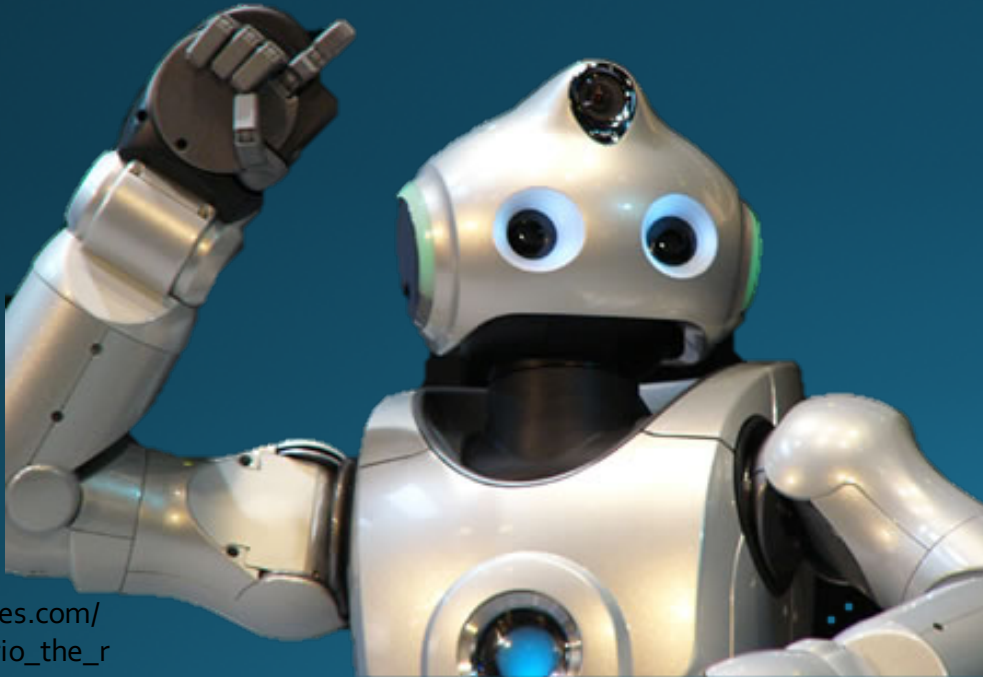


# Socialization between toddlers and robots at an early childhood education center

Fumihide Tanaka, Aaron Cicourel, and Javier R. Movellan



Elena Giacomazzi  
Social Robot Lab  
Journal Club, Bangor 18/10/2017

# Overview of the study

- 45 sessions in 5 month split into 3 phases
- What did they do?
  - Put QRIO into classroom of 18- to 25-month old toddlers
  - Recorded each sessions with two video cameras

# Overview of the study

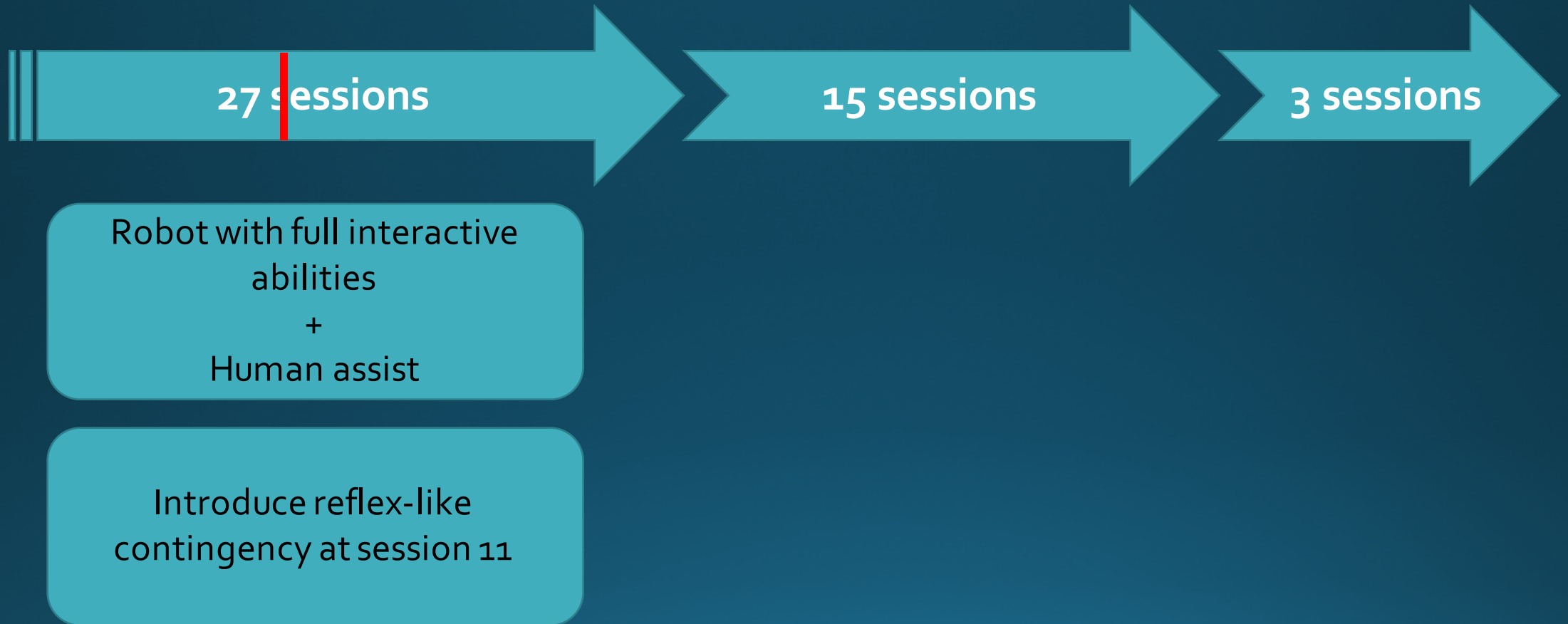
- 45 sessions in 5 month split into 3 phases
- What did they do?
  - Put QRIO into classroom of 18- to 25-month old toddlers
  - Recorded each sessions with two video cameras
- What did they want to investigate?
  - Will the toddlers bond to the robot?
  - Will they overcome the “10-h barrier”?

