

Perceived Risks and Benefits of Soft Robots

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R 1: Do individuals assess soft robots more positively or negatively compared to conventional robots?

R 2: What are the most significant risks and benefits associated with soft robots in the two case studies of search and rescue and socially assistive soft robots? **Focus on argument structures**

R 3: What is the influence of demographic factors, particularly gender and age, on the positive or negative assessment of soft robots?

Study Design

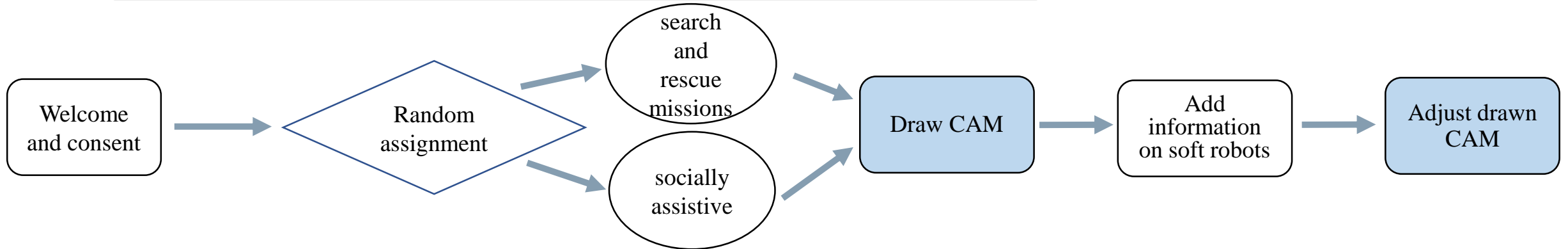
Background Information

Literature review on ethics and soft robots

Our focus RQ 2

RQ 2: **qualitatively** survey layperson perception on soft robots

RQ 1, 2, 3: **quantitatively** survey layperson perception on soft robots

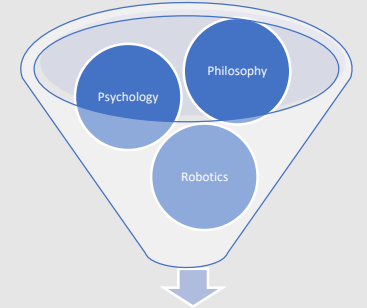


RQ additional?: **qualitatively** survey expert evaluation on risks and benefits

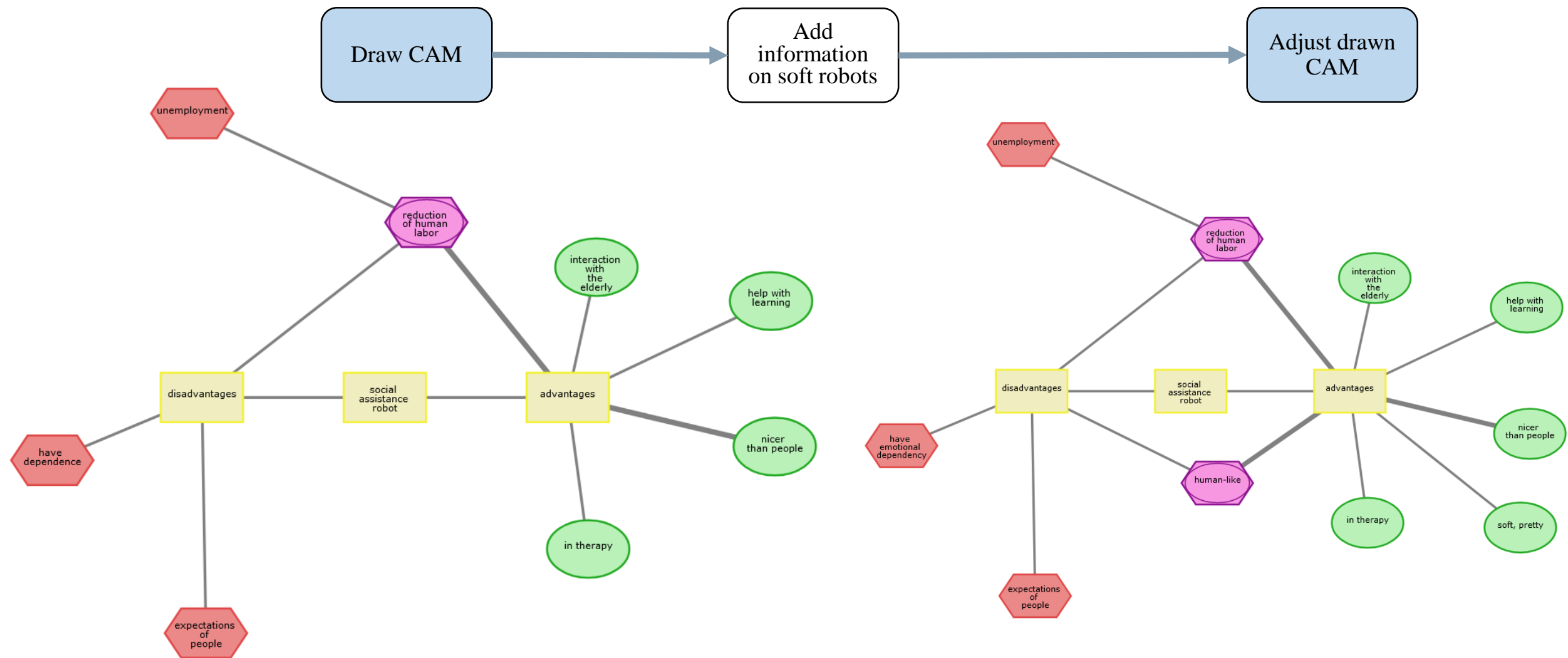
Expert evaluation on risks and benefits of soft robots within livMatS

