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A Basic Study of the Physiological and Psychological Effects of Museum Bathing (6):

Case Studies of Walking, Seeing/Touching, and Viewing

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Abstract: This paper is in continuation of the author's proposed basic study of the physiological and psychological effects of "museum bathing." Previous experiments in this series examined diverse populations (junior high, senior high, and university students; museum curators and staff; and elderly persons) and modes of museum bathing (seeing, touching, and walking), and as of February 2024 have yielded physiological and psychological data for a total of 902 subjects across 65 collaborating research settings located throughout Japan, consistently demonstrating the relaxing effect of museum bathing across all studied populations and modes. The present study aimed to expand upon that foundation with experiments representing additional populations (elderly persons, university students, and high school students) across three distinct modes of engagement (a walking course at an archaeological park, an opportunity to see and handle the collection at an anthropological museum, and an opportunity to view a program screened at a planetarium). Physiological and psychological data obtained from these experiments provided further evidence for the relaxing effect of museum bathing, while also suggesting potential differences in physiological and psychological impact depending on how the subjects engage in museum bathing: alone versus in groups or in silence versus while conversing. These results may prove useful in advocating the establishment of multi-modal museum bathing programs as a means to bolster mental health in local communities.

Keywords: museum bathing, mental health, physiological measurement, psychological measurement, walking, seeing-and-touching, viewing

1. Introduction

In their 2019 study, Fancourt et al. at the University of London in the United Kingdom reported that individuals who engage with receptive arts activities on a frequent basis have a lower risk of dying than those who engage on an infrequent basis.[12]

Based in part on these findings, the United Kingdom's National Health Service, with collaboration from the University of London and other institutions, has begun implementing arts-and-humanities-based mental health programs in local communities. Similar programs can be found within the framework of other national healthcare systems, such as those of Canada and Belgium, wherein healthcare professionals (namely medical doctors) may, through the assistance of locally-based link workers, prescribe patient-appropriate educational programs offered by nearby museums or other cultural venues to supplement or even supplant more traditional pharmaceutical treatments.

[12] Daisy Fancourt and Andrew Steptoe. (2019). The art of life and death: 14 year follow-up analyses of associations between arts engagement and mortality in the English Longitudinal Study of Ageing. *BMJ2019.*

At present, Japan is grappling with the realities of its super-aging, high-mortality society, bracing for fast-approaching milestones such as the "2025 Problem," at which point all members of the country's *dankai* (baby boomer) population will be 75 or older, and the "2042 Problem," upon which all members of its *dankai junior* (second-generation baby boomer) population will be classified as elderly (age 65 or older). This demographic shift highlights serious issues faced by the country, including an enormous expected increase in social welfare expenditures compounded by a shrinking labor force.

Meanwhile, societal stress is a grave issue in the country, with an estimated 300,000 children refusing to attend school (according to a 2022 study conducted by the Ministry of Education, Culture, Sports, Science and Technology) and 650,000 young people living as *hikikomori*, or shut-ins unwilling or unable to engage with the outside world (as reported in March 2023 by the Cabinet Office). In a 2022 study conducted by the Ministry of Health, Labour and Welfare, a staggering 82.5% of Japan's labor force reported experiencing "intense anxiety, aggravation, and distress." It can be said that we are in a society where the young and working generations find it increasingly difficult to live actively.

How should the cultural and artistic activities, including museums, these social issues?

One answer might be "museum bathing," or the practice of visiting museums or other cultural venues to harness their mentally soothing properties, thereby promoting better health and natural resistance to stress and disease. The author's ongoing study of the physiological and psychological effects of museum bathing seeks to establish a body of evidence for how this activity can help combat our grave social issues.

The present study builds off previous papers in this series, namely Research Note① Verification of the Relaxation Effect of "Museum Bathing": Toward a New Role for Museums in a Super-aging Society[2]; Research Note②Prospects for Furthering the Study of Museum Bathing: A Review of the International Research Literature Based on a Scoping Review by Law et al. [3]; Research Note③A Basic Study of the Physiological and Psychological Effects of Museum Bathing (1): A Case Study of Junior and Senior High School Students[4]; Research Note④A Basic Study of the Physiological and Psychological Effects of Museum Bathing (2): A Case Study of Curators and Museum Workers[5]; Research Note⑤A Basic Study of the Physiological and Psychological Effects of Museum Bathing (3): A Case Study of University Students "Learning" and "Not Learning" Museology[6]; Research Note⑥A Basic Study of the Physiological and Psychological Effects of Museum Bathing (4): Case Studies of "Appreciation," "Hands-on Experience," and "Town

[2] Izumi Ogata. (2021). *Kyushu Sangyo University Journal of Collaborative Regional Development*, *6*, 55-72. Retrieved from http://repository.kyusan-u.ac.jp/dspace/bitstream/11178/8117/1/chiiki%20vol.6_04.pdf
[3] Izumi Ogata. (2022). *Kyushu Sangyo University Journal of Collaborative Regional Development*, *7*, 35-52. Retrieved from http://54.64.211.208/dspace/bitstream/11178/8122/1/chiiki%20vol.7_03.pdf
[4] Izumi Ogata. (2022). *Kyushu Sangyo University Journal of Collaborative Regional Development*, *8*, 17-49. Retrieved from http://repository.kyusan-u.ac.jp/dspace/bitstream/11178/8220/1/chiiki%20vol.8_02.pdf
[5] Izumi Ogata. (2022). *Kyushu Sangyo University Journal of Collaborative Regional Development*, *9*, 27-47. Retrieved from http://repository.kyusan-u.ac.jp/dspace/bitstream/11178/8263/1/chiiki%20vol.9_03.pdf
[6] Izumi Ogata. (2022). *Kyushu Sangyo University Journal of Collaborative Regional Development*, *9*, 48-76. Retrieved from http://repository.kyusan-u.ac.jp/dspace/bitstream/11178/8264/1/chiiki%20vol.9_04.pdf

Walking"[7]; Research Note⑦A Basic Study of the Physiological and Psychological Effects of Museum Bathing (5): Case Studies of Various Fields of Appreciation, Archaeology, Arts, Natural History, etc.[8]

The series as a whole serves as a foundation from which to explore ongoing questions regarding the new value and social responsibility of museums, which have been tasked with expanding upon their traditional role as places of intellectual stimulation, learning, and enjoyment to further serve as centers of community health and well-being.

In attempt to facilitate easier data sharing with other ongoing museum bathing research conducted in countries such as the UK, Italy, Switzerland, and the US, and to offer a standard framework of experimental procedures and research methodologies based on physiological and psychological markers, the author's investigations have thus far centered on the following six questions as proposed by Law et al.[9] at the University of Auckland in New Zealand:

(1) What populations and settings were studied?
(2) What research methodologies were used?
(3) What stress outcomes were measured?
(4) What type and content of artworks were viewed?
(5) What was the duration of the artwork viewing and how many artworks were viewed?
(6) Did the studies show changes in the stress outcomes?

However, of the questions listed above, previous studies in the series have not managed to fully address items one ("What populations and settings were studied?") and six ("Did the studies show changes in the stress outcomes?"). Further research was therefore necessary to explore the physiological and psychological impact of museum bathing across varied populations, settings, and modes.

To that end, the present study aims to evaluate the relaxing effect of museum bathing in three distinct settings, each employing a unique mode of engagement: a walking-mode experiment conducted at an archaeological park, a seeing-and-touching-mode experiment conducted at an anthropological museum, and a viewing-mode experiment conducted at a planetarium.

Approval for this research was obtained from the Kyushu Sangyo University Ethics Committee (Notice No. 2020-004). Prior to participation, subjects were thoroughly briefed on the nature of the experiment and assured that all collected data would be anonymized, any personally identifying information would remain confidential, and that the study would adhere to secure data-handling practices. Subjects were informed that participation in the study was entirely voluntary, and that they could elect to discontinue at any time without repercussion. Finally, all participating

[7] Izumi Ogata. (2023). *Kyushu Sangyo University Journal of Collaborative Regional Development*, *10*, 101-134. Retrieved from http://repository.kyusan-u.ac.jp/dspace/bitstream/11178/8347/3/chiiki%20vol.10_07.pdf
[8] Izumi Ogata. (2023). *Kyushu Sangyo University Journal of Collaborative Regional Development*, *11*, 57-88. Retrieved from http://repository.kyusan-u.ac.jp/dspace/bitstream/11178/8392/1/chiiki%20vol.11_04.pdf
[9] Mikaela Law, Nikita Karulkar, and Elizabeth Broadbent. (2021). Evidence for the effects of viewing visual artworks on stress outcomes: A scoping review. *BMJ Open*.

subjects consented to the use and publication of all physiological and psychological data obtained from the present experiments in any ongoing or future research activities.

2. Methodology and Content of Museum Bathing Experiments Based on Modes of Walking, Seeing and Touching, and Viewing

2.1 Walking-mode museum bathing experiment at Iseking Munakata (Taguma-Ishihatake Archaeological Site and Park, Munakata City, Fukuoka Prefecture, Japan)

(1) **Setting:** The Taguma-Ishihatake Archaeological Site and Park [10] (Address: 2-2-13 Taguma, Munakata City, Fukuoka Prefecture). It is located east of central Fukuoka City, roughly 16 minutes' walk from Tōgō Station on the JR Kagoshima Line. The park was opened to preserve the National Historic Site Taguma-Ishihatake and has been open to the public since 2015. It is affectionately referred to by the local nickname "Iseking Munakata."

