Experiencing Nature
Final Report

Ondrej Mitas
Ben Wielenga

Tourism Destination Management Master student Kees Evers, collecting data for this project, June 2022

Summary

Natural areas are under conflicting pressures from visitors, nearby residents, and governments. Carefully placed architectural interventions are possible mechanism for relieving these pressures. How visitors experience them is poorly understood, however. We used wearable emotion and location tracking technologies to examine visitor experience and outcomes. Our sample comprised 57 Fort de Roovere and 66 Sallandse Heuvelrug visitors. Of these 123 participants, 87 also provided valid location and wearable data, and 80 filled in the follow-up questionnaire one week after their visit.

Participants experienced improvement in life satisfaction, positive emotions, and some even in health. Their visits were memorable and likely to be recommended to others. These effects were related to connection with nature and experiencing novelty (a change from the every day). Visitors to natural areas experience built features as generally more emotionally arousing, while natural areas (no built features) are less emotionally arousing. Taking natural spaces at each location as a reference category, the most calm locations during the experiences were modest, unobtrusive built features which let nature shine. The most exciting locations were larger, more dominant built features, including expressive ones like the visitor center and lookout tower, but also restaurants and parking lots. Furthermore, it is important to note that some trails, especially those at boundaries between landscape types, were far more exciting than others. The calmest ones tended to be in the deep woods, but other wooded trails were exciting.

The most memorable and impressive elements of the Fort de Roovere experience are the bridge and the tower—the built features enhancing connection with nature—while the most memorable and impressive elements of the Sallandse Heuvelrug are natural elements themselves, with no built features in them.

The experience makes fairly little difference in pro-environmental behavior, but it clearly helps to be impressed by nature. In fact, the biggest effect of the experience appears to be in getting participants to talk to others about their behavior.

Experiences by proximity (‘locals’ vs. ‘visitors’) vary little in terms of outcomes. However, visitors to Fort de Roovere are more emotional at nature-enhancing built locations, and less emotional in natural areas, than locals. Visitors to the Sallandse Heuvelrug are less emotional in all built areas than locals. Nearby residents—the rather few in our sample—perceived middling tourism development impacts, though somewhat more at the Sallandse Heuvelrug than at Fort de Roovere. The somewhat ‘positive’ impacts of employment and maintenance correlated with those of traffic and crowding, and negatively with pride. As a whole, these impacts were positively related with connection with nature during the visit.

Based on these findings, we recommend managers of natural areas to first prioritize a variety of available experiences, from those which are more social and busy to truly quiet opportunities to connect with nature. Light-handed architectural interventions which let nature shine are best. That said, spectacular lookout towers do indeed attract visitors and can be implemented as a specific “magnet” to draw visitors’ attention, when that specific goal is sought.

Introduction

Natural areas not only provide a haven for relaxation and recreation, but also play a crucial role in maintaining biodiversity and ecological balance. These areas are under increasing and conflicting pressures, however, from increasing levels of current visitors and the need to preserve natural elements and processes for generations of future visitors.

Contact with nature is widely understood to enhance health. Natural environments restore attention and promote physical activity, resulting in positive emotions, reduced stress, and lower blood pressure in the short term, faster healing, and higher subjective well-being in the long term (Kaplan & Kaplan, 1989; Kaplan, 1995; Ulrich, Dimberg, et al., 1991; Ulrich, Simons, et al., 1991). These well-known outcomes are important reasons for governments to protect natural areas, and for park managers to invest in facilities for visitors such as interpretive programs, parking, trails, signage, benches, and lookout towers.

In recent years, there has been a noticeable increase in architectural attention to the design of these built features. They are now frequently designed not only for low cost and basic function, but also for their own aesthetic beauty and fit with the natural landscape (Wielenga et al., 2022, Wielenga, 2021). Examples include intricate and sculptural lookout towers, such as on the Devinska Kobyla hill near Bratislava, and museums which appear to grow out of the landscape, such as The Whale Museum in Norway. One major hope behind increased investment in these facilities is to improve the visitor experience. More concretely, it is assumed that a well-designed bench or lookout point provides closer and more intimate access to nature, and enhances the already-known positive effects of the natural environment. This assumption is untested, however, as emotional reactions to specific environmental stimuli are fleeting and difficult to capture in the moment (Bastiaansen et al., 2019). Developments in wearable tracking of emotional arousal have made such recording possible. When combined with GPS location tracking, wearable emotion recordings have opened up possibilities of linking emotional reactions to specific environmental stimuli (Mitas et al., 2020; Strijbosch et al., 2021).

