

# Gaze distribution of an observer while imagining wearing clothing portrayed in an advertisement and predicting the impression on others

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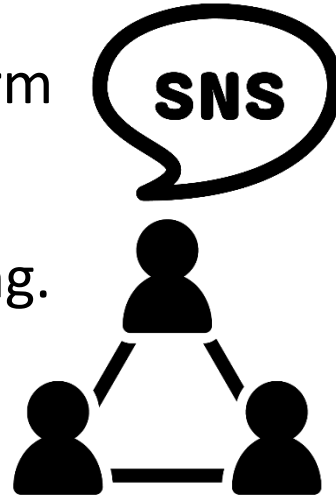
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# Introduction (1/2)

Image-sharing social networking services (SNSs) have become a common platform for advertising and purchasing clothing.

SNS feeds show many images of people wearing fashionably coordinated clothing.



We refer to the people in the images as subjects.

The subjects in SNS images are often photographed from head to toe, or their heads are hidden.

**Whole-body image:** a subject is visible from **head to toe**.

**Head-occluded image:** a subject is visible from **shoulder to toe**.

# Introduction (2/2)

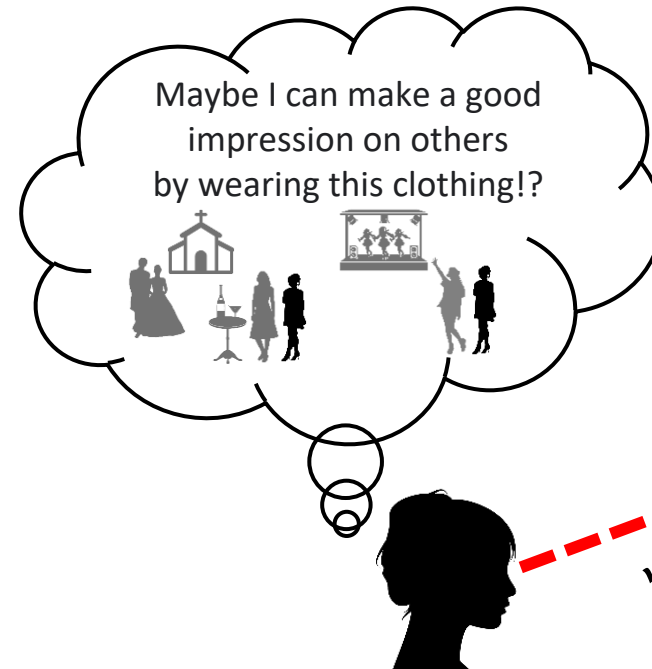
People using SNSs subjectively predict whether they would make a good impression on others in a certain outfit by imagining themselves wearing the portrayed subject's clothing.

We refer to people who use SNSs as observers.

When observers who are using SNSs make a prediction about the impression on others that a certain outfit would produce, **they look directly at the subject's body.**

While imagining wearing the subject's clothing, it is likely that the observer's gaze is drawn to the **subject's body parts**, which could **provide cues about the impression on others.**

- ✓ Imagine wearing a subject's clothing
- ✓ Predict the impression on others



Observer



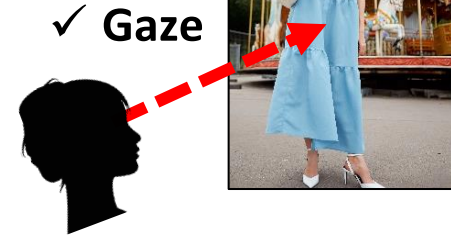
Subjects in SNS images

# Positioning of this study

## Goal:

We investigated the gaze of female observers who were asked to imagine wearing a subject's clothing and to predict the impression on others.

Although the analysis conditions differed from those in our present research, several previous studies investigated the subject body parts that were most frequently gazed at by observers who were asked to predict the degree to which others would find the subject attractive.



## Previous studies:

Gervais et al. examined gaze characteristics for subjects with different body shapes in a whole-body image.

[Sex Roles, 2013]

Cornelissen et al. examined gaze characteristics for naked subjects in a head-occluded image.