# Study

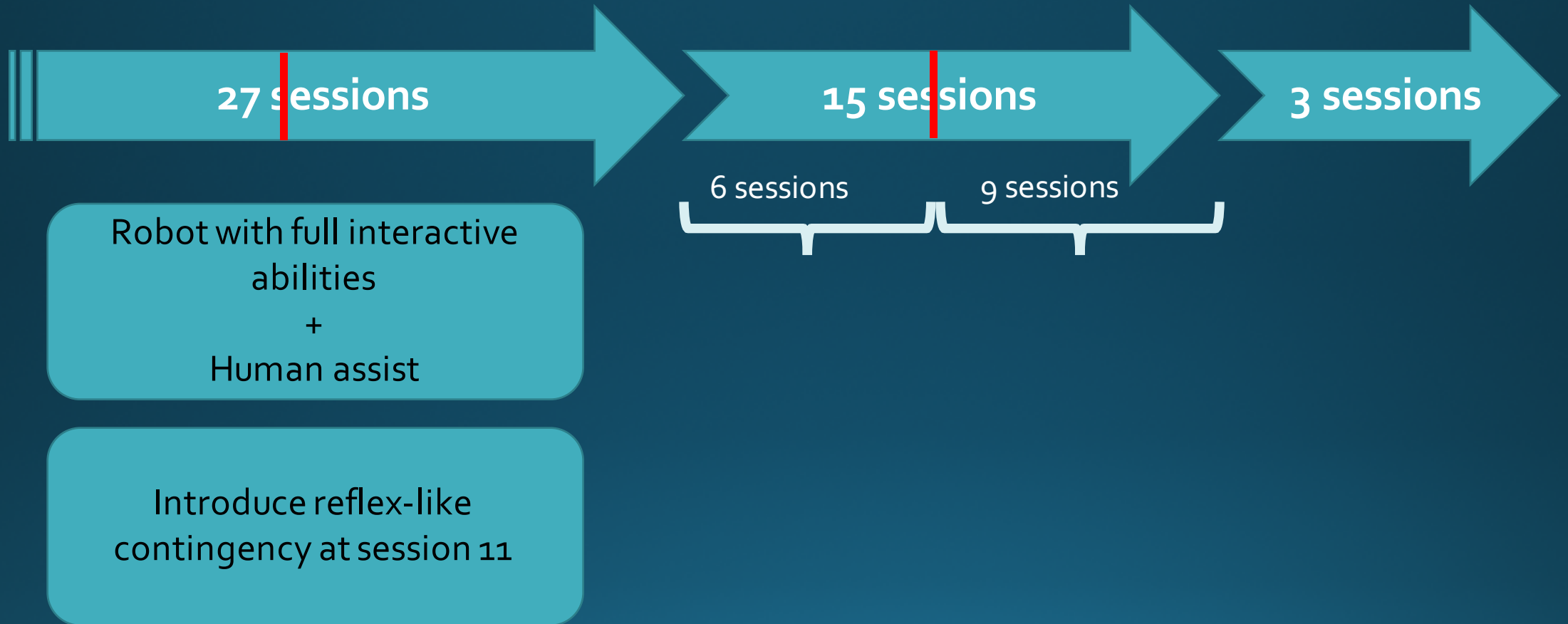




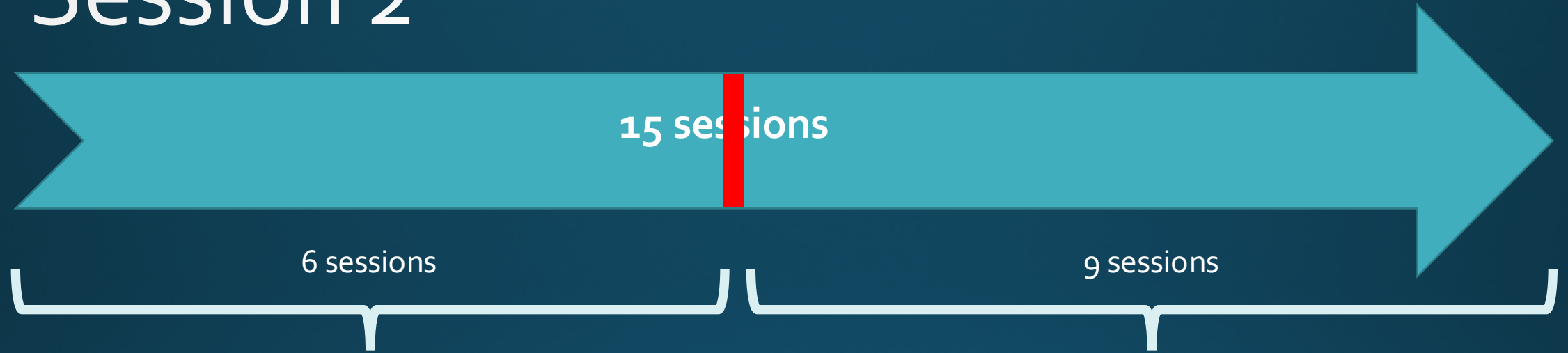
# Study



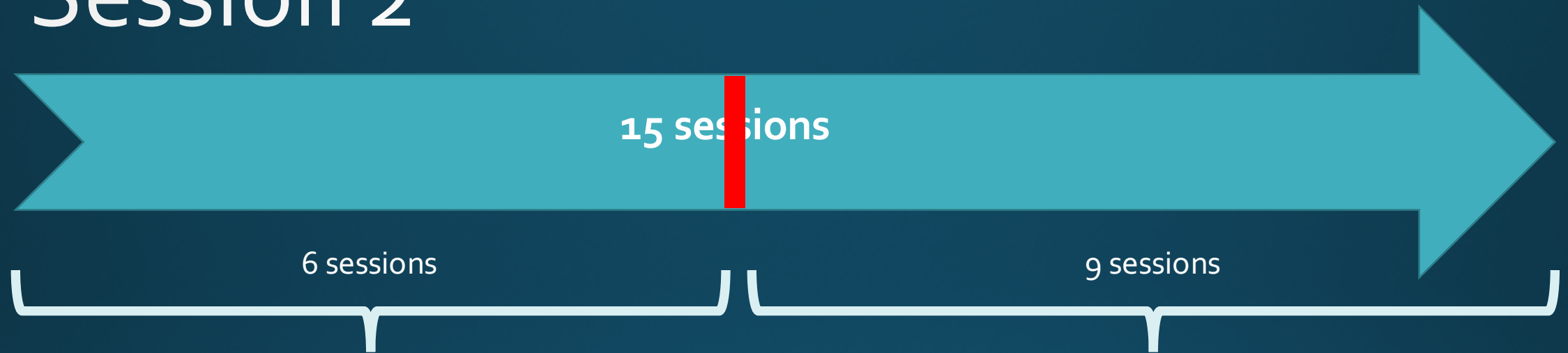
# Study



# Session 2



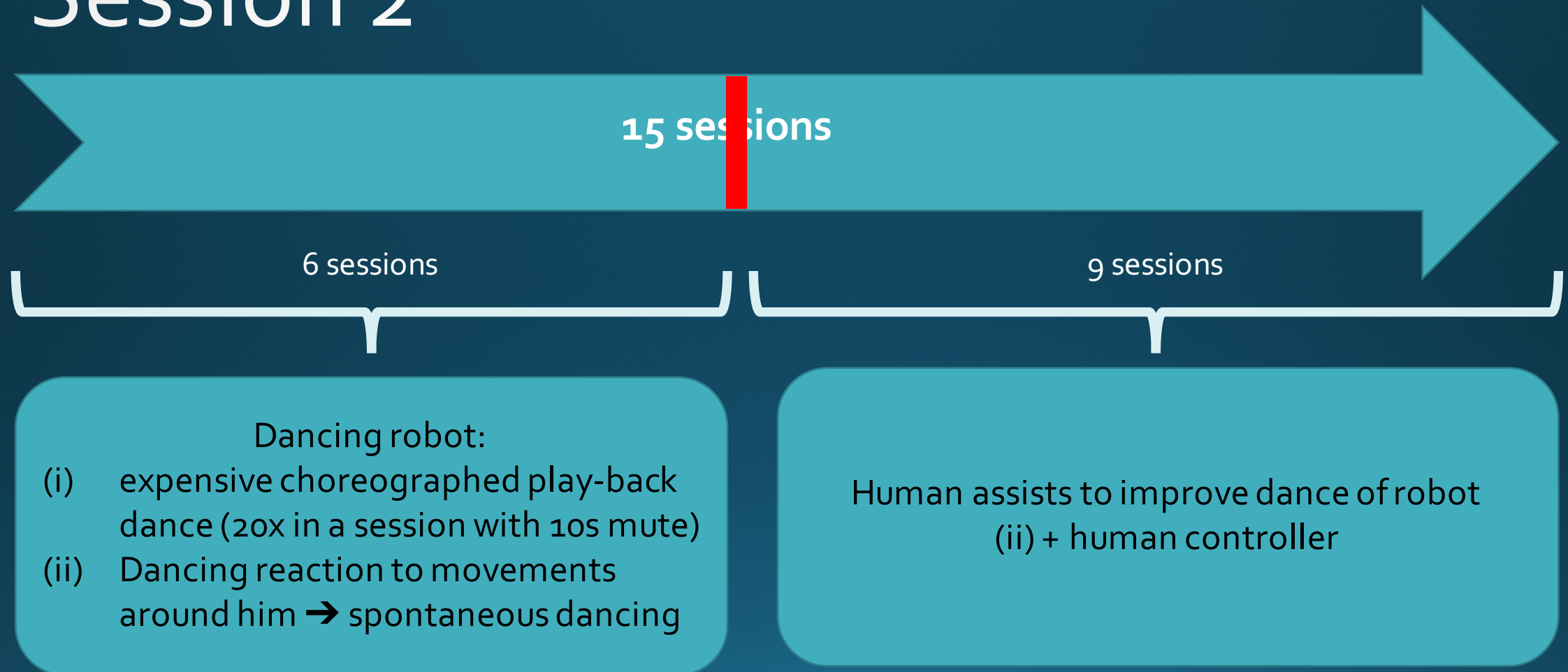
