京都大学 KYOTO UNIVERSITY

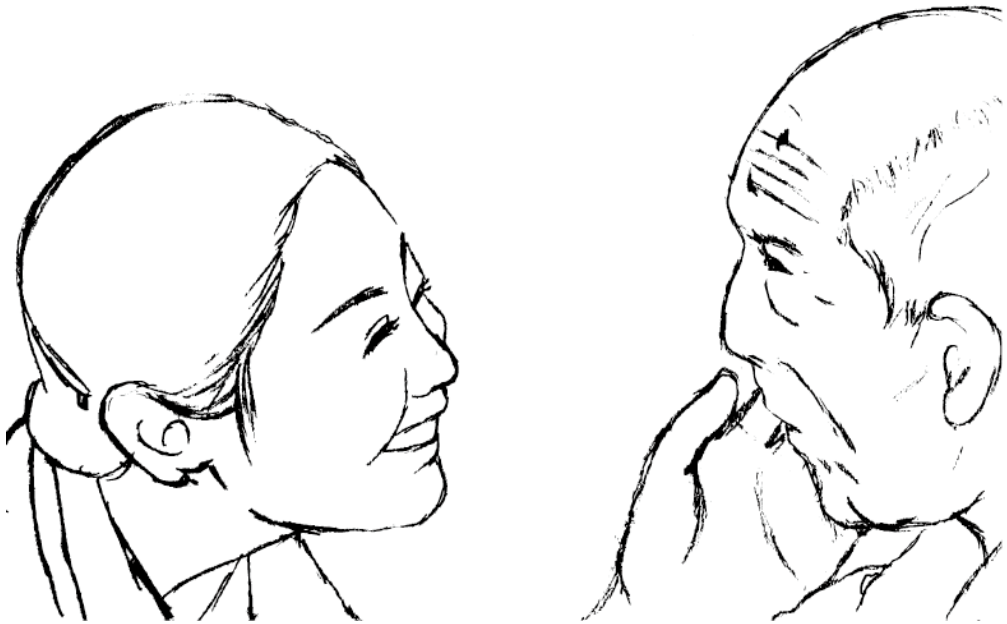
CREST 戦略的創造研究推進事業 Core Research for Evolutionary Science and Technology

TENDER-CARE SCIENCE, INFORMATICS and ROBOTICS

優しいケアコミュニケーションとAI/ロボティクス

Institute of Informatics, Kyoto University

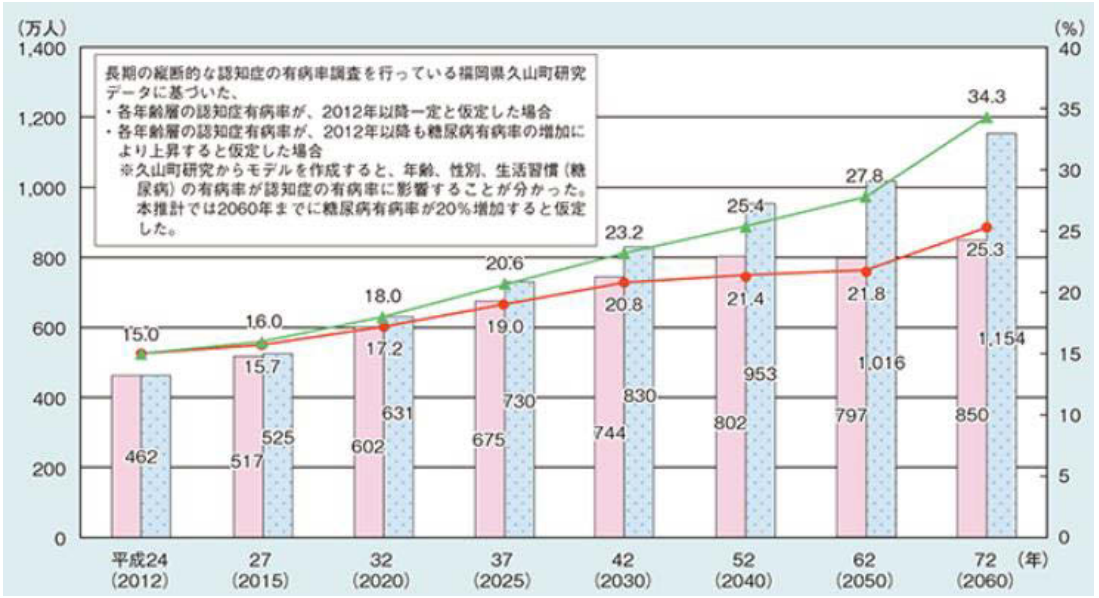
Atsushi Nakazawa



Our World Is Aging

People with dementia (PwD)

- > **7 million** in 2025 (Japan).
- **Shortage of caregivers**: **380,000 (!)**



http://www8.cao.go.jp/kourei/whitepaper/w-2016/html/gaiyou/s1_2_3.html

Issues *in CARE*

- PwD sometimes has **BPSD** (Behavioral and Psychological Symptoms of Dementia) which includes agitation, depression, anxiety.

↓

Increasing workloads of caregivers / family
Resignation of the care-giving jobs

↓

Solve by technologies!