[Evolution and Human Behavior, 2009]

## Issue:

Previous studies did not consider the gaze of observers asked to imagine wearing a subject's clothing and to predict the impression on others.

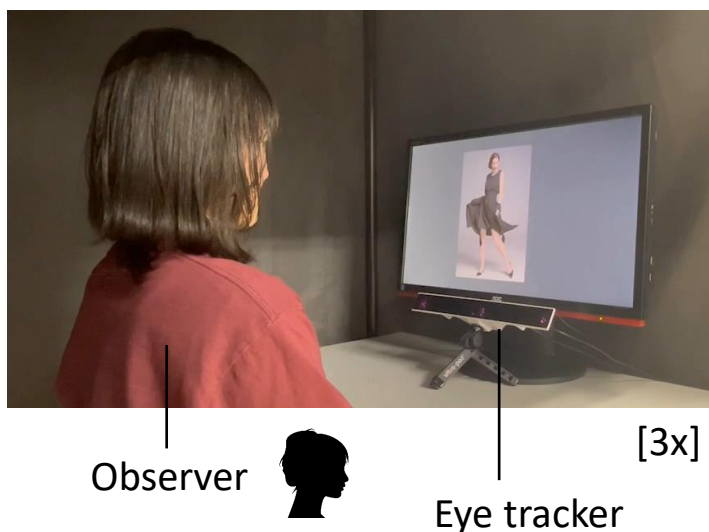
# Purpose

We attempted to determine which body parts in a whole-body image or a head-occluded image were the focus of a female observer who was asked to imagine wearing the portrayed subject's clothing and to predict the impression on others.

Whole-body images



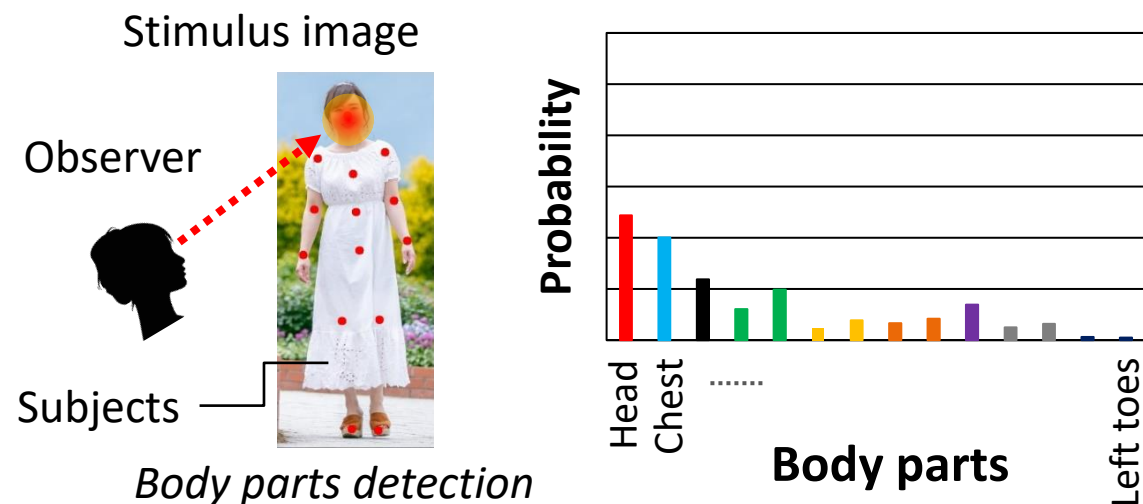
## 1. Gaze measurement



Head-occluded images



## 2. Gaze distribution analysis



# Hypothesis

To investigate the degree to which the observer's gaze was focused on each subject's body part, we asked the female observer to imagine wearing the portrayed subject's clothing and to predict the impression on others.

**H1:** When a female observer imagines wearing a subject's clothing in a *whole-body* image and predicts the impression on others, the observer's gaze will be most focused on the subject's *head*.



**H2:** When a female observer imagines wearing a subject's clothing in a *head-occluded* image and predicts the impression on others, the observer's gaze will be most focused on the subject's *stomach*.