In the current project, the Experience Lab of Breda University of Applied Sciences teamed up with the European Tourism Futures Institute (ETFI) of NHL Stenden University of Applied Sciences in Leeuwarden, facilitated by the Centre of Expertise in Leisure, Tourism and Hospitality (CELTH). We intercepted, tracked, and mapped visitor experiences for two areas: Fort de Roovere, part of the Zuiderwaterlinie in the province of North Brabant, and Nationaal Park Sallandse Heuvelrug. We mobilized wearable emotion and location tracking technologies to examine visitors experience and outcomes at the two locations natural areas, contrasting nature-enhancing built features with purely functional built features and with non-built, natural parts of the sites. Thus, we aimed to gain deeper insight into both subjective and objective aspects of visitor experience. The use of questionnaires allowed us to explore visitor perceptions and evaluations of their experiences. Location tracking allowed us to map visitor movements within the surveyed areas, and to link them to experience physiology and self-report. Applying the Empatica E4 provided us with a unique window into the physiological and emotional responses of visitors during their visit to nature.

The partial fusion of these data sources not only promises a deep understanding of the visitor experience, but also provides the opportunity to develop strategies for visitor management in natural areas. We work under the assumption that the ultimate aim of managing natural areas in the Netherlands is to optimize the visitor experience and well-being, not only at present, but also for future generations.

Methods

We measured visitor experiences at Fort de Roovere and Nationaal Park Sallandse Heuvelrug by taking an intercept sample of visitors in March and April (Fort de Roovere) and May and June (Sallandse Heuvelrug) of 2022. We used questionnaires at the beginning and end of each visit as well as continuous tracking of location using GPS and emotional arousal using the Empatica E4 wearable wristband. At the end of their visit, after filling out the exit questionnaire, participants also received informational materials about sustainable behavior. Their response to these materials, as well as a second measurement of wellbeing, were measured in a follow-up questionnaire sent by email 14-16 days after their visit.

Sample

Days to take intercept samples were selected based on expected peaks in activity. Days scheduled for very wet weather were canceled. Each person entering the park through the parking lot, except when the researchers were already occupied with participants, were approached. Both sites are popular not only with hikers but with cyclists. However, for comparability of the location data, cyclists were excluded. Also, most families with children declined to participate. The final sample in the questionnaire data comprised 57 Fort de Roovere and 66 Sallandse Heuvelrug visitors. Of these 123 participants, 87 also provided valid location and wearable data, and 80 filled in the follow-up questionnaire one week afeter their visit.

The sample at the fort was, on average, 42 years old (sd = 14 years), well educated (64% with bachelor degree), and evenly split between men and women. The sample at the national park was on average about 10 years older (54 years; sd = 17 years), less well educated (38% with bachelor degree) and overwhelmingly female (72%).

Sustainable behavior intervention

As one of the goals of the present study was to determine the effect of experiencing nature on changes toward more sustainable behavior, we concluded each participant's visit with an information intervention. The goal of this intervention was twofold—first, to suggest concrete behavior changes about which we could directly inquire at follow-up, and second, to act as an *accelerant*, amplifying any motivations or intentions toward sustainable behavior triggered by the visit. The intervention comprised a brochure which urged participants to make three modest changes in their current daily life: to take shorter showers, to grow their own herbs (garden cress), and to use these in cooking a vegetarian meal. An hourglass-type shower timer and garden cress seeds were also provided.

Measures

Unless otherwise noted, we measured all variables on a *Not at all – Extremely* 5-point Likert-type scale. We aimed to measure participants' wellbeing baseline and demographics before they started their visit. At the end of their visit, we took a second wellbeing measurement, as well as measuring their reflections on their thoughts during the experience, and how they perceived the experience impacted them. Finally, we asked them to evaluate the experience.

Continuous experience tracking. During their visit, we asked participants to carry a smartphone with the popular workout application Strava recording GPS location 1 per second. We also outfitted them with an Empatica E4 wristband to measure skin conductance, a proxy for emotional arousal, at 4 times per second. The wristband records skin conductance from 2 wires which attach to stick-on electrodes worn on the fingers. The skin conductance signal was cleaned from artifacts due to movement and slow changes in the signal, due to physical activity, temperature, and wearing of the device, were filtered out using

deconvolution (Benedek & Kaernbach, 2010). Skin conductance signals were also Z-standardized to cancel out differences in skin responsiveness between participants.

Reflections on thoughts during the experience. Based on previous research conducted by our lab, as well as Filep et al. (2022), Mitas et al. (2023), and Mitas and Bastiaansen (2018), we expected three aspects of the experience to be prominent in people's thoughts after their visit, and to be related to outcomes such as wellbeing and evaluations: novelty, connection with people, and connection with nature. Novelty was measured using the average of two items based on Mitas and Bastiaansen (2018). Connection with people was measured using a single item based on Mitas et al. (2023). This item was reworded from "people" to "nature" to measure connection with nature. Furthermore, participants were asked to indicate to what extent they experienced natural beauty.