Elderly care and technology

Two types of technologies:

1. Support **physical** aspect in care
   - Patient observation: excretion support, swallowing assessment
   - Reduce caregivers burden(s): automated generation of care plan, automated care records
2. Support **mental** aspect in care
   - Support communications: conversational support, conversation encouragement, Humanitude
   - Dementia prevention by communication
   - Reduce communication burden of dementia

Care and technology

Two types of technologies

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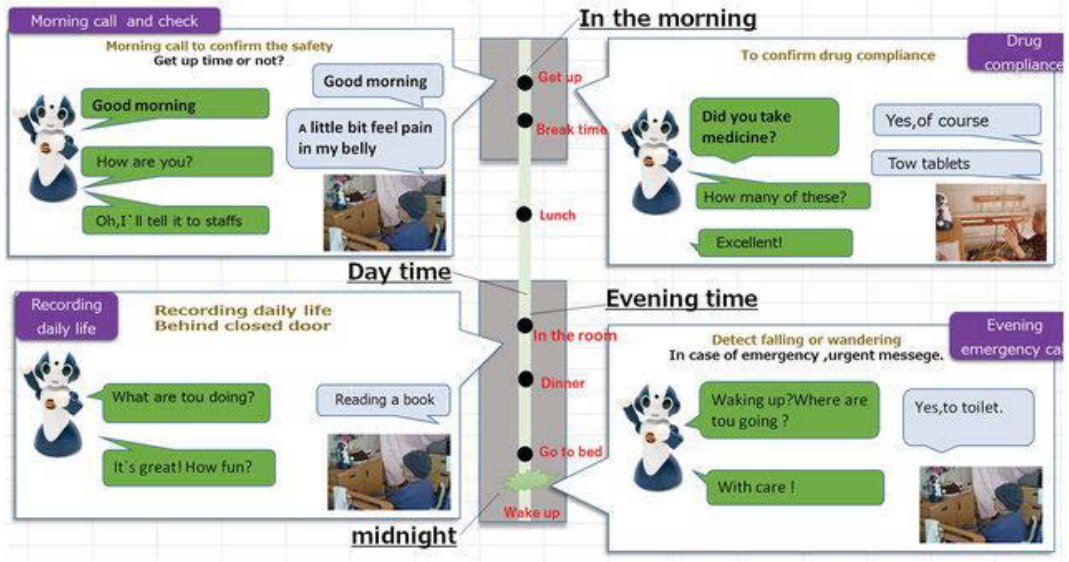
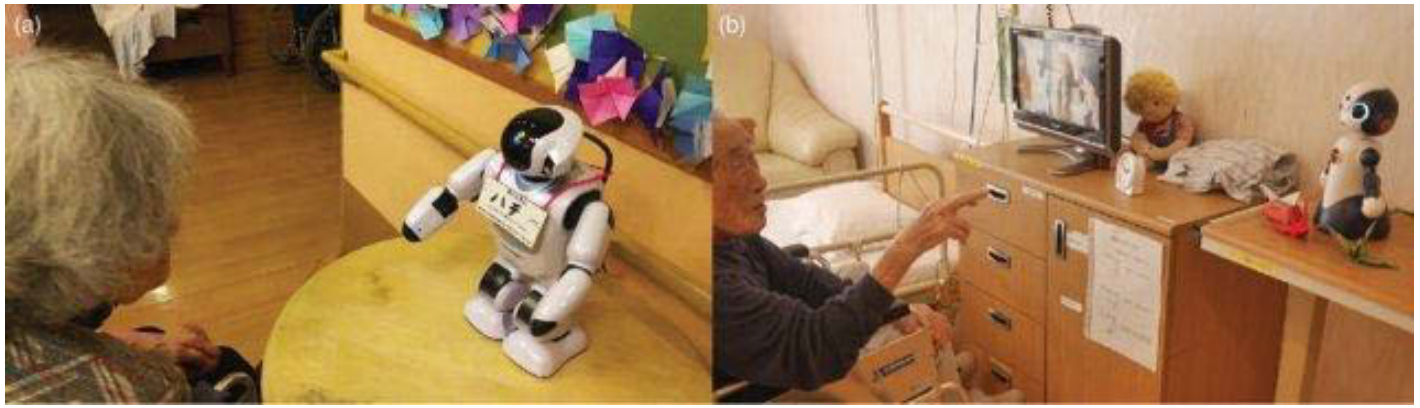
Communication robot for Elderlies

- Introducing communication robot increases the QOL of the elderlies.
- Increases social activities and speaking, reduces BPSD.





Obayashi et.al, Socially assistive robots and their potential in enhancing older people's activity and social participation, J. Am Med Dir Assoc

Communication ***WORKS*** for patients with dementia

※権利関係の都合により、一部画像を削除しております。

※権利関係の都合により、一部画像を削除しております。

Typical care

Tender-care (Humanitude*)

**Humanitude*: French-originated tender-care system developed by Y. Gineste and R. Marescotti through their 40-years experience.

