Study on the movement during walking beautifully and the perception of beauty

Yura Honda*, Shogo Takeuchi, Jun Muramatsu, Satoru Kizawa, Masaki Tamura, and Ayuko Saito

Department of Mechanical Science and Engineering, School of Advanced Engineering, Kogakuin University, Tokyo, Japan.
E-mail: s519046@ns.kogakuin.ac.jp

Abstract

This study aimed to show the evaluation criteria of beauty when a person looks at a man who walks beautifully. We examined the relation between the kinematic factors during walking. The psychological factors when a person evaluates beauty were evaluated by using a questionnaire survey.

1. Introduction

"Beautiful walking" that a person walks elegantly while maintaining the correct posture is gaining popularity mainly among women [1]. In addition to the health benefits of exercise, "Beautiful walking" improves mental health by looking beautiful [2]. "Beautiful walking" could be accepted by many people as a form of exercise that supports mental and physical health [3].

The elements that are perceived as beautiful in the beautiful walking are based on personal sensibility. In addition, it is possible that gender differences are related to sensibility. For example, a person feels "fresh" and "neat" rather than "beautiful" as a first impression when looking at a man who walks beautifully. Kinematic features during walking beautifully that transcend gender may exist. This study aimed to show the evaluation criteria of beauty when a person looks at a man who walks beautifully. We examined the relation between the kinematic factors, such as joint angles during walking, and the psychological factors when a person evaluates beauty. Firstly, the 3D motion capture system measured the walking exercise of a participant who was a male professional walking instructor. The two types of gait were measured during the experiment; "Beautiful walking" that a person walks while maintaining his pelvis straight, "Not-beautiful walking" that a person walks while maintaining his pelvis backward. Secondly, the subjective evaluation experiment was conducted. The evaluators watched the video that was taken in the gait measurement. A questionnaire survey on the " Beautiful walking" and "Not-beautiful walking" was conducted.

2.Gait measurement experiment

The experiment was conducted at Kogakuin University, Shinjuku campus. A healthy male (height 1.76m, weight 58kg) participated in the experiment. Study approval was obtained from the Research Ethics Board, Kogakuin University. The participant gave his written informed consent to participate after understanding the purpose and requirements of the study. Kinematic date were collected using an optical motion capture (MAC3D; Motion Analysis). The sampling frequencies of the optical motion capture was 100 Hz. 29 reflective markers were attached to the participant's body by referring to the Helen Hayes Marker Set (Fig. 1). The participant was instructed to walk using a natural stride in time with a metronome 90 bpm (Fig.2). The two types of gait were measured during the experiment; "Beautiful walking" that a person walks while maintaining his pelvis straight, "Not-beautiful walking" that a person walks while maintaining his pelvis backward.

This study focused on the joint angles of the sagittal plane. The results of the head angle, trunk angle, pelvis tilt angle, right shoulder joint angle, right elbow joint angle, right wrist joint angle, right hip joint angle, right knee joint angle, and right ankle joint angle are shown in Fig. 3. The solid red lines represent the results of "Beautiful walking", and the blue solid red lines represent the results of "Not-beautiful walking". The horizontal axis is 100% for one gait cycle that includes one stance phase and one swing phase. The toe-off time of "Beautiful walking" was at about 60%, and the toe-off time of "Not-beautiful walking" was at about 63%.

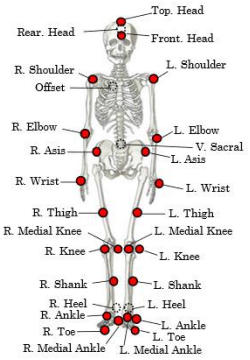


Fig. 1. Marker positions.