# Experimental condition 1

## Stimulus images:

- The total number of stimulus images per observer was 104, with 52 whole-body images and 52 head-occluded images.
- We used only the subject's standing posture, where her clothes and face were visible.

## Observers:

- We recruited 24 female observers (21.5±1.3 years old, university students, Japanese ethnicity).

## Question:

- We asked a female observer the following question when she viewed the subject in the stimulus image.

**Q:** When you imagine yourself wearing the subject's clothes, do you feel that the people around you will have a good impression of you?

Each observer responded on a 4-point scale (4: yes, 3: likely yes, 2: likely no, 1: no).



Whole-body images



Head-occluded images

The same number of stimulus images for both formal and casual clothing



Above the tip line of a chin

# Experimental condition 2

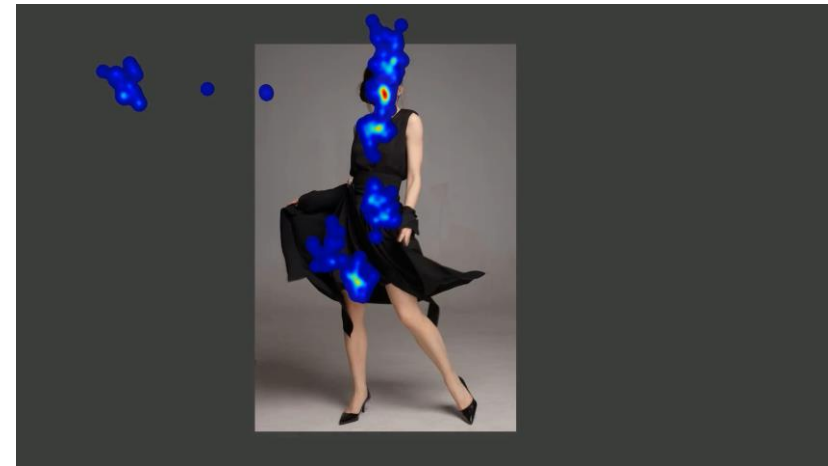
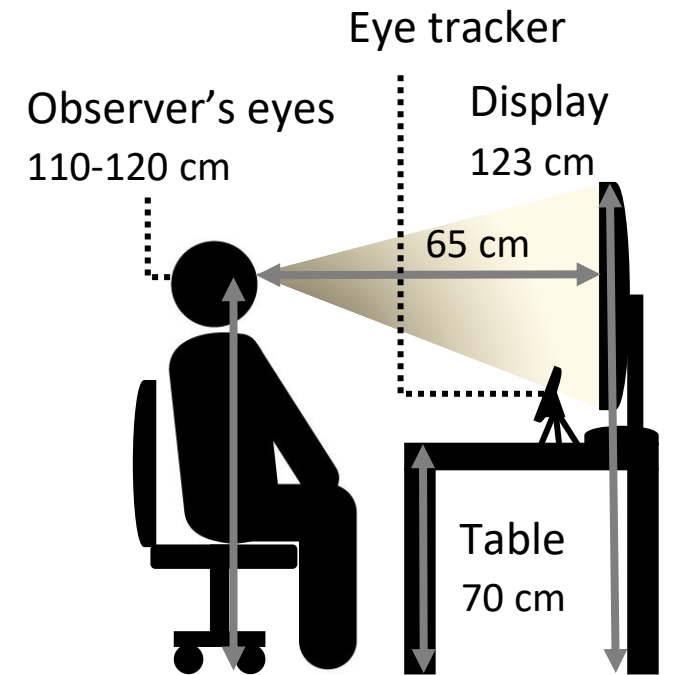
## Setting:

- 24-inch display (1920 x 1080 pixel resolution)
- Stationary eye-tracker (gazepoint GP3 HD, 150 Hz)
- We performed resampling using linear interpolation at 50 Hz to ensure that the time intervals were equally aligned.