* Taguma-Ishihatake site has been a nationally-designated historic site since February 22, 2010, identified as the location of a settlement dating to the Yayoi and Kofun periods of Japanese history. The site consists of a slightly-raised lot sitting at roughly 12 meters above sea level and borders the middle stretch of the Tsurikawa River in west-central Munakata City.

(2) **Date:** Thursday, October 12, 2023, a normal operating day for the park. Weather conditions were sunny, with an ambient temperature of 21.7°C at 11:00 am, relative humidity of 41%, and wind speed of 4.8 m/s, as reported by the Japan Meteorological Agency.

(3) **Subjects:** Sixteen adults (10 male, 6 female; at time of study, 3 were aged 80–89, 10 were aged 70–79, and 3 were aged 60–69).

(4) **Pre- and post-session assembly point, measurement venue:** Pavilion located within the archaeological park.

(5) **Method of implementation:** Two courses were prepared: One along the outer strolling loop at Taguma-Ishihatake Archaeological Site and Park (hereafter "the archaeological park"), and a control course following a sidewalk on the shoulder of a major road (a portion of former national highway) in Munakata City (Fig. 1). Subjects were divided into two groups. Each group completed two walking sessions, and each walking session was followed by a measurement session. Group A first completed the archaeological park course, and then proceeded to the roadside course. Group B completed the roadside course and then the archaeological park course. Subjects were asked to match their pace to a guide person that would lead the group along the relevant course. They were also instructed to spend the first session walking in silence and the second session conversing among themselves as they walked. A complement of 14 university students was present to ensure participant safety during the experiment.

[10] *Iseking Munakata website,* Retrieved from http://isk-m.net

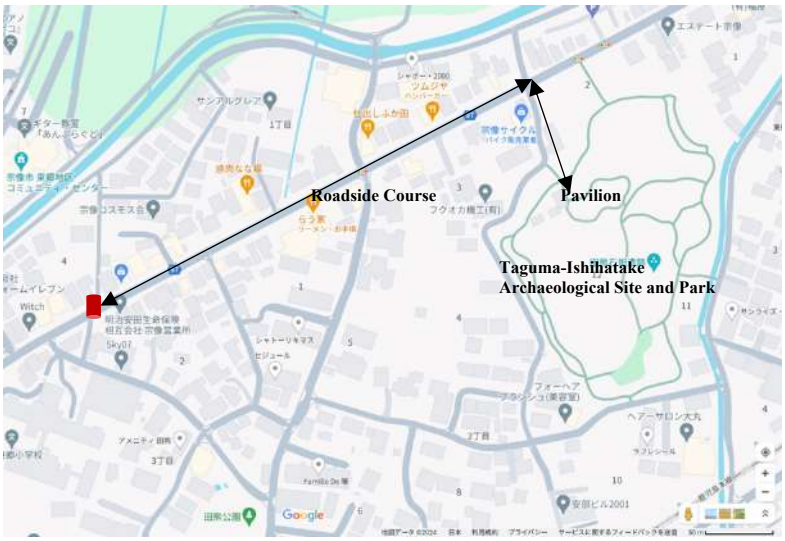

Fig. 1 Courses for walking-mode museum bathing experiment
(Archaeological park course: one lap around the park's outer strolling loop; roadside course: roundtrip from pavilion to the parking lot of a local business)


Physiological measurement (blood pressure, pulse)


Psychological measurement (POMS)


Walking along the roadside course


Walking along the archaeological park course

Fig. 2 Walking-mode museum bathing experiment at Taguma-Ishihatake Archaeological Site and Park, Munakata City (October 12, 2023)

(6) **Program for the day:** (Fig. 2)

09:45 Registration (at pavilion located within archaeological park)

10:00 Opening ceremony, explanation of museum bathing experiment, consent for measurement
(at pavilion)

10:05 Measurement 1 (physiological: blood pressure, pulse; psychological: POMS (short form))

Health questionnaire administered by Munakata City (at pavilion)

10:30 Warm-up exercises, hydration

11:00 Walking session (15 minutes)
Group A: archaeological park course, one loop
Group B: roadside course, to parking lot of local business (Akasaka School Uniforms) and back

11:15 Relocate to pavilion (both groups)

11:20 Measurement 2 (physiological: blood pressure, pulse; psychological: POMS (short form))
(at pavilion)

11:40 Break

11:45 Walking session (15 minutes)
Group A: roadside course, to parking lot of local business (Akasaka School Uniforms) and back
Group B: archaeological park course, one loop

12:05 Measurement 3 (physiological: blood pressure, pulse; psychological: POMS (short form))
(at pavilion)

12:20 Relocate to pavilion (both groups)

12:25 Oral survey with subjects

12:45 Brief review (over lunch, at pavilion)

13:45 Closing ceremony, experiment ends, cleanup

(7) **Duration of walking experience:** On both the archaeological park course and the roadside course, subjects maintained a pace of 40 meters per minute for a total of 15 minutes (roughly 1000 steps or 700 meters total distance), which may be interpreted as a particularly leisurely pace when compared to a more typical walking speed of 67 meters per minute.

(8) **Instructions for walking experience:** For the first walking session, subjects were instructed to walk without speaking while matching the pace of the guide person leading their group. For the second session, subjects were instructed to engage in conversation with other nearby subjects while matching the guide person's pace.

(9) **Measurement methods:** Subjects self-reported physiological (blood pressure, pulse) and psychological (POMS (short form)) data.

- Physiological measurement: Each subject was issued an OMRON HEM-6121 Wrist Blood Pressure Monitor to measure blood pressure and pulse. For each measurement session (baseline and again after each walking session), subjects took two readings and recorded the individual values as well as the mean.
- Psychological measurement: Each subject completed a POMS sheet (short form, as printed by the publishing company Kaneko Shobo) at baseline and again after each walking session.

(10) **Measurement results:** Group A (archaeological park course in silence followed by roadside course while conversing) exhibited a decrease in systolic blood pressure (max), diastolic blood pressure (min), and pulse between first (baseline) and second measurement. Between second and third measurement, values for all three parameters increased. Meanwhile, Group B (roadside course in silence followed by archaeological park course while conversing) exhibited a similar pattern, with decreases in all three parameters between baseline and second measurement, but an increase between second and third measurement.

On the POMS, Group A demonstrated a decrease for all negative emotions (Anger–Hostility, Confusion–Bewilderment, Depression–Dejection, Fatigue–Inertia, and Tension–Anxiety) between baseline and second measurement. From second to third measurement, values for Anger–Hostility and Confusion–Bewilderment continued to fall, whereas Depression–Dejection and Tension–Anxiety increased, and Fatigue–Inertia remained unchanged. Values for the positive emotion Vigor–Activity rose continuously across all three measurements.

Meanwhile, Group B showed a decrease for all negative emotions between baseline and second measurement, and again between second and third measurement. Values for the positive emotion Vigor–Activity rose across all three measurements.

(11) **Comparison of and reflection on physiological and psychological data across groups and measurements**

Comparison for the physiological markers of systolic blood pressure (max), diastolic blood pressure (min), and pulse (Table 1) revealed the following trends.

From first to second measurement, representing changes in subjects after the 15 minutes spent walking in silence, systolic fell by 8.28 mmHg in Group A (archaeological park course). In Group B (roadside course), the same parameter fell slightly, by 1.07 mmHg. From second to third measurement, representing changes in subjects after the 15 minutes spent walking while conversing, systolic in Group A (roadside course) rose slightly, by 0.28 mmHg. In Group B (archaeological park course), it rose by 1.21 mmHg. Similar patterns were observed over these periods for diastolic and pulse. These observations appear to align with comments made by the subjects during review, such as “I found it invigorating to speak with university students while walking.” and “My heart rate increased even more when I was talking while walking.”

Group A_Session 1: Park Session 2: Roadside

Systolic Blood Pressure (Max)		
Measurement 1	Measurement 2	Measurement 3
133.72	125.44	125.72

Diastolic Blood Pressure (Min)		
Measurement 1	Measurement 2	Measurement 3
75.83	72.06	73.17

Pulse		
Measurement 1	Measurement 2	Measurement 3
76.56	76.31	79.44

Group B_Session 1: Roadside Session 2: Park

Systolic Blood Pressure (Max)		
Measurement 1	Measurement 2	Measurement 3
134.86	133.79	135.00

Diastolic Blood Pressure (Min)		
Measurement 1	Measurement 2	Measurement 3
77.86	73.07	77.57

Pulse		
Measurement 1	Measurement 2	Measurement 3
77.85	72.26	75.93

Table 1 Comparison of physiological values from walking-mode museum bathing experiment at Taguma-Ishihatake Archaeological Site and Park, Munakata City

Analysis revealed statistical significance ($p < 0.05$) for change in systolic blood pressure between first and second measurement in Group A, and for change in pulse between second and third measurement in Group A. No statistical significance was found for any measurements in Group B.