Computational tender-care science

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Computational and cognitive neuroscientific approaches for understanding the tender care

優しい介護インタラクションの計算的・脳科学的解明

http://www.ii.ist.i.kyoto-u.ac.jp/crest/

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Shogo ISHIKAWA, Shizuoka Univ.
Jun TAKAMATSU, NAIST

Kyoto Univ. Kyushu Univ. NAIST Tokyo Medical Center Shizuoka Univ. EXAWIZARDS

Our objective: Finding of good care communication skill by AI

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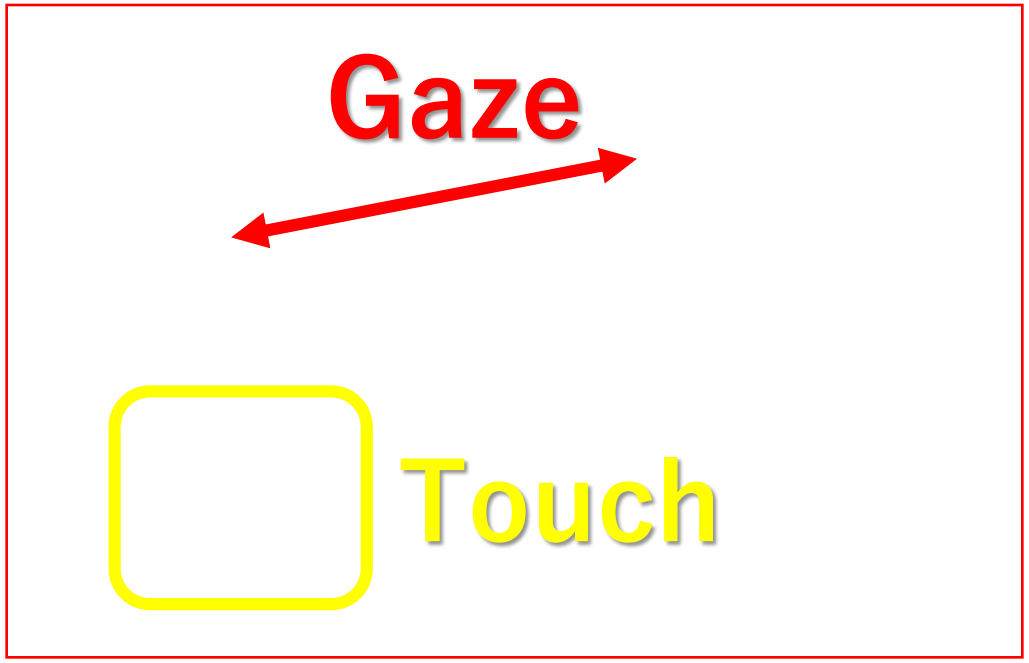

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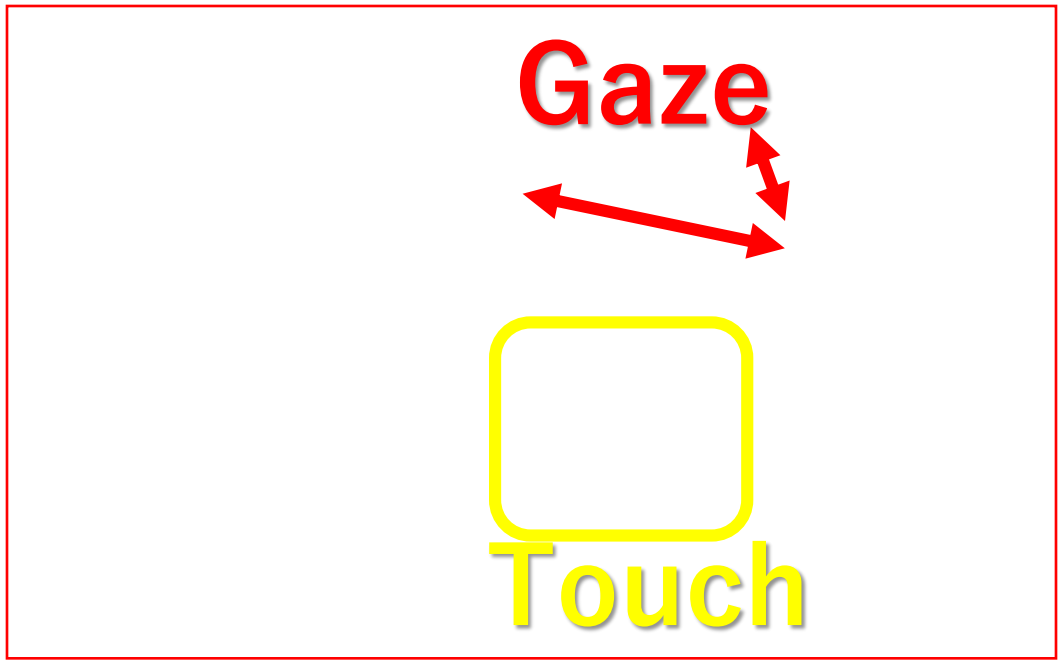