Open question on risks and benefits of SR

Measuring risks and benefits of soft robots



Intervention Design: Outcome



Informed by (scenario-based approach)

Information of
rigid robots

Add
information
on soft robots

search
and
rescue
missions

socially
assistive

Second Page in Experiment

Socially Assistive Robots (SAR)

Benefits of socially assistive robots (SAR) might be:

- Serve as companions for individuals who are socially isolated or have limited social interaction, such as the elderly or those living in remote areas
- Increase social interaction, for example by serving as a social companion for individuals with autism, assisting them to recognize and understand emotions in others, which can enhance interpersonal communication skills
- Support educational activities and learning, particularly for children with special needs or learning difficulties

Possible risks of socially assistive robots (SAR) might be:

- Users may develop a dependency on the robot, particularly if it provides significant support or assistance with daily activities
- The use of socially assistive robots (SAR) might lead to unemployment, as robots might replace humans at the workplace (for example as therapists)
- Human-robot interactions may influence human-human interactions, as they can shape our expectations, behaviors, and perceptions in social settings

Please read the following information on soft robots carefully.

Afterwards we will ask you to adjust your CAM.

First Page in Experiment

Currently, there is a trend towards using a new type of so-called soft robots as socially assistive robots for therapy, elderly care, education or as social companions. Soft robots are designed to mimic the properties of living entities such as animals. Unlike rigid robots, which are typically composed of hard materials like metal or hard plastic, soft robots do not have electronic devices in themselves and are made of flexible soft materials like silicone, making them more adaptable and lifelike. They often have natural shapes and can bend, twist, and stretch like living organisms, such as snakes or octopi. Designed with inspiration from living entities, these soft robots often look and feel more lifelike than rigid robots.

Furthermore, soft robots have the ability to express and perceive human emotions, communicate through expressions such as gaze and gestures, and offer a life-like experience due to their softness and flexibility. For example, Paro, a robot for animal therapy in nursing homes, looks like a baby harp seal and has soft white artificial fur, responds to stroking or even harsh petting by moving its tail and opening/closing its eyes.