## Procedure:

### *Measuring gazes*

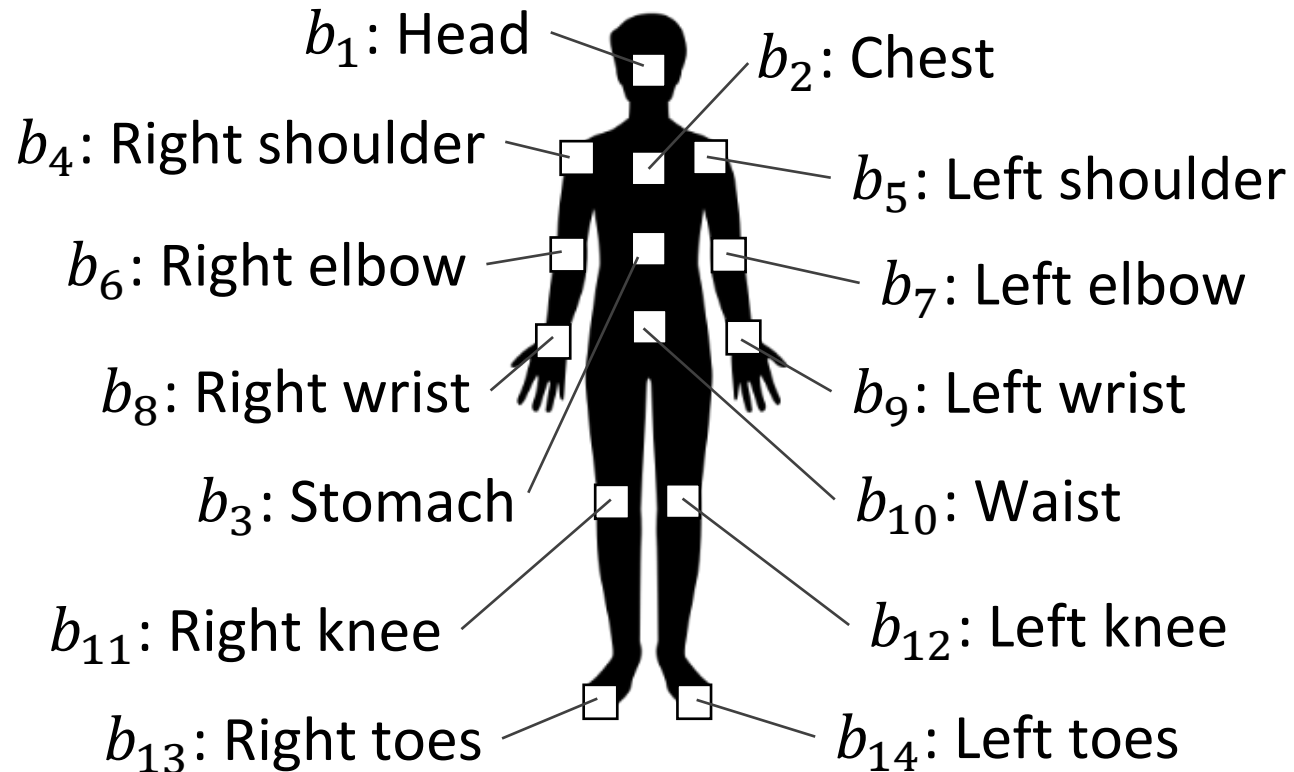
- Start image (2 seconds) → stimulus image (3 seconds) → end image (2 seconds)
- We asked an observer to look at the randomly placed white cross in the start image to avoid center bias.







