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Relationship Between the Benefit of Inconvenience and Emotions in a Sightseeing Experiment: An ANOVA and Correlation Analysis*

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Abstract— **This study examines the "benefit of inconvenience" in tourism through an experiment conducted in Nijo, Kyoto. Participants used two intentionally inconvenient tools: "Blur Navigation," which gradually obscures walked paths and lacks search functions, and an "Unfriendly Camera," which requires entering the reason and location for each photo and has a three-second delay in capturing. Emotional changes were measured before and after the tour using PANAS and POMS2, and Scenery memory was assessed with a post-tour quiz. Results showed that positive emotions such as "Enthusiastic," "Excited," and "Proud," as well as negative emotions like "Ashamed" and "Nervous," were significantly correlated with higher memory scores. Questionnaire responses indicated that the obscuring of paths and lack of search functions encouraged active route selection and attention to surroundings, while the camera delay promoted intentional photography but sometimes caused missed opportunities. These findings support that moderate inconvenience can enhance engagement, emotional richness, and memory retention in tourism experiences.**

I. INTRODUCTION

The "benefit of inconvenience" refers to experiential value gained through moderate effort or restriction [1], encouraging engagement, creativity, and stronger memory. Previous studies, including our work in Arashiyama and Uzumasa using PANAS, have found that intentionally inconvenient tools, such as blurred maps and delayed cameras, enhance travelers' attention and deepen their experience [2].

Tourism research has explored how modifying support tools influences behavior and satisfaction: restricted map functions fostered unplanned discoveries [7], minimal wayfinding cues promoted exploration [8], and seasonal photo displays or travel journals added emotional richness [9], [10], [11]. However, most relied on questionnaires without assessing long-term memory or mood. This study integrates affective scales with a post-tour memory quiz to evaluate broader impacts in real settings.

Environmental and participant factors may also shape emotional responses to inconvenience. To investigate this, midsummer tours were conducted in Kyoto's Nijo district using two deliberately inconvenient tools "Blur Navigation" and "Unfriendly Camera" selected because navigation and photography are central to sightseeing. Emotional changes were measured with PANAS and POMS2 and analyzed by mixed-design ANOVA. Unlike previous studies based mainly on PANAS and simple t-tests, this work applies POMS2 to assess sustained mood and examines the effects before-after and between-conditions. All group members used the same applications on their own smartphones, including both Japanese and international participants, enabling cross-cultural comparison of shared emotional responses. The aim is to investigate how the benefit of inconvenience influences emotions and memory in tourism, while also considering situational and cultural contexts as supplementary factors.

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II. METHODS

A. Setting and Participants

The field experiment took place in Kyoto's Nijo district, refining the methodology used in prior Uzumasa and Arashiyama studies [2]. Nijo was selected for its walkable streets, low traffic, and multiple route options, enabling natural disorientation during tours.

Twenty-one Kansai-region university students participated (20 male, 1 female; 12 Japanese, 9 international). For reference, the Uzumasa and Arashiyama experiments involved 24 and 11 participants, respectively. Participants in Nijo formed small groups of two or three so that all could use the tools while interacting within the group. Grouping was mostly random, but in Nijo, Japanese and international students were separated to facilitate communication. Each tour was conducted in a different period, preventing participant overlap across sites.

TABLE I
FOUR EXPERIMENTAL CONDITIONS IN THE NIJO FIELD EXPERIMENT

	Normal map	Inconvenient map
Normal camera	O (6)	A (5)
Inconvenient camera	B (5)	AB (5)

Table I summarizes the four experimental conditions and participant numbers, defined by combinations of navigation and camera tools. When both tools were standard, the condition was labeled Case O; when both were inconvenient, Case AB; and when only one was inconvenient, Case A or Case B. These labels follow a naming convention inspired by blood type notation (O, A, B, AB) for intuitive distinction.

B. Intervention: Inconvenient Tools

Two intentionally inconvenient iOS applications were used: *Blur Navigation* and the *Unfriendly Camera*. While previous versions were developed for Android [12], both were redesigned for iOS and adapted for the Nijo field study.