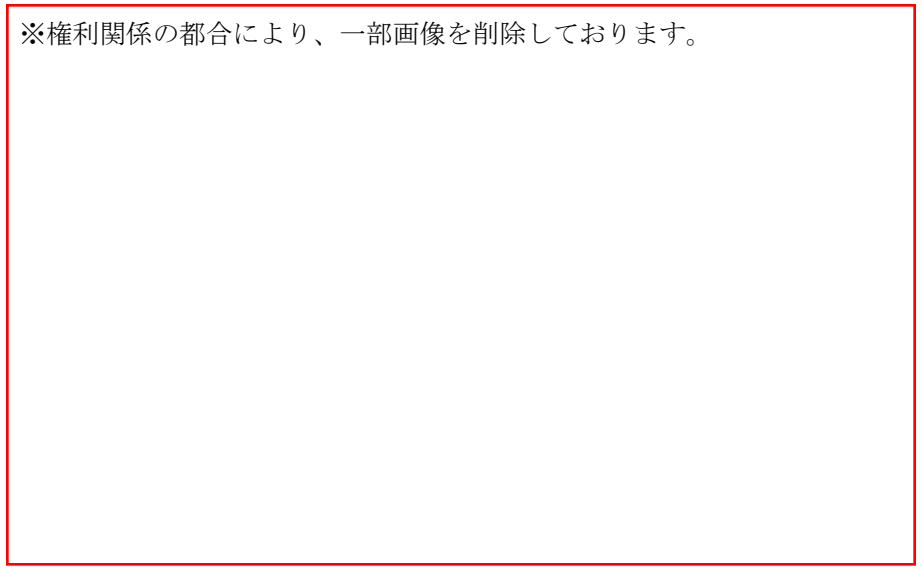
Sense the care skill including gazing, touching and talking

Find the **essential component** by AI and transfer to the learners / robots

Experimental design

- Find the difference of face-to-face communication behaviors between experts and novices.

Caregiver wears head-mounted camera



クローズアップ現代＋2019.1.10「科学的介護」

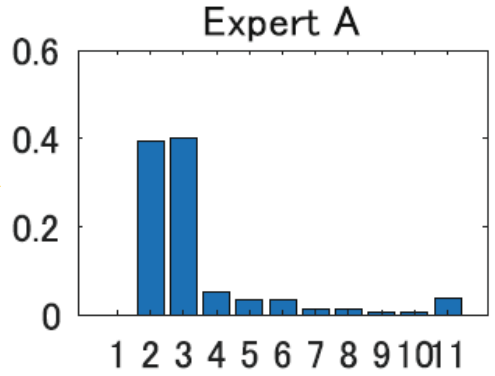
Mutual facial distance/poses using computer vision