Assessment of psychological markers (Tables 2 and 3) revealed a decrease in values for all negative emotions (Anger–Hostility, Confusion–Bewilderment, Depression–Dejection, Fatigue–Inertia, and Tension–Anxiety) after the 15 minutes spent walking in silence (baseline to second measurement) in both Group A (archaeological park course) and Group B (roadside course). Specific changes were as follows: Anger–Hostility (A: −1.56 points, B: −1.43 points), Confusion–Bewilderment (A: −1.00 points, B: −1.71 points), Depression–Dejection (A: −0.89 points, B: −0.14 points), Fatigue–Inertia (A: −0.33 points, B: −1.00 points), and Tension–Anxiety (A: −1.34 points, B: −3.57 points). Significant difference ($p < 0.05$) was found for Depression–Dejection and Tension–Anxiety in Group A, as well as for all negative emotions in Group B.

From second to third measurement, representing changes in subjects after the 15 minutes spent walking while conversing, values for all negative emotions fell in Group B (archaeological park course). Specific changes were as follows: Anger–Hostility (−0.14 points), Confusion–Bewilderment (−0.72 points), Depression–Dejection (−0.57 points), Fatigue–Inertia (−1.29 points), and Tension–Anxiety (−0.57 points). No significant difference ($p < 0.05$) was found.

Meanwhile, in Group A (roadside course), values fell for Anger–Hostility (−1.33 points) and Confusion–Bewilderment (−0.56 points) during this same period. No change was observed for Fatigue–Inertia, and values increased for Depression–Dejection (+0.56 points) and Tension–Anxiety (+0.23 points). Comments made by subjects during review, such as “It was stressful having to keep an eye out for cars and bicycles, as well as for curbs and other unevenness along the sidewalk.” and “The pace felt too slow, which

bothered me." appear to support these observations. No significant difference ($p < 0.05$) was found for any of these changes.

Comparison of the two groups' experiences suggests that both of the walking sessions were fun and relaxing, whether along the archaeological park course or the roadside course. However, the final increases observed in Group A (roadside course) for Depression–Dejection and Tension–Anxiety (Fig. 3) may imply that of the two courses, the archaeological park provided a greater degree of enjoyment and relaxation.

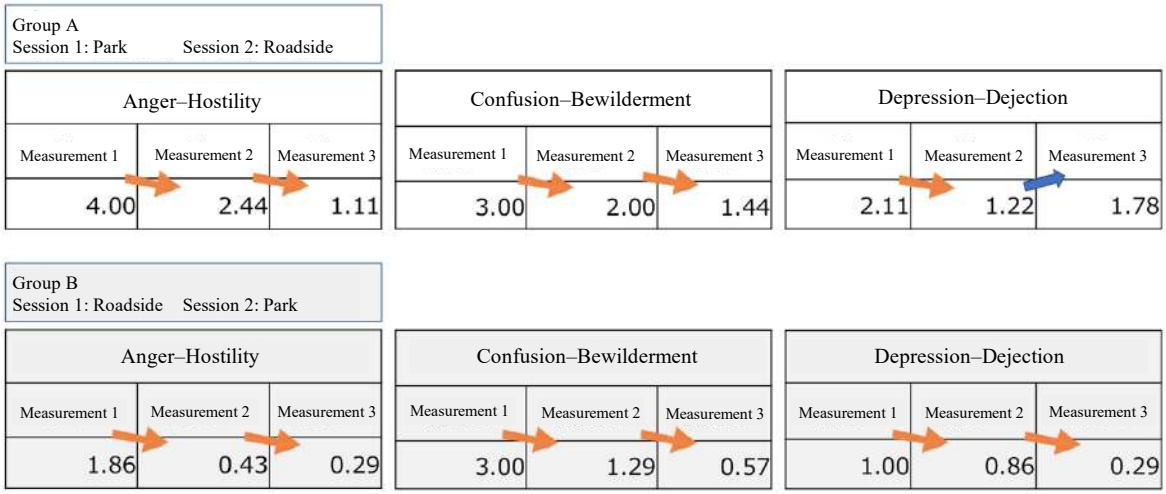

Table 2 Comparison of psychological values from walking-mode museum bathing experiment at Taguma-Ishihatake Archaeological Site and Park, Munakata City (Part 1)

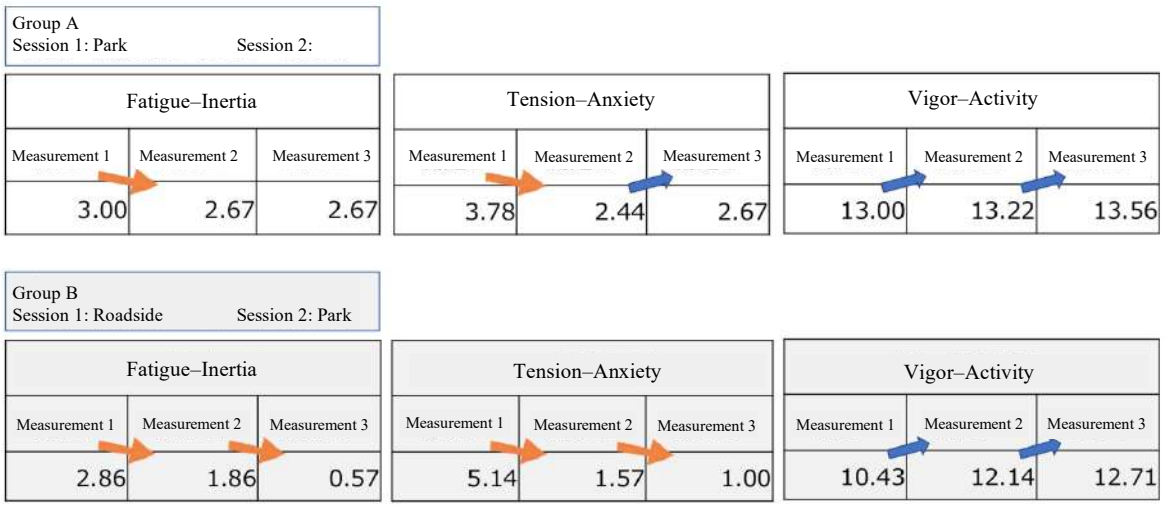

Table 3 Comparison of psychological values from walking-mode museum bathing experiment at Taguma-Ishihatake Archaeological Site and Park, Munakata City (Part 2)

Finally, when looking at Vigor–Activity, the sole positive emotion measured by the POMS, values rose in both groups continually across all three measurements (Table 3). From baseline to second measurement, values in Group A increased by 0.22 points, and from second to third measurement, values increased by 0.34 points. In Group B, values rose by

1.71 points between baseline and second measurement, and by 0.57 points between second and third measurement. Comments from subjects in support of this trend include “By moving at a slow pace along the highway, I had a chance to discover shops I’d never noticed before, and to become more aware of the potential dangers of roadside walking.” and “Thanks to the conversation, this session seemed to go by in an instant.” These results suggest that walking slowly and walking while talking may stimulate a sympathetic nervous response sufficient to heighten subjects’ focus and have them feeling engaged enough to lose their sense of time.

No significant difference ($p < 0.05$) was found for changes in positive emotion.

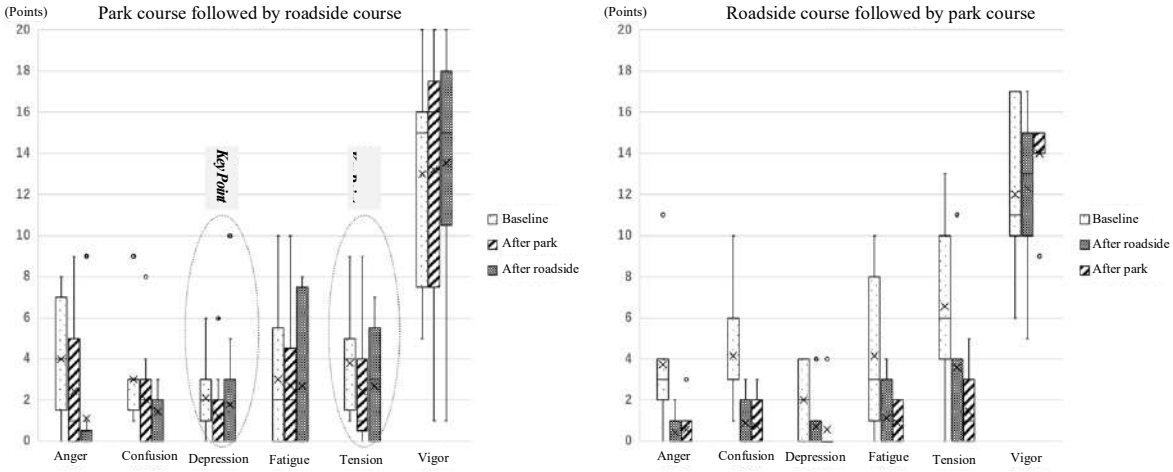

Fig. 3 Comparison of Depression and Tension values from experiment at Taguma-Ishihatake Archaeological Site and Park

(12) **Relaxing effect in terms of Total Mood Disturbance**

Analysis of Total Mood Disturbance (TMD) for the walking-mode museum bathing experiment at Taguma-Ishihatake Archaeological Site and Park (Fig. 4) revealed a continuous overall decrease in negative emotions for both Group A (archaeological park course followed by roadside course) and Group B (roadside course followed by archaeological park course). Specifically, for Group A, TMD fell by 5.66 points between baseline and second measurement, and by 1.44 points between second and third measurement. For Group B, TMD fell by 14.28 points between baseline and second measurement, and by 4.14 points between second and third measurement. This suggests that even the brief 15-minute walks utilized in this experiment were sufficient to reduce subjects’ psychological stress. All changes in TMD, with the exception of the decrease in Group A between measurements two and three, were found to be statistically significant ($p < 0.05$).