1) Blur Navigation (iOS version): Originally proposed in earlier work [12], "Blur Navigation" was redesigned for smartphones with updated visuals and interaction rules, as shown in Fig. 1. Its main features were:

- Progressive blurring of already-walked paths
- Removal of destination search functionality
- Illustration changes triggered by cumulative walking distance

These features aimed to discourage efficiency-driven navigation and promote greater environmental engagement, as the map gradually becomes unreadable, forcing participants to rely less on it and pay more attention to their surroundings.

Fig. 1. Interface of the Blur Navigation app used in the field experiment

2) Unfriendly Camera (iOS version): The design of the "Unfriendly Camera" was inspired by existing photography applications that deliberately incorporate inconvenience into the user experience [13], [14]. For this study, we implemented a custom iOS version tailored specifically for field tourism experiments, as shown in Fig. 2. Its main constraints were:

- Mandatory input of a short "reason" and "location" before shutter release
- A fixed 3-second delay before the photo was captured
- A capped memory of 10 entries, with the oldest record automatically overwritten

These constraints were intended to encourage mindful photography, greater attention to context, and deeper appreciation of the captured scenery, since entering the reason and location before shooting inevitably prompts deliberate reflection on why and where the photo is taken.

C. Procedure

Participants began and ended their tours at JR Nijo Station. Before departure, each group received three destination options: pre-planning, Takenobu Inari Shrine, Mibudera Temple, and Hosojikobundo Inpo to reduce pre-planning and encourage spontaneous route choice. All trials were conducted under clear weather conditions to minimize external stressors, and minor tourist sites were selected to avoid crowding. Groups had 120 minutes to visit all locations and return using public transport.

Both applications were distributed via the iOS App Store for installation on participants' own smartphones, allowing direct use of *Blur Navigation* and the *Unfriendly Camera*. Participants were not informed of the "benefit of inconvenience" concept in advance.

Fig. 2. Interface of the Unfriendly Camera app used in the field experiment

D. Measures

1) PANAS: Emotional states were measured using the Positive and Negative Affect Schedule (PANAS) [15] before and after the tour. The survey was administered via Google Form in Japanese or English, depending on each participant's language preference. Three contexts were assessed:

- Current Mood
- Feelings When the Lost Way
- Feelings When Enjoy the View

Each item was rated on a 6-point Likert scale across eight positive and eight negative emotions, yielding Positive (P) and Negative (N) scores from 8 to 48. The emotion list is shown in Table II.

TABLE II
PANAS POSITIVE AND NEGATIVE AFFECT ITEMS USED IN THIS EXPERIMENT [15]

Positive	Negative
Enthusiastic	Jittery
Determined	Ashamed
Strong	Distressed
Active	Afraid
Excited	Nervous
Inspired	Irritable
Proud	Upset
Alert	Scared

2) POMS2: In addition to PANAS, the short-form Profile of Mood States, Second Edition (POMS2) [6] was administered before and after the tour in Japanese or English. While PANAS captured short-term affective reactions, POMS2 evaluated more sustained mood states, complementing emotional assessment during sightseeing. The scale comprises seven domains, as summarized in Table III, and a Total Mood Disturbance (TMD) index was calculated following standard procedures. POMS2 also allowed comparison between Japanese and international participants to identify cultural differences in mood adjustment.

TABLE III

POMS2 POSITIVE AND NEGATIVE MOOD DOMAINS USED IN THIS STUDY

Positive	**Negative**
Friendliness (F)	Anger–Hostility (AH)
Vigor–Activity (VA)	Confusion–Bewilderment (CB)
	Depression–Dejection (DD)
	Fatigue–Inertia (FI)
	Tension–Anxiety (TA)

3) Post-Tour Questionnaire and Memory Quiz: Immediately after the tour, participants completed a brief questionnaire on differences from previous sightseeing and impressions of the experimental tools.

To evaluate Scenery memory, a recall quiz was conducted one week later. It included 10 photographs from the actual route and 10 dummy images with blurred landmarks. For each, participants chose one of three options: *Passed*, *Did not pass*, or *Unsure*. Scores were based on a 40-point system (correct = 2, unsure = 1, incorrect = 0), encouraging careful judgment rather than random guessing. Note that the three categories (*Current Mood*, *Lost Way*, *Enjoy the View*) mentioned elsewhere refer to the PANAS contexts, not to the memory quiz.