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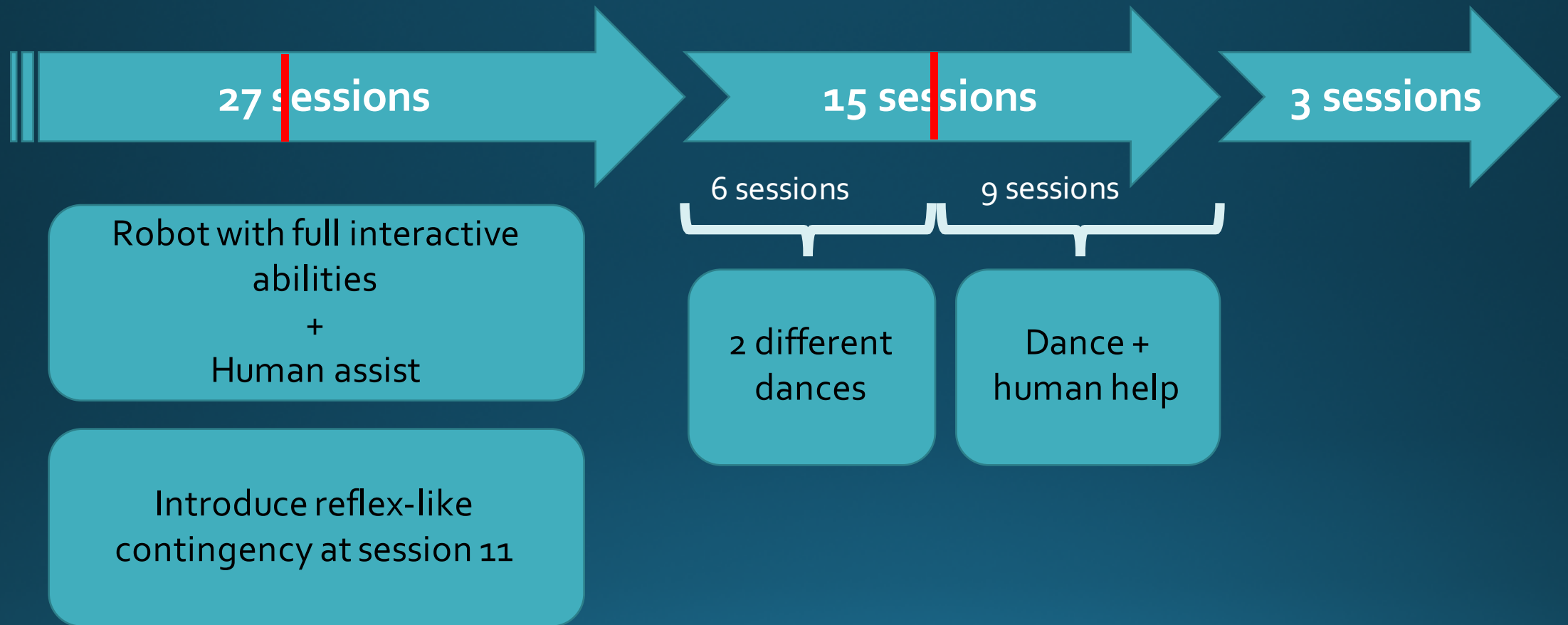
## Dancing robot:

- (i) expensive choreographed play-back dance (20x in a session with 10s mute)
- (ii) Dancing reaction to movements around him → spontaneous dancing