* (TMD is a comprehensive measure of an individual’s negative emotional state, devised to serve as a global indicator of emotional disturbance, psychological distress, and

subjective well-being. It is calculated from the individual scores of its six component factors, with lower TMD scores indicating better mood and emotional state.)

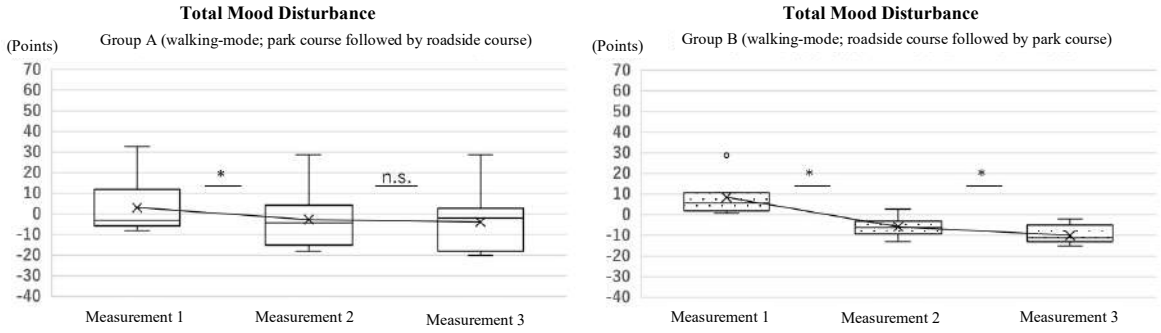

Fig. 4 TMD for walking-mode museum bathing experiment

(13) **Study limitations:** The walking pace for both the archaeological and roadside courses, as set by the guide person, was 40 meters per minute. Each course was completed in a total of 15 minutes, roughly equating to 1000 steps or 700 meters. Some subjects commented that it was frustrating not being able to walk at their own usual pace. Future studies should examine the impact of different walking speeds (such as a more typical walking pace of 67 meters per minute, a strolling pace of 75 to 85 meters per minute, and a hurried pace of 94 meters per minute) or of allowing subjects to complete the courses at their own preferred pace.

2.2. Seeing-and-touching-mode museum bathing experiment at Nanzan University Museum of Anthropology (Aichi Prefecture, Japan)

(1) **Setting:** The Nanzan University Museum of Anthropology.[11] (Address: 18 Yamazato-cho, Showa Ward, Nagoya City, Aichi Prefecture.) Originally established in 1949 as part of the university's Institute of Anthropology and Ethnology (known presently as the Anthropological Institute), the museum has relocated throughout the university campus several times over its history. Its most recent renovation and reopening in October 2013 brought it to floor B1 of campus Building R, approximately 8 minutes' walk from Exit 1 of Yagoto Nisseki Station on the Meijo Subway Line.

(2) **Date:** Thursday, January 11, 2024, a normal operating day for the museum.

(3) **Subjects:** Nineteen Nanzan University students that were enrolled in a practical museology course, separated into two groups: a seeing-mode museum bathing group (6 male, 3 female), and a seeing-and-touching mode museum bathing group (1 male, 9 female).

(4) **Pre- and post-session assembly point, measurement venue:** Training room located within the Nanzan University Museum of Anthropology. As this room is not divided from the

[11] *Nanzan University Museum of Anthropology website*. Retrieved from https://rci.nanzan-u.ac.jp/museum/

museum's exhibition space by any wall or doors, an opaque curtain was installed to partition the area off for the duration of the experiment.

(5) **Method of implementation:** Subjects were split into two groups. Group A engaged in seeing-mode museum bathing, while Group B engaged in seeing-and-touching-mode museum bathing. The groups moved back and forth between the training room and neighboring exhibition space, spending two 10-minute sessions appreciating the museum's permanent collection.

For the first session, Group A was asked to look at the exhibits in silence, and Group B was asked to look at and handle the exhibits in silence. For the second session, subjects were directed to move about the exhibition space in twos and threes; members of Group A were to look at the exhibits while conversing with their assigned partner(s), while members of Group B were to both look at and handle the exhibits while conversing with their assigned partner(s).

(6) **Quantity and type of works viewed:** Subjects viewed items on display as part of the museum's permanent collection. The permanent collection is comprised of 1035 items divided into four categories, each given its own dedicated portion of the exhibition space (Fig. 5): "Faith and Research," "Anthropology and Archaeology of Nanzan University," "Entrusted to Nanzan," and "Showa Collection Catalogue."

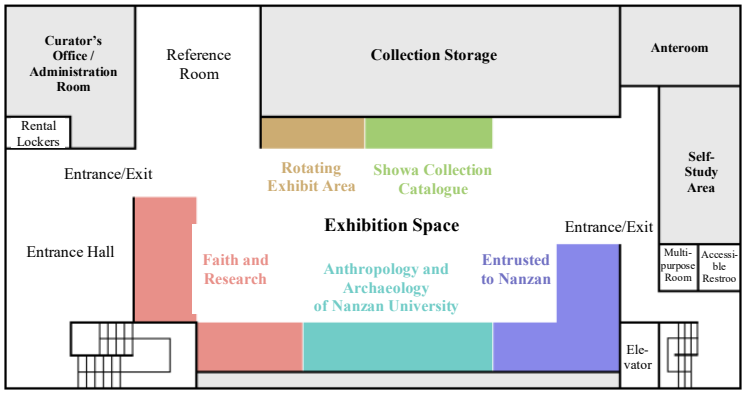

Fig. 5 Floor plan of the Nanzan University Museum of Anthropology
(Source: Nanzan University Museum of Anthropology website)

(7) **Content of works:** The official website for the Nanzan University Museum of Anthropology describes the four categories of its permanent collection as follows:

* Faith and Research (377 items): Items personally collected by Catholic priests belonging to the Societas Verbi Divini ("Society of the Divine Word"), which founded and operates Nanzan University. It includes Paleolithic stone tools from Europe

collected by Father Johannes Maringer ("the Maringer collection") and artifacts from Japan's Jomon period collected by Father Gerard Groot ("the Groot collection").

* Anthropology and Archaeology of Nanzan University (approximately 200 items): Ethnographic materials collected in Papua New Guinea in the 1960s by university faculty members as part of the Nanzan University Investigation Team of the Eastern Highlands of New Guinea, as well as Yayoi period earthenware excavated from archaeological sites in Nagoya City, such as the Takakura Tumulus in Atsuta Ward and the Mizuho Tumulus Group in Mizuho Ward.
* Entrusted to Nanzan (approximately 150 items): Items donated to the museum's collection by other institutions. This includes the Masayuki Nishie Collection (cultural artifacts from various locations in Africa, Papua New Guinea, the Americas, and Asia), items collected from the late 1960s to early 1970s by the Sophia University Expedition to Study the History and Culture of Northwestern Thailand (traditional garb and ceremonial tools), and artifacts from the Ōsu-Futagoyama Tumulus (*keikō*-style armor, horse tack, *haniwa* terracotta figurines, mirrors, etc.).
* Showa Collection Catalogue (308 items): Items typical to Japanese households and lifestyles, primarily dating from the late 1950s to early 1970s, displayed as it were a retail shopping catalog. Though numerous other museums now include exhibits on this facet of recent history, the Nanzan University Museum of Anthropology's Showa collection was considered groundbreaking upon its introduction in the early 1980s, and this forward-thinking foray into the subject matter enabled it to amass an exhaustive array of period-specific daily essentials.

(8) **Program for the day:** (Fig. 6)

13:35 Registration, explanation of museum bathing experiment, consent for measurement

13:44 Measurement 1 (physiological: blood pressure, pulse; psychological: POMS (short form))

13:55 Relocate to exhibition space

14:00 Engagement session 1

Subjects divided into two groups; asked to search the collection and choose a favorite item

Group A: seeing alone in silence

Group B: seeing-and-touching alone in silence

14:10 Relocate to measurement venue

14:12 Measurement 2 (physiological: blood pressure, pulse; psychological: POMS (short form))

14:18 Relocate to exhibition space

14:20 Engagement session 2

Subjects further divided into twos and threes; asked to introduce the favorite item selected during engagement session 1 to their partner(s)

Group A: seeing while conversing

Group B: seeing-and-touching while conversing

14:30 Relocate to measurement venue

14:32 Measurement 3 (physiological: blood pressure, pulse; psychological: POMS (short form))

14:45 Explanation of museum bathing research

15:05 Brief review

15:20 Closing ceremony, experiment ends, cleanup

Fig. 6 Seeing-and-touching-mode museum bathing experiment at Nanzan University Museum of Anthropology (January 11, 2024)

(9) **Duration of engagement:** Mean time spent in the exhibition space was 10 minutes per session.

(10) **Instructions for engagement:** Subjects were instructed to identify a favorite item from among the collection.

(11) **Measurement methods:** Subjects self-reported physiological (blood pressure, pulse) and psychological (POMS (short form)) data.

- Physiological measurement: Each subject was issued an OMRON HEM-6121 Wrist Blood Pressure Monitor to measure blood pressure and pulse. For each measurement session (baseline and again after each engagement session), subjects took two readings and recorded the individual values as well as the mean.