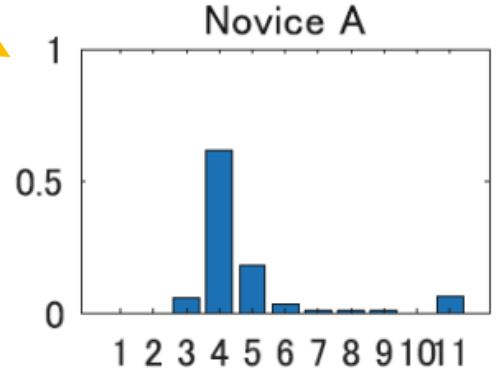
顔間距離

顔間角度

Images of the wearable camera

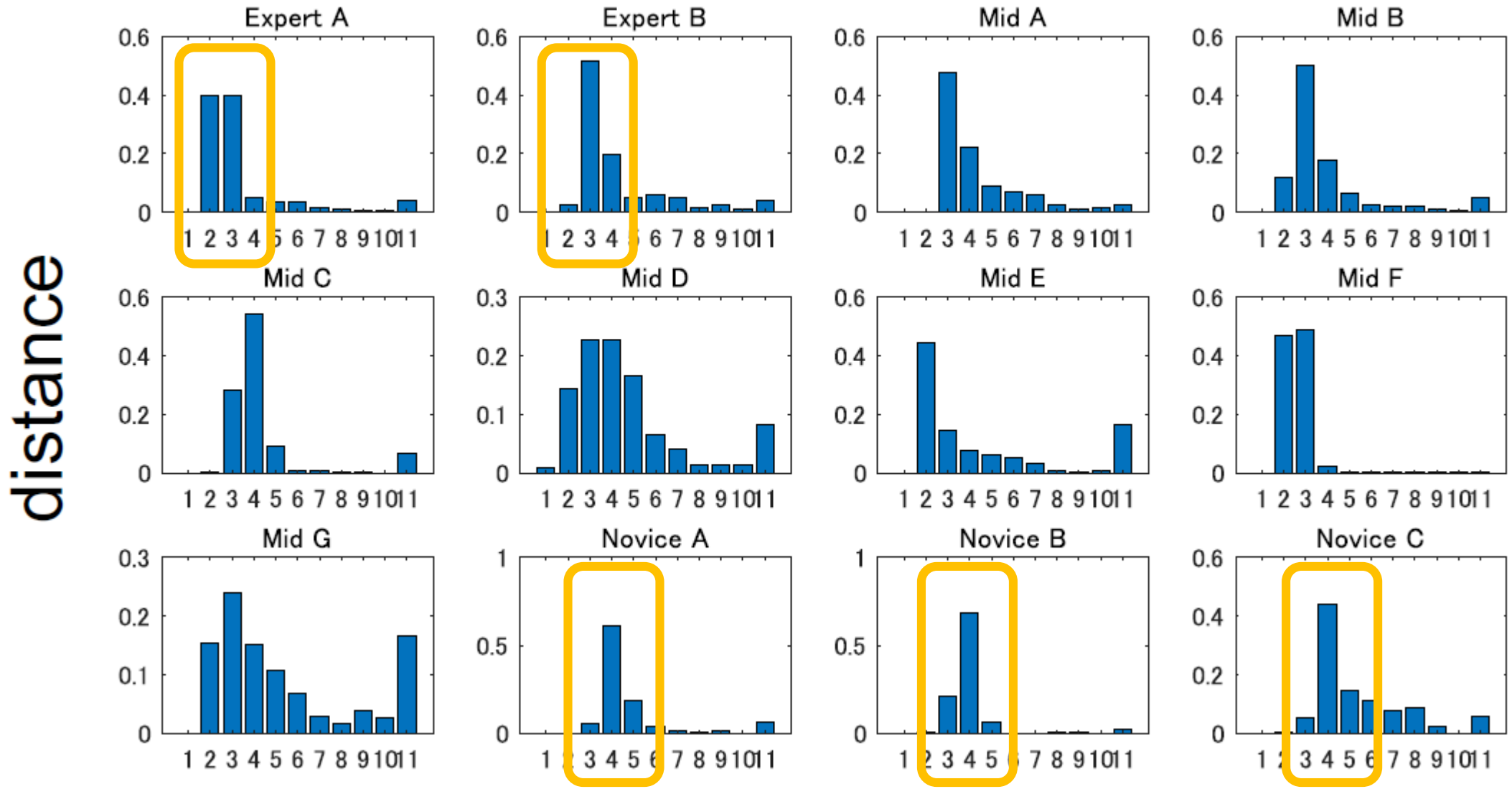
Find behavioral differences



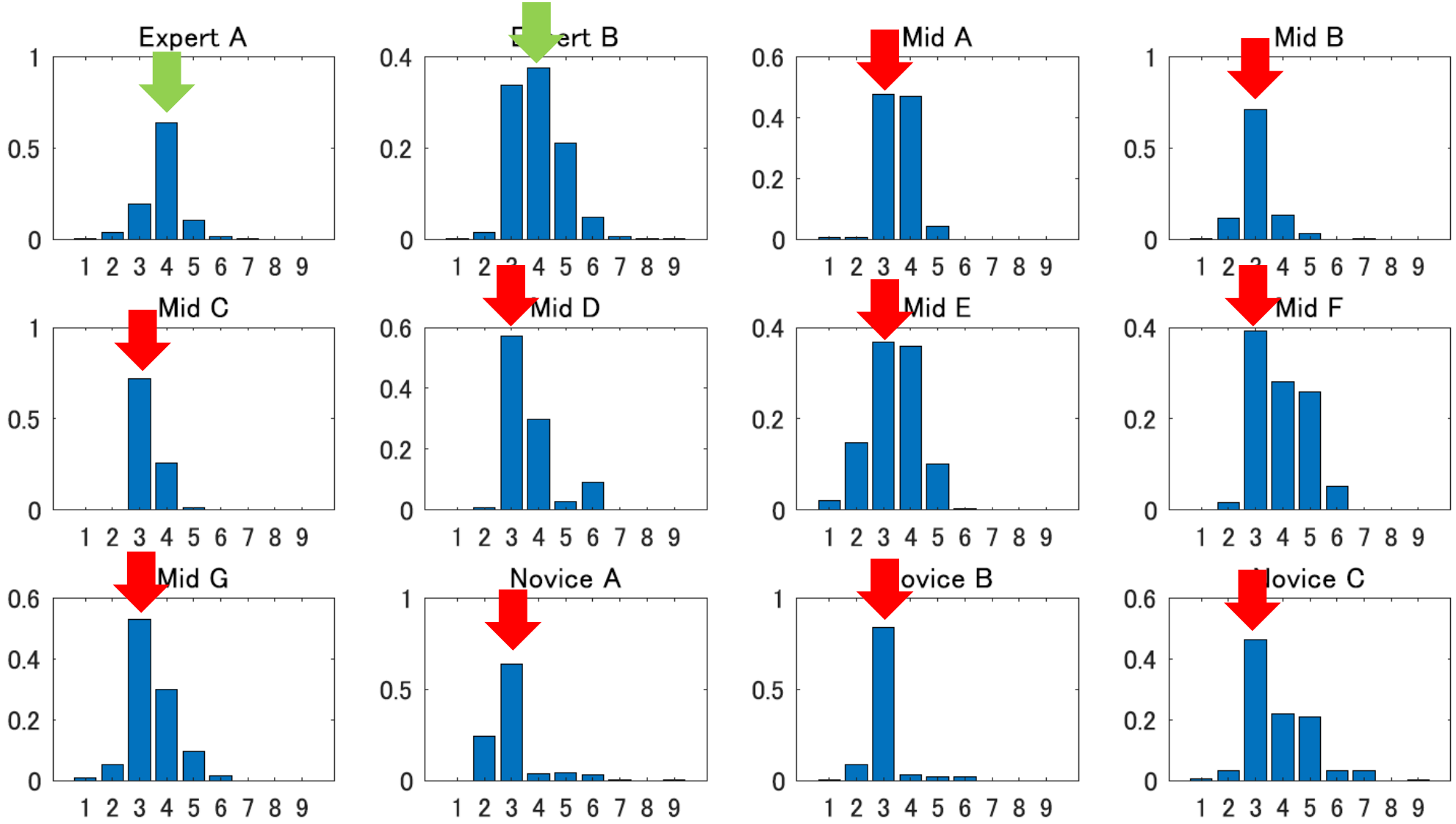


Nakazawa, A., Mitsuzumi, Y., Watanabe, Y., Kurazume, R., Yoshikawa, S., & Honda, M. (2019).
First-person video analysis for evaluating skill level in the humanitude tender-care technique. *Journal of Intelligent & Robotic Systems*, 1-16.