# Body parts for gaze analysis



- Whole-body image: **14** body parts

$$B_w = \{b_1, b_2, \dots, b_{14}\}$$

- Head-occluded image: **13** body parts

$$B_h = \{b_2, b_3, \dots, b_{14}\}$$

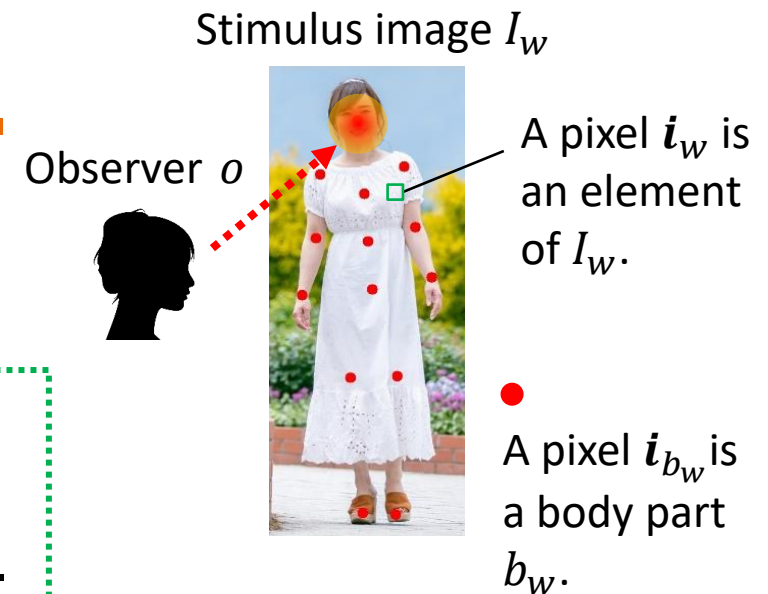
*Excluding the head  $b_1$*



When performing gaze analysis, we detected the body part positions using OpenPose.

# Body-part attention probability

This probability indicates how likely it was that the observer's gaze was focused on each subject body part.



The first term is a normal distribution. The closer the distance from a pixel  $\mathbf{i}_w$  to a pixel  $\mathbf{i}_{b_w}$ , the higher value is recorded.

The second term means the probability that the gaze of an observer is focused at a pixel  $\mathbf{i}_w$ .

$$p(b_w | o, I_w) = \sum_{\mathbf{i}_w \in I_w} \mathcal{N}(\mathbf{i}_w | \mathbf{i}_{b_w}, \Sigma) p(\mathbf{i}_w | o, I_w)$$

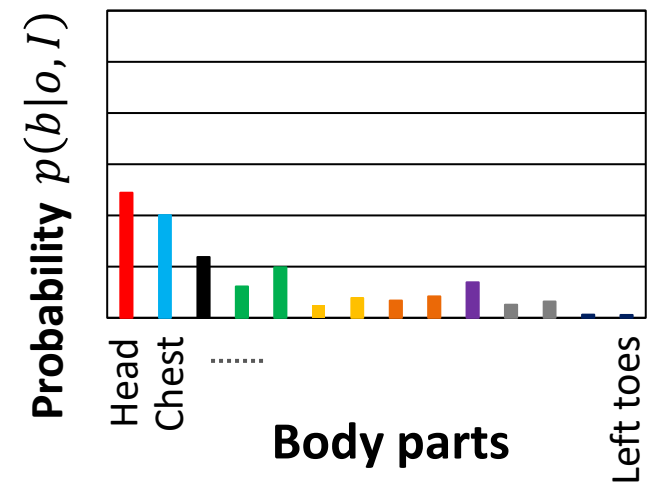
$\Sigma = \text{diag}(\sigma^2, \sigma^2)$