- Psychological measurement: Each subject completed a POMS sheet (short form, as printed by the publishing company Kaneko Shobo) at baseline and again after each engagement session.

(12) **Measurement results:**

1. Group A (seeing-mode museum bathing)

   Systolic blood pressure (max) fell between baseline (first) and second measurement, corresponding to the session spent browsing the collection alone in silence. Systolic then rose between second and third measurement, as subjects engaged with the collection while conversing in twos and threes. Meanwhile, pulse fell between baseline and second measurement, and fell again slightly between second and third measurement.

   Looking at the POMS, all negative emotions (Anger–Hostility, Confusion–Bewilderment, Depression–Dejection, Fatigue–Inertia, and Tension–Anxiety) fell continuously across all three measurements. Baseline values for Confusion–Bewilderment, Fatigue–Inertia, and Tension–Anxiety were notably higher than those of the other two negative emotions.

   For the positive emotion Vigor–Activity, values fell between baseline and second measurement, but rose between second and third measurement.

2. Group B (seeing-and-touching-mode museum bathing)

   Values for both systolic blood pressure (max) and pulse fell between baseline (first) and second measurement, again corresponding to the session spent engaging with the exhibits alone in silence, then rose between second and third measurements, as subjects spent time engaging with the collection while conversing in twos and threes.

   On the POMS, values for all negative emotions fell continuously across all measurements. Like Group A, baselines for Confusion–Bewilderment, Fatigue–Inertia, and Tension–Anxiety were notably higher than those of the other two negative emotions.

   The trend for Vigor–Activity also resembled that of Group A, with values falling from baseline to second measurement but rising from second to third.

(13) Comparison of and reflection on physiological and psychological data across groups and measurements

Regarding physiological measurements for Group A (seeing-mode museum bathing) (Table 4), systolic blood pressure (max) fell by 2.17 mmHg between first and second measurement, and diastolic (min) fell by 1.73 mmHg. This may be indicative of a parasympathetic response at work as subjects viewed the collection alone in the calm, quiet atmosphere of the exhibition space. Between second and third measurement, values for systolic and diastolic rose, by 1.84 mmHg and 5.34 mmHg respectively. Compared to the first session spent alone in silence, the second session appears to have produced a mild sense of excitement and sympathetic response as subjects engaged with the collection while conversing with their partner(s). However, pulse fell slightly between second and third measurement, by 0.78 bpm, which could indicate that the slow, methodical pace at which subjects moved about the exhibition space had less of an impact.

Of these changes, significant difference ($p < 0.05$) was found only for the decrease in diastolic between first and second measurement.

Seeing

Systolic Blood Pressure (Max)		
Measurement 1	Measurement 2	Measurement 3
107.50	105.33	107.17

Diastolic Blood Pressure (Min)		
Measurement 1	Measurement 2	Measurement 3
65.67	63.94	69.28

Pulse		
Measurement 1	Measurement 2	Measurement 3
79.67	76.22	75.44

Seeing and handling

Systolic Blood Pressure (Max)		
Measurement 1	Measurement 2	Measurement 3
107.15	104.90	105.30

Diastolic Blood Pressure (Min)		
Measurement 1	Measurement 2	Measurement 3
67.25	65.30	67.05

Pulse		
Measurement 1	Measurement 2	Measurement 3
77.90	74.10	74.70

Table 4 Comparison of physiological values from seeing-mode and seeing-and-touching mode museum bathing experiments

In Group B (seeing-and-touching-mode museum bathing) (Table 4), systolic fell by 2.25 mmHg between first and second measurement, diastolic by 1.95 mmHg, and pulse by 3.8 bpm, suggesting that this group also experienced a parasympathetic response when viewing the collection alone in silence. From second to third measurement, systolic rose by 0.40 mmHg, diastolic by 1.75 mmHg, and pulse by 0.60 bpm, indicating a sympathetic response brought about by the brief, stimulating period spent not only looking at but also handling the exhibits, and doing so in twos or threes while additionally delighting in conversation.

Of physiological changes observed in Group B, significant difference ($p < 0.05$) was found only for that of pulse between first and second measurement.

Anger–Hostility		
Measurement 1	Measurement 2	Measurement 3
4.00	0.33	0.22

Confusion–Bewilderment		
Measurement 1	Measurement 2	Measurement 3
8.33	3.89	2.44

Depression–Dejection		
Measurement 1	Measurement 2	Measurement 3
3.78	1.44	1.11

Fatigue–Inertia		
Measurement 1	Measurement 2	Measurement 3
8.67	4.56	2.89

Tension–Anxiety		
Measurement 1	Measurement 2	Measurement 3
8.56	3.00	2.44

Vigor–Activity		
Measurement 1	Measurement 2	Measurement 3
10.22	7.22	7.78

Table 5 Results of psychological measurements from seeing-mode museum bathing experiment

Anger–Hostility		
Measurement 1	Measurement 2	Measurement 3
3.70	0.10	0.10

Confusion–Bewilderment		
Measurement 1	Measurement 2	Measurement 3
8.00	1.20	0.10

Depression–Dejection		
Measurement 1	Measurement 2	Measurement 3
4.60	0.30	0.30

Fatigue–Inertia		
Measurement 1	Measurement 2	Measurement 3
7.10	0.80	0.60

Tension–Anxiety		
Measurement 1	Measurement 2	Measurement 3
9.50	2.30	0.80

Vigor–Activity		
Measurement 1	Measurement 2	Measurement 3
6.80	4.10	7.00

Table 6 Results of psychological measurements from seeing-and-touching-mode museum bathing experiment

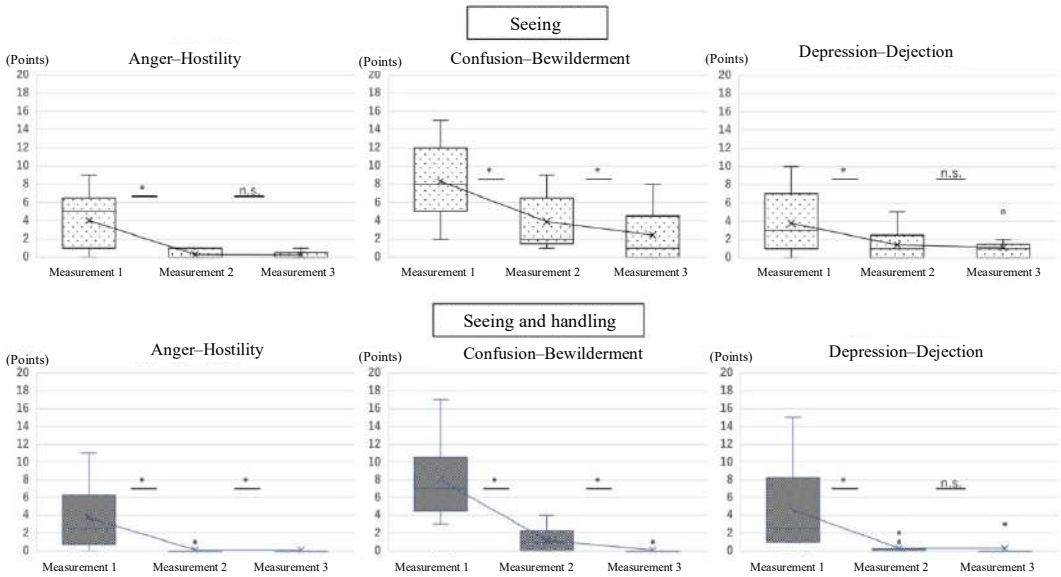

Fig. 7 Comparison of psychological values from seeing-mode and seeing-and-touching-mode museum bathing experiment (Part 1)

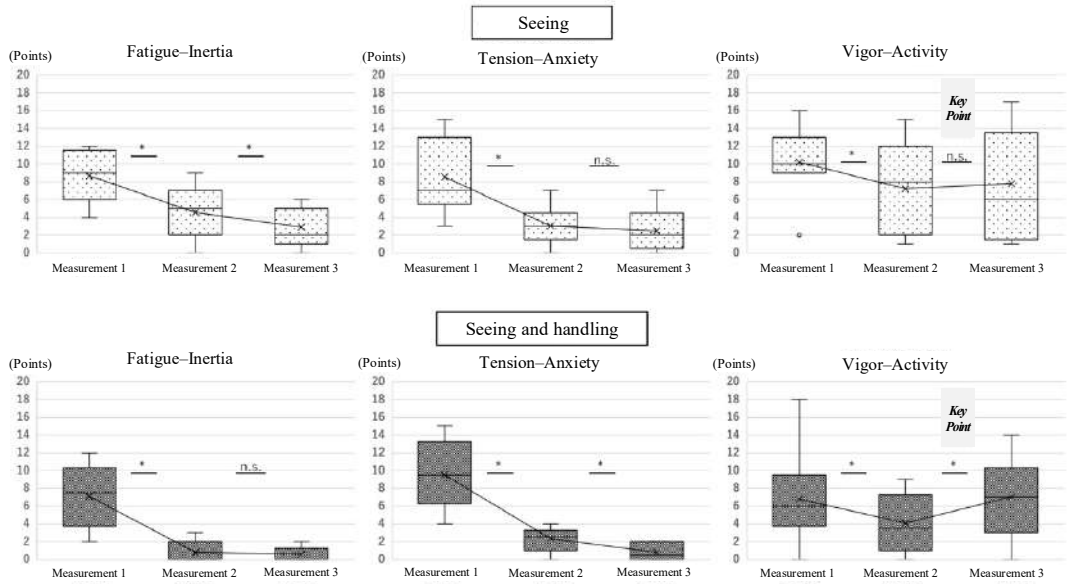

Fig. 8 Comparison of psychological values from seeing-mode and seeing-and-touching-mode museum bathing experiment (Part 2)