E. Statistical Analysis

All analyses were conducted using Microsoft Excel and Python (pandas and scipy). A significance level of $p < 0.05$ was used.

To examine emotional changes, a mixed-design ANOVA was performed with *Time* (Before vs. After sightseeing) as a within-subject factor and *Case* (O, A, B, AB) as a between-subject factor.

Pearson's correlation coefficients were calculated to explore relationships between emotional changes (PANAS) and Scenery memory performance. Welch's t-test was applied to POMS2 results to compare overall mood changes between Japanese and international participants, accounting for unequal variances.

III. EXPERIMENTAL RESULTS

Because the Nijo, Arashiyama, and Uzumasa experiments differed in season and participant conditions, analyses were conducted separately to avoid confounding and clarify location-specific patterns.

A. PANAS Survey (Nijo)

Table IV shows the proportion of participants whose positive (P) and negative (N) affect scores changed after the tour for "Current Mood." Figure 3 visualizes individual changes: horizontal arrows indicate increases in P and vertical ones decreases in N. Results for "Lost Way" and "Enjoy the View" are presented in Tables V, VI and Figures 4, 5. A *favorable* outcome denotes increased P with decreased N, and an *unfavorable* one denotes the opposite. Unlike our previous individual-tour study in Arashiyama, the Nijo experiment was conducted in midsummer (average $> 33\,^{\circ}$C) with small

TABLE IV

PANAS ON CURRENT MOOD (NIJO)

Case	O	A	B	AB	All
P increase (%)	50	40	60	40	48
N decrease (%)	50	40	100	100	76

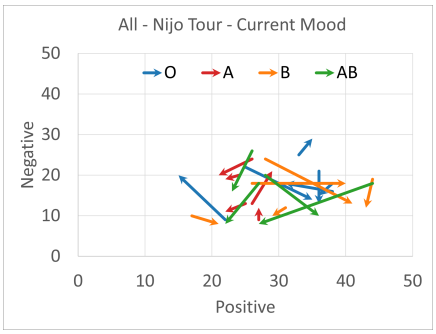

Fig. 3. Graph of PANAS on Current Mood (Nijo)

TABLE V

PANAS ON FEELINGS WHEN THE LOST WAY (NIJO)

Case	O	A	B	AB	All
P increase (%)	67	80	80	40	67
N decrease (%)	100	80	100	100	95

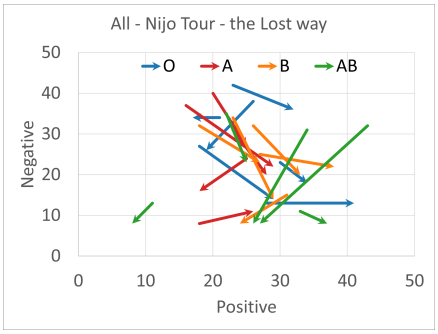

Fig. 4. Graph of PANAS on Feelings When the Lost way (Nijo)

TABLE VI

PANAS ON FEELINGS WHEN ENJOY THE VIEW (NIJO)

Case	O	A	B	AB	All
P increase (%)	83	80	40	40	62
N decrease (%)	50	40	100	60	62

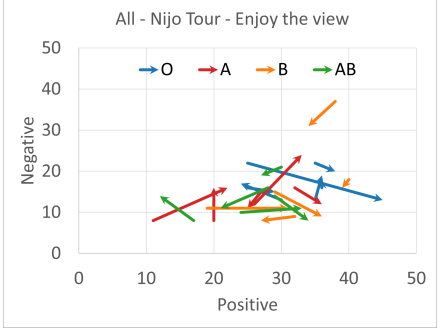

Fig. 5. Graph of PANAS on Feelings When enjoy the view (Nijo)

groups, so environmental heat and group dynamics were considered when interpreting results.

1) Current Mood: As shown in Table IV, only 48% of participants increased positive affect (P), likely due to the heat suppressing positive mood. In contrast, negative affect (N) decreased in 76%, and in Cases B and AB (inconvenient camera), all participants showed reductions, suggesting that camera friction helped ease negative feelings. Two unfavorable results appeared in Case O, possibly because high convenience made the tour feel task-oriented.