# Session 2

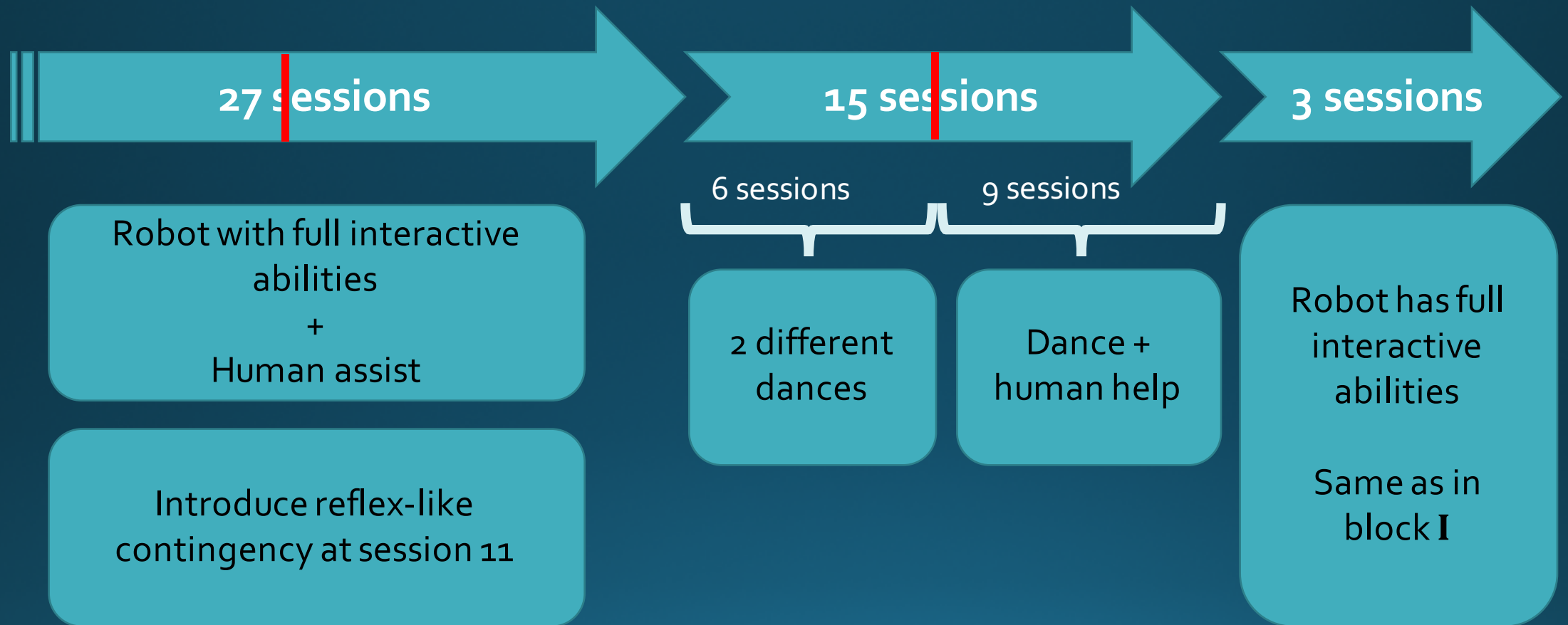


# Study





# Study



# Development of the Quality of Interaction

How did they find out about the quality of interaction?

# Quality of interaction



- Those 15 sessions were coded frame-by-frame by 5 undergraduate students
  - Show on dial in real time the quality of interaction

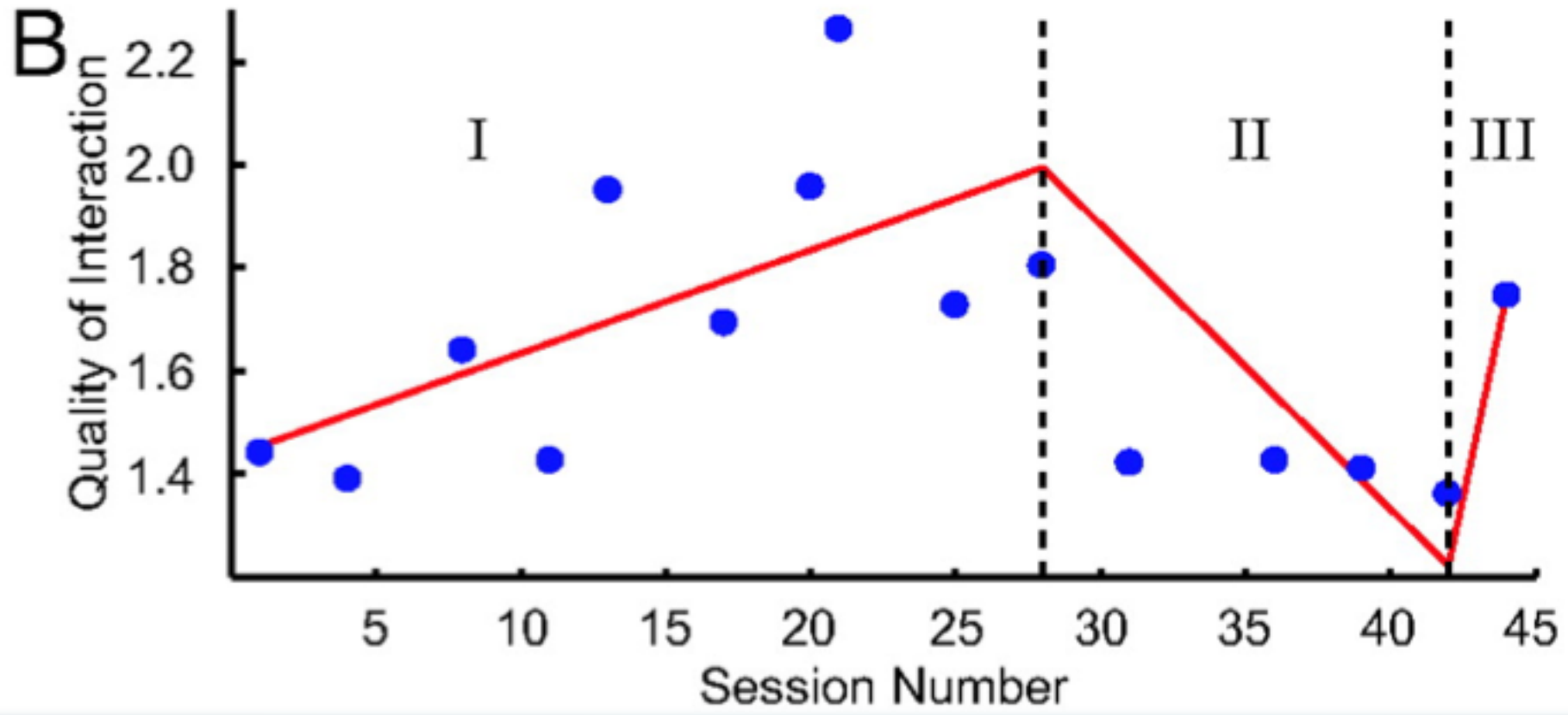
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# Quality of interaction