Turning to psychological measurements (Tables 5 and 6; Figs. 7 and 8), a continual downward trend was observed in both groups for all negative emotions (Anger–Hostility, Confusion–Bewilderment, Depression–Dejection, Fatigue–Inertia, and Tension–Anxiety). Specific changes were as follows: Anger–Hostility, baseline to second (A: −3.67 points, B: −3.60 points), second to third (A: −0.11 points, B: no change); Confusion–Bewilderment, baseline to second (A: −4.44 points, B: −6.80 points), second to third (A: −1.45 points, −1.10 points); Depression–Dejection, baseline to second (A: −2.34 points, B: −4.30 points), second to third (A: −0.33 points, B: no change); Fatigue–Inertia, baseline to second (A: −4.11 points, B: −6.30 points), second to third (A: −1.67 points, B: −0.20 points); and Tension–Anxiety, baseline to second (A: −5.56 points, B: −7.20 points), second to third (A: −0.56 points, B: −1.50 points).

This global decrease in negative emotions further suggests that seeing-mode museum bathing and seeing-and-touching mode museum bathing, performed either alone in silence or together with others while conversing, both produce a parasympathetic nervous response and consequent relaxing effect.

Statistical analysis found significant difference ($p < 0.05$) for all negative emotions in both groups between first and second measurement. Between second and third measurement, significant difference was found in Group A for Confusion–Bewilderment and Fatigue–Inertia and in Group B for Anger–Hostility, Confusion–Bewilderment, and Tension–Anxiety.

Finally, for the positive emotion Vigor–Activity (Fig. 8), values fell in both groups between baseline and second measurement (A: −3.00 points, B: −2.70 points), but rose between second and third measurement (A: +0.56 points, B: +2.90 points).

The decline for Vigor–Activity in both groups between baseline and second measurement provides further evidence for a parasympathetic response as subjects carefully examined (or examined and handled) the museum's collection alone in a calm, silent atmosphere. Conversely, the rise in Vigor–Activity between second and third suggests a sympathetic response when engaging with the collection while conversing with others.

With the exception of second to third measurement in Group A, significant difference ($p < 0.05$) was found for all changes for Vigor–Activity in both groups.

The decline for all negative emotions in both groups implies a relaxing effect at work, whether subjects were merely looking at the collection or also handling its items. However, from baseline to second measurement, there was a striking difference in relative rate of decrease between modes (Table 7).

This difference in percentage change is most notable for Confusion–Bewilderment, Depression–Dejection, and Fatigue–Inertia, where values decreased much more sharply in the seeing-and-touching-mode group than they did in the seeing-mode group. This suggests the possibility of museum bathing prescriptions precisely tailored to a patient's current psychological state, much as a physician might consider dosage when administering a particular drug. Further exploration of modes and experimental conditions may reveal other minute differences, serving to diversify medical practitioners' array of treatment options.

Negative Emotion	**Seeing-mode**	**Seeing-and-touching-mode**
Anger–Hostility	91.8% decrease	97.3% decrease
Confusion–Bewilderment	53.3% decrease	85.0% decrease
Depression–Dejection	61.9% decrease	93.5% decrease
Fatigue–Inertia	47.4% decrease	88.7% decrease
Tension–Anxiety	65.0% decrease	75.8% decrease

Table 7 Differences in relative decrease of negative emotions from first (baseline) to second measurement

(14) **Relaxing effect in terms of Total Mood Disturbance**

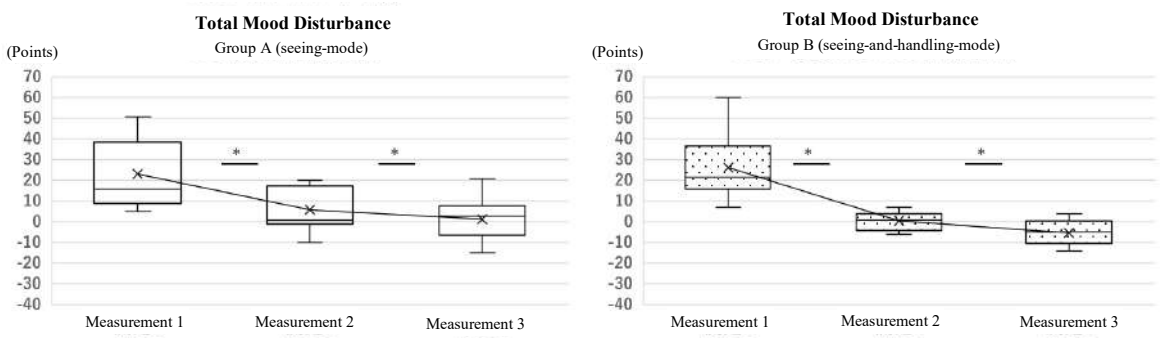

Fig. 9 TMD for seeing-and-touching-mode museum bathing experiment

Analysis of TMD for the seeing-and-touching-mode museum bathing experiment at Nanzan University Museum of Anthropology (Fig. 9) revealed a continuous overall decline in negative emotions for both Group A (seeing alone in silence followed by seeing while conversing with partner(s)) and Group B (seeing-and-touching alone in silence followed by seeing-and-touching while conversing with partner(s)). Specific changes were as follows: Group A, baseline to second (−17.11 points), second to third (−4.67 points); Group B, baseline to second (−25.60 points), second to third (−5.70 points). Statistical analysis found significant difference ($p < 0.05$) for all changes.

Once more, this demonstrates that negative emotions decreased after engaging with the museum collection regardless of whether the subject only looked at the items or also handled them. And again, this suggests that these modes of engagement are effective in reducing psychological stress. The comparatively dramatic relaxing effect observed in Group B suggests that the combination of seeing-and-touching may be a particularly fruitful mode of engagement for museums to explore when developing programs to promote community well-being.

(15) **Study limitations:** The measurement venue for this experiment was a small training room located adjacent to the exhibition space, as shown in Fig. 5. The size of the training room necessitated that subjects be seated at tables facing each other, in contrast with the classroom-style layout of previous studies. Future research may need to examine for the influence of mutual visibility of subjects' responses during measurement sessions.

2.3 Viewing-mode museum bathing experiment at Fukuoka City Science Museum (Fukuoka Prefecture, Japan)

(1) **Setting:** Fukuoka City Science Museum.[12] (Address: 4-2-1 Ropponmatsu, Chuo Ward, Fukuoka City, Fukuoka Prefecture.) Open since 2017, the museum and its planetarium (known as the Dome Theater) are easily accessible via Exit 3 of Ropponmatsu Station. They may be reached from Fukuoka International Airport via the city subway's Airport Line, transferring at Hakata Station to the Nanakuma Line and continuing on to Ropponmatsu Station.

(2) **Date:** Saturday, October 28, 2023, a normal operating day for the museum.

(3) **Subjects:** Eleven high school students (3 male, 8 female).

(4) **Pre- and post-session assembly point, measurement setting:** Multipurpose Room 1, located on the museum's 4th floor.

(5) **Method of implementation:** Subjects walked from Multipurpose Room 1, on the museum's 4th floor, to the Dome Theater, located on the 6th floor, where they viewed a screening of "Tales of the Stars, Autumn 2023 Edition: The Story of the Hero Perseus (with Full Live Commentary)." Other museum patrons (members of the general public) were also

[12] *Fukuoka City Science Museum website*. Retrieved from https://www.fukuokacity-kagakukan.jp

present at the screening. The theater space is equipped with wide, reclining seats, which are easily adjustable to allow for optimal views of the expansive overhead screen.

(6) **Quantity and type of works viewed:** "Tales of the Stars, Autumn 2023 Edition: The Story of the Hero Perseus (with Full Live Commentary)" (Running time: approximately 45 minutes).

(7) **Content of works:** Subjects viewed starscapes projected onto the overhead screen as a museum staff member provided live commentary, recounting the myths associated with different constellations and, in particular for this program, the legend of the Greek hero Perseus.

(8) **Program for the day (Fig. 10):**

10:15	Registration (in Multipurpose Room 1, located on the museum's 4th floor)
10:45	Opening ceremony, explanation of museum bathing, consent for measurement
10:56	Measurement 1 (physiological: blood pressure, pulse; psychological: POMS (short form))
11:20	Lunch
12:20	Explanation of points to keep in mind while viewing the planetarium program
12:35	Relocate to Dome Theater (6th floor) via escalator from Multipurpose Room 1 (4th floor)
13:00	View planetarium program
13:45	Relocate to Multipurpose Room 1 (4th floor) via escalator from Dome Theater (6th floor)
13:56	Measurement 2 (physiological: blood pressure, pulse; psychological: POMS (short form))
14:15	Break
14:25	Explanation of museum bathing research
14:45	Review
15:20	Closing ceremony, experiment ends, cleanup

(9) **Duration of engagement:** Subjects were asked to view the 45-minute program "Tales of the Stars, Autumn 2023 Edition: The Story of the Hero Perseus (with Full Live Commentary)," screened in the 6th floor Dome Theater.

