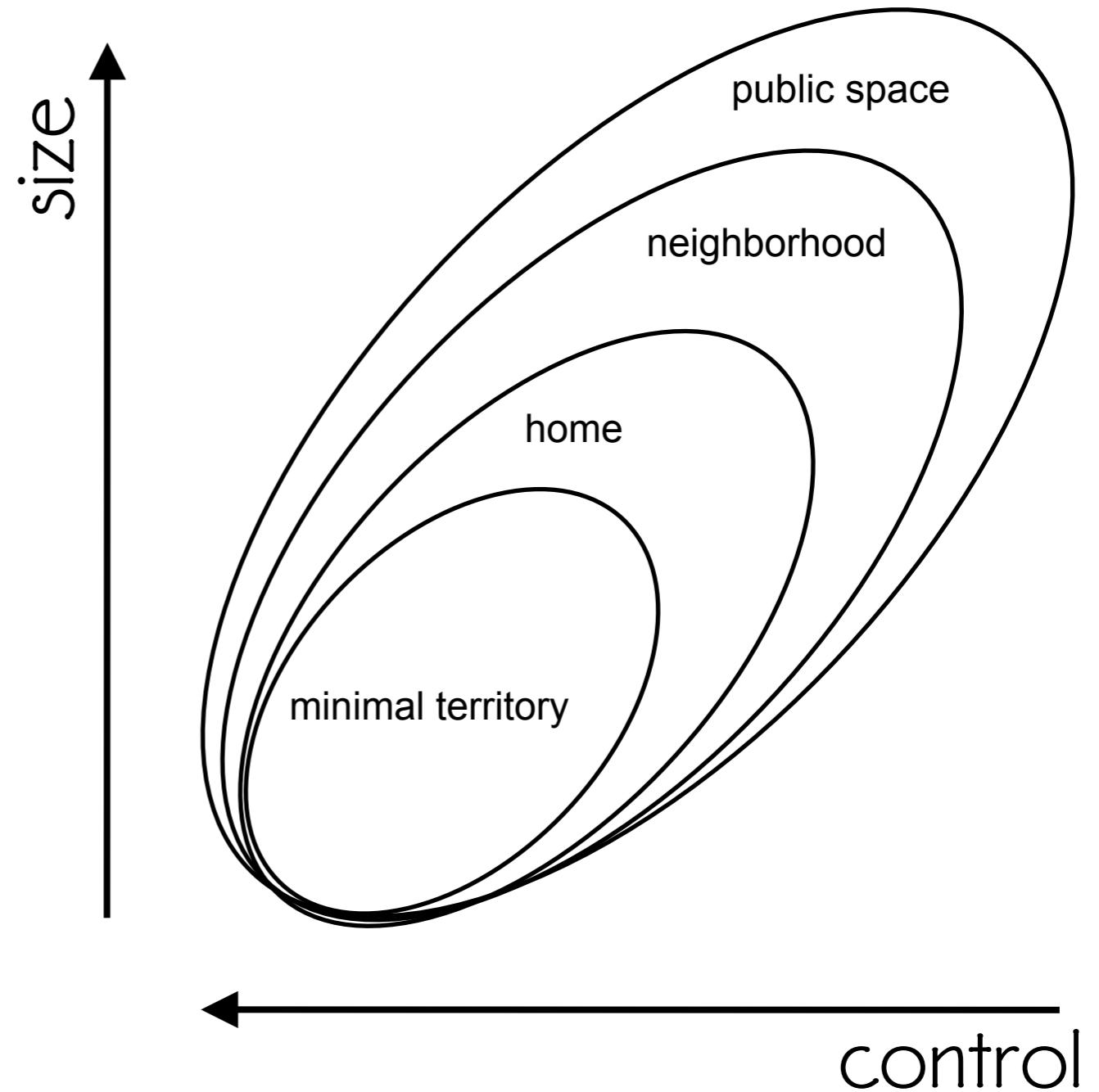


Tischler (2000)



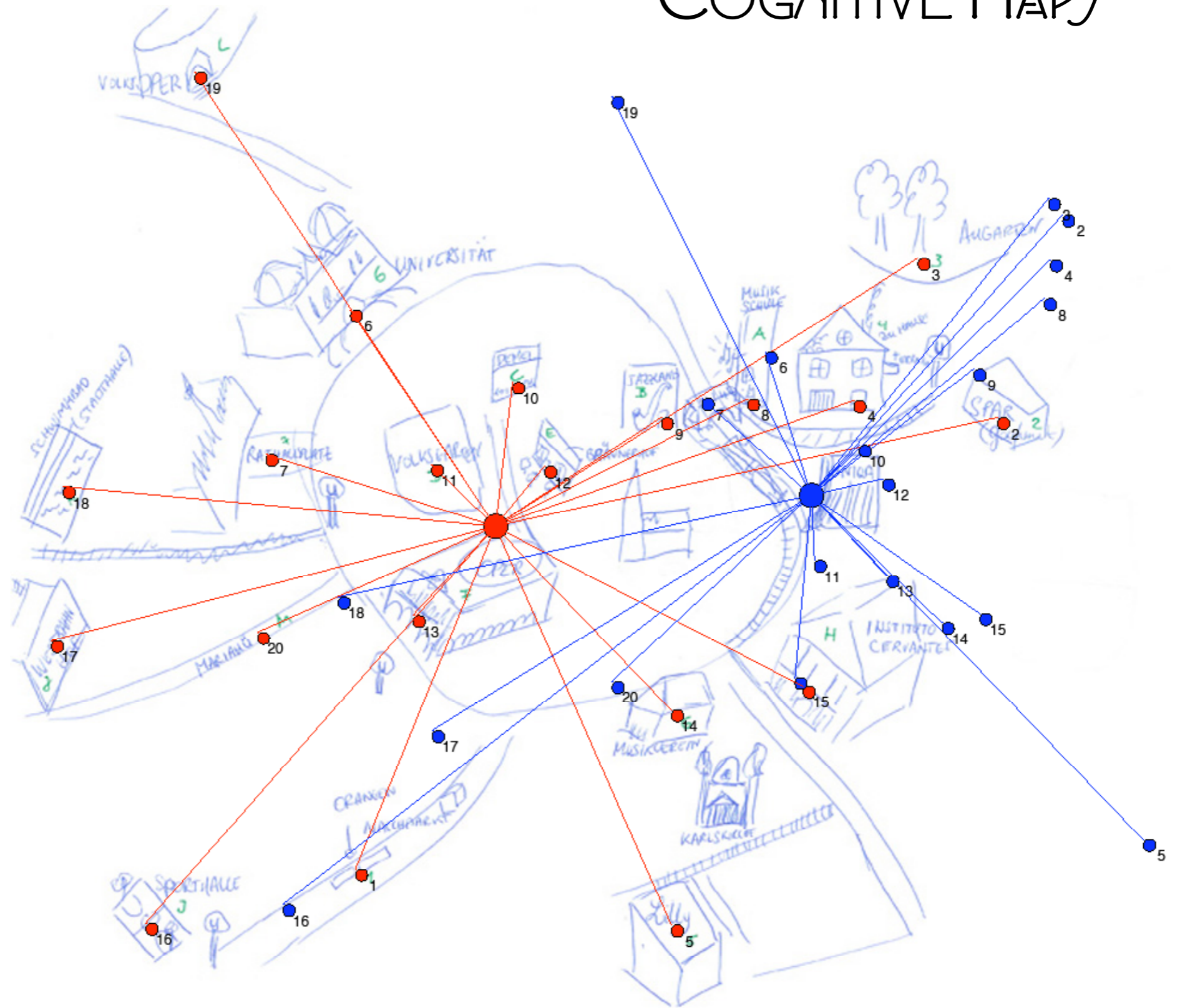
TERRITORIALITY

- ▶ occupancy of space
- ▶ location and dominance
- ▶ surrounding and behavior
- ▶ personal identity
- ▶ group identity
- ▶ group cohesion
- ▶ control
- ▶ access to resources



Walden 1995

COGNITIVE MAPS



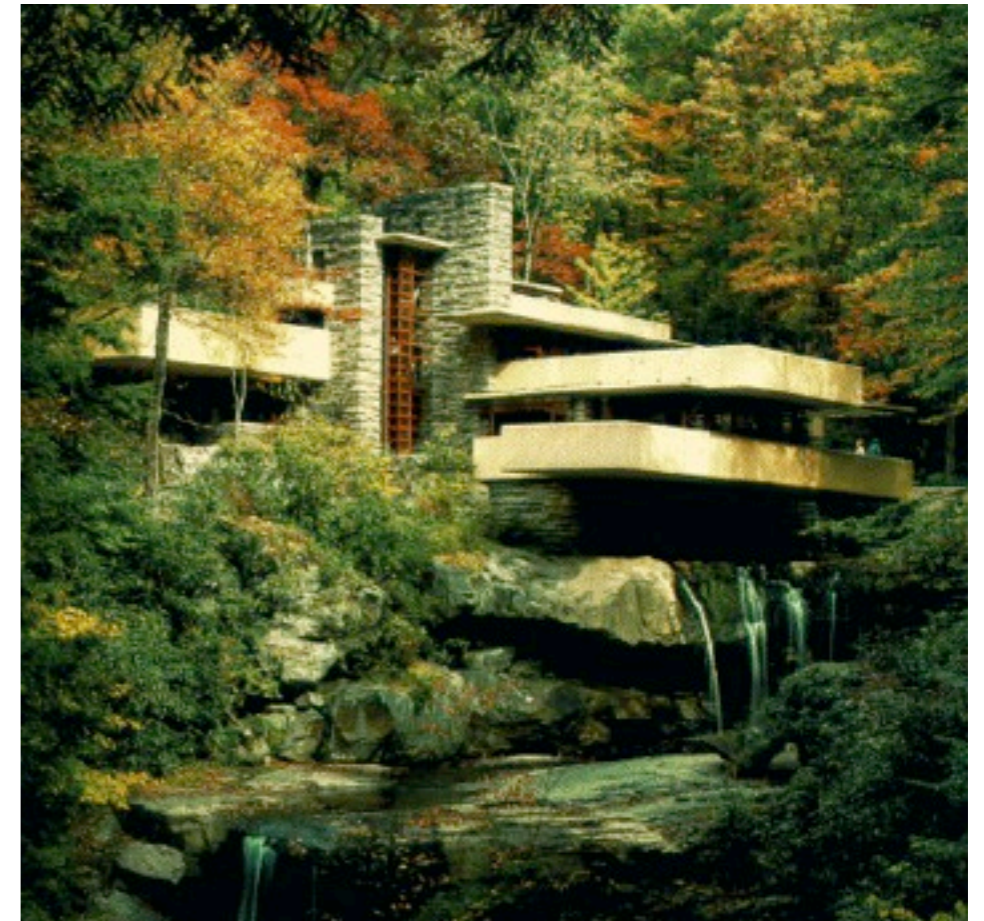
PERSONAL SPACE

- ▶ no fixed borders
- ▶ linked to person
- ▶ context dependent
- ▶ interaction partner dependent
 - ▶ familiarity
 - ▶ closeness
 - ▶ dominance
- ▶ cultural differences
 - ▶ north-south-devide



PROSPECT-REFUGE THEORY

- ▶ see without being seen
 - ▶ good overview
 - ▶ resources
 - ▶ predators
 - ▶ danger
 - ▶ refuge
 - ▶ to escape danger
 - ▶ could hide danger
 - ▶ Prospect-Refuge-Escape-Theory
 - ▶ potential to escape from predators
- ⇒ explore, monitor and escape



HOW IS BEHAVIOR DISTRIBUTED?