Body-part attention probability

$$\sum_{b_w \in B_w} p(b_w | o, I_w) = 1$$

$B_w = \{b_1, b_2, \dots, b_{14}\}$

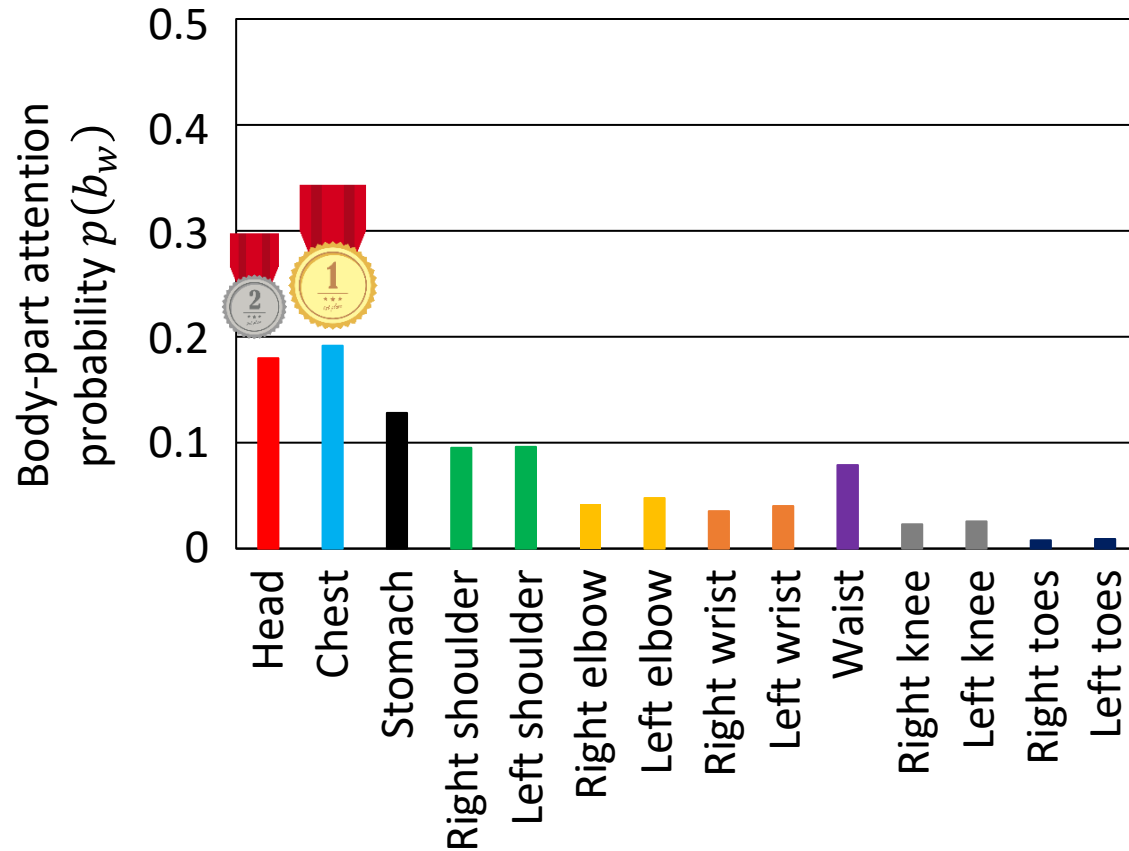
Visualization of the body-part attention probability as a bar graph.



# Subjective assessments on hypothesis H1

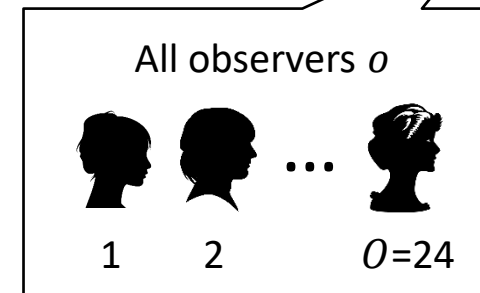


**H1:** The observer's gaze will be most focused on the subject's *head* in a *whole-body* image.



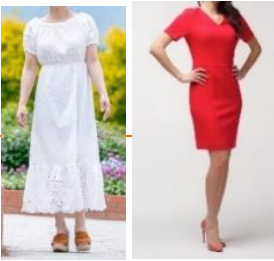
We calculated the marginalized probability  $p(b_w)$  for whole-body images.