Fumihide Tanaka et al. PNAS 2007;104:17954-17958

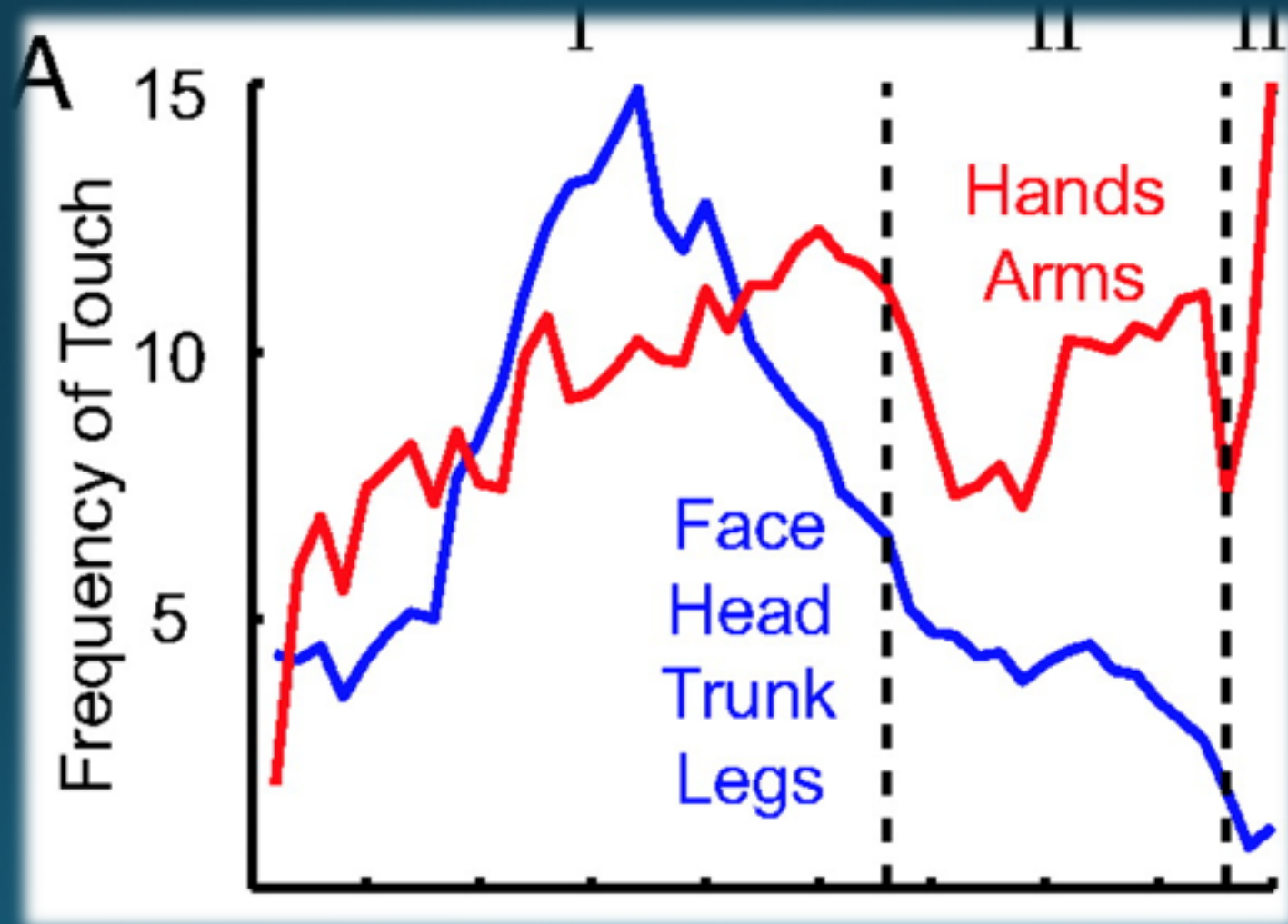


# Haptic Behavior Toward Robot and Peers

# Robot and Peer

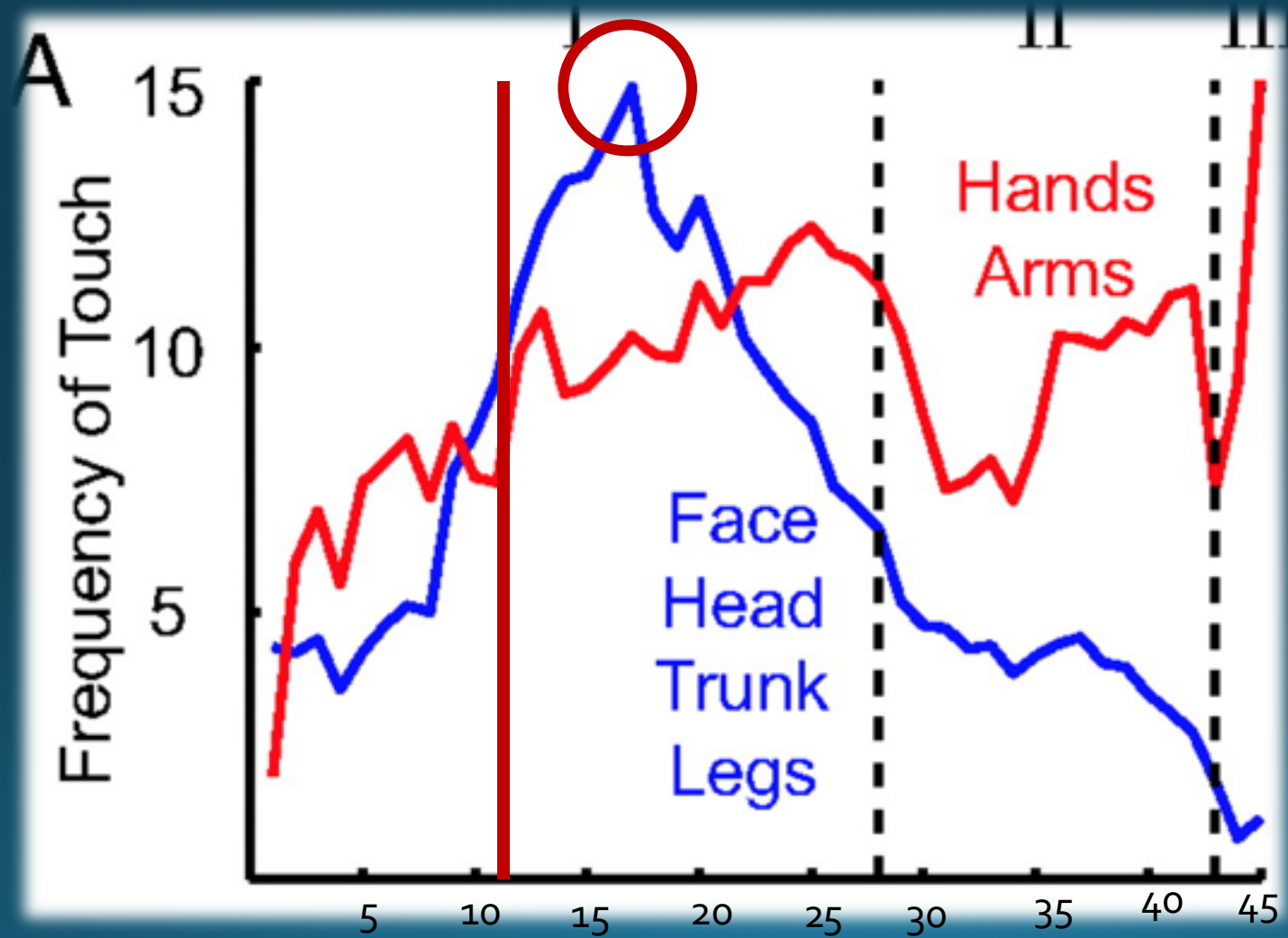
- Contact episodes categorized:
  - Arm/hand
  - Leg/foot
  - Head
  - Face
  - Trunk
- Counting what was touched in which block
- For comparison:
  - used last 2 sessions to analyse toddler-toddler contact