THE USE OF SPACE IN A HOTEL



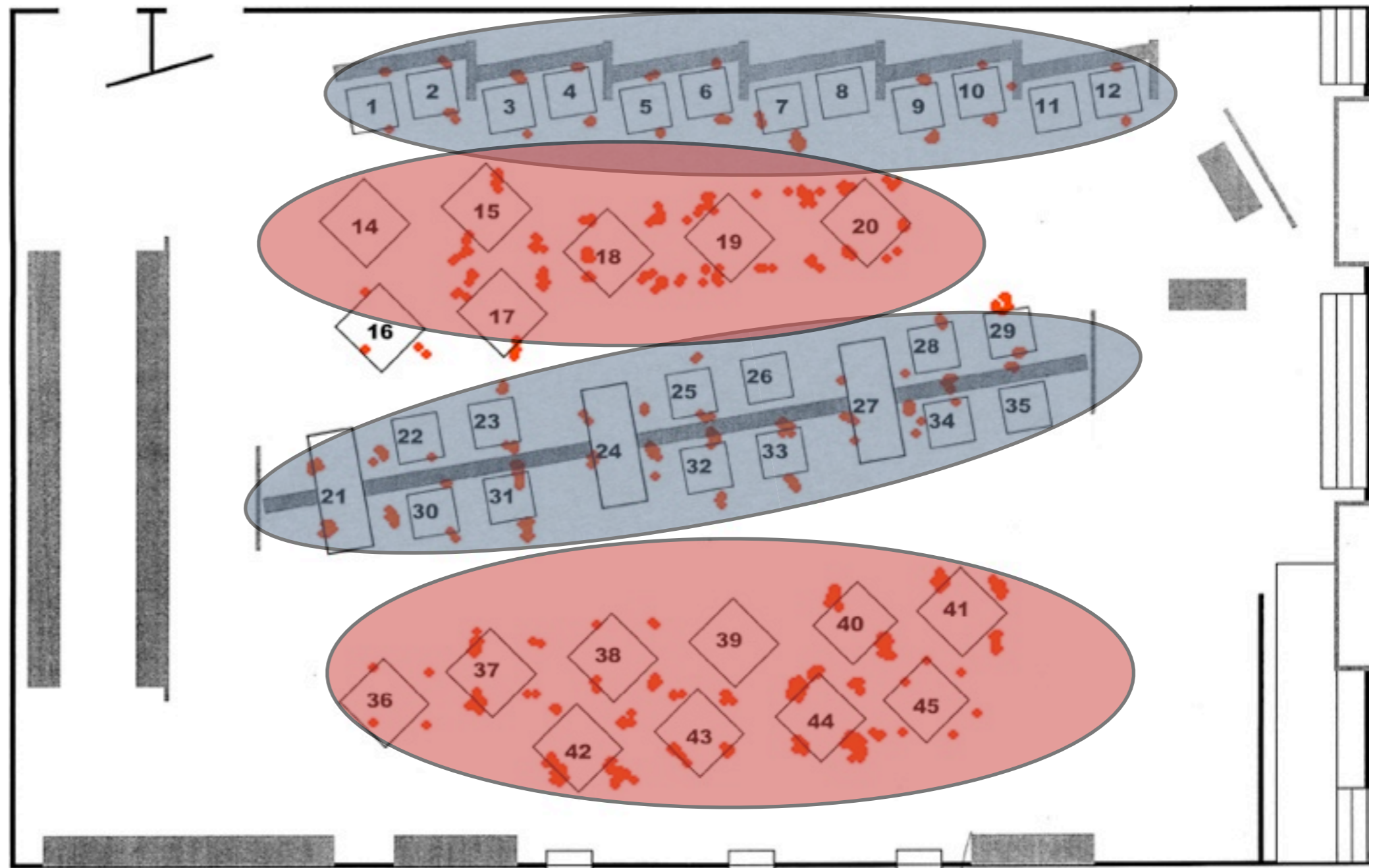
Oberzaucher & Grammer (2006)

STRUCTURAL EVALUATION

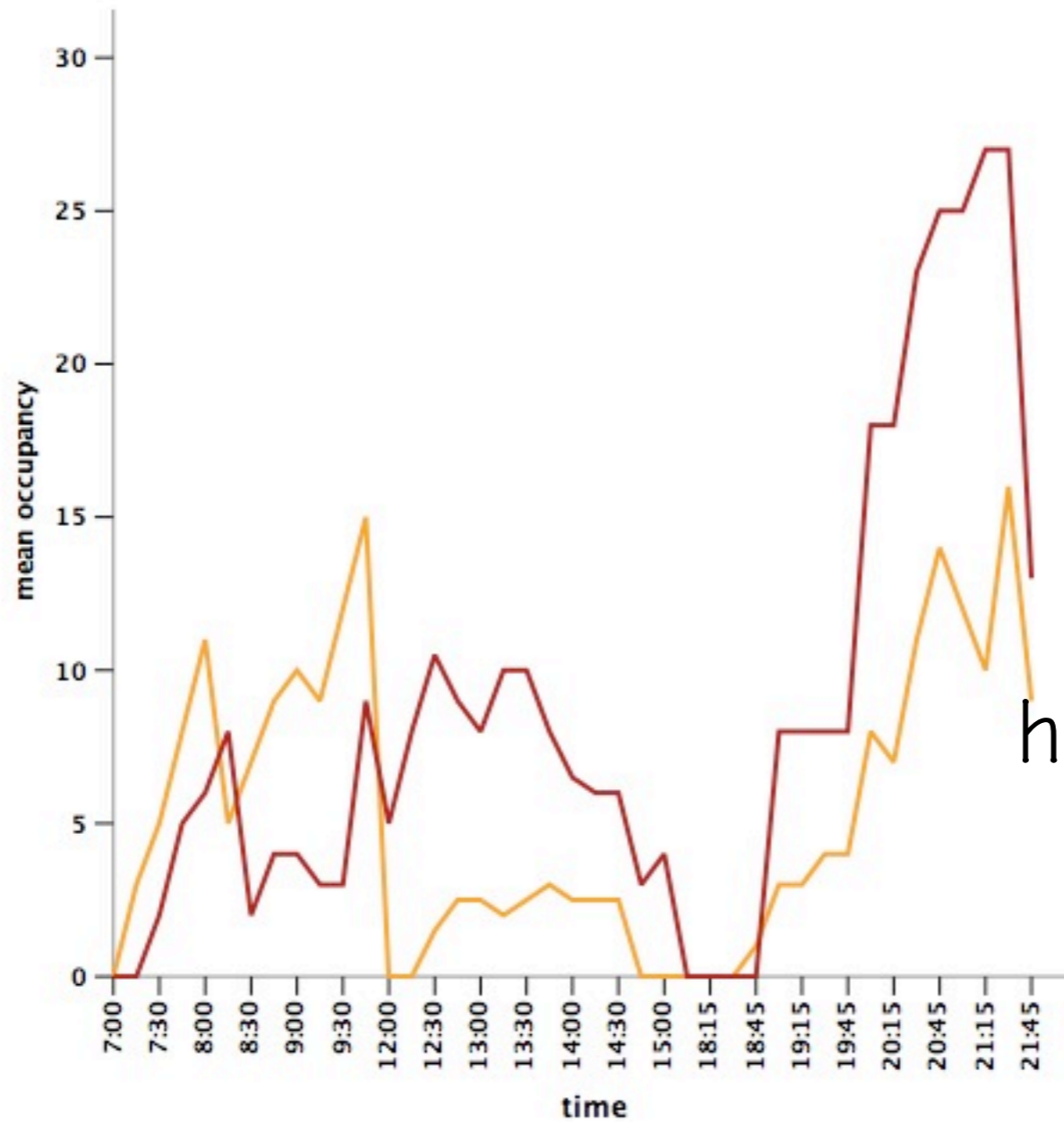
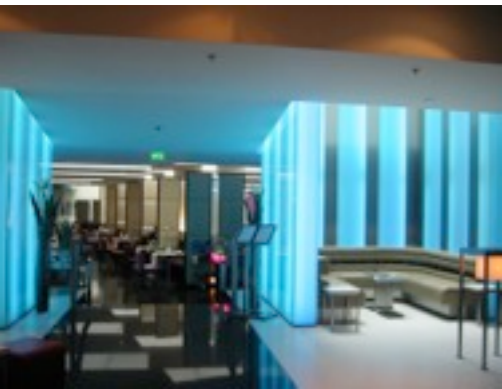
- ▶ lack of prospect and refuge causes many areas to be unused
- ▶ lack of natural elements
- ▶ art difficult to access
- ▶ no exploration and interaction possibilities
- ▶ large empty room without anchor points
- ▶ very minimalistic
- ▶ light concept