2) Feelings When the Lost Way: As shown in Table V, only 40% of AB participants increased P, indicating that using both inconvenient tools suppressed positive emotions toward being lost. In contrast, A and B each reached 80%, supporting that moderate inconvenience can promote positive affect. For N, 95% decreased overall, and all but A reached 100%, suggesting that real-world exploration softened negative emotions related to disorientation. No unfavorable arrows appear in Figure 4, confirming this trend.

3) Feelings When Enjoy the View: As shown in Table VI, over 80% of participants in O and A increased P, showing strong positive reactions to the scenery, while B and AB (40%) showed lower gains. For N, only B reached 100% decrease, implying that the camera's small viewfinder encouraged direct observation and reduced negative feelings. One unfavorable case each appeared in O and AB, suggesting that some participants found the scenery less impressive than expected.

B. The Scenery Memory Quiz

Figure 6 presents the results of the Nijo Tour, while Table VII compares average scores across Uzumasa, Arashiyama, and Nijo. To maintain consistency, Uzumasa scores (originally 20 points) were converted to a 40-point scale.

TABLE VII
AVERAGE SCENERY MEMORY QUIZ SCORES FOR EACH TOUR

Tour	Case O	Case A	Case B	Case AB
Nijo	21.0	21.8	**22.4**	22.2
Arashiyama	23.0	24.0	**28.3**	25.7
Uzumasa*	25.5	26.0	26.0	**30.2**

*Scores doubled from a 20-point scale for comparability.

ANOVA results showed a significant difference only for the Arashiyama Tour ($F = 8.93$, $\eta^2 = 3.83$, $p = 0.0086 < 0.05$), while Nijo ($F = 0.15$, $\eta^2 = 0.026$, $p = 0.93$) and Uzumasa ($F = 1.42$, $\eta^2 = 0.21$, $p = 0.27$) showed no significance; Therefore, p-values are not displayed for the Nijo Tour results shown in Figure 6.

In the Nijo Tour, conducted under midsummer heat, Case B—using only the inconvenient camera—achieved the highest mean score. However, the range of mean values was very narrow (21.0-22.4), and the standard deviations within each case (O = 4.32, A = 3.43, B = 1.85, AB = 3.31) indicated that individual variation was larger than the difference between conditions, making it difficult to conclude a strong effect. Similarly, in Arashiyama, Case B yielded the top score, suggesting that a moderate level of inconvenience may enhance scenic memory. This pattern implies that slight friction in the photographing process encouraged more deliberate observation and deeper memory formation.

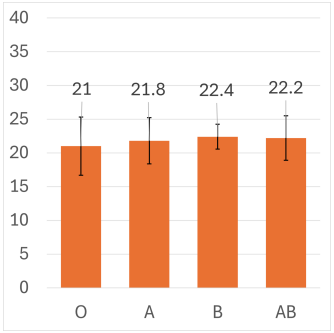

Fig. 6. Average scenery memory quiz scores for the Nijo Tour

C. Comparison between Japanese and International Students (POMS2)

To examine cultural differences in emotional responses, before–after change scores (After−Before) were compared between Japanese and international participants. Positive values indicate increases and negative values decreases. The mean values represent the average change within each group, and the numbers in parentheses indicate standard deviations. Sample sizes for each group are listed as n in Table VIII. Welch's t-test was applied with a significance threshold of $p < 0.05$. The Japanese and English versions were scored by Kaneko Shobo [16] and Multi-Health Systems (MHS) [17], respectively.

As shown in Table VIII, *Total Mood Disturbance* (TMD) decreased in both groups, indicating an overall mood improvement regardless of nationality. Although no comparisons reached statistical significance, *Anger-Hostility* (AH) and *Fatigue-Inertia* (FI) showed moderate differences between groups, suggesting potential cultural influences worth further examination. AH decreased more among Japanese participants, whereas FI tended to increase in Japanese but decrease in international participants, possibly reflecting variations in engagement level or travel behavior. These results imply that while mood improved universally, specific emotional tendencies may differ across cultural or behavioral contexts.