Wellbeing. We defined wellbeing according to the well-known Diener framework of subjective wellbeing (Diener et al., 1999). In this framework, a person's wellbeing is partly cognitive and partly emotional. The cognitive part is measured as life satisfaction using 5 agree-disagree items (Diener et al., 1985). The emotional part is sometimes measured as emotions people feel over several weeks, or on a typical day. However, we chose to focus on the experience of visiting the site. Thus, we asked people to what extent they were feeling each of 8 emotions "right now" before the visit to get a baseline measurement, and to what extent they felt each "during their visit" right after. The 8 emotions, adjusted slightly from Diener et al. (2010), were *positive, joyful, happy, content, positively surprised, angry, sad, and afraid.* Positive emotions were averaged together into a single variable. Negative emotions were also averaged together into a single variable.

Evaluation. The experience was evaluated according to the common measures of intent to recommend (extremely unlikely to extremely likely), and overall grade for the experience (very poor to excellent), on a 0 to 10 scale (Reichheld, 2003; Strijbosch et al., 2021). Furthermore, we asked about the impact of the experience using one item each for each level of experience impact as defined by Lundberg et al. (2021). According to this framework, being emotionally touched make experiences *memorable*. An experience which also produces insight becomes *meaningful.* These insights sometimes change a person. The experience then reaches the highest possible level of impact, *transformational.*

Changes toward more sustainable behavior. We used an informational brochure, shower timer, and garden cress seeds to give participants ideas for specific behavior changes. This intervention was intended as an accelerant to any motivations or intentions related to sustainability triggered by the visit. In the follow-up (two weeks after visit) questionnaire, we used six items in a binary yes-no response format to measure possible behavior change. With three items, we measured if participants had done the suggested behaviors, namely "consciously saved water while showering," "planted garden cress seeds," and "cooked a vegetarian recipe." The latter three items touched on other behaviors related to nature, namely "made a donation to an organization connected to nature protection, recreation in nature, or sustainability," "work on your own or in a community garden," and "told other people about any of these actions."

Open-ended questions. For practical purposes, the exit and follow-up questionnaire each had a single open question, to which participants could type brief verbal responses. While the exit questionnaire asked, "is there anything you miss at [site]?" the follow-up questionnaire asked "what about your visit stayed with you?"

Findings

Fort de Roovere

On the four items measuring people's reflections on their thoughts during the experience, they reported high levels of natural beauty and connection with nature. Thus, we would conclude the Fort de Roovere experience is characterized by nature. Novelty scored slightly lower (about 3.5 on a 1 to 5 scale) and connection with other people actually scored below the scale midpoint, at around 2.7 (Figure 1).