Mutual facial distance



Mutual facial pose (r_z)



Bin4:
-30～-10 deg

Bin3:
-50～-30 deg

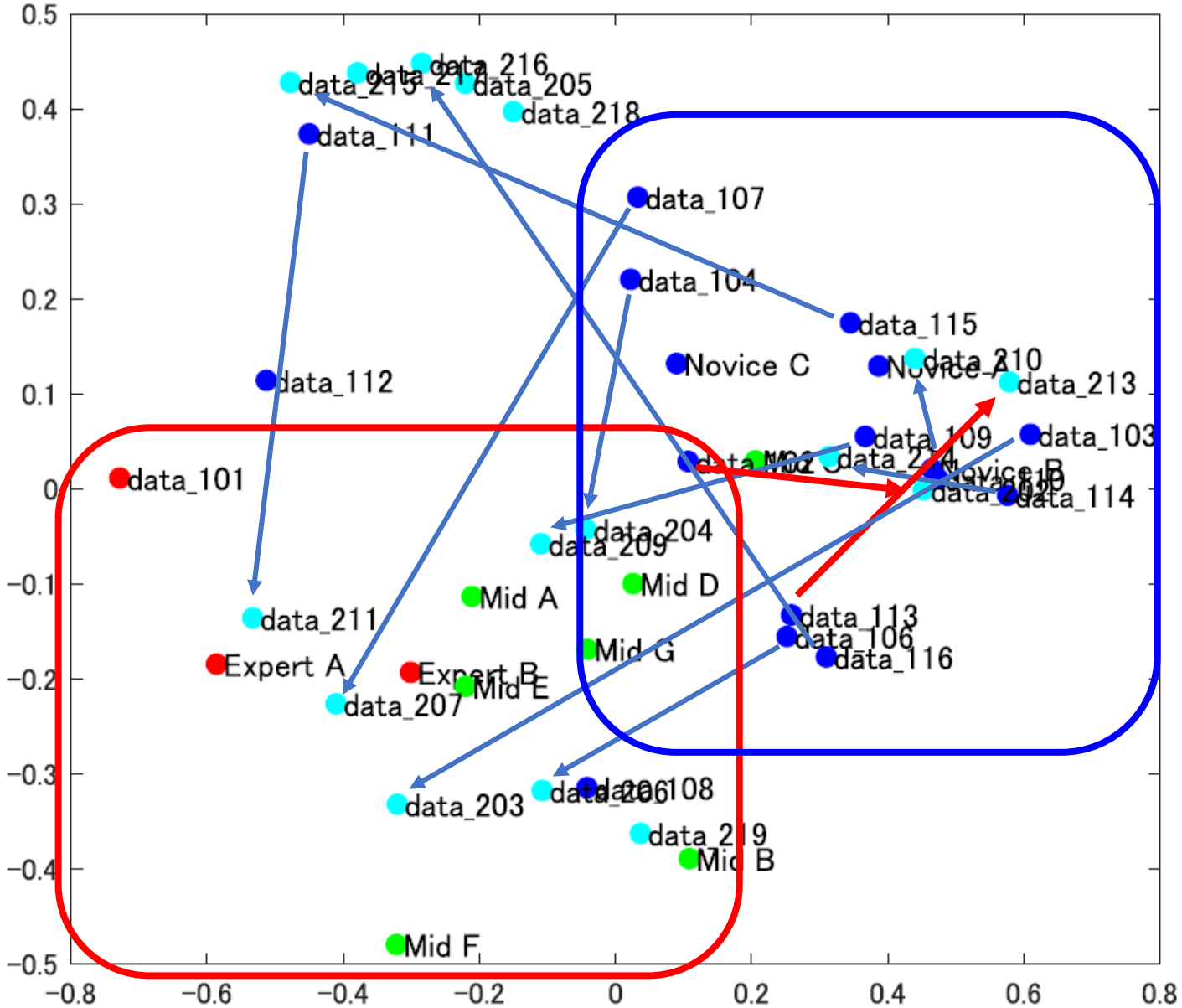
Visualization of skill acquisition

PCA of dist + r_z histogram

- Experts
- Middle level (TMC)
- Novice (before training)
- Novice (after training)

10 novices moves to expert clusters after training

→ Can be used skill evaluation



Skilled

What PCA detected?