RESTAURANT



OCCUPANCY OF THE RESTAURANT

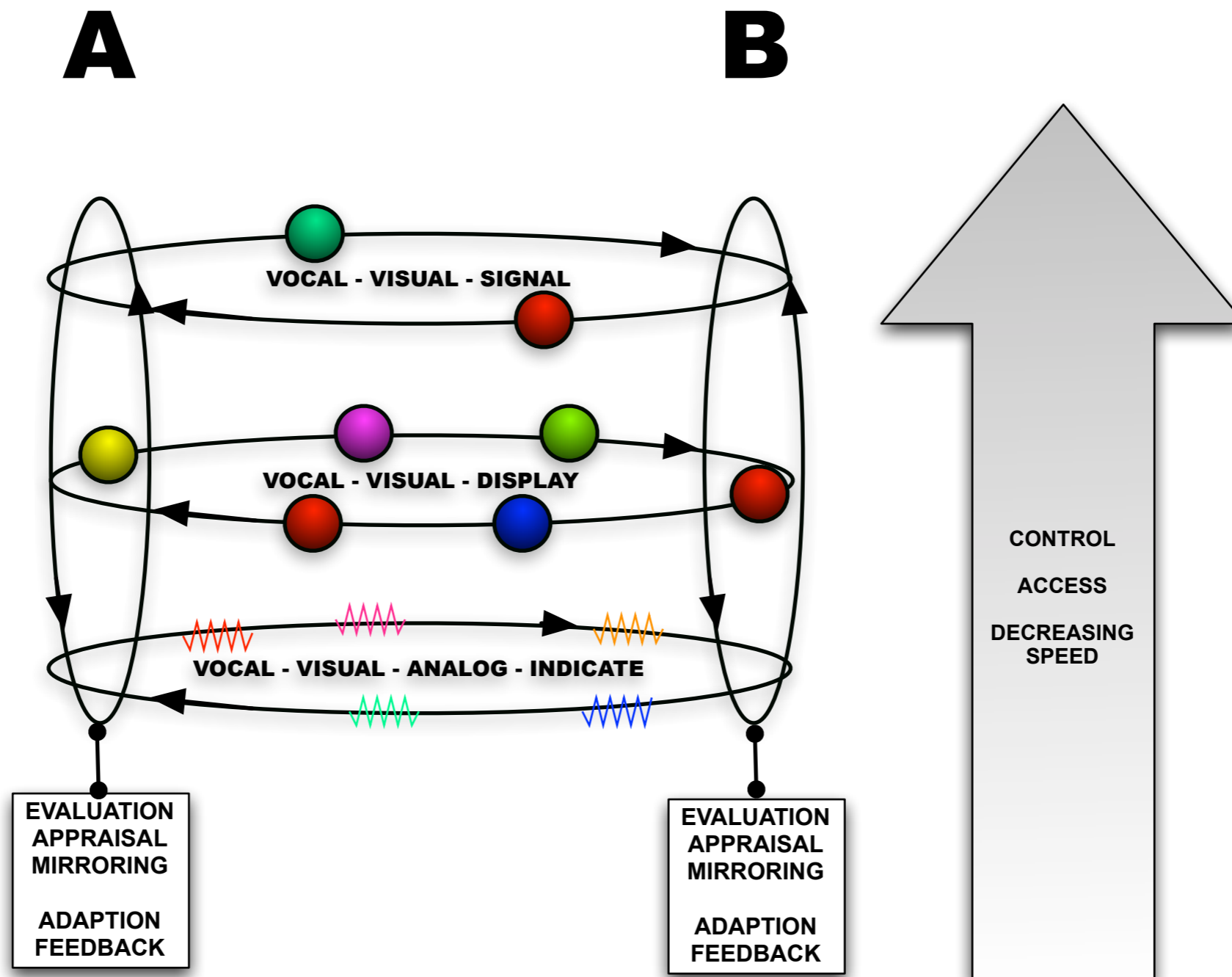


high prospect-refuge

THE CHALLENGE



THE BIELEFELD MODEL OF COMMUNICATION



ALL LEVELS INTERACT TO CREATE MEANING

IS IT POSSIBLE
TO UNDERSTAND THE UPPER LEVELS
FROM LOW-LEVEL ANALYSES?

WHAT IS BEHAVIOR?

WHAT IS BEHAVIOR ?

- ▶ it depends ...
 - ▶ research question
 - ▶ setting
 - ▶ methodology
 - ▶ discipline

HOW TO DESCRIBE IT ?

TOP-DOWN OR BOTTOM-UP ?

TOP-DOWN OR BOTTOM-UP ?

- ▶ Behavior Scientists
 - ▶ top-down
 - ▶ behavior categories
 - ▶ annotation by hand
 - ▶ theory-driven
 - ▶ time consuming

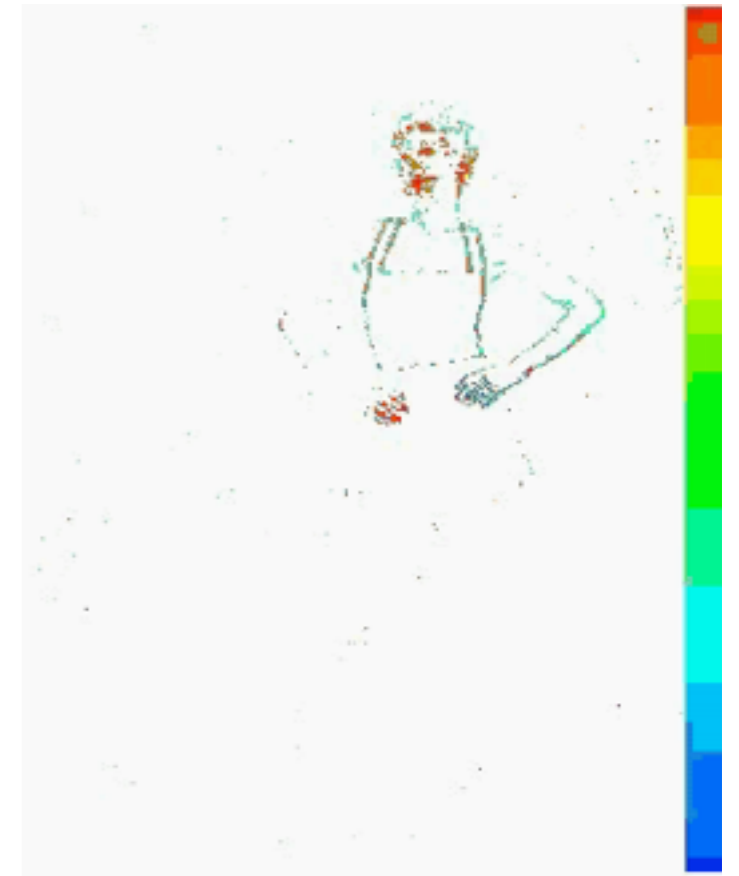
TOP-DOWN OR BOTTOM-UP ?

- ▶ Behavior Scientists
 - ▶ top-down
 - ▶ behavior categories
 - ▶ annotation by hand
 - ▶ theory-driven
 - ▶ time consuming
- ▶ Computer Vision
 - ▶ bottom-up
 - ▶ feature extraction
 - ▶ automated analysis
 - ▶ technical limitations
 - ▶ ground truth

VENUS AND MARS ?

COMPUTER VISION IN ETHOLOGY

- ▶ dance to your own beat
- ▶ Charisma Cam
- ▶ Friend Finder
- ▶ *s*trangers Meet



Grammer & Bechinie 2003

Oberzaucher 2003

Grammer, Kruck & Magnusson 1998

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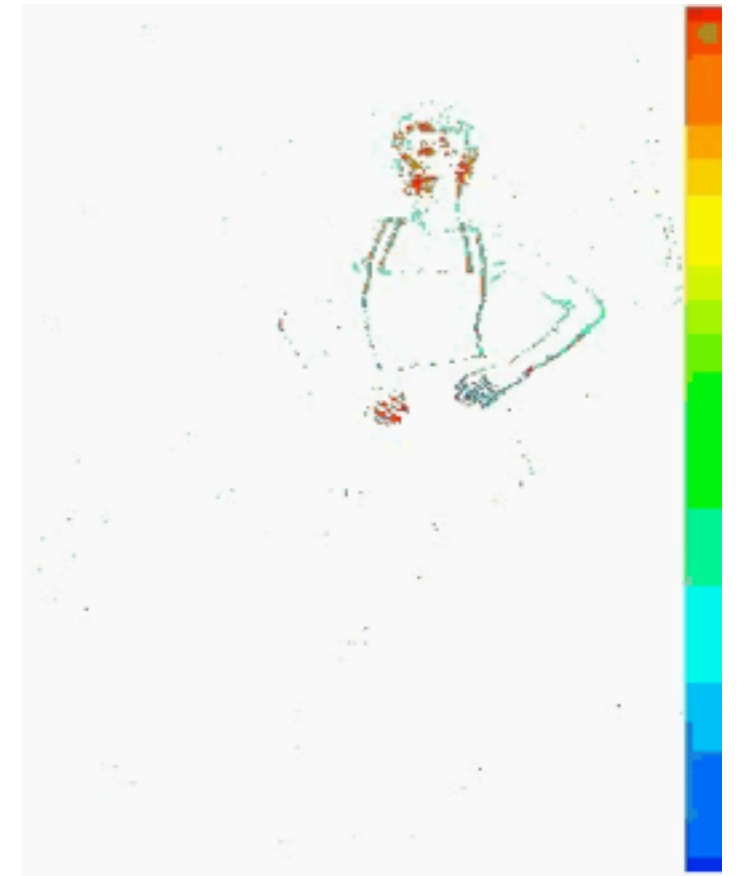
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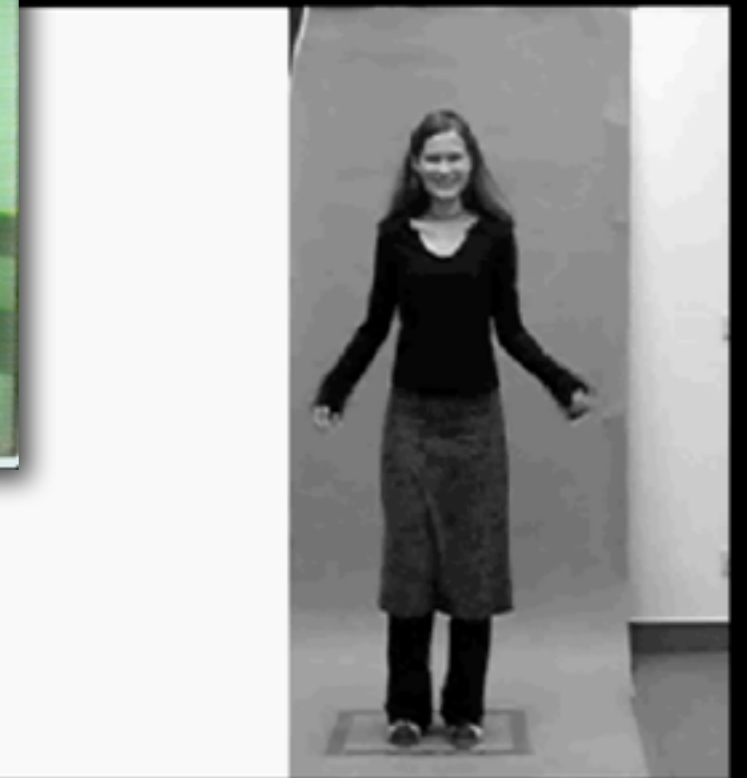
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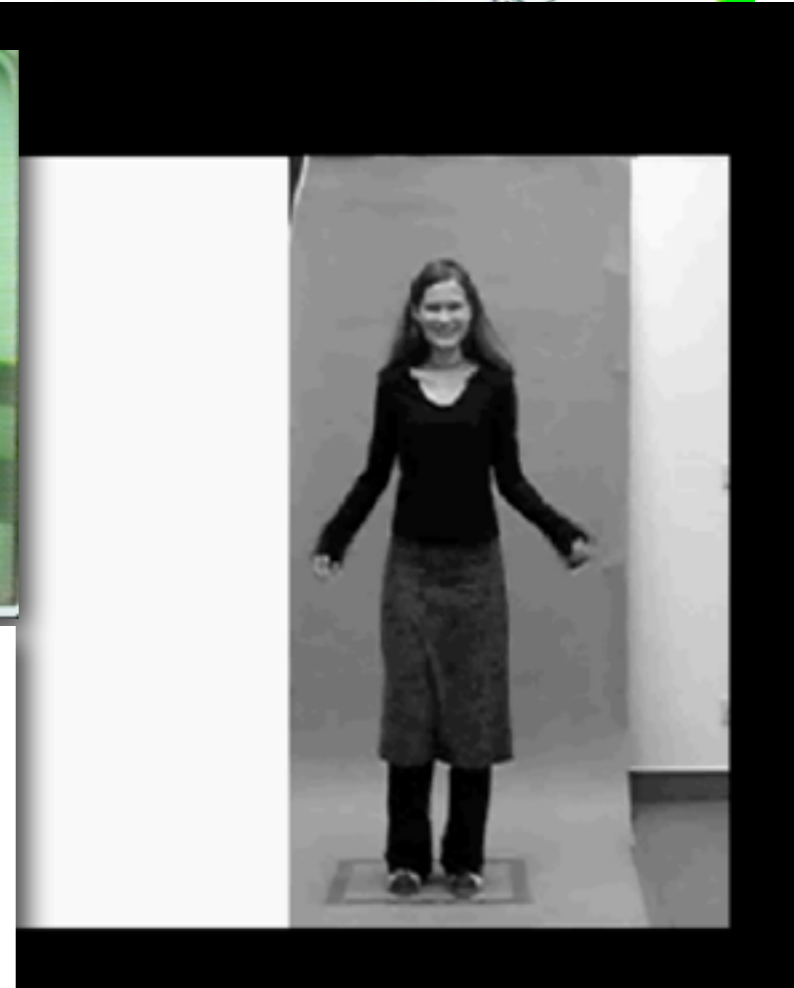
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CLASSICAL ETHOLOGY