Results

Focus of results

RQ 2: **qualitatively** survey layperson perception on soft robots

RQ 1, 2, 3: **quantitatively** survey layperson perception on soft robots

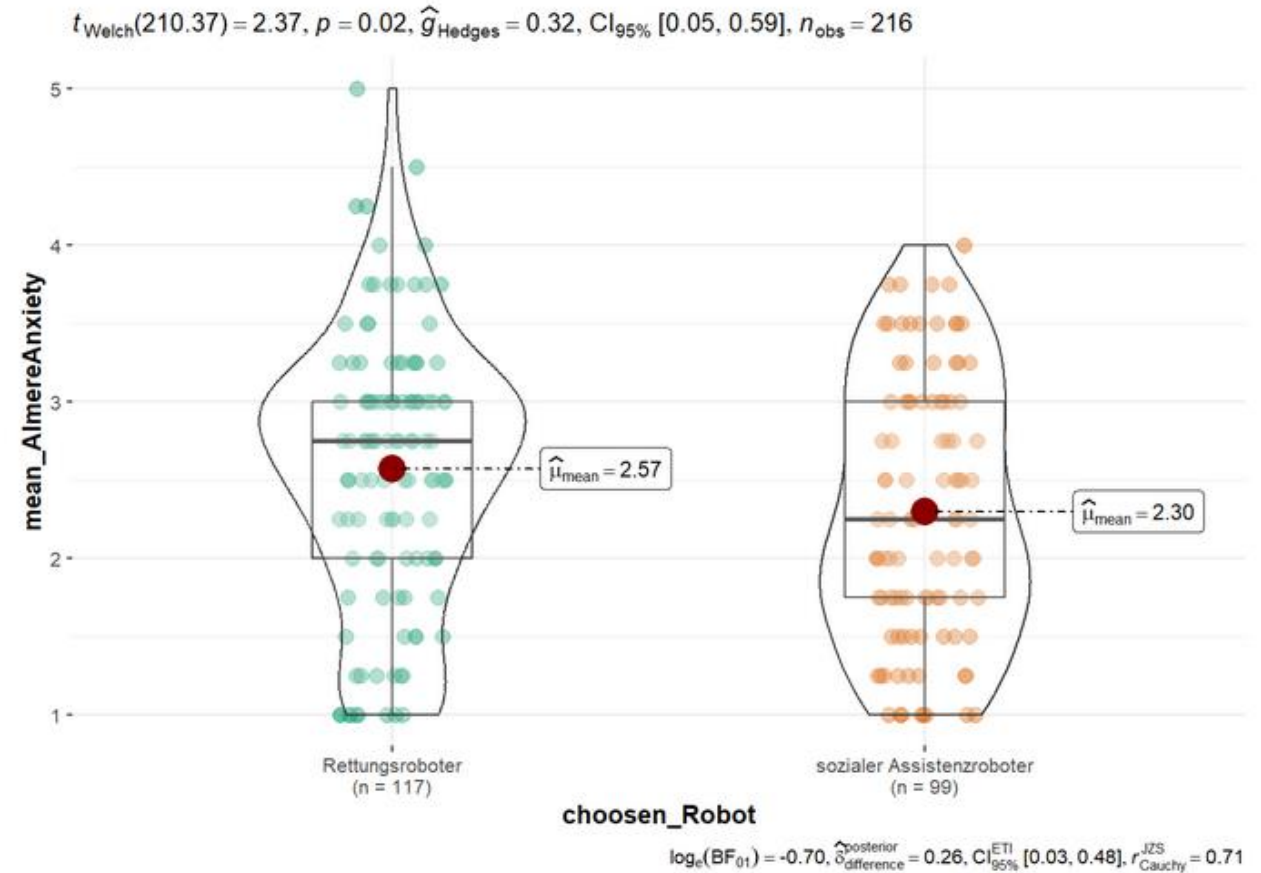
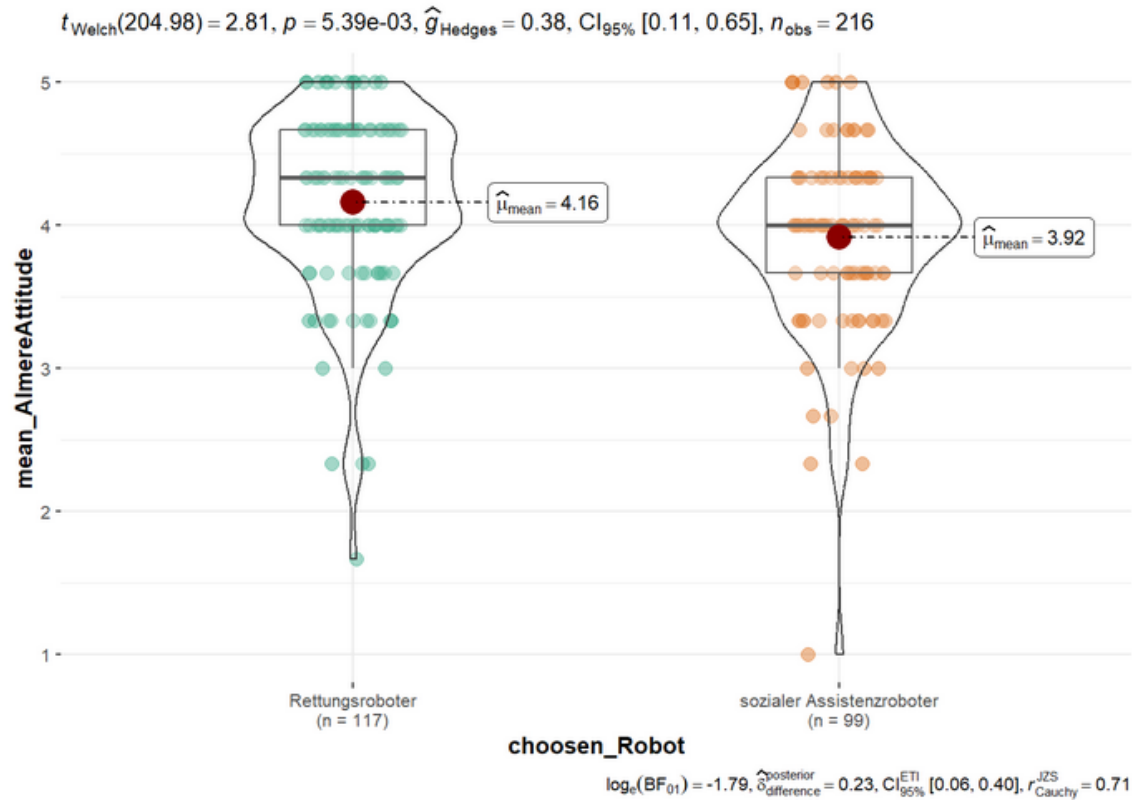
RQ additional?: **qualitatively** survey expert evaluation on risks and benefits