(10) **Instructions for engagement:** Subjects were asked to identify a favorite constellation as they watched the program and listened to the live commentary provided by the planetarium staff.

(11) **Measurement methods:** Subjects self-reported physiological (blood pressure, pulse) and psychological (POMS (short form)) data.

- Physiological measurement: Each subject was issued an OMRON HEM-6121 Wrist Blood Pressure Monitor to measure blood pressure and pulse. For each measurement session (baseline and again after the viewing session), subjects took two readings and recorded the individual values as well as the mean.

- Psychological measurement: Each subject completed a POMS sheet (short form, as printed by the publishing company Kaneko Shobo) at baseline and again after the viewing session.

Physiological measurement (blood pressure, pulse)

Psychological measurement (POMS)

Planetarium screening (viewing in silence)

Fig. 10 Museum bathing experiment at Fukuoka City Science Museum (October 28, 2023)

(12) **Measurement results:** Systolic blood pressure (max) and pulse rose slightly from baseline (first) to second measurement, while diastolic blood pressure (min) slightly fell.

On the POMS, values for all negative emotions (Anger–Hostility, Confusion–Bewilderment, Depression–Dejection, Fatigue–Inertia, and Tension–Anxiety) decreased between first and second measurement. Baseline values for Confusion–Bewilderment, Fatigue–Inertia, and Tension–Anxiety stood out as notably higher than those of the other two negative emotions. Baseline for Fatigue–Inertia in particular was quite high.

Values for the positive emotion Vigor–Activity fell slightly between measurements.

(13) **Comparison of and reflection on physiological and psychological data across measurements**

For this experiment, subjects viewed a 45-minute long program entitled, “Tales of the Stars, Autumn 2023 Edition: The Story of the Hero Perseus (with Full Live Commentary),” which was screened in the 6th floor Dome Theater.

As shown in Fig. 11, values for systolic blood pressure were 3.18 mmHg higher after viewing the program, while diastolic values had fallen by 2.77 mmHg. Mean pulse rose by 2.10 bpm.

No significant difference ($p < 0.05$) was found for any of these changes.

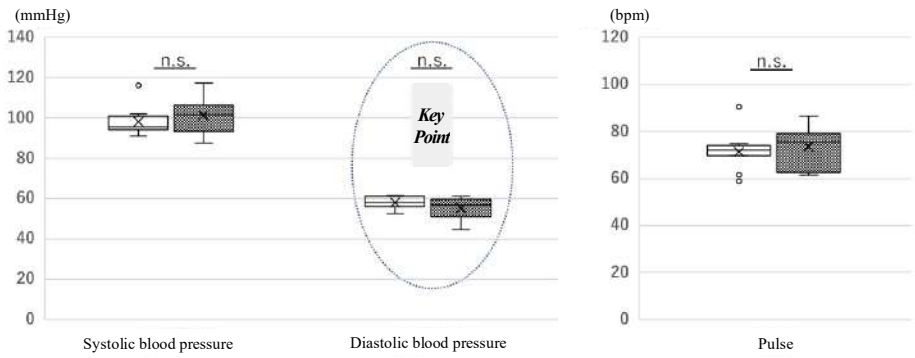

Fig. 11 Comparison of physiological values from viewing-mode museum bathing experiment

A curious finding for this experiment pertains to the values observed at baseline for systolic and diastolic blood pressure. As shown in Table 8, all 11 subjects exhibited low initial systolic values, ranging from 91.0 to 116.0 mmHg, with a mean of 98.18 mmHg. Initial values for diastolic blood pressure, displayed in Table 9, were similarly low, ranging from 52.5 to 61.5 mmHg, with a mean of 57.94 mmHg. The World Health Organization defines hypotension as a resting blood pressure of less than 100 mmHg systolic and 60 mmHg diastolic. Thus, the average subject in this cohort may be regarded as having atypically low blood pressure.

At second measurement, following the planetarium screening, mean systolic rose slightly, to 101.36 mmHg, while mean diastolic fell to 55.18 mmHg.

Bearing in mind the subjects' atypical baseline, these observations suggest that the planetarium's program was not an effective treatment for this group of high school students, at least in terms of blood pressure, and that when designing treatment programs for individuals with hypotension, planetariums should carefully evaluate what type of content may be most beneficial to that population.

Subject	1	2	3	4	5	6	7	8	9	10	11
Measurement 1	91.5	94.0	94.5	101.0	91.0	116.0	102.0	100.0	95.0	99.5	99.5
Measurement 2	89.5	101.0	87.5	102.5	93.5	114.5	102.0	106.5	99.0	117.5	101.5

Table 8 Comparison of systolic blood pressure before and after planetarium viewing session (Units: mmHg)

Subject	1	2	3	4	5	6	7	8	9	10	11
Measurement 1	57.5	58.0	61.0	60.5	59.5	56.0	52.5	61.5	53.0	56.5	61.5
Measurement 2	51.0	48.0	44.5	54.5	60.0	61.0	59.5	56.0	57.0	58.5	57.0

Table 9 Comparison of diastolic blood pressure before and after planetarium viewing session (Units: mmHg)

On the POMS, mean values for all negative emotions fell after viewing the program (Fig. 12), with specific changes as follows: Anger–Hostility (−6.09 points), Confusion–Bewilderment (−6.36 points), Depression–Dejection (−4.18 points), Fatigue–Inertia (−8.72 points), and Tension–Anxiety (−6.64 points). This suggests that planetarium screenings may serve to ameliorate negative emotional states and thus reduce psychological stress.

Notably, the mean value for the positive emotion Vigor–Activity also fell after viewing, albeit only slightly (−1.09 points). This observation seems to align with the aforementioned physiological data, further underscoring that for this particular group of subjects, the planetarium screening was not effective in improving positive emotional state.

Aside from those of Vigor–Activity, all changes in psychological values were found to be statistically significant ($p < 0.05$).

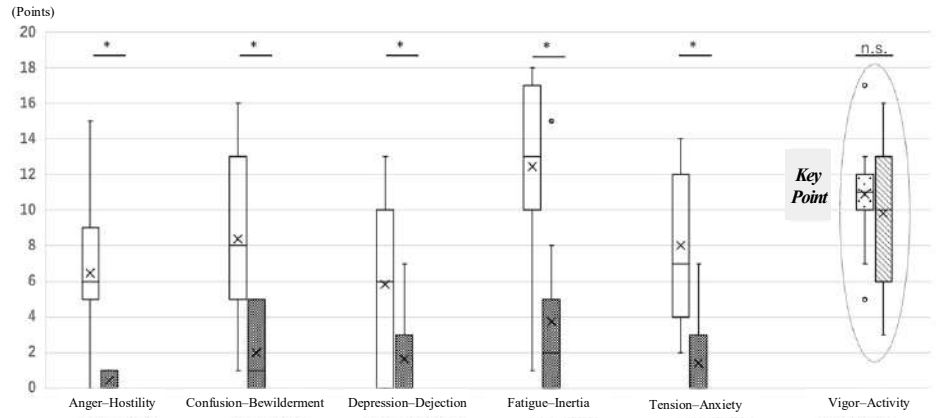

Fig. 12 Comparison of psychological values before and after planetarium viewing session

(14) **Relaxing effect in terms of Total Mood Disturbance**

Analysis of TMD for the viewing-mode museum bathing experiment at Fukuoka City Science Museum (Fig. 13) revealed a large, statistically-significant ($p < 0.05$) drop between first and second measurement. The size of this drop (−32.64 points), coupled with the fact that all individual negative emotions decreased from baseline to post-viewing, strongly suggests that planetarium sessions are effective in reducing psychological stress.

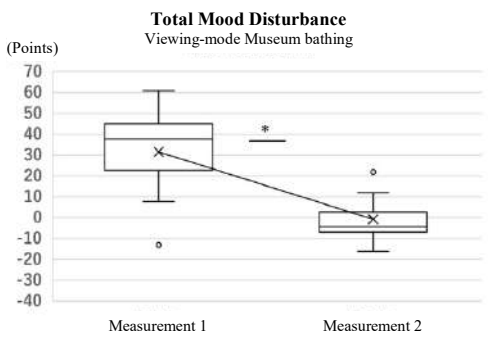

Fig. 13 TMD for viewing-mode museum bathing experiment

(15) **Study limitations:** The distance between the measurement venue (Multipurpose Room 1, located on the 4th floor of the museum) and experimental venue (Dome Theater, located on the 6th floor) necessitated traversing multiple hallways and escalators. Ideally, measurement and experimentation would take place in adjacent or near-adjacent spaces such that subjects can move between the two with minimal physical exertion. However, this may not always

be feasible, and future studies may therefore need to account for the potential impact of extended relocations involving movement between floors of a building on subjects' physiological and psychological states.

3. Overall Results of Component Experiments

As noted in the introduction, the present study sought to address two questions from a set of six proposed by Law et al.[13] Those questions were "What populations and settings were studied?" and "Did the studies show changes in the stress outcomes?" The component experiments were therefore designed to incorporate a diverse array of populations, settings, and modes of museum bathing, and subjects' physiological and psychological reactions were analyzed to establish the presence and degree of any relaxing effect. Specifically, this study incorporated a walking-mode experiment within an archaeological park, a seeing-and-touching-mode experiment centered around a set of anthropological collections, and a viewing-mode experiment conducted via a program screened at a planetarium.