# Robot and Peer



Fumihide Tanaka et al.  
PNAS 2007;104:17954-17958

# Robot and Peer

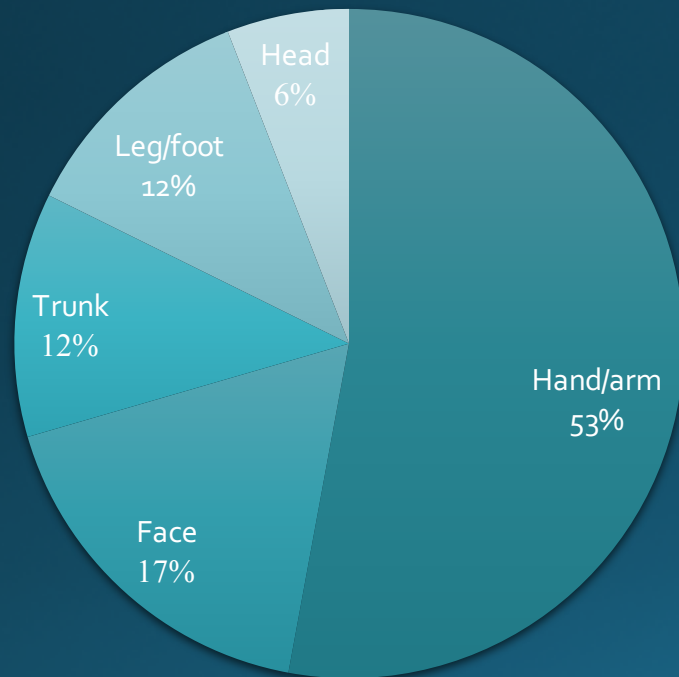


11<sup>th</sup> session:  
introduction of  
contingency

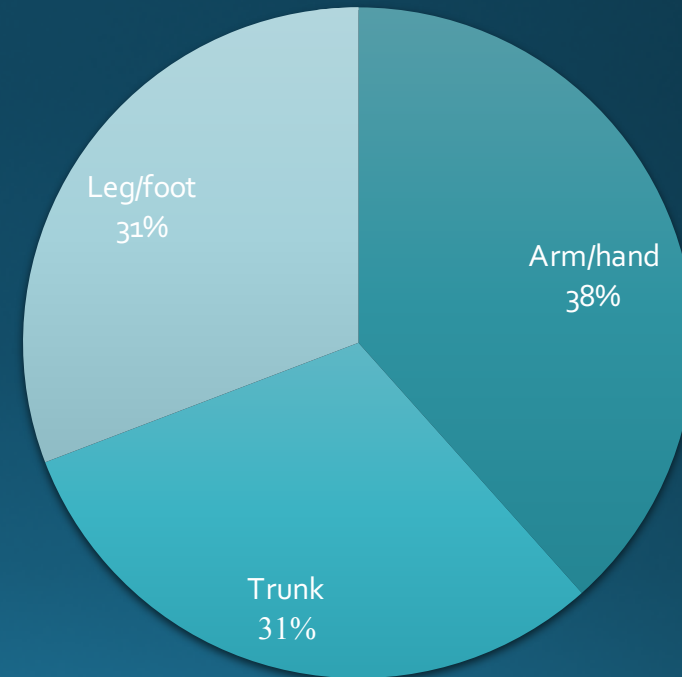
Fumihide Tanaka et al.  
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# Peer-to-peer contact

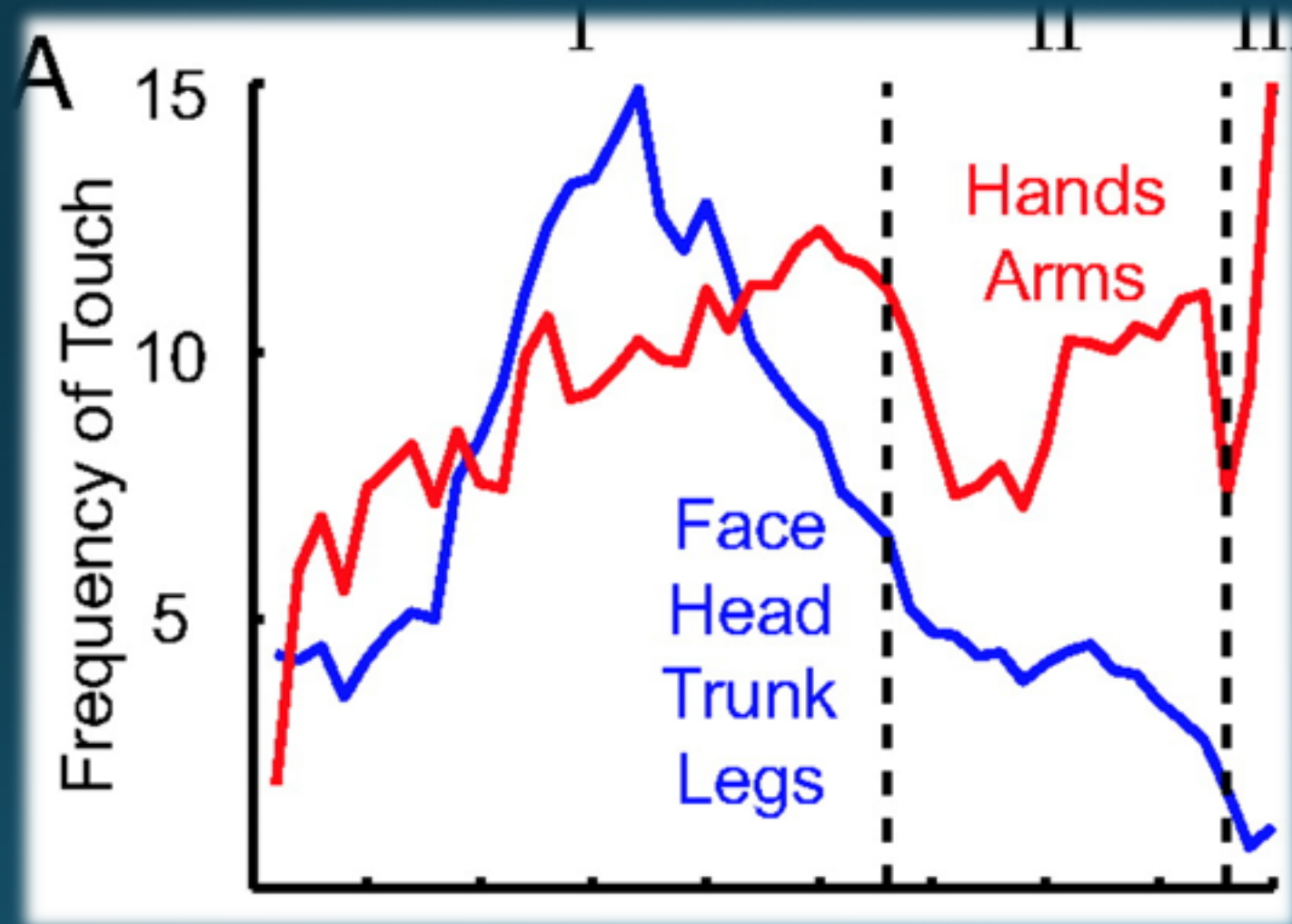
## Intentional peer-to-peer contact



## Incidental peer-to-peer contact



# Robot and Peer



- Toddlers developed same trend in touching the robot as they do toward peers
- Only two exceptions
  - Contingency
  - Dancing