R1: Perceived risks and benefits quantitative

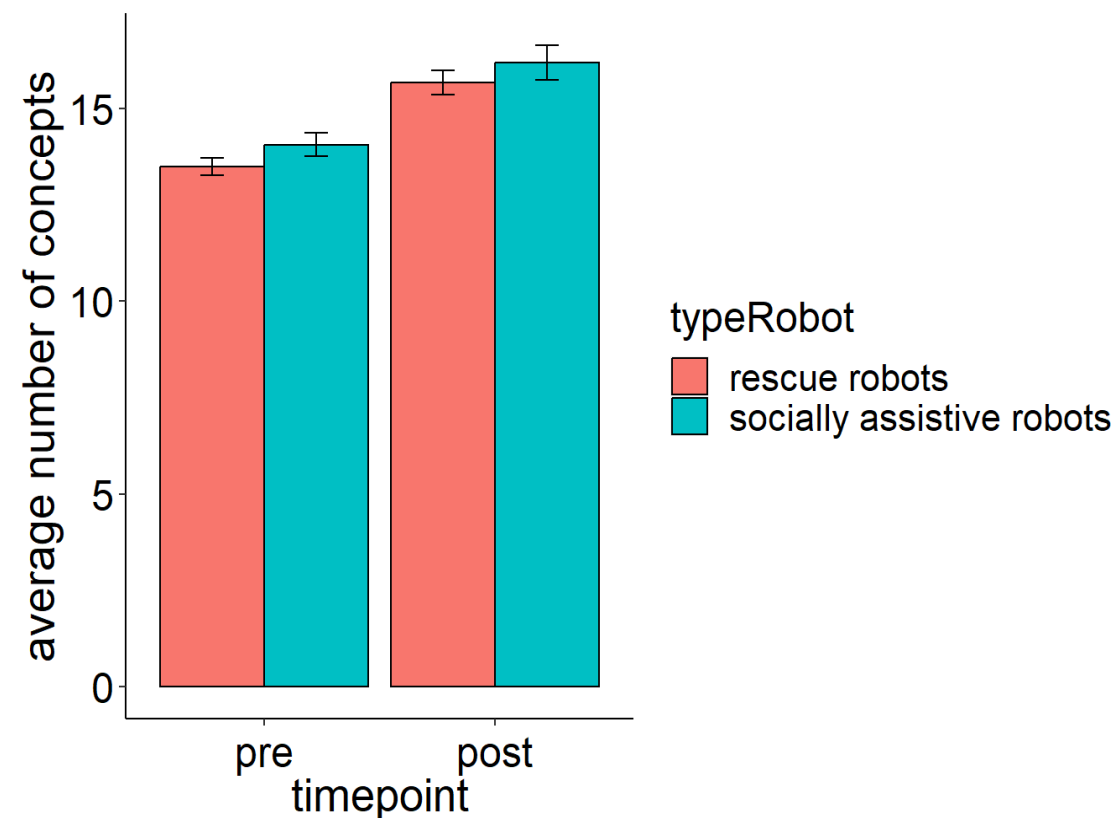
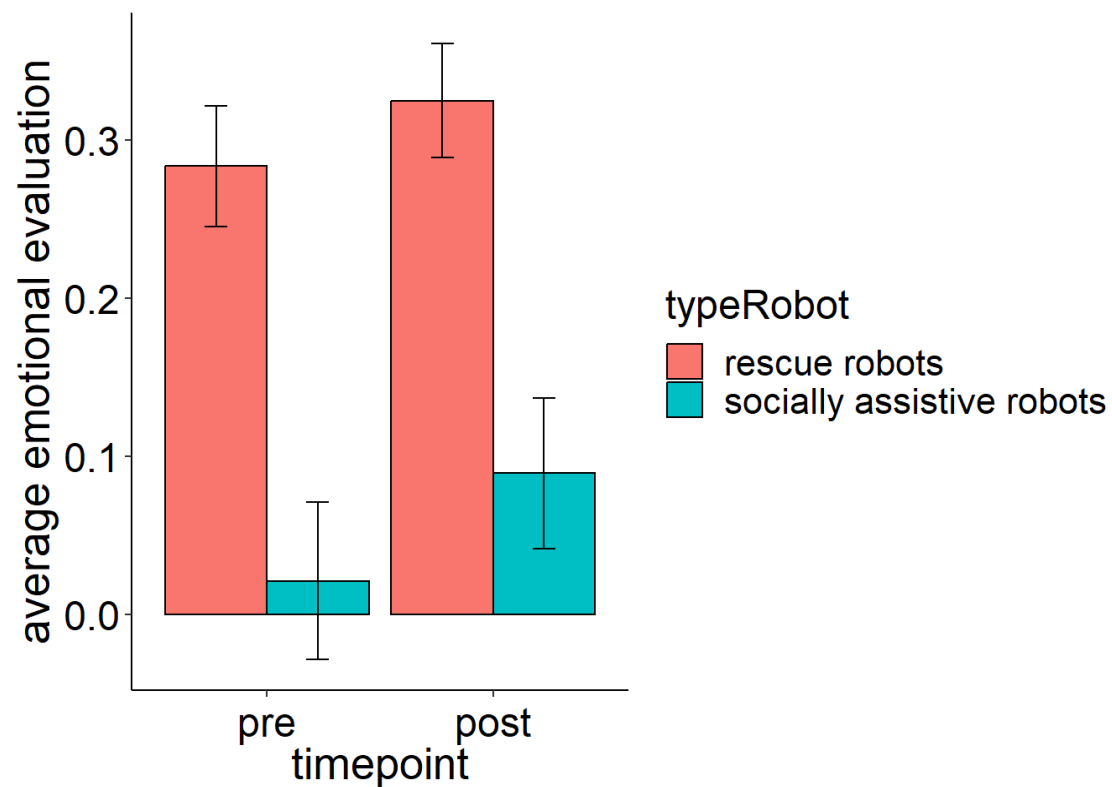
R2: Perceived risks and benefits qualitative **Our focus RQ 2**