CREATING A BEHAVIOR CATALOGUE

Standard ethological methods
Ad Lib Observation
Catalogue construction

Sex

- 1.male
- 2.female

Age

- 3.<18
- 4.18-60
- 5.>60

Group Size and ID

Object

- 1.on the floor
- 2.carry
- 3.without backpack

Locomotion and Posture

- 1.stand still
- 2.stand dynamic
- 3.stand supported
- 4.walk
- 5.non-linear locomotion
- 6.run
- 7.hindrance of locomotion
- 8.non-upright posture
- 9.sit

gaze direction

- 1.group member
- 2.underground equipment
- 3.gaze around
- 4.other person

Arm

- 1.Arm posture
- 2.Auto manipulation
- 3.Priming
- 4.manipulation of carried objects
- 5.manipulation of environment

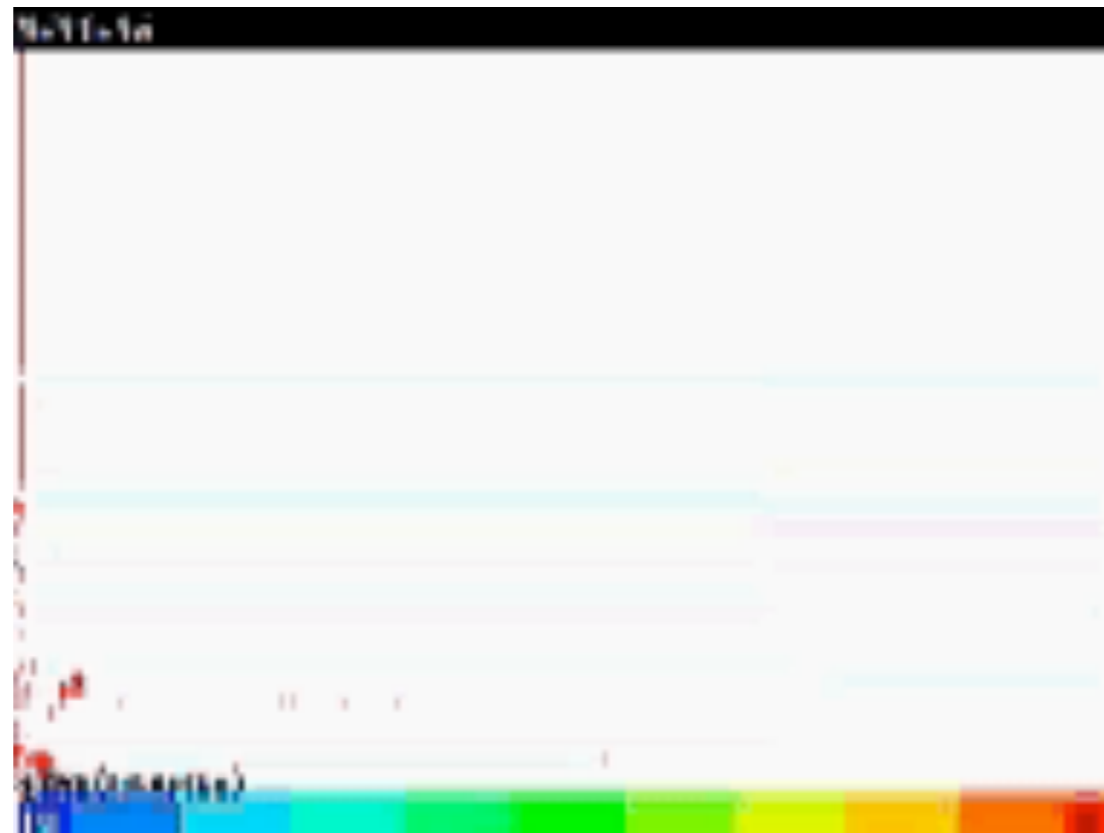
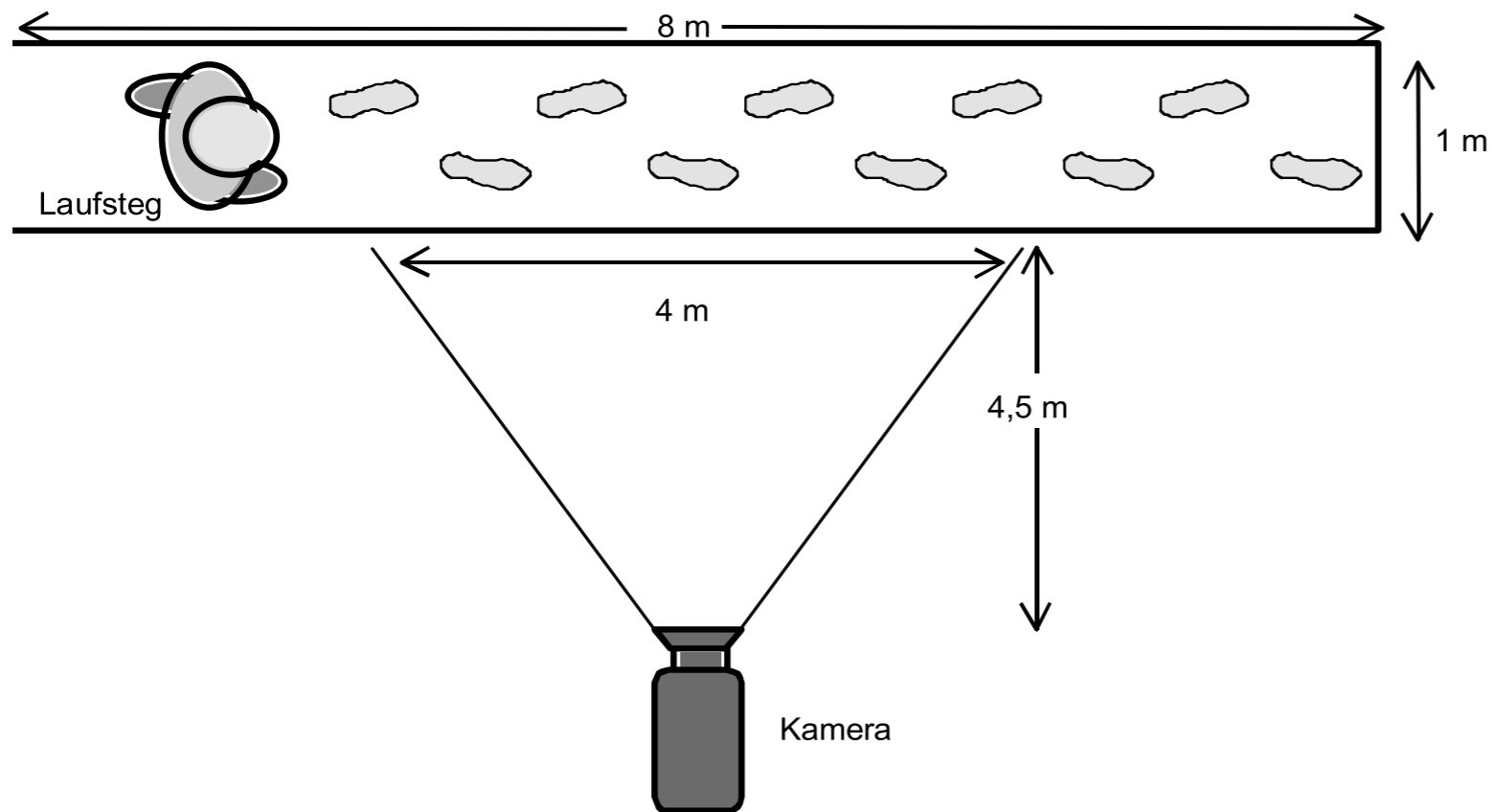
take in or give off object