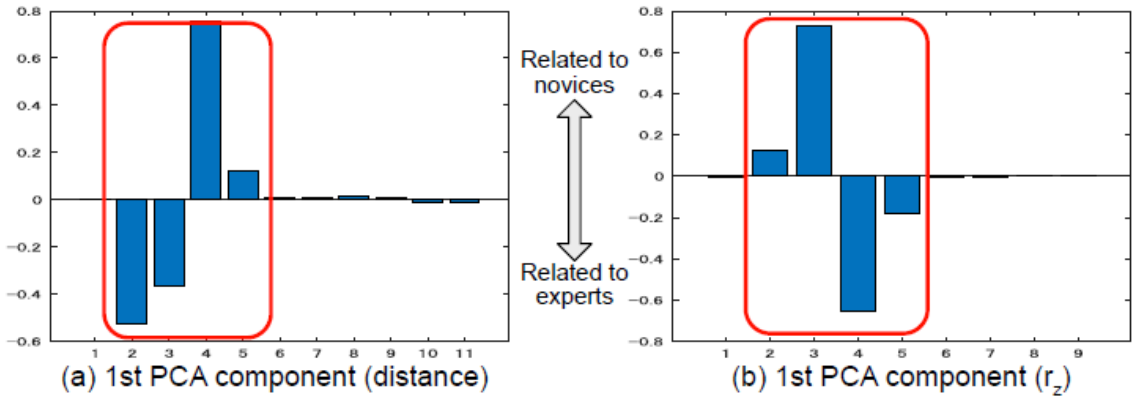
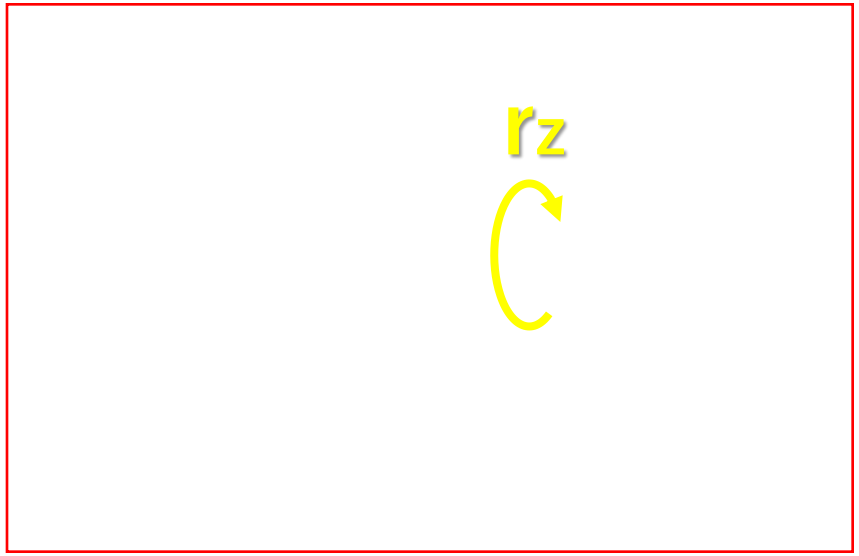


Fig. 11 1st components of PCA of the distance and r_z histograms. Negative elements are related to the experts' behaviors while positive elements are related to the novices' behaviors. In distance histogram, the bins 2 and 3 (0.2 - 0.4 [m]) are related to the experts while the bins 4 and 5 (0.4 - 0.6 [cm]) are related to novices. Regarding r_z histogram, the bins 4 and 5 (-30 - +10 [deg]) are related to the experts while the bins 2 and 3 (-70 - -30 [deg]) are related to the novices.