R3: Perceived risks and benefits mediated by gender and age

R1: Perceived risks and benefits quantitative: survey scales



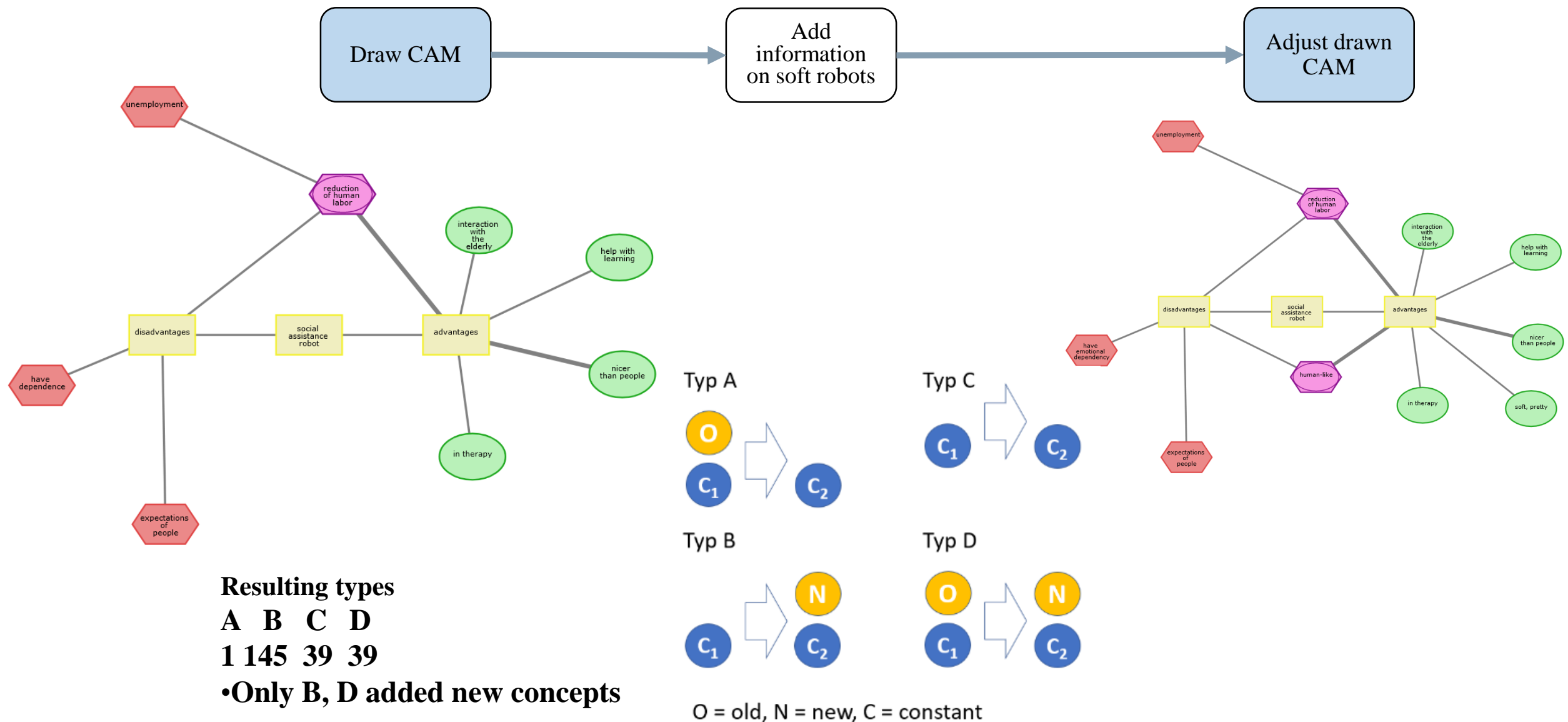
R1: Perceived risks and benefits quantitative: CAM network indicators



First results

- (1) More positive assessment of soft robots compared to rigid robots in both case studies
- (2) More positive assessment of *search and rescue soft robots* compared to *socially assistive soft robots*
- (3) More concepts in post-CAMS (both case studies)