Fumihide Tanaka et al.  
PNAS 2007;104:17954-17958



# Haptic Behavior Toward Robot and Toys

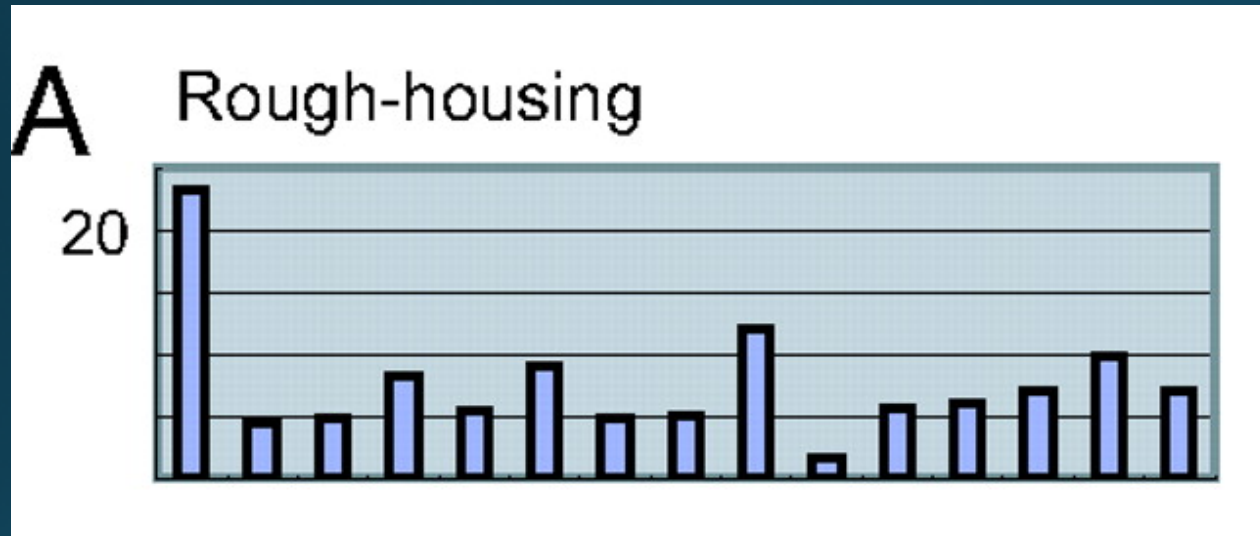
# Robot and Toy

- Introduce control toys:
  - I. Soft toy as a teddy bear
  - II. “Robby” an inanimate toy robot

# Robot and Toy

- Introduce control toys:
  - I. Soft toy as a teddy bear
  - II. “Robby” an inanimate toy robot
- 4 new categories of haptic behavior
  - I. Rough-housing
  - II. Hugging
  - III. Touching with objects
  - IV. Care-taking

# Robot and Toy

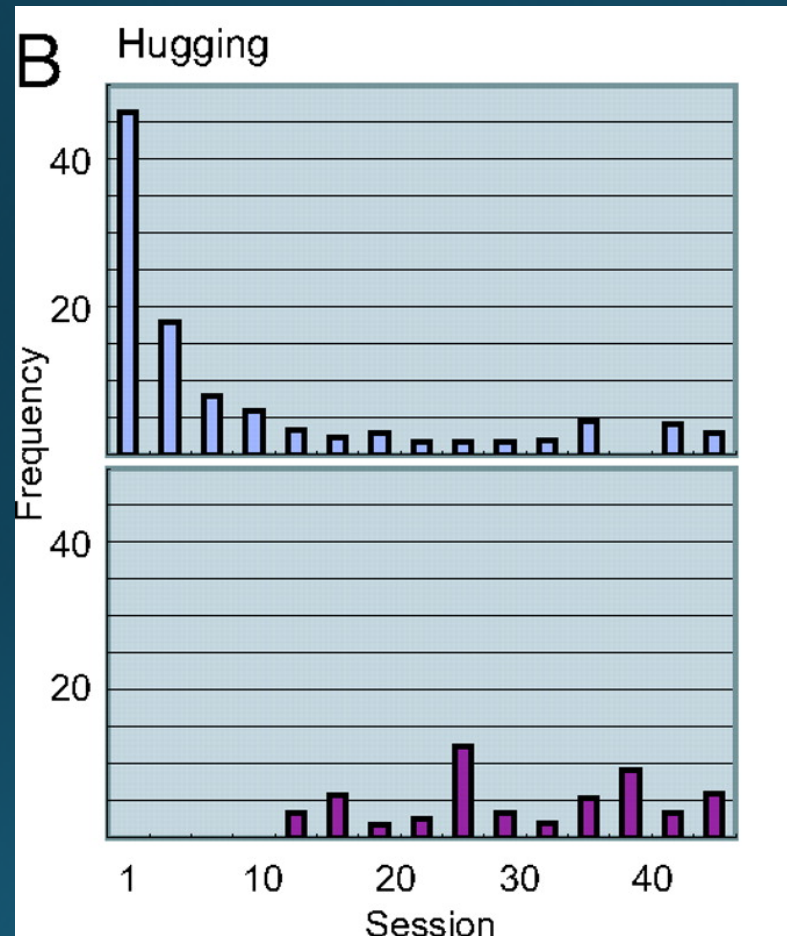


- Rough-housing towards Robby only

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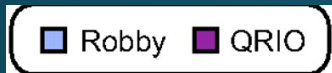
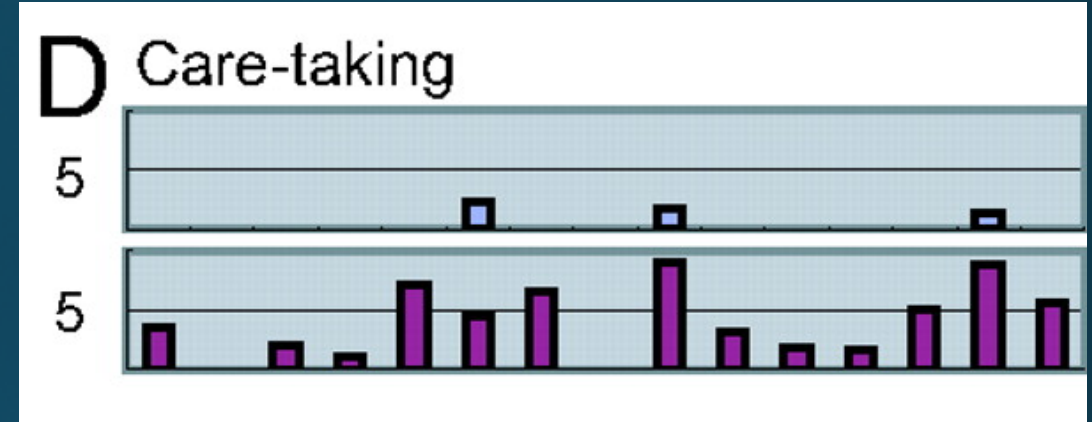
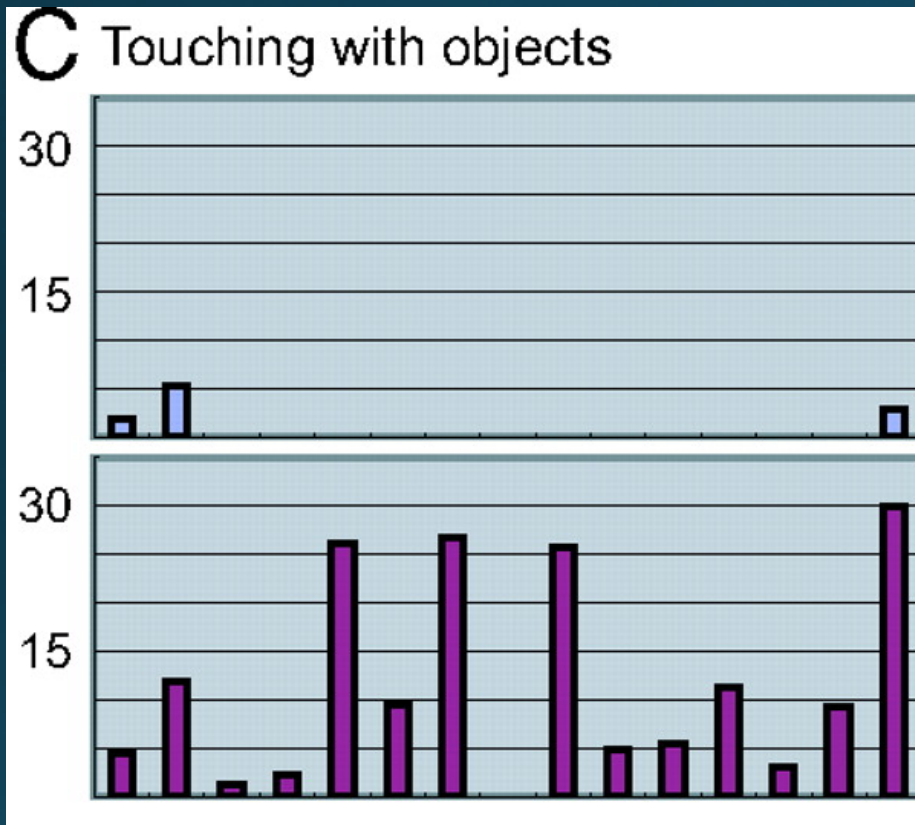


# Robot and Toy



- When hugging Robby decreased when hugging QRIO increased
- Often looked at QRIO while hugging Robby

# Robot and Toy



- Seldom toward Robby but more frequent toward QRIO

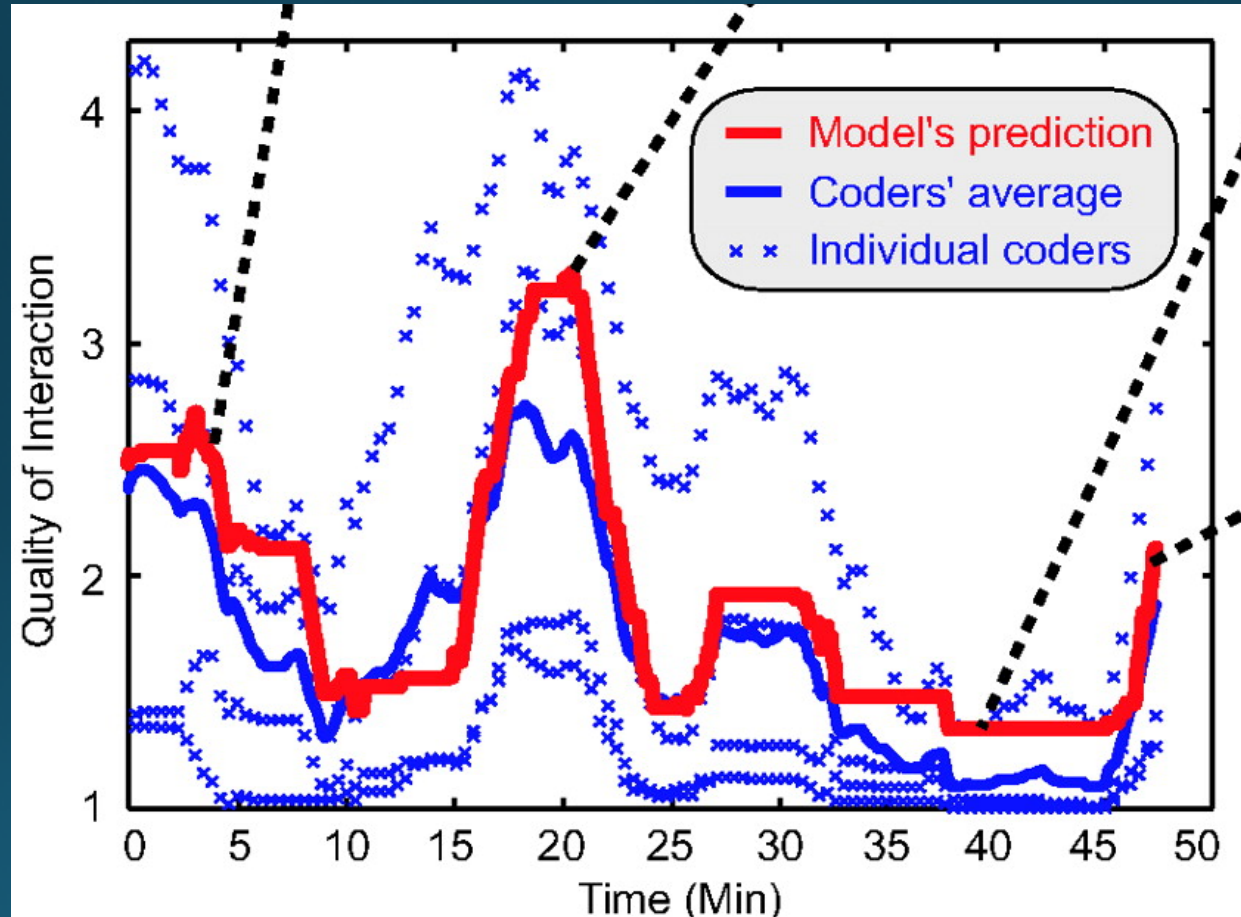


# Automatic Assessment of Connectedness

# Statistical Models

- Should predict the quality of interaction the students evaluated
  - For each frame model got binary input whether part of body was or was not touched
  - 8 binary inputs:
    - touching head, touching face, touching trunk, touching arm/ hand, touching leg/foot, hugging, touching with objects, and care-taking
- should predict the quality of interaction score

# Statistical Models



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# Conclusion

# Conclusion

- long-term bonding and socialization occurred between toddlers and a social robot
  - Interaction improved over time
  - Children exhibited a care-taking habit
  - Treated it more as a peer than as a toy
- 
- Touch is very important for social interaction

# Critique

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- 10h barrier
  - Did they really overcome the barrier? (5 month but each session ca. 50 min)
- Interaction
  - What else than touch is high quality interaction if you can not talk to the robot?
  - Would you say that the toddlers bonded to the robot?



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## Discuss!