- 1.eat/drink
- 2.throw up/spit/sneeze

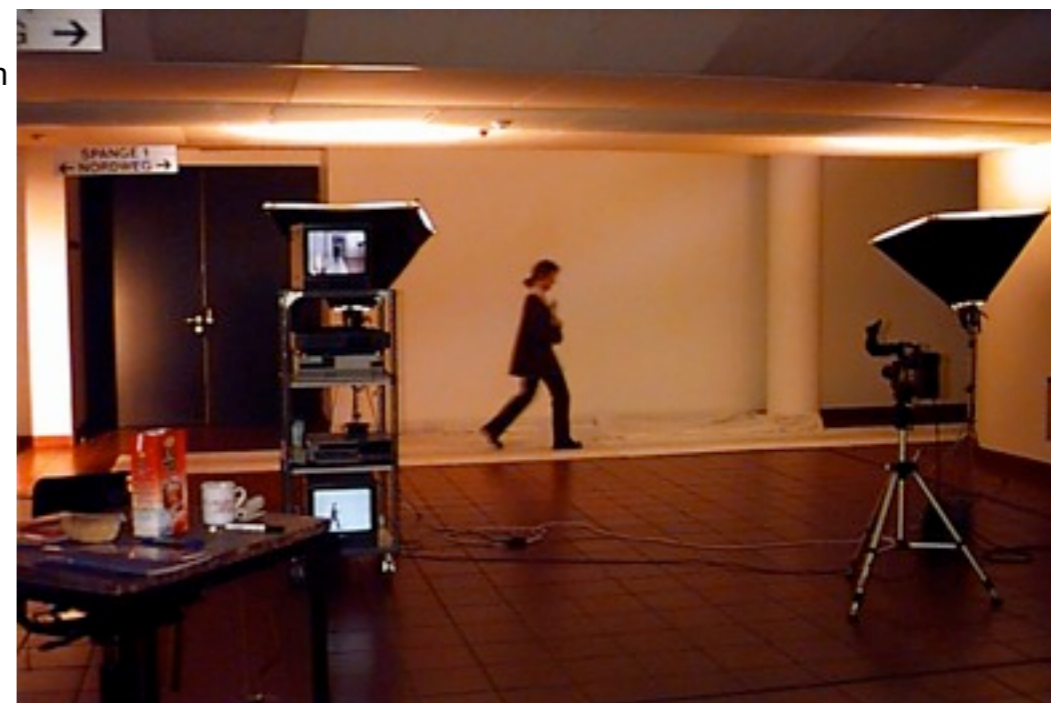
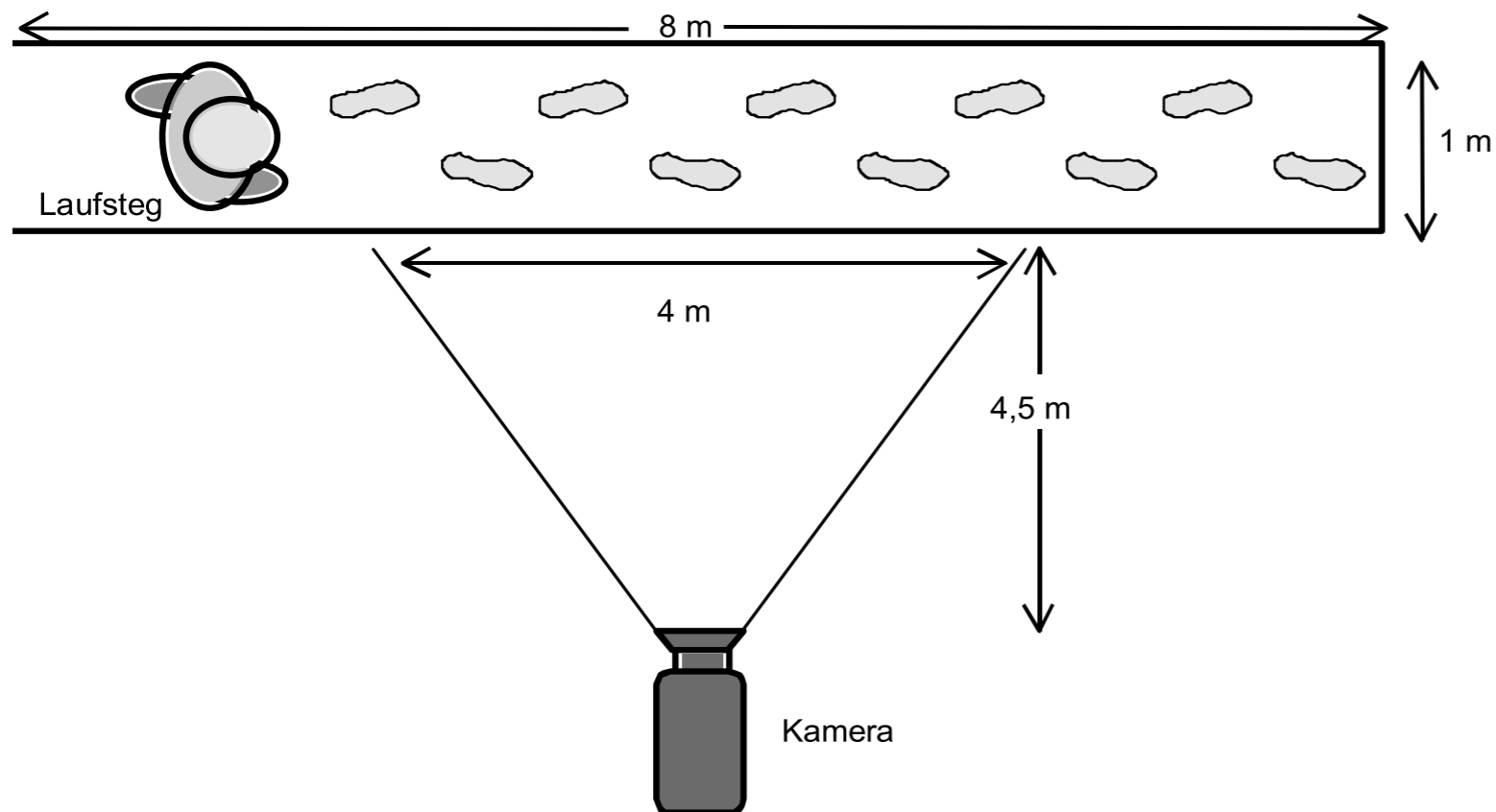
body contact

communication

HOW TO IDENTIFY *SEX* IN COMPUTER VISION?



Keki 1999



TDNN - 63% correct Classification



Keki 1999

DEFINITION OF CATEGORIES

DEFINITION OF CATEGORIES

Auto Manipulation

DEFINITION OF CATEGORIES

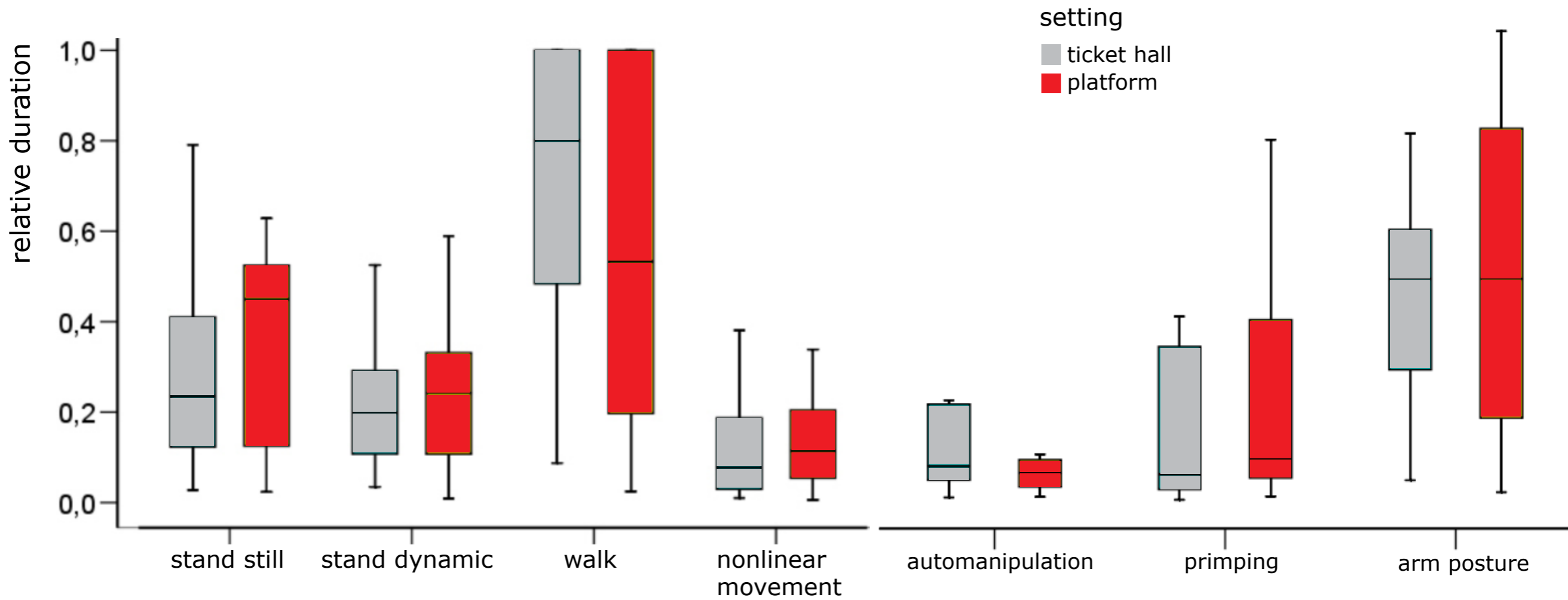
- ▶ to touch the face
 - ▶ one hand touches the face
 - ▶ (compare with “to rest the head on the limb”)
- ▶ to put one or more fingers in the mouth
 - ▶ one or more fingers are put into the mouth
- ▶ to pick one’s nose
 - ▶ one finger is put in one nostril
- ▶ to touch the head
 - ▶ hand touches the head (without touching the face); no noticeable primping function (see also def. “primping”)
- ▶ to hold one hand in front of the face
 - ▶ to cover the mouth and/or the nose with one hand
- ▶ to touch the upper body
 - ▶ the palm of one hand is lying on the stomach, the shoulders, the breast bone (sternum) or the neck
- ▶ to adjust the hair
 - ▶ to change the hairstyle with the help of one hand