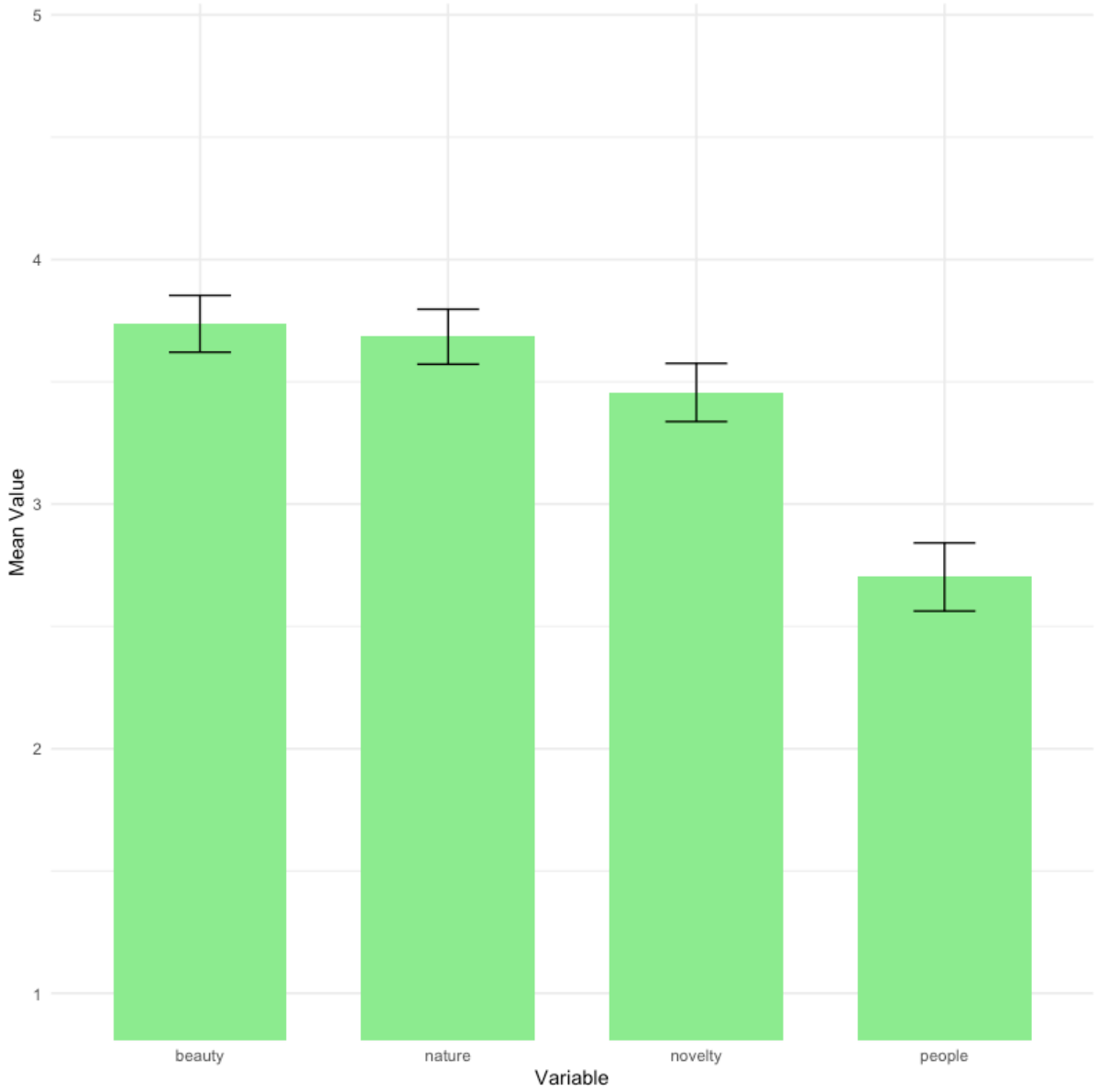

Figure 1. The experience of Fort de Roovere.

All self-report data bivariate correlations are shown in Figure 2.