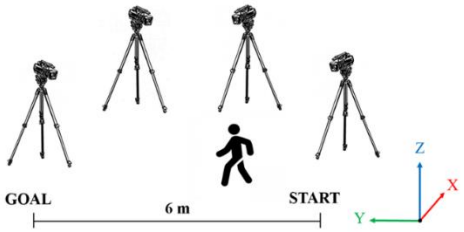
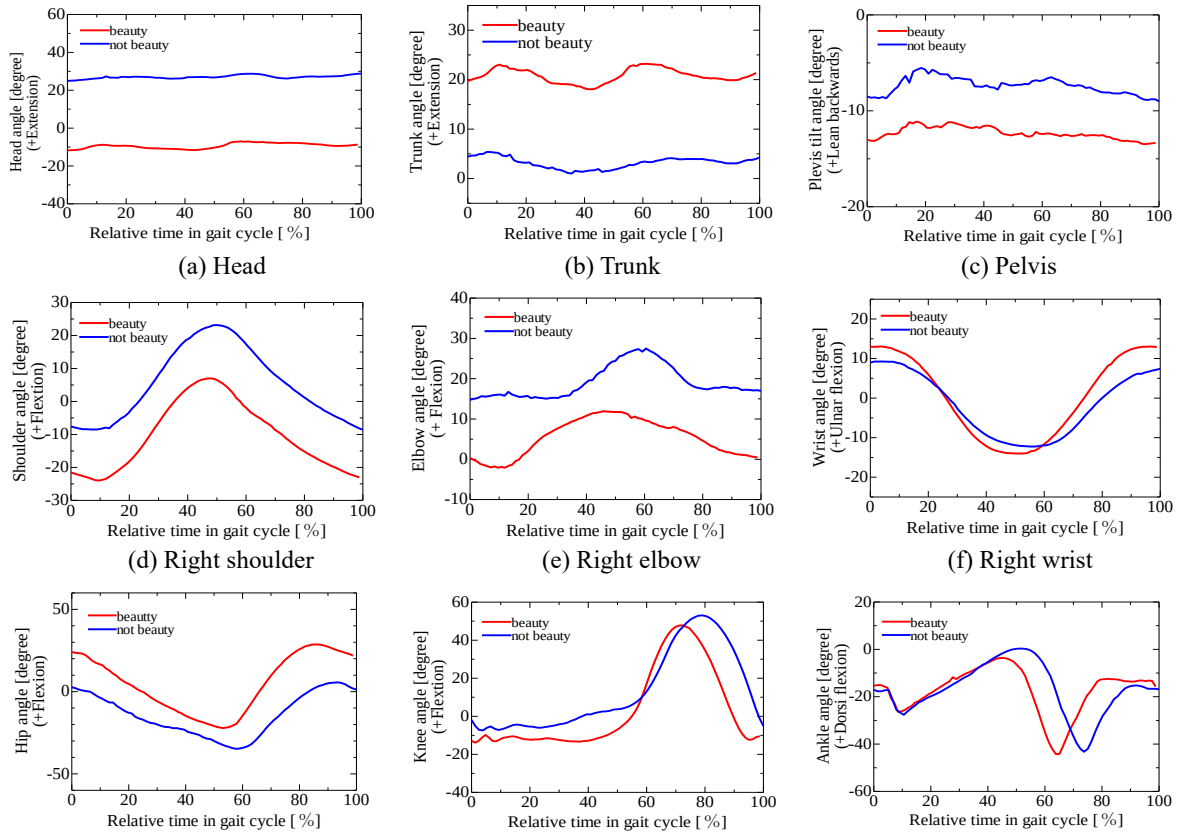


Fig.2.Walking path



(a) Head (b) Trunk (c) Pelvis

(d) Right shoulder (e) Right elbow (f) Right wrist

(g) Right hip (h) Right knee (i) Right ankle

Fig.3 The sagittal joint angles during walking obtained from the 3D motion analysis system

The head angles did not change throughout the gait cycle in both two types of walking. The trunk angles, pelvic tilt angles, right shoulder angles, right wrist angles, and right hip angles of the two types of walking were almost the same. The right elbow angles, right knee angles, and right ankle angles of the two types of gait walking show differences. Therefore, these three joints' motions may influence the subjective evaluation.