Auto Manipulation

BEHAVIOR SETTING

Barker 1968

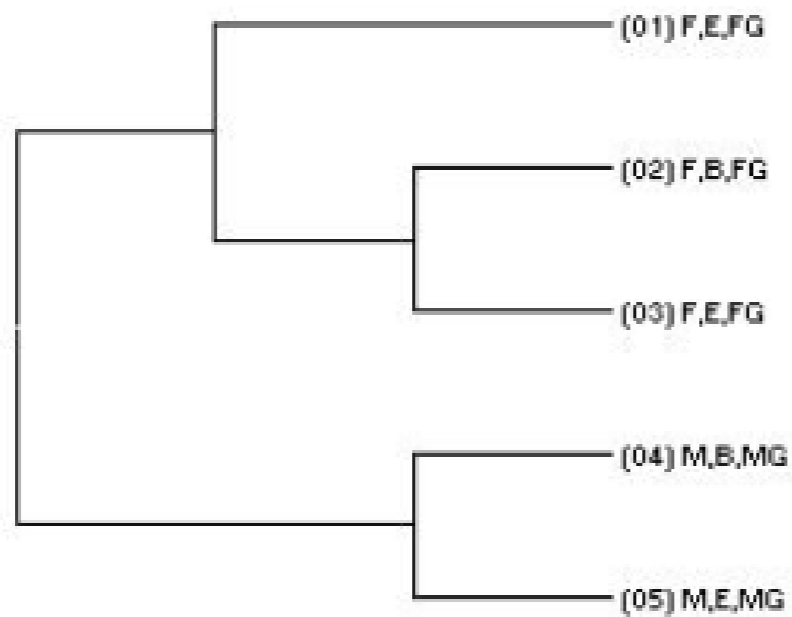
BEHAVIOR SETTINGS



WHAT IS UNUSUAL
DEPENDS ON
BEHAVIOR SETTING

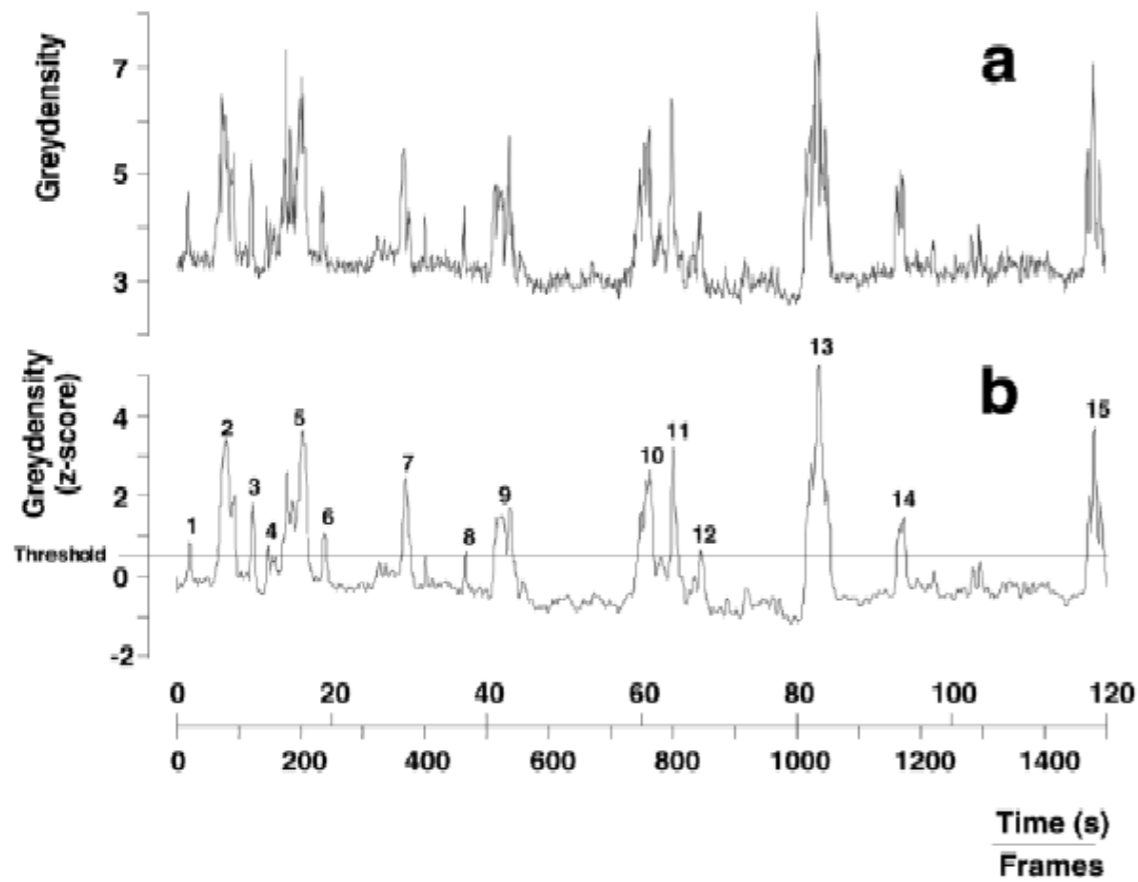
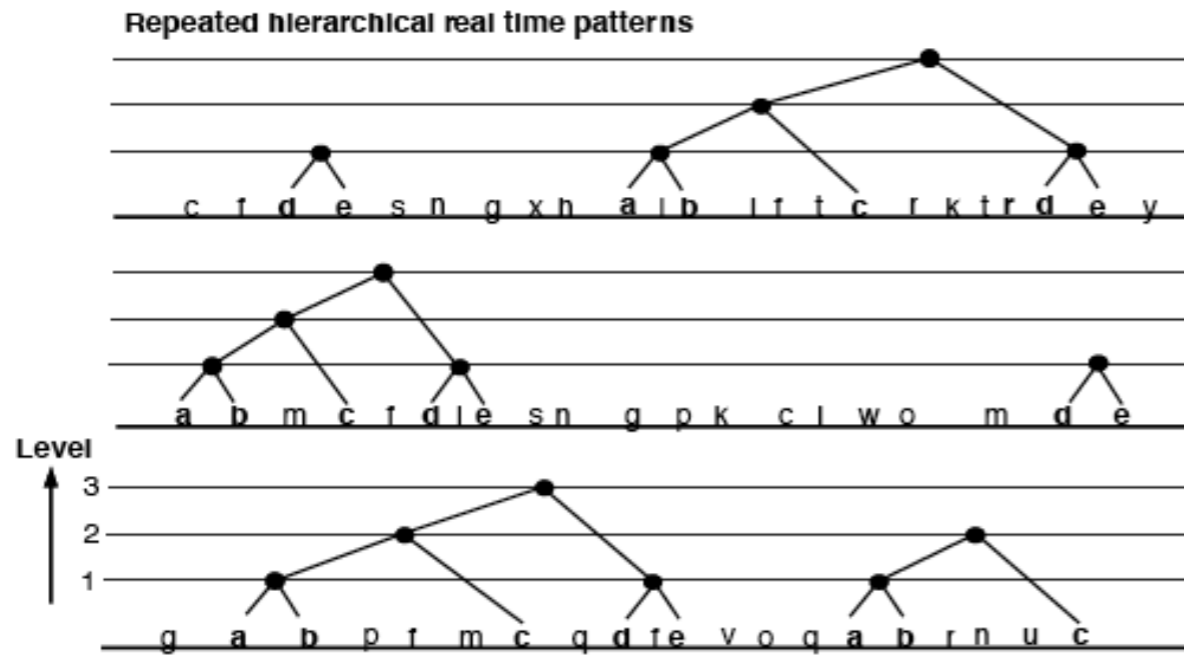
HOW TO IDENTIFY AUTO-MANIPULATION WITH COMPUTER VISION?