R2: Perceived risks and benefits qualitative: CAM semantic content



R2: Perceived risks and benefits qualitative: CAM semantic content

socially assistive robot:

```
data.frame(post = diag(CAMaggregated_post[[1]]),
           pre = diag(CAMaggregated_pre[[1]]),
           differences = diag(CAMaggregated_post[[1]]) - diag(CAMaggregated_pre[[1]]))
```

	post	pre	differences
Soziale Assistenzroboter	99	99	0
Nachteile	99	99	0
Vorteile	99	99	0
RCPP	54	39	15
LC	37	35	2
T	43	42	1
SIP	92	90	2
HRIP	78	67	11
AN	50	43	7
SIN	119	112	7
R	33	26	7
HC	37	36	1
AP	25	45	-20
HRIN	77	22	55
RCN	54	64	-10
SA	40	36	4
TP	63	35	28
TL	35	59	-24
RCPN	41	37	4
RCA	42	39	3
MT	46	10	36

rescue robot:

```
data.frame(post = diag(CAMaggregated_post[[1]]),
           pre = diag(CAMaggregated_pre[[1]]),
           differences = diag(CAMaggregated_post[[1]]) - diag(CAMaggregated_pre[[1]]))
```

	post	pre	differences
Rettungsroboter	117	117	0
Nachteile	117	117	0
Vorteile	117	117	0
MT	120	119	1
AN	35	34	1
R	78	56	22
T	46	43	3
SIP	42	38	4
TP	125	40	85
SA	153	103	50
RCN	44	145	-101
RCPP	55	36	19
TL	83	67	16
RCPN	42	32	10
AP	24	21	3
HRIN	22	20	2
RCA	43	44	-1
HC	56	54	2
LC	14	13	1
HRIP	9	22	-13
SIN	23	4	19

R2: Perceived risks and benefits qualitative: CAM semantic content

Input:

What is the difference between the following two wordlists. The topic is the perceived positive Human Robot Interaction. List 1 is theirby the perception of rigid robot and list 2 the perception of the rigid robot after participants have been informed that the robot is actually soft.

List 1:

[1] "for special needs" "future help"
[3] "interaction with isolated" "interaction with older people"
[5] "linguistic barriers are eliminated" "enabling individual learning pace"

List 2:

[1] "for special needs" "future help"
[3] "interaction with isolated" "interaction with older people"
[5] "linguistic barriers are eliminated" "enabling individual learning pace"

HRI, pos. Link: <https://chatgpt.com/share/3b56c65d-4ef9-4c6d-9a0e-6819bbd20e3f>

Output:

The differences between List 1 (perception of a rigid robot) and List 2 (perception of the rigid robot after being informed it's actually soft) highlight changes in perceived attributes and benefits. Here's a detailed comparison:

Similarities

- Both lists mention interactions with special needs, older people, and isolated individuals.
- Common themes include societal integration, elimination of linguistic barriers, individualized learning, and support for educational activities.
- Emotional benefits like reducing shame, providing company, and emotional relationships appear in both lists.
- Support in practical and emotional areas (elderly care, anxiety, educational support, etc.) is recognized in both.

Differences

New Positive Perceptions in List 2

1. Emotional Attachment and Comfort:

- List 2 includes terms like "emotional attachment," "comforting," and "emotional support" which aren't in List 1.

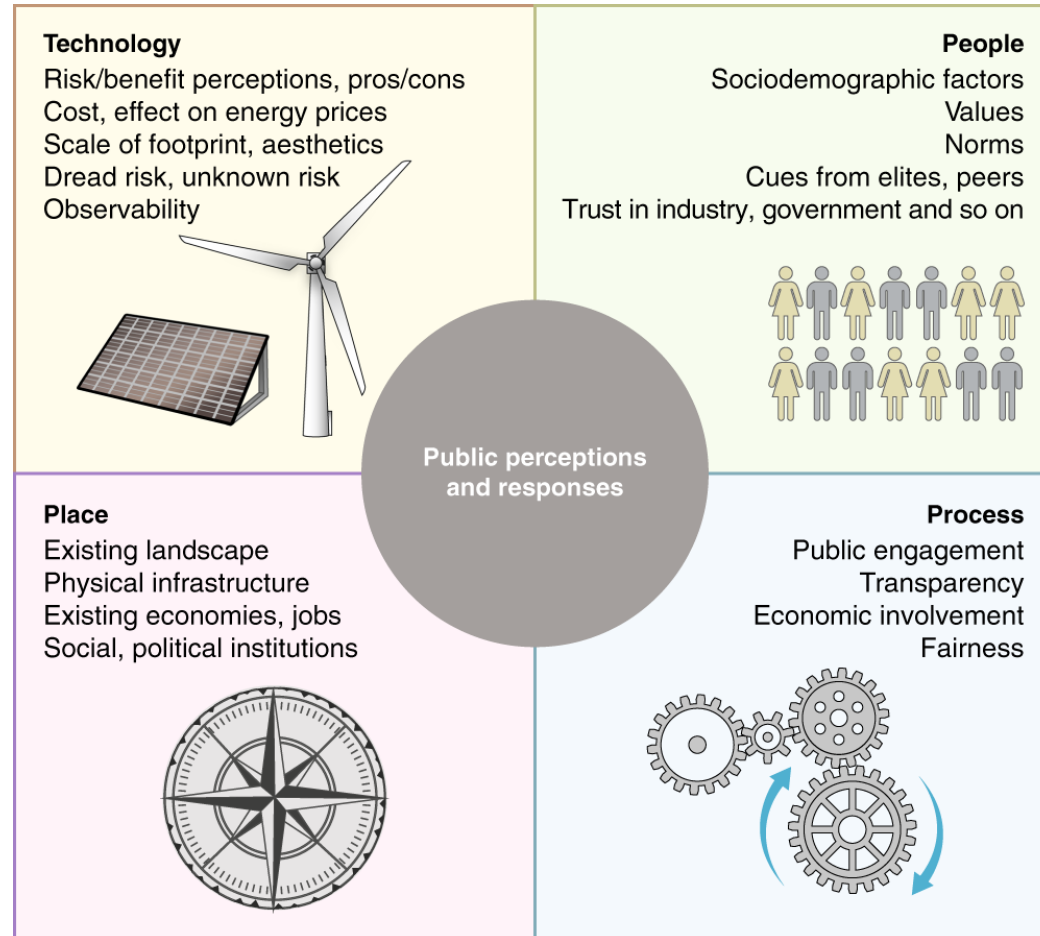
2. Physicality and Haptics:

- Terms like "physicality," "haptics," and "touch starved people" reflect an appreciation for the physical interaction potential of a soft robot.

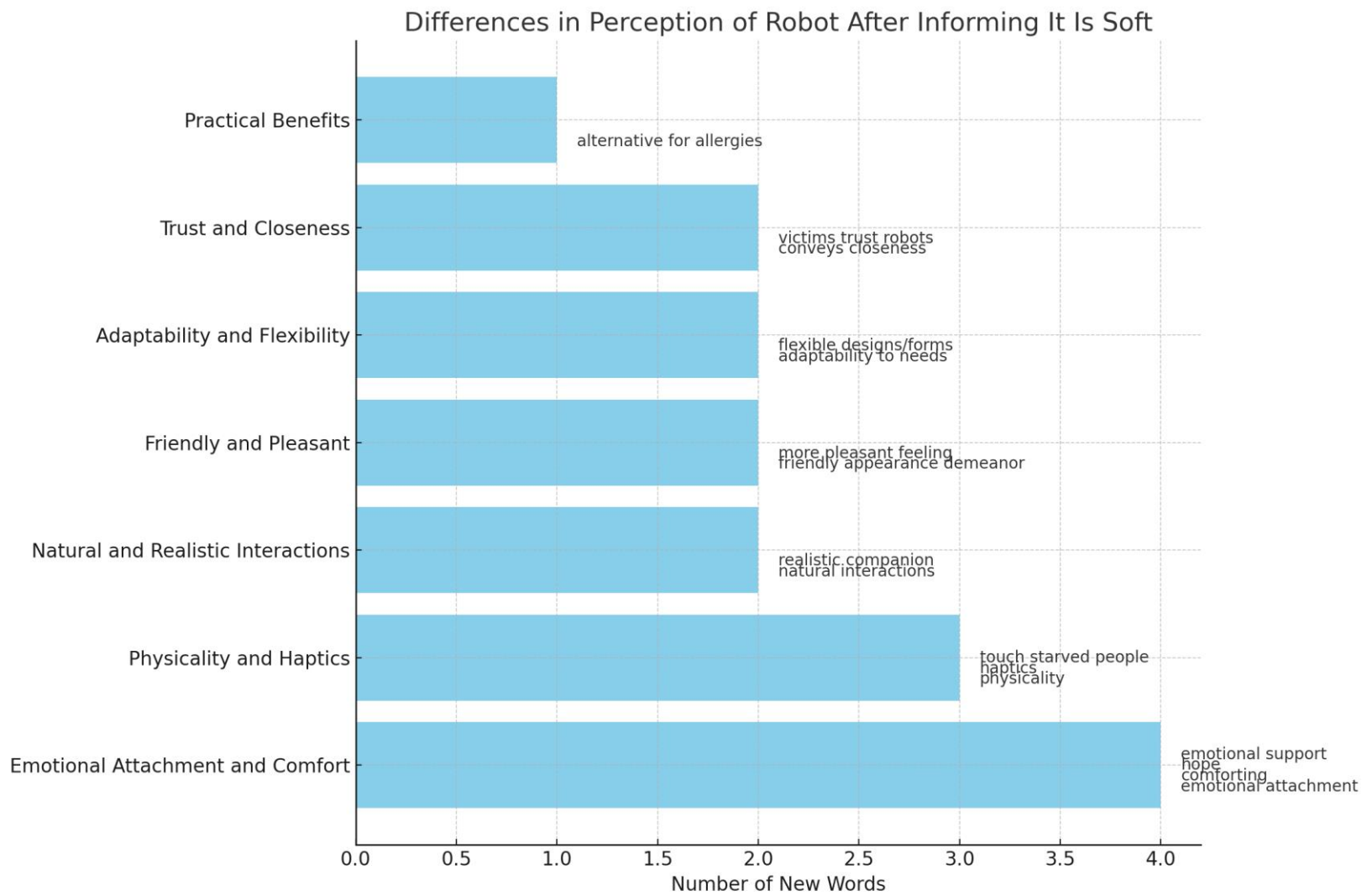
3. Natural and Realistic Interactions:

- Words like "natural interactions" and "realistic companion" suggest a perception of more lifelike and natural behavior.

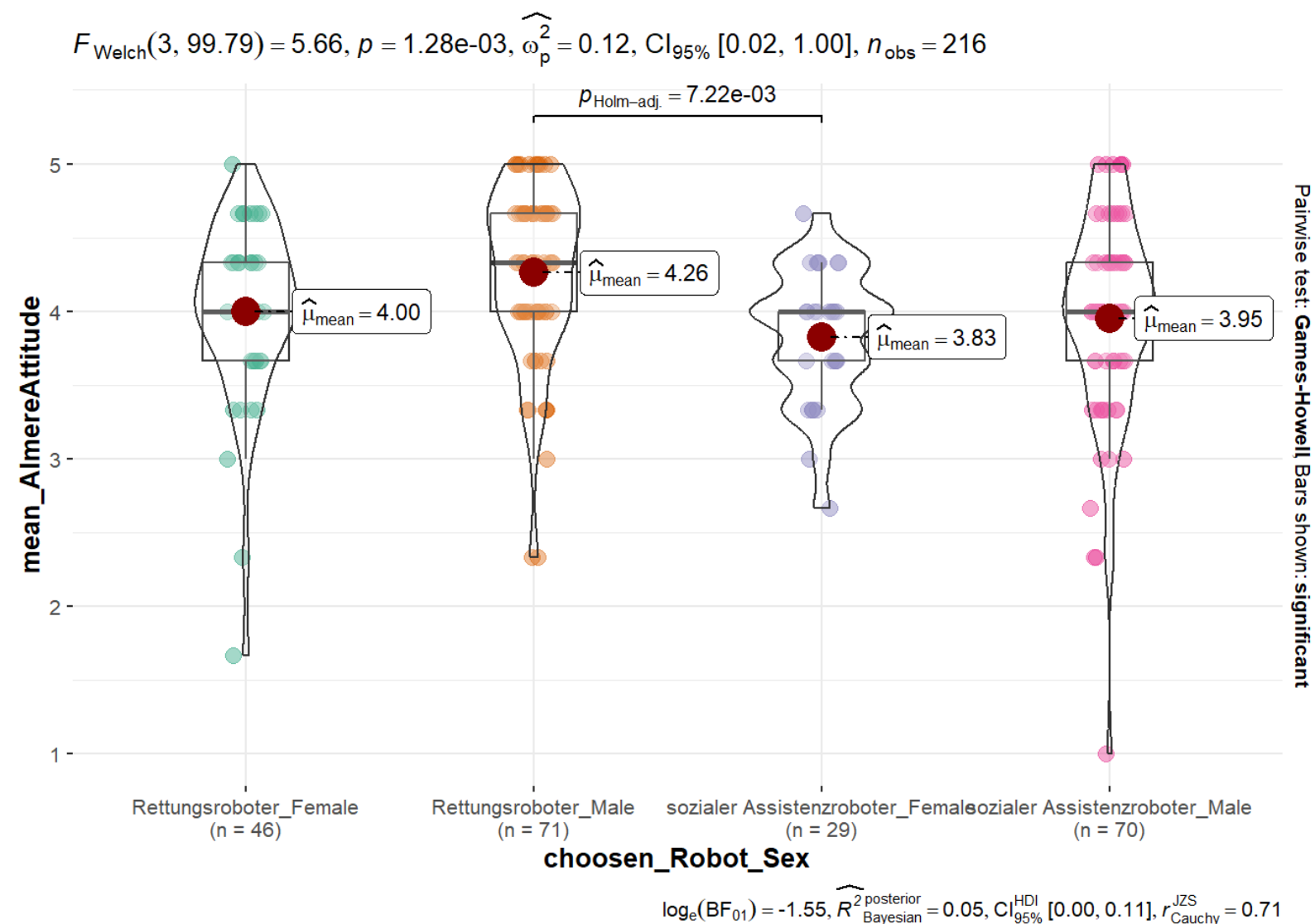
R2: Perceived risks and benefits qualitative: CAM semantic content - overview



R2: Perceived risks and benefits qualitative: CAM semantic content – single topic



R3: Perceived risks and benefits qualitative diff. by gender: survey scales



R3: Perceived risks and benefits qualitative diff. by gender: survey scales