3.Subjective evaluation experiment

The subjective evaluation of the two types of walking was conducted referring to the previous study. 10 evaluation words were selected for the evaluation of walking. We asked 34 evaluators including men and women to watch the video which was taken in the gait measurement. A questionnaire survey on the video using the selected evaluation words was conducted. The evaluators answered 1 to 5 for each evaluation word (1: Very XXX 2: Slightly XXX 3: Neither 4: Slightly ○○○ 5: Very○○○). Fig.1 shows the evaluation sheet used in the experiment.

4.Result

Table 2 shows the questionnaire results. The results show the mean values and standard deviations of each word. The mean of all words for "Beautiful walking" was 2.97. We determined that 3.05 or higher was a high evaluation and less than 2.70 was a low evaluation. "Beautiful walking" results which were 3.05 or higher were "beautiful," "elegant," "unusual," and "healthy. The mean of all words for "Not-beautiful walking" was 1.73. We determined that less than 1.40 was a low evaluation. "Not-beautiful walking" results which were less than 1.40 were "beautiful," "elegant," "attractive," and "healthy. The results indicate that the three words, "beautiful," "elegant," and "healthy",

Table 1 Table1 Evaluation word pairs.

Like	⇔	Dislike
Beauty	⇔	Not beauty
Elegant	⇔	In elegant
Stability	⇔	Instability
Soft	⇔	Hard
Calm	⇔	Restless
Rare	⇔	Commonplace
Pleasant	⇔	Unpleasant
Attractive	⇔	Unattractive
Health	⇔	Unhealthy

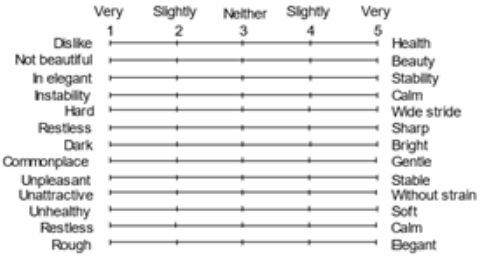


Fig.4 Evaluation sheet

Table2 Average points and standard deviations of questionnaire results

Evaluation word	Beauty	Not beauty
Like	2.76(1.21)	1.49(0.92)
Beauty	3.07(1.24)	1.30(0.70)
Elegant	3.05(1.25)	1.16(0.43)
Stability	3.02(1.34)	1.56(0.79)
Soft	2.60(1.05)	2.44(1.39)
Calm	2.71(0.92)	1.84(0.99)
Rare	3.64(0.97)	3.49(1.13)
Pleasant	2.86(1.15)	1.72(0.87)
Attractive	2.60(1.35)	1.19(0.44)
Health	3.38(1.19)	1.09(0.36)

showed a particularly large difference in the evaluation of the two types of walking. We concluded that these three keywords were particularly strongly related to the evaluation of the two types of walking.

References:

[1] S. Saito, N. Ushifusa, H. Sakai, M. Kondo, Y. Kobayashi, "Kinematic characteristics of aesthetic gait patterns", Journal of the Society of Biomechanisms. 25, 195-209, (2020).

[2] Y. Nakatani, I. Sato-Suzuki, N. Tsujino, A. Nakasato, Y. Seki, M. Fumoto, H. Arita, "Augmented brain 5-HT crosses the blood-brain barrier through the 5-HT transporter in rat", Eur J Neurosci, 27(9), 2466-2472, (2008).

[3] Y. Ryu, T. Maekawa, D. Yoshino, N. Sakitani, A. Takashima, T. Inou, J. Suzurikawa, J. Toyohara, T. Tago, M. Makuuchi, N. Fujita, K. Sawada, S. Murase, M. Watanave, H. Hirai, T. Sakai, Y. Yoshikawa, T. Ogata, M. Shinohara, M. Nagao, Y. Sawada, "Mechanical Regulation Underlies Effects of Exercise on Serotonin-Induced Signaling in the Prefrontal Cortex Neurons", iScience, 23(2), https://dx.doi.org/10.1016/j.isci.2020.100874, (2020).

[4] S. Takeuchi, J. Muramatsu, M. Tamura, and A. Saito, "Experiment on selecting evaluation words for sensory evaluation of beautiful walking", 19th International Symposium on Advanced Technology, (2021).