MAYBE IT IS NOT NECESSARY

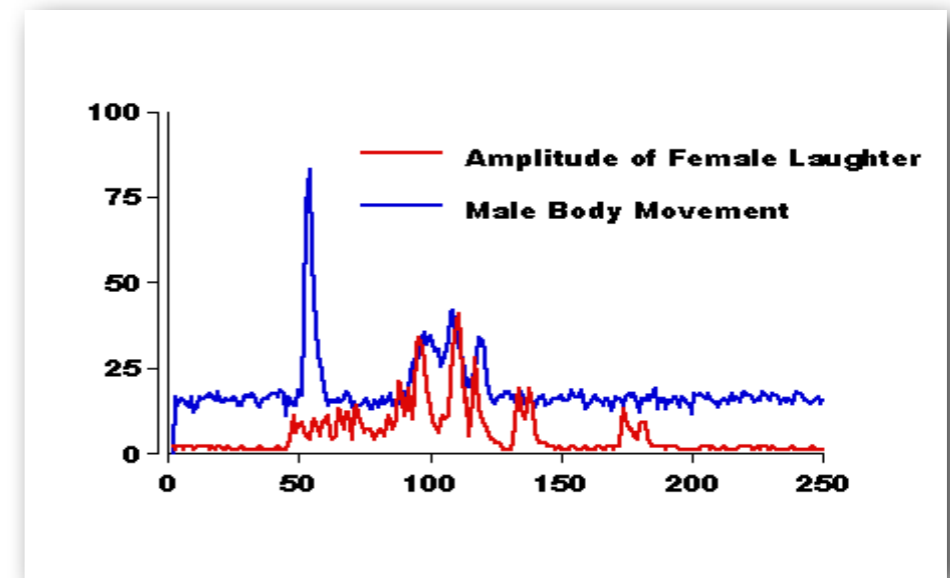
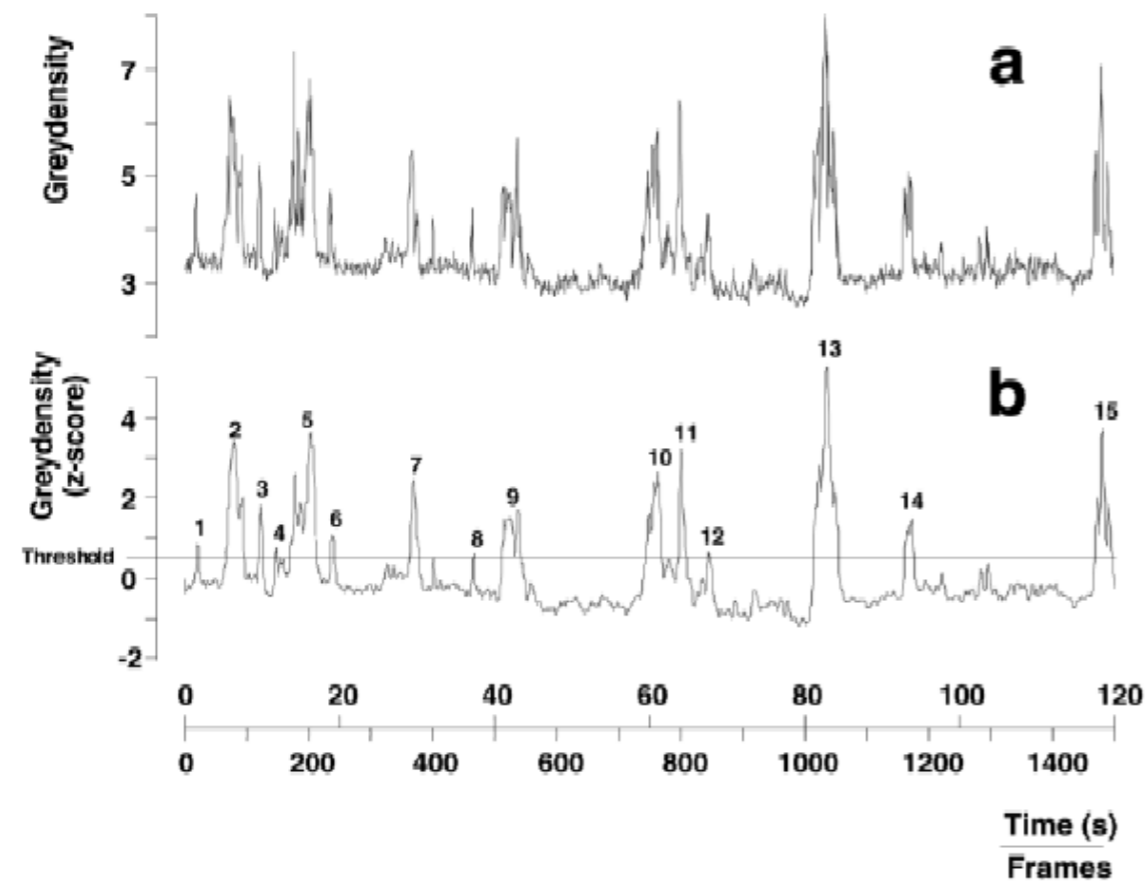
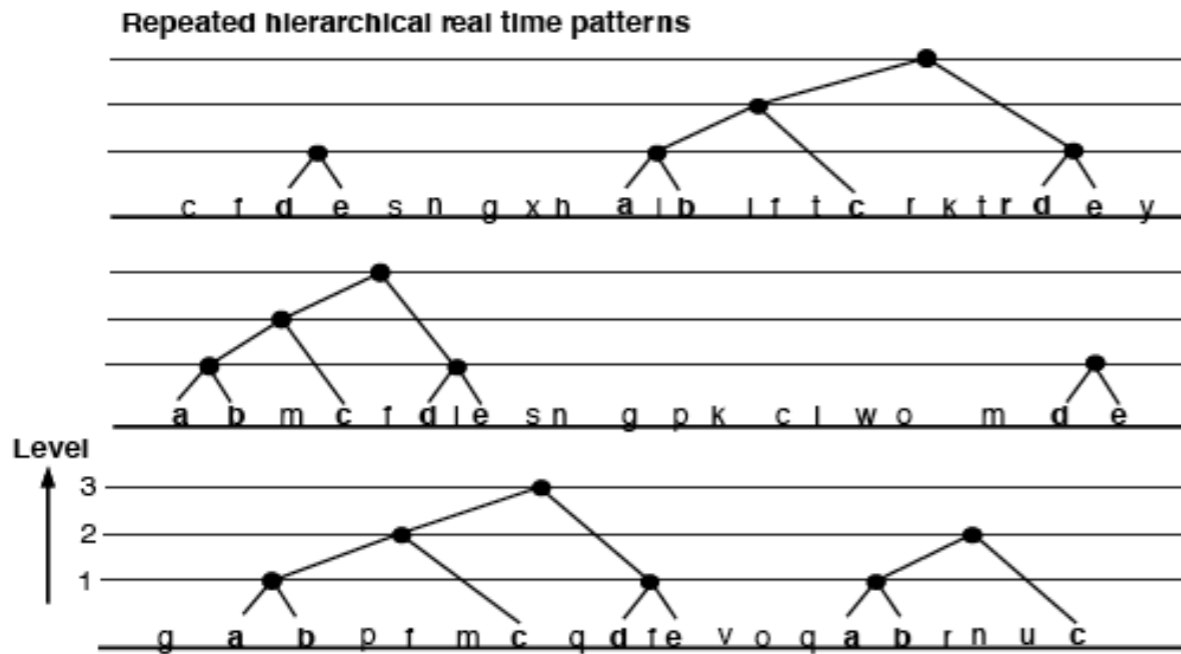


BEHAVIOR *SHOWS* TEMPORAL PATTERNS

CROSS-MODAL PATTERNS



CROSS-MODAL PATTERNS



HIDDEN PATTERNS

Grammer, Kruck & Magnusson 1998



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HIDDEN PATTERNS



Grammer, Kruck & Magnusson 1998

HIDDEN PATTERNS



HIDDEN PATTERNS



WHAT IS INTERESTING?

SOCIAL ATTENTION OF HUMAN

THE VIRTUAL OPERATOR

- ▶ four screens
- ▶ click the button corresponding to the scene which captures your interest
- ▶ 100 subjects
- ▶ 130 x 2 min movies
- ▶ 16 movies per subject



PEOPLE AGREE ON WHAT IS INTERESTING



Attention is recorded in the movie timeline
Compare attention to machine vision and extract cues
Social attention cues on the index level

EYE TRACKING

- ▶ n= 53 male 59 female subjects
- ▶ 150 2 min videos
- ▶ 4 x 4 randomly selected movies
- ▶ EOG - Powerlab (Adinstruments) 400 samples/sec

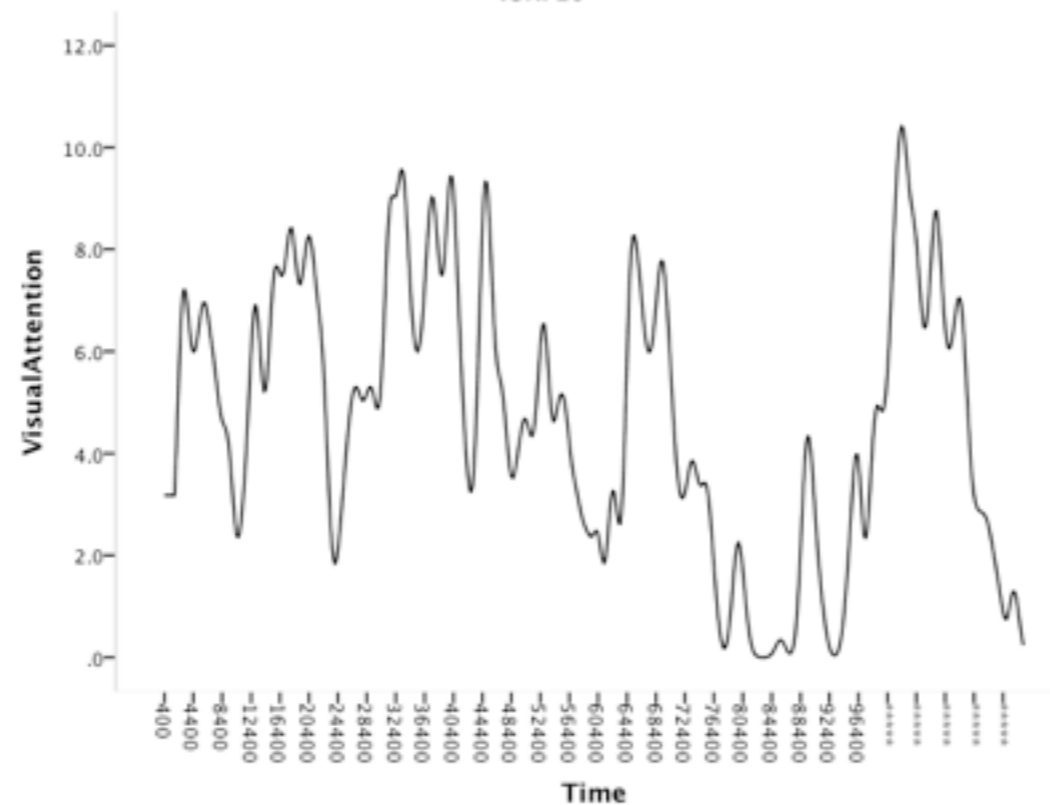


Smole, Oberzaucher & Grammer (2012)