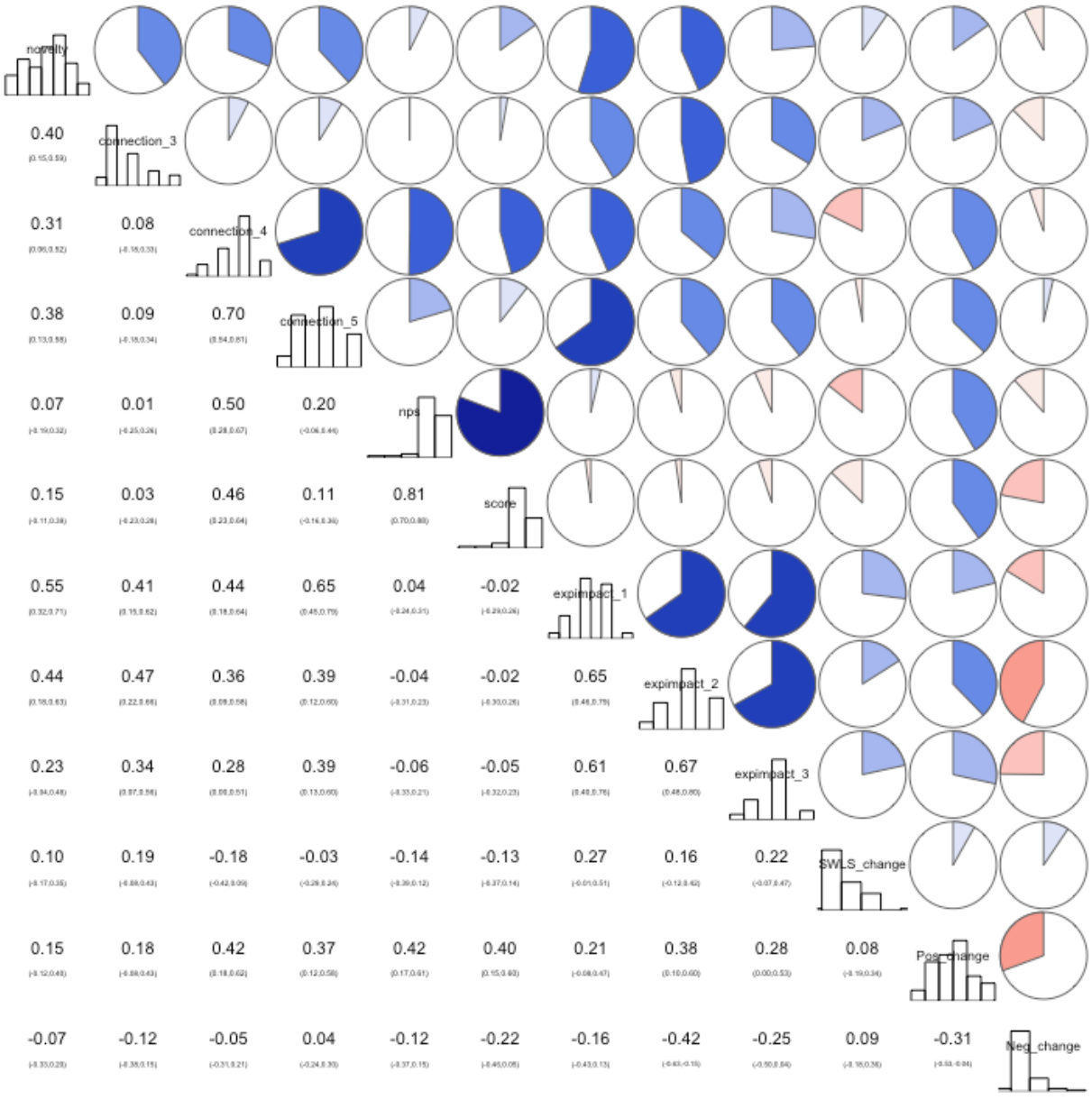

Figure 2. Correlogram for Fort de Roovere self-report data.

The map of skin conductance (Figures 3 and 4) shows the data by 6-meter hexagonal bins with minimum 3 participants in each. Emotional arousal varied over the fort. Emotional arousal was low in the forested area around the fort, especially to the east of the fort. On the other hand, the forested paths along canals just south of the fort featured strong emotions. Basically, when in the trees, participants got more emotional the closer to the water they got. This could be because the elevation changes are interesting, but also a bit frightening, as they are steep. Also strongly emotional was the entrance, the snackbar, the very tip (and probably the top) of the viewing tower, and the location on the fort wall where the Moses bridge comes into view. Remarkably, the bridge itself and the rest of the tower seems to have a rather calming influence.