3.1 Results of walking-mode museum bathing experiment

In a previous experiment designed to evaluate the effectiveness of walking-mode museum bathing, the author prepared historical photographs of seven locations in a given area and asked a group of subjects to collaborate in identifying the corresponding modern locations while traversing a 3 km course.[14] That particular experiment was conducted from roughly 2:00 pm to 3:00 pm on Sunday, January 29, 2023, a sunny winter day with an ambient temperature of 5°C and relative humidity of 60%. Despite the seasonal conditions, the activity did appear to produce a relaxing effect. Bearing that in mind, the present study elected to evaluate walking-mode museum bathing during a different season—this time in the autumn. The experiment at the nationally-designated historic site Taguma-Ishihatake Archaeological Site and Park, conducted from roughly 11:00 am for two 15-minute walking sessions on Thursday, October 12, 2023, featured similar sunny weather, but with warmer temperatures (21.7°C as of 11:00 am), relative humidity of 41%, and wind speed of 4.8 m/s. A control course was set up adjacent to the archaeological park, following a major road (portion of a former national highway), and subjects were divided into two groups, spending one 15-minute session each on the archaeological park walking course and the roadside walking course. The first session was completed in silence, while in the second, subjects were encouraged to converse with each other as they walked. Data obtained from the experiment suggests that the relaxing effect of this activity was greatest when walking in the archaeological park while conversing with others.

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[13] See note 9.
[14] See note 7.

Existing literature has frequently made note of the beneficial effects of casual conversation. One study[15] recorded the real-time increase in sympathetic nervous response over the course of a pleasant, 5-minute chat among elderly participants of a community-based senior health program, followed by the real-time increase in parasympathetic activity after the chat had ended, which coincided with subjects' reported feelings of satisfaction and enjoyment from participating in the activity. Other literature has demonstrated the relaxing effect of walking in green spaces, including one experiment involving a 3 km, 1-hour course at Kobe Municipal Arboretum,[16] and another involving a 15-minute course at Chiba Prefectural Hokuso Hananooka Park.[17] Outside of Japan, one paper[18] quite eloquently summed up the observed impact of such activities in two statements: 1) green spaces influence health by ameliorating stress-response, and 2) green spaces influence health by inducing physical activity.

According to the Database of Cultural Properties of Japan, maintained by the Agency for Cultural Affairs, there are 1888 nationally-designated historic sites in Japan as of February 1, 2024, of which 92 are located within Fukuoka Prefecture. Many of these sites are incorporated into park-like spaces established to better preserve the site. However, managing organizations tend to fixate almost entirely on the sites' cultural and historical value. A prime example of this is the "Basic Road Map for Maintenance of the Taguma-Ishihatake Archaeological Site" (published in March 2011 by the Munakata City Board of Education), which is primarily focused on ways to ensure the site's history is passed down to future generations and how study of the site can enrich the community and local residents.

Daily walking is indispensable to good health, and the present study provides evidence that setting makes a difference. While traversing sidewalks past man-made structures is still an effective means of exercise, the mental benefits of walking—namely in combating stress[19] and promoting relaxation—are further enhanced when the activity takes place in a space featuring greenery and cultural stimulation, such as an archaeological park.

It is the author's sincere hope that historic sites and parks can be widely appreciated by the history enthusiasts, but also more widely by the locals as a place that helps support their physical and mental health and well-being in our society, and to build resistance against stress.

3.2 Results of seeing-and-touching-mode museum bathing experiment

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[15] Daisuke Takada et al. (2013). A study showing changes in autonomic nervous system activity and relaxation in the elderly induced by "pleasant conversation" compared to "reading aloud." *Journal of General and Family Medicine*, 36(1), 5-10.
[16] Tomoyo Mitsui. (2011). Stress-reducing effect of forest walking in the forest botanical park. *Japanese Journal of Psychosomatic Medicine*, 51(4), 345-348 (in Japanese).
[17] Yuki Masuda et al. (2011). Ryokuchi ni okeru walking no shinri kōka ni kan suru kisoteki kenkyū [A basic study on the psychological effects of walking in green areas]. *Journal of the Japanese Society of Revegetation Technology*, 37(1), 249-252 (in Japanese).
[18] Richard Mitchell, Frank Popham. (2008). Effect of exposure to natural environment on health inequalities: an observational population study. *The Lancet*, 372(9650), 1655-1660.
[19] Tomohiko Ikeda. (2022). Stress shakai wo ikinuku hatarakikata, dai 4 kai: shinrin yoku shūkan wa stress taishoryoku wo takameru kanōsei ga aru [Ways for professionals to get by in a stressful society, part 4: A regular habit of forest bathing may boost stress-coping ability]. *Industrial Safety and Health*, *23*(4), 73-75 (in Japanese).

The seeing-and-touching-mode component of this study was conducted at the Nanzan University Museum of Anthropology, which prides itself on making its entire collection available for patrons to touch and handle. Subjects were divided into two groups, and they spent two sessions engaging with the collection. For the first session, Group A was instructed to look at the collection alone in silence, while Group B was additionally encouraged to touch and handle the objects. For the second session, subjects were further divided into twos and threes; members of Group A were instructed to look at the collection while conversing with their partner(s), while members of Group B were told to do the same, with the additional instruction to touch and handle the collection while conversing.

Though the previous experiment and its corresponding discussion already touched upon the mental benefits of pleasant conversation, the experiment at the museum of anthropology introduces an additional tactile element, which appears to have a major impact on the activity's relaxing effect.

A look at existing literature offers insight regarding this impact. One study involving "shiny mud balls"[20] (a Japanese analogue to the childhood activity of making mud pies) echoes responses observed among the Nanzan students when handling earthenware pottery. The subjects of the mud ball study, also university students, were asked to use their bare hands to knead soil with water and roll the resulting mud into smooth spheres. Prior to the activity, negative responses such as disgust, anxiousness, and irritation were prevalent, but once the activity was underway, these gave way to other, positive responses such as enjoyment, comfort, and excitement. Another study, this one conducted outside Japan, examined the effects of handling museum objects among hospitalized patients.[21] The study concluded that the various modes of touching observed (such as stroking, careful handling of a prehistoric artifact, or absent-minded touching while looking elsewhere) had a positive impact on well-being, and that the opportunity to handle objects often prompted episodes of deep personal reminiscence.

Museums throughout Japan frequently incorporate tactile exhibits for the additional academic insight this mode of interaction provides. But there is little ongoing discussion about the instinctive desire to handle objects or the types of stimulation these experiences provide, including sensations such as pressure, pain, heat, and chill. Future research should perhaps focus on these questions, further exploring the role and value of tactile interaction in health and well-being.

3.3 Results of viewing-mode museum bathing experiment

The viewing-mode museum bathing component of this study centered around a program screened by the Dome Theater planetarium at Fukuoka City Science Museum. Comparison of values

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[20] Hideaki Hirai et al. (2023). Psychological effects of simulated soil experience using a shiny mud ball kit: Introductory material for experiential soil educational program. *Soil Science and Plant Nutrition*, *94*(3), 170-178 (in Japanese).
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obtained before and after subjects viewed the program suggests that this mode of museum bathing also produces a relaxing effect.

Previous literature in this vein includes a study conducted at theaters managed by Konica Minolta Planetarium,[22] which reported improved relaxation in working women aged 20–49 after viewing a similar program, and which further noted that the relaxing effect may be enhanced when certain types of content is shown, such as starry skies, nature scenes, and optically-projected starscapes displayed immediately following static digital images of the night sky. Another study in this field, wherein employees of a designated special nursing home attended multiple viewing sessions over time in a planetarium-like setting,[23] reported that the experimental cohort displayed "increased capacity to manage anger, less preoccupation with stressors, and a greater degree of humility" when compared to a control group that did not attend the viewing sessions.

However, while existing work has identified a potential parasympathetic nervous response related to planetarium viewing sessions, the present study suggests that this sort of effect may not be ideal for all populations. For example, given the already low resting blood pressure observed among the high school students at Fukuoka City Science Museum, further decreases are probably undesirable for this group.

Planetariums seeking to contribute to community well-being may therefore need to plan their regular screening schedules based on an understanding that ideal content type could vary according to the expected viewers' default autonomic states.

4. Conclusion

This study provides further evidence for the beneficial physiological and psychological effects of museum bathing, extending that understanding to new modes, including walking through an archaeological park, seeing-and-touching objects in an anthropological museum, and viewing a program screened at a planetarium. Though the author's ongoing series of experiments has yielded data for 902 subjects across 65 settings located throughout Japan (as of February 2024), a more robust body of data will be necessary to fully explore the complex relationship between engagement with cultural materials and the consequent relaxing effect. Future studies should seek to expand the body of data to cover additional communities, populations, durations of engagement, and quantities and types of artworks.

Recent literature outside of Japan is actively examining how museums and other cultural venues can best partner with medical and social welfare bodies to establish health-focused programs.[24]

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Researchers in Japan, too, need to explore suitable ways for our institutions to establish such relationships. It is the author's hope to see more and diverse studies carried out at museums across the spectrum of arts and sciences with cooperation from government and industry bodies, and that results from these studies will foster an environment in which our society makes extensive use of museum bathing in promoting societal health and well-being.

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