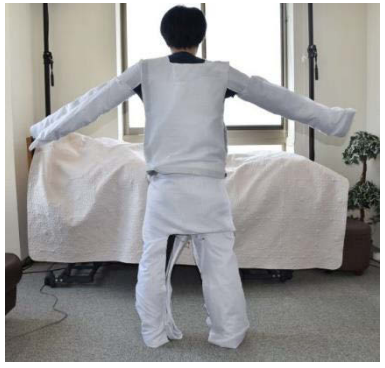
※権利関係の都合により、一部画像を削除しております。

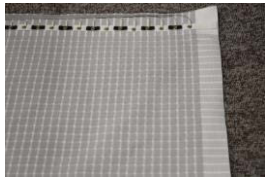


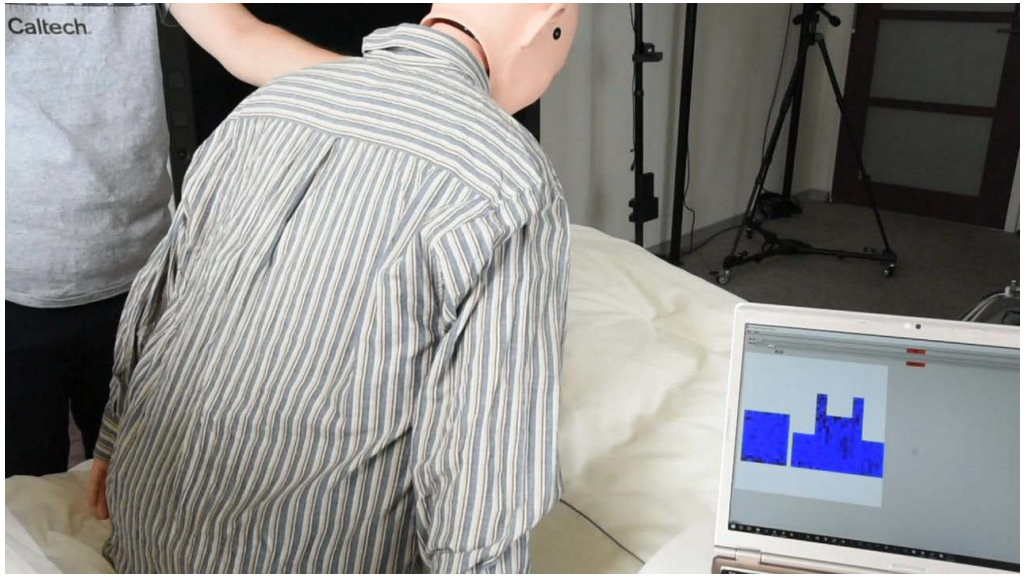
- Distance: 20-30cm → Expert
  Rz → -30 ～ +30 [deg] (ほぼ正面向き)
- Novice:
  Mutual-facial distance: Far, Face-to-face rotation (r_z) : Large
  Middle level:
  Mutual-facial distance: Near, Face-to-face rotation (r_z) : Large

J. Intelligent & Robotics Systems, 2019.

Whole body tactile sensor (Kurazume Lab. Kyushu Univ.)







Care skill training system using VR/AR

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VR (AR) Glass

Virtual patient

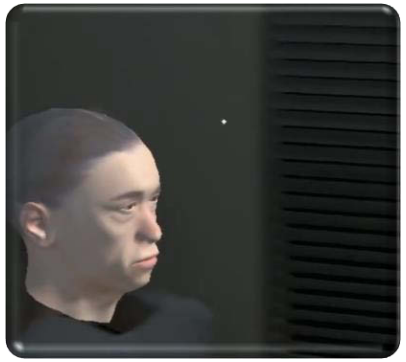

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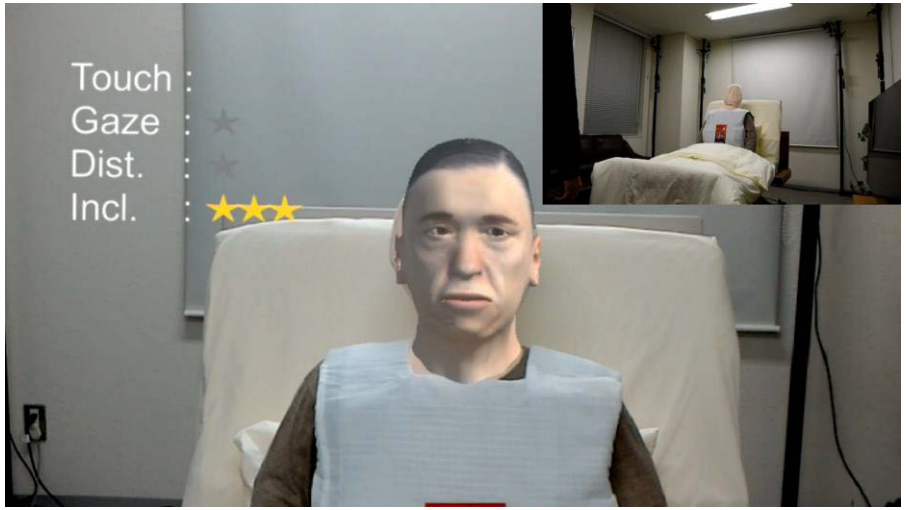
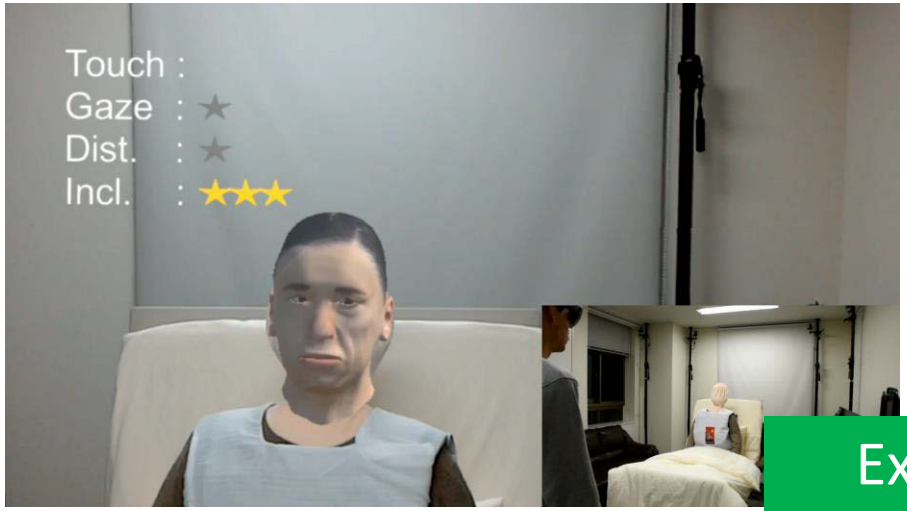
Figure + touch sensor

Touch sensor

Gaze skill feedback



Touch skill feedback



Exawizards
Kyushu Univ.

Care skill education for citizens (Fukuoka City)