$$p(b_w) = \frac{1}{ON} \sum_o \sum_w p(b_w | o, I_w)$$

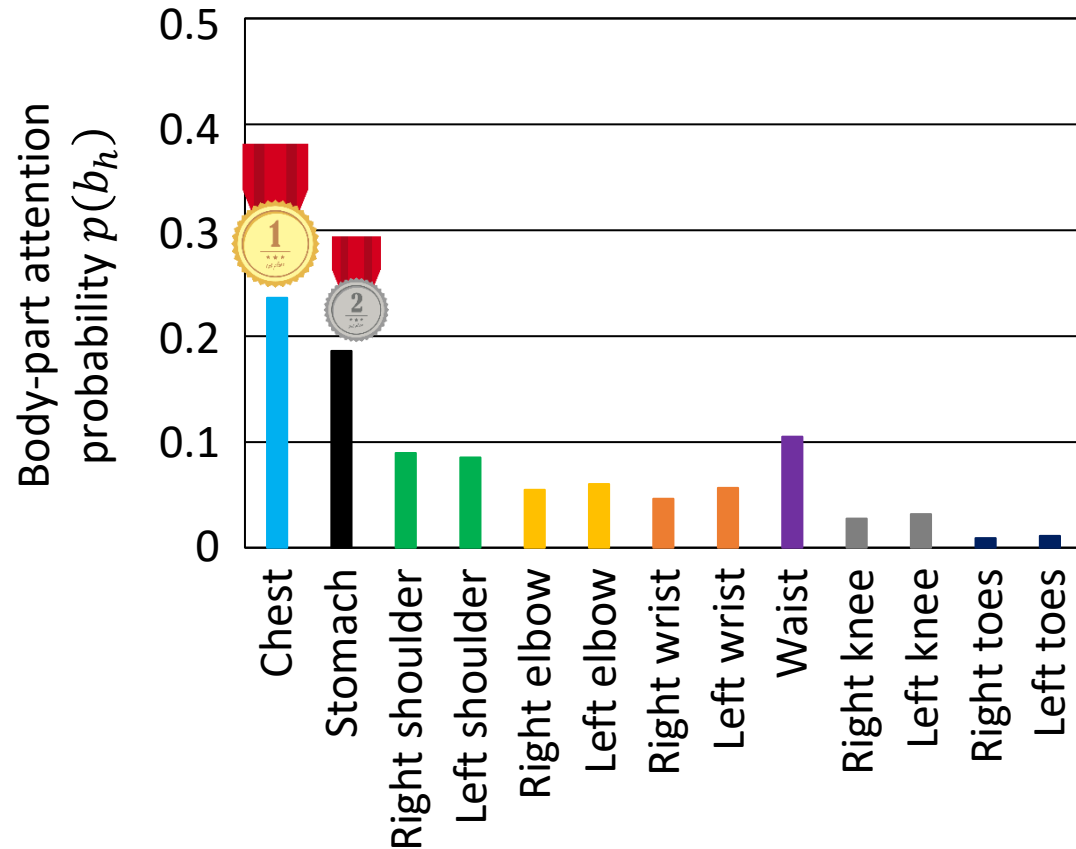


H1 did not hold. Instead, in the case of whole-body images, the female observer's gaze tended to be focused **most on the chest, followed by the head.**

# Subjective assessments on hypothesis H2

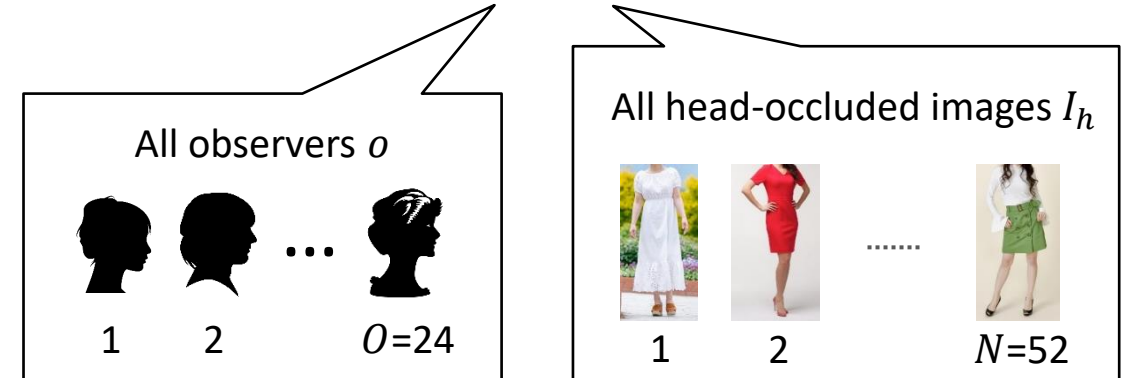


**H2:** The observer's gaze will be most focused on the subject's *stomach* in a *head-occluded* image.



We calculated the marginalized probability  $p(b_h)$  for head-occluded images.