ATTENTION TIME LINE

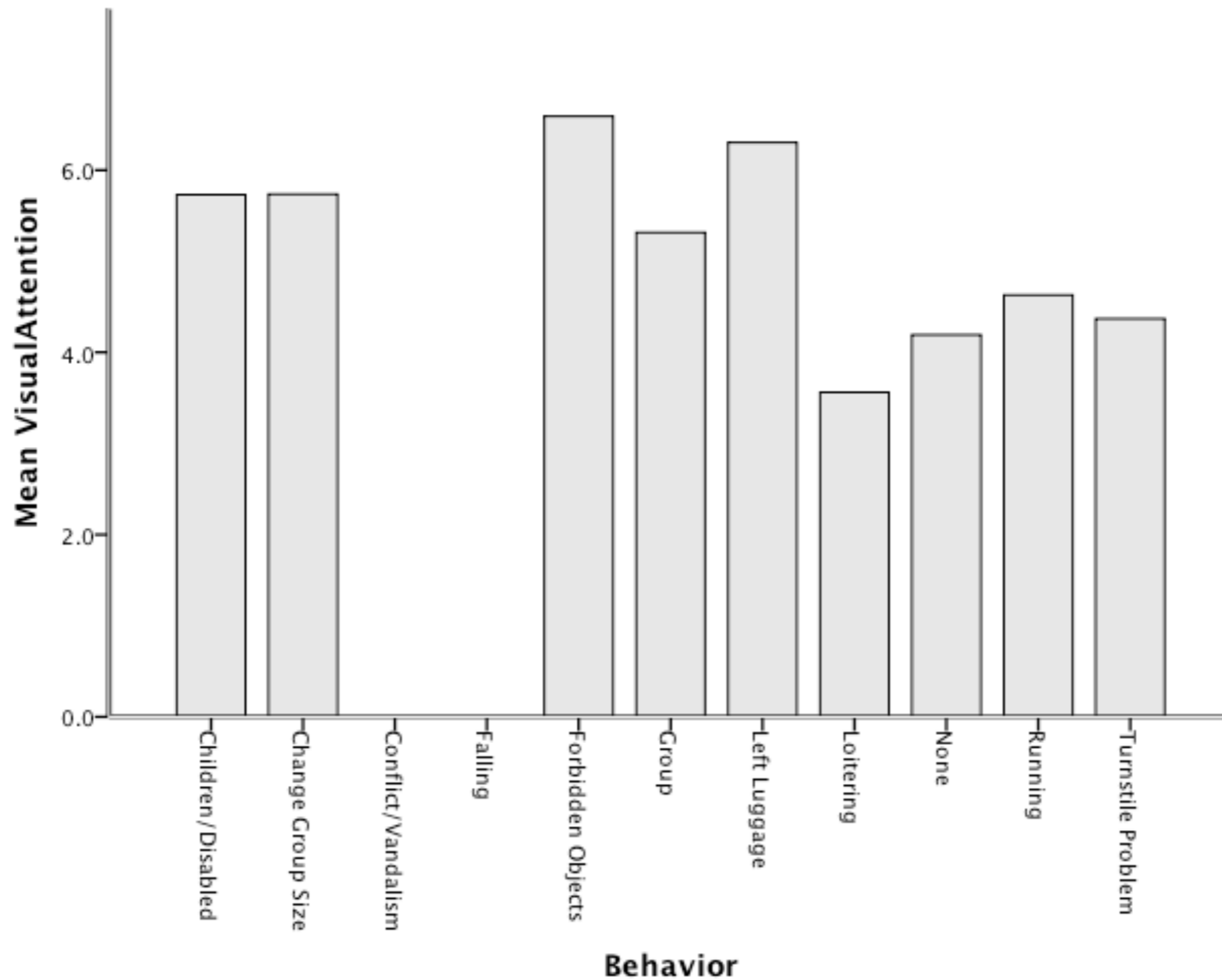


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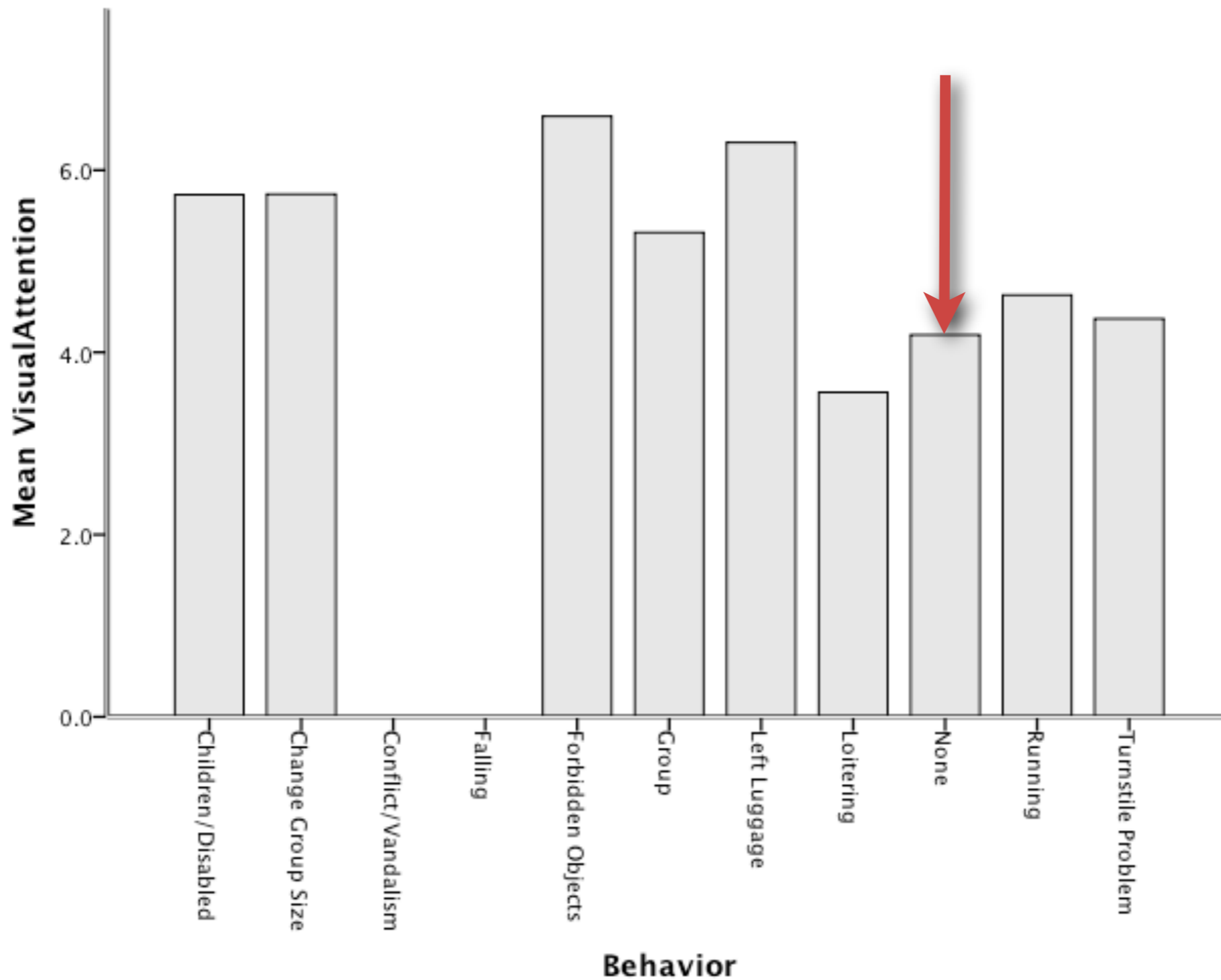


gaussian smoothing

HOW ARE BEHAVIORS LINKED TO VISUAL ATTENTION ?

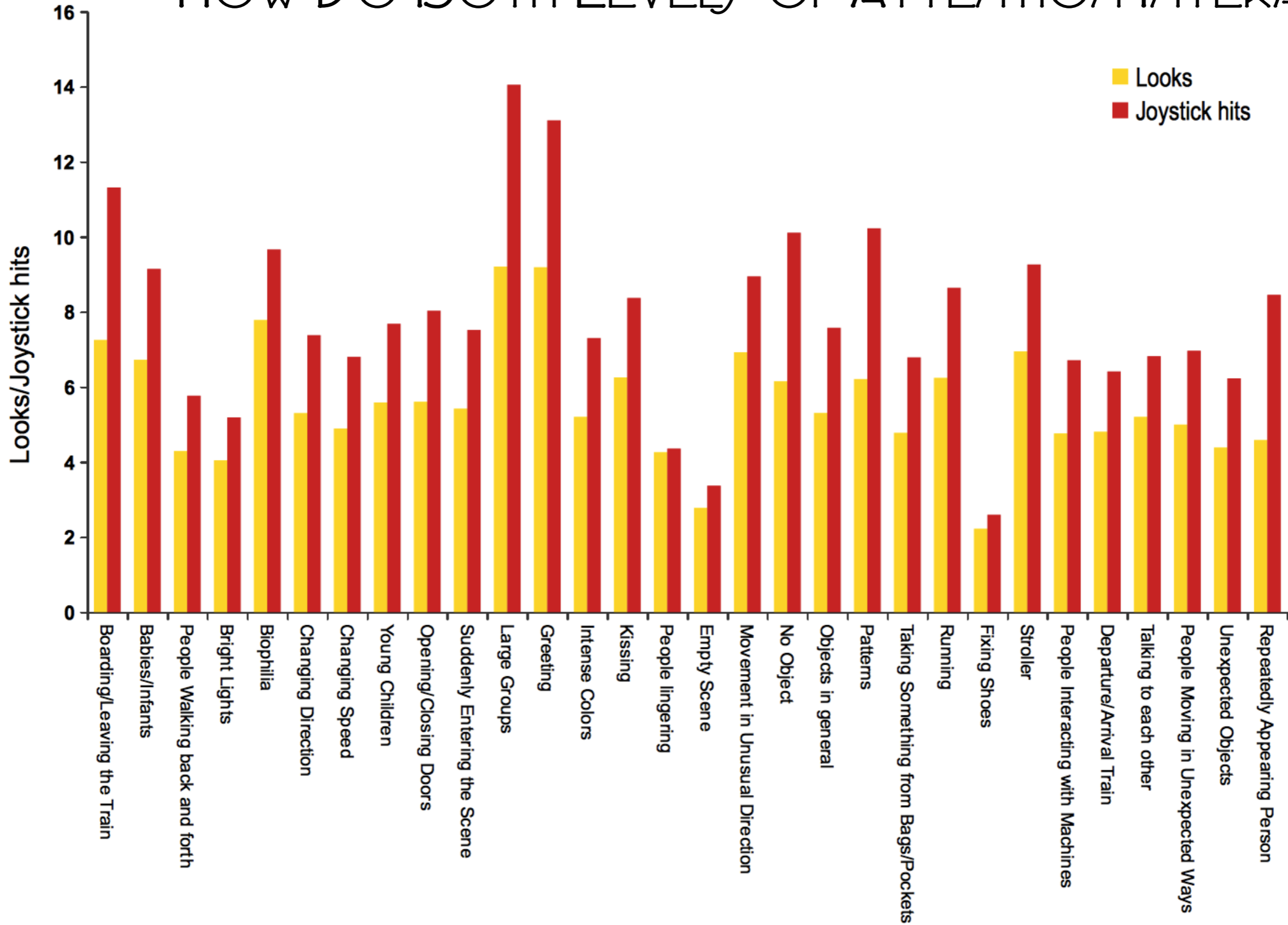


HOW ARE BEHAVIORS LINKED TO VISUAL ATTENTION ?



ADDITIONAL BEHAVIORS

HOW DO BOTH LEVELS OF ATTENTION INTERACT?



HUMAN PERCEPTION

BEHAVIOR ANALYSIS

RETINA

COMPUTER VISION

VISUAL CORTEX

BEHAVIOR ANALYSIS

A

B

BEHAVIOR
OBSERVATION

EVALUATION

BELIEFS

APPRAISAL

MACHINE
VISION

EMOTION
MIRROR
ADAPTATION
FEEDBACK

VOCAL - VISUAL - SIGNAL - SYMBOLIC

VOCAL - VISUAL - DISPLAY

VOCAL - VISUAL - INDICATE

EVALUATION

BELIEFS

APPRAISAL

EMOTION
MIRROR
ADAPTATION
FEEDBACK

↑
INCREASING
CONTROL
ACCESS
↓
DECREASING
SPEED

THANK YOU!

www.urbanethology.at

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