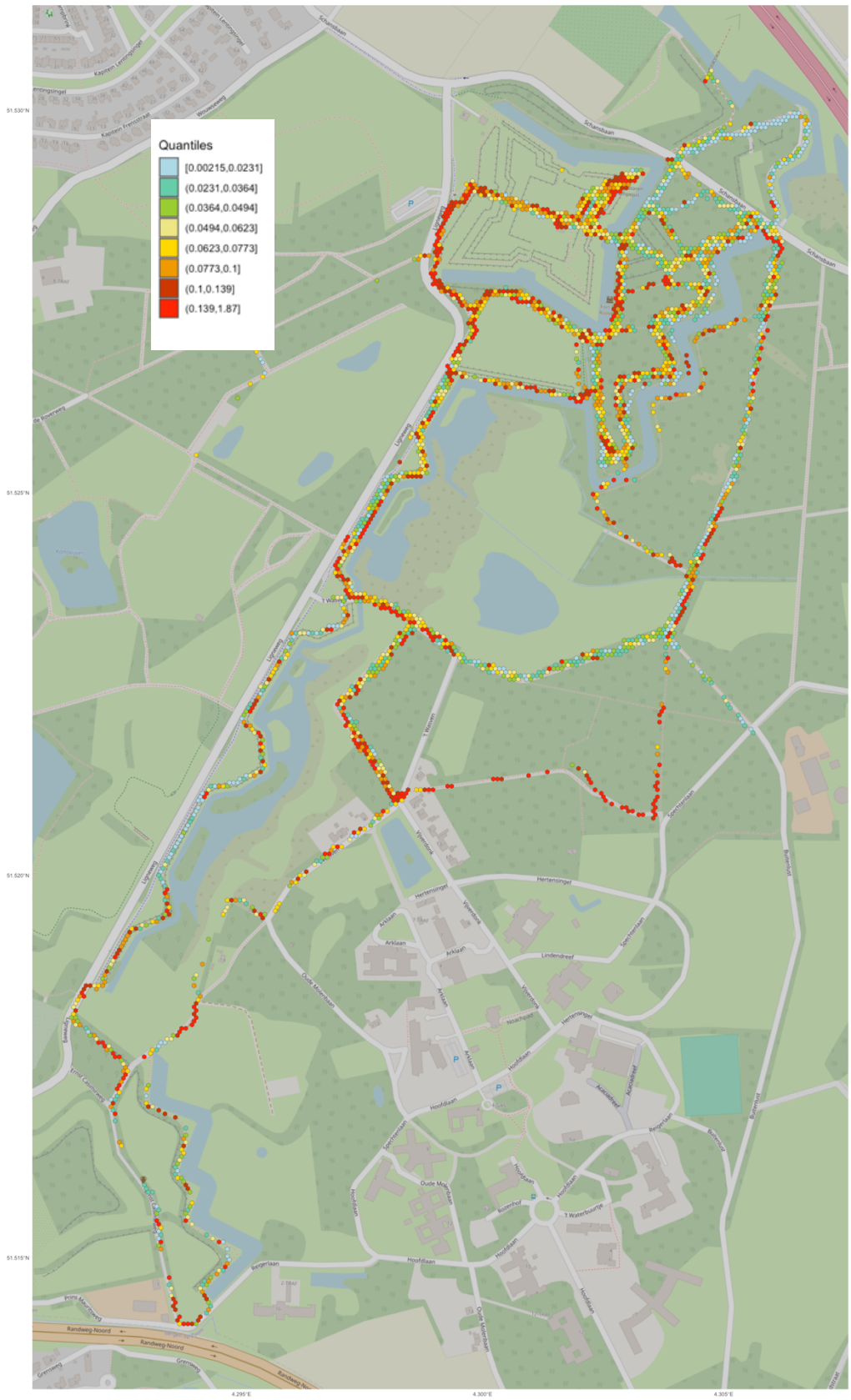

Figure 3. Fort de Roovere skin conductance map overview.

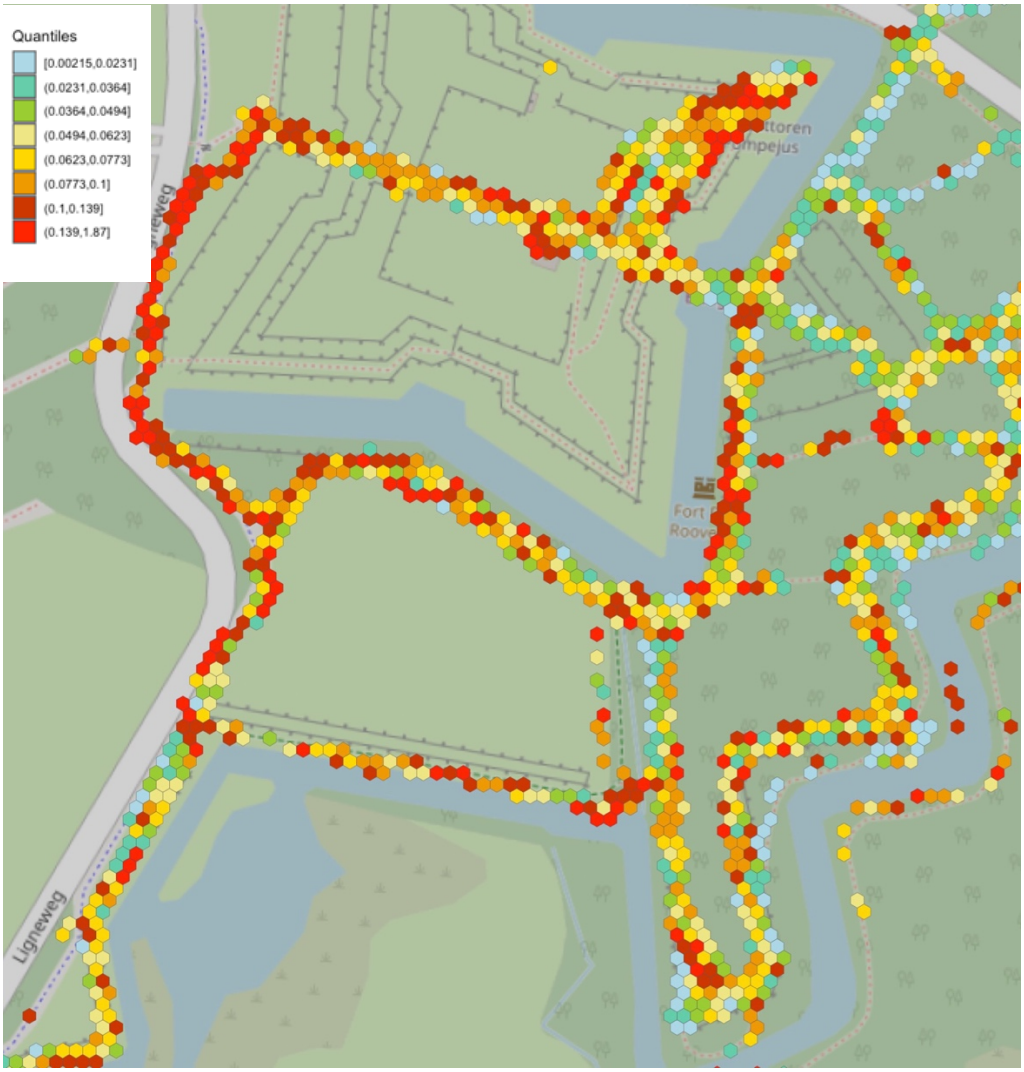

Figure 4. Fort de Roovere skin conductance map detail.

Fort visitors evaluated the experience as quite positive, with intent to recommend (NPS) and grade of around 8 on a 0-to-10 scale. The experience was not evaluated as very impactful, however, with scores for a meaningful (impact2) and transformational (impact3) experience all below the scale midpoint of 5; the score for a memorable experience (impact1) was just above (Figure 5).

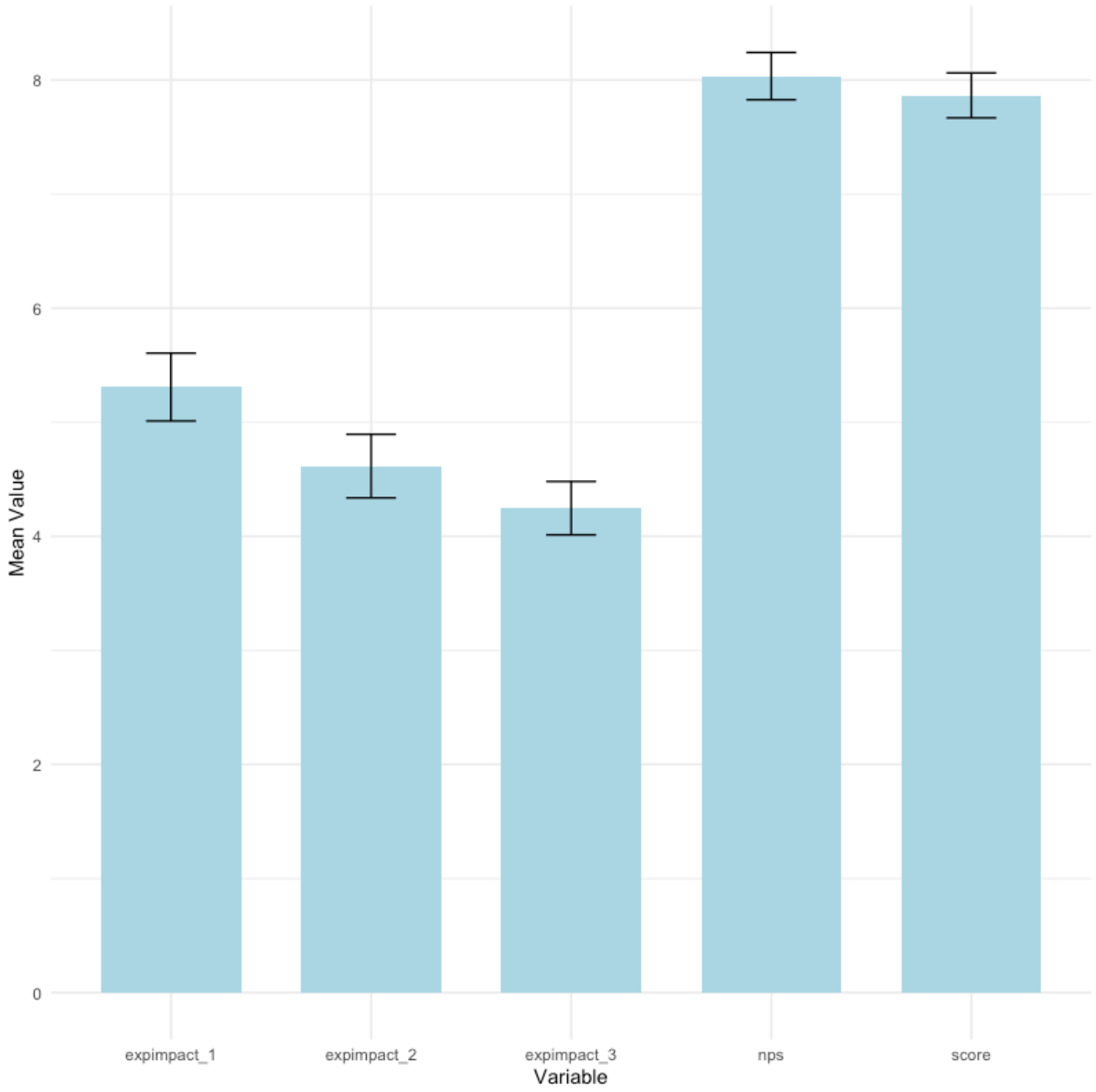

Figure 5. Experience outcomes of visit to Fort de Roovere.

Despite the fairly low impact scores, the experience had an immediate, positive effect on visitors' sense of wellbeing. From the start to the end of the experience, life satisfaction (SWLS) increased slightly, positive emotions increased remarkably (about 0.5 on a 5-point scale), and negative emotions increased negligibly (Figure 6).