$$p(b_h) = \frac{1}{ON} \sum_o \sum_n p(b_h | o, I_n)$$

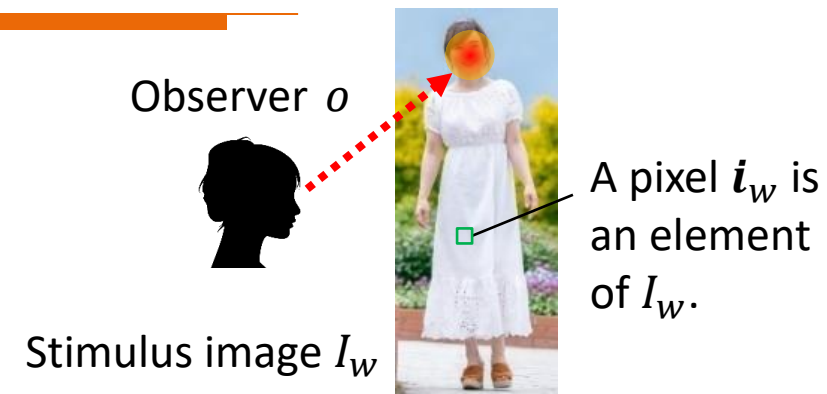


H2 did not hold. Instead, in the case of head-occluded images, the female observer's gaze tended to be focused **most on the chest, followed by the stomach.**

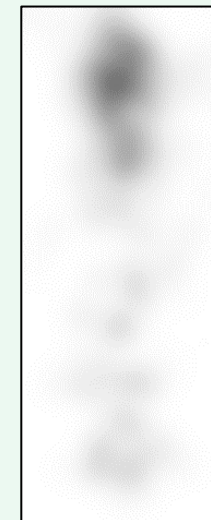
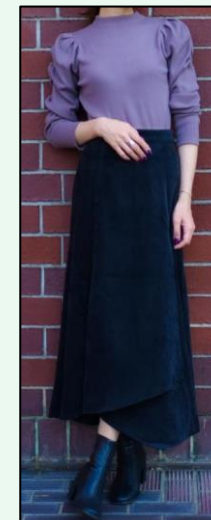
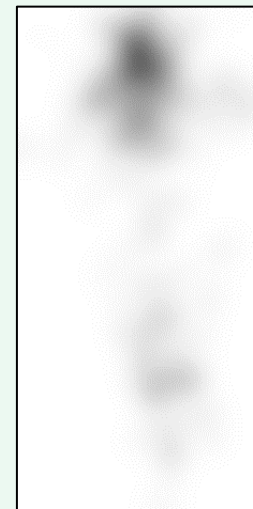
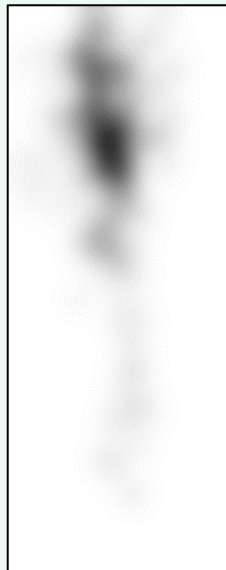
# Gaze distribution for each stimulus image

We visualized how the gaze was focused on body parts for each stimulus image.

We generated heatmaps using the probability  $p(\mathbf{i}_w | o, I_w)$ .



Focused  Not focused



The gaze was focused **most on the subject's chest, followed by the head.**

The gaze was focused **most on the subject's chest, followed by the stomach.**



# Conclusions

We investigated which body parts were the focus of a female observer who was asked to imagine wearing a subject's clothing and to predict the impression on others.

The female observer's gaze would be focused **most on the subject's chest, followed by the head**, in the case of whole-body images.



The female observer's gaze would be focused **most on the subject's chest, followed by the stomach**, in the case of head-occluded images.



## Future work

- We will investigate the observer's gaze distribution by measuring gaze diversity concerning the gender, age, and ethnicity of observers.
- We will expand our analysis to various subjects' postures in stimulus images, such as sitting and side-facing standing postures.