TABLE VIII
COMPARISON OF POMS2 BEFORE–AFTER CHANGES BETWEEN JAPANESE AND INTERNATIONAL PARTICIPANTS

Measure	Japanese ($n = 12$)	International ($n = 9$)	p
TMD	-3.33 (6.93)	-5.22 (3.83)	0.437
AH	-6.25 (8.75)	-1.44 (1.51)	0.087
FI	5.17 (7.37)	-0.89 (6.25)	0.057

TABLE IX

CORRELATION BETWEEN PANAS EMOTION CHANGES AND MEMORY QUIZ SCORES IN THE NIJO TOUR

	Positive			Negative		
	Enthusiastic	**Excited**	**Proud**	**Ashamed**	**Nervous**	**Distressed**
Increase in Current Mood	0.41	-	-	-0.66	-0.47	-
Increase in the Lost Way	0.53	0.51	0.84	-	-0.41	0.51
Increase in Enjoy the View	-	0.41	-	-	-	-

TABLE X

SIGNIFICANT EMOTION–TOOL INTERACTION EFFECTS FOUND IN THE MIXED-DESIGN ANOVA

Location	**Mood Measurement Type**	**Emotion**	F	p	η^2
Nijo	Current Mood	Enthusiastic	3.61	0.0350	0.389
		Inspired	4.14	0.0225	0.422
	Enjoy the View	Jittery	4.34	0.0191	0.434
		Nervous	4.19	0.0217	0.425
Arashiyama	Current Mood	Irritable	5.30	0.0320	0.694
	The Lost Way	Ashamed	4.72	0.0417	0.669
Uzumasa	Enjoy the View	Alert	5.01	0.00945	0.429
		Jittery	5.39	0.00698	0.447

D. Correlation Analysis between PANAS and Scenery memory

Pearson's correlation coefficients were calculated in Excel with a significance threshold of $p < 0.05$. Correlations were classified as strong ($|r| \geq 0.7$), moderate ($0.4 \leq |r| < 0.7$), or inverse (negative r). This analysis examined how emotional changes related to Scenery memory performance.

PANAS was administered before and after the tour in three contexts—*Current Mood*, *Lost Way*, and *Enjoy the View*. Correlations were computed between 16 emotion change scores (post–pre) and Scenery Memory Quiz results across Nijo, Arashiyama, and Uzumasa. Table IX presents the results for Nijo (“increase” = post–pre). Results from Uzumasa and Arashiyama were reported in our previous study [2]; thus, only Nijo results are newly shown here.

Nijo Tour: Six emotions showed strong correlations among 21 participants. *Proud* correlated strongly ($r = 0.84$), suggesting that pride when lost enhanced memory. *Excited* was also positive, while *Ashamed* and *Nervous* were negative. *Distressed* correlated positively, opposite to Arashiyama, implying site-specific effects.

Uzumasa and Arashiyama Tours (previous study [2]): In Arashiyama, *Excited* ($r = 0.80$) correlated positively with memory, while *Alert* was negative, suggesting that careful movement improved recall. Lower *Distressed*, *Irritable*, and *Jittery* were also linked to higher scores. In Uzumasa, only *Active* showed a moderate positive correlation ($r = 0.42$), and relationships with other emotions were weak (max $r = 0.039$).

E. Interaction Effects in Mixed-Design ANOVA

To examine how inconvenient tools influenced emotional changes over time, A mixed-design ANOVA was conducted with *Time* (before vs. after sightseeing) as a within-subject factor and *Case* (four conditions) as a between-subject factor, using PANAS emotion scores as the dependent variable across the three sightseeing locations. Table X summarizes the emotions that showed significant interaction effects ($p < .05$), categorized by location and mood type. Here, F denotes the ANOVA statistic, p the probability value, and η^2 the effect size.

Nijo Tour: “Enthusiastic” and “Inspired” in “Current Mood,” as well as “Jittery” and “Nervous” in “Enjoy the View,” showed significant interaction effects ($p < .05$), indicating varied emotional responses across tool conditions.

Arashiyama Tour: “Irritable” in “Current Mood” and “Ashamed” in “Lost Way” were significant, suggesting that emotional reactions to navigation uncertainty differed by condition.