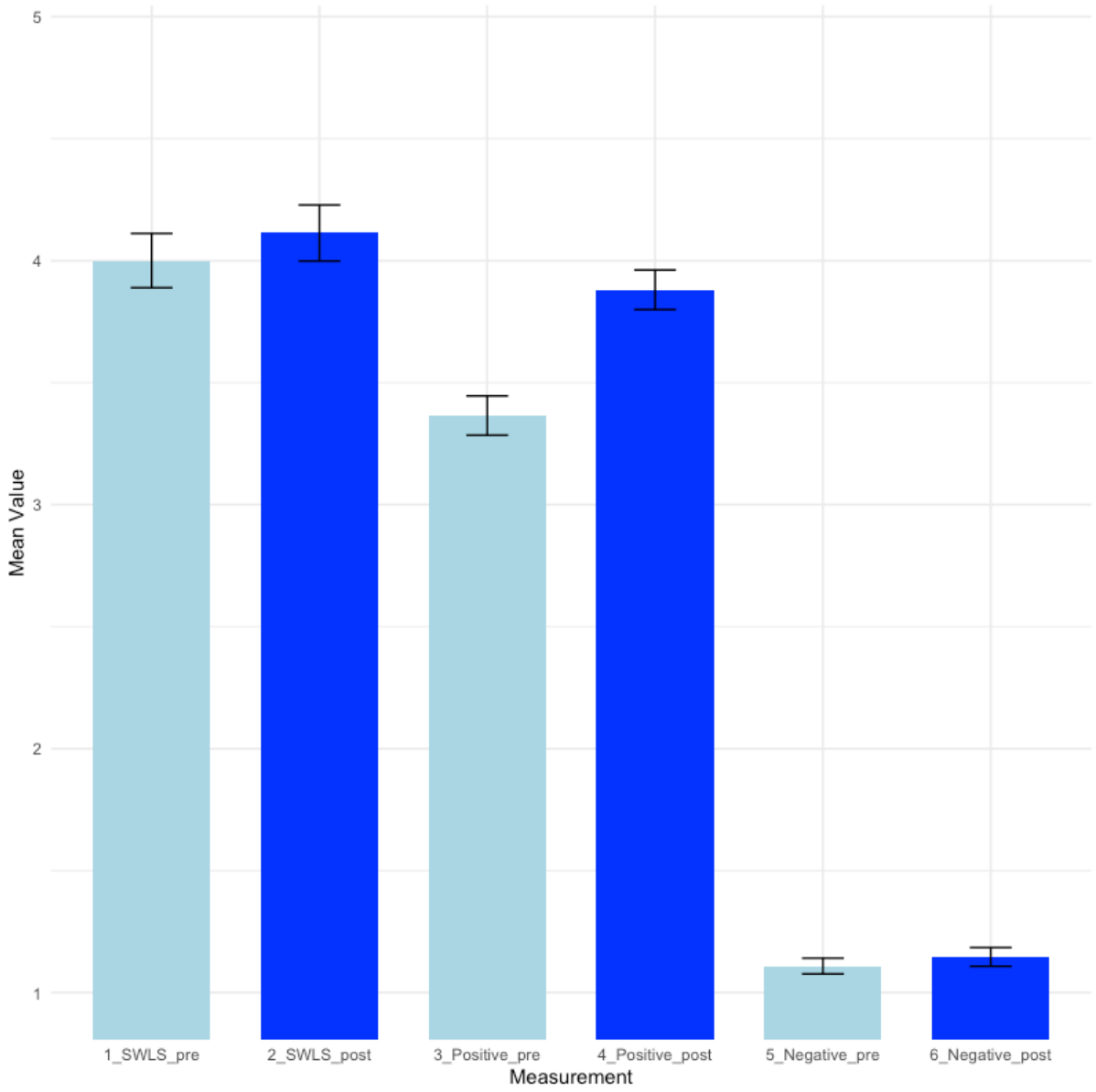

Figure 6. Change in well-being over a visit to Fort de Roovere.

To determine the relative importance of different parts of the experience for wellbeing, we ran a linear multiple regression model of life satisfaction after the visit as a function of pre-visit life satisfaction, connection with nature and other people, novelty, and natural beauty. Together these variables explained 62% of the variation between people in life satisfaction, and the only significant predictor was their life satisfaction before the visit. Connection, novelty, and beauty did not have an effect.

We ran a similar model for positive emotions, explaining 59% of the variation. Here we found that baseline positive emotion did *not* have an effect; rather two aspects of the experience were significant: novelty and connection with nature. The effect of connection with nature was very slightly stronger; both uniquely explained about 7% of the variation in positive emotions over and above other predictors (Figure 7).