Uzumasa Tour: “Alert” and “Jittery” in “Enjoy the View” showed significant effects, implying that some tools enhanced attentiveness during sightseeing.

Effect sizes ranged from moderate to large, indicating strong interaction impacts. The recurrence of “Jittery” in Nijo and Uzumasa suggests that a moderate level of tension or alertness was common across environments. Distinct emotions in Nijo between mood types imply context-dependent emotional responses. The results from Uzumasa further suggest that inconvenient tools can enhance attentiveness during sightseeing.

1) Post-hoc comparison.: For emotions that showed significant interactions, Tukey HSD tests were performed at each level of *Time*. No significant between-case differences were found *before* the tour, while several differences emerged *after*, indicating that emotional changes occurred during sightseeing rather than at baseline. Significant pairs are listed in Table XI.

IV. DISCUSSION

A. Nijo Tourism

Compared with our previous studies in Arashiyama and Uzumasa, the Nijo experiment offers new insights by com-

TABLE XI
POST-HOC RESULTS FOR SIGNIFICANT EMOTION–TOOL INTERACTIONS (AFTER)

Location	Emotion	Significant pair(s)	p_{adj}
Nijo	Enthusiastic	AB > B	0.0411
Nijo	Nervous	AB > O	0.0448
Uzumasa	Jittery	AB > B, B > O	0.0217, 0.0472

bining emotional (PANAS/POMS2) and cognitive (quiz) analyses under midsummer, small-group conditions.

Six emotions were notably related to Scenery memory. In the "Feelings When the Lost Way" context, *Proud* showed the strongest positive correlation ($r = 0.84$), suggesting that accomplishment during self-directed navigation deepened memory. *Excited* and *Inspired* were also positive, whereas *Ashamed* and *Nervous* were negative. Interestingly, *Distressed* correlated positively in Nijo but negatively in Arashiyama, implying location-dependent effects.

Mixed-design ANOVA found significant Time $\times$ Case interactions for *Jittery* and *Nervous* in "Feelings When Enjoy the View," with moderate-to-large effect sizes, indicating that emotional change depended on both timing and sightseeing context. POMS2 showed overall mood improvement in both Japanese and international participants, with near-significant differences in *Anger-Hostility* and *Fatigue-Inertia* suggesting cultural or behavioral variation.

Overall, pride and excitement enhanced memory, while reduced negative affect supported better performance. These mechanisms align with our previous findings, suggesting consistency across different environments and tool platforms.

B. Post-Experiment Questionnaire Analysis

Participants' qualitative feedback further explained the quantitative trends.

Differences from Previous Sightseeing: Case A participants reported faster movement and stronger route memory due to the lack of auto re-routing. Case AB explored unfamiliar paths without search, while Case B practiced intentional photography by entering reason and location before each shot. Case O (normal map) yielded few novel impressions.

Impressions of the Experiment: Cases A, AB, and B frequently described the experience as "fun" or "refreshing," whereas Case O participants noted less novelty and more fatigue from the heat.

Effects of Inconvenient Features: Removing the search produced both excitement and uncertainty. The blurred map enhanced Scenery memory, while the camera's three-second delay encouraged reflection and pride, but sometimes irritation when missing shots. Overall, intentional inconvenience deepened engagement and memorability, whereas the regular map provided fewer opportunities for novelty.

V. CONCLUSION AND FUTURE WORK

This study deepened understanding of the benefit of inconvenience by examining how intentionally inconvenient tools affect emotions and memory during real-world sightseeing in Kyoto. By combining PANAS, POMS2, and post-tour quizzes, it provided a broader emotional and cognitive evaluation than previous studies.

Moderate inconvenience enhanced engagement and memory: positive emotions such as "Excited" and "Proud," along with manageable negatives like "Nervous," correlated with better memory, suggesting that emotional activation—not comfort drives experience and retention.

Feedback supported this view, showing that navigation limits and camera delays promoted decision-making and self-reflection, though occasional frustration highlighted the need for balance.

Future work should test diverse tourist settings, apply multiple-comparison corrections (e.g., Bonferroni), and refine system functions to sustain the enjoyment–challenge balance. A larger, gender-balanced sample will also clarify emotional and cognitive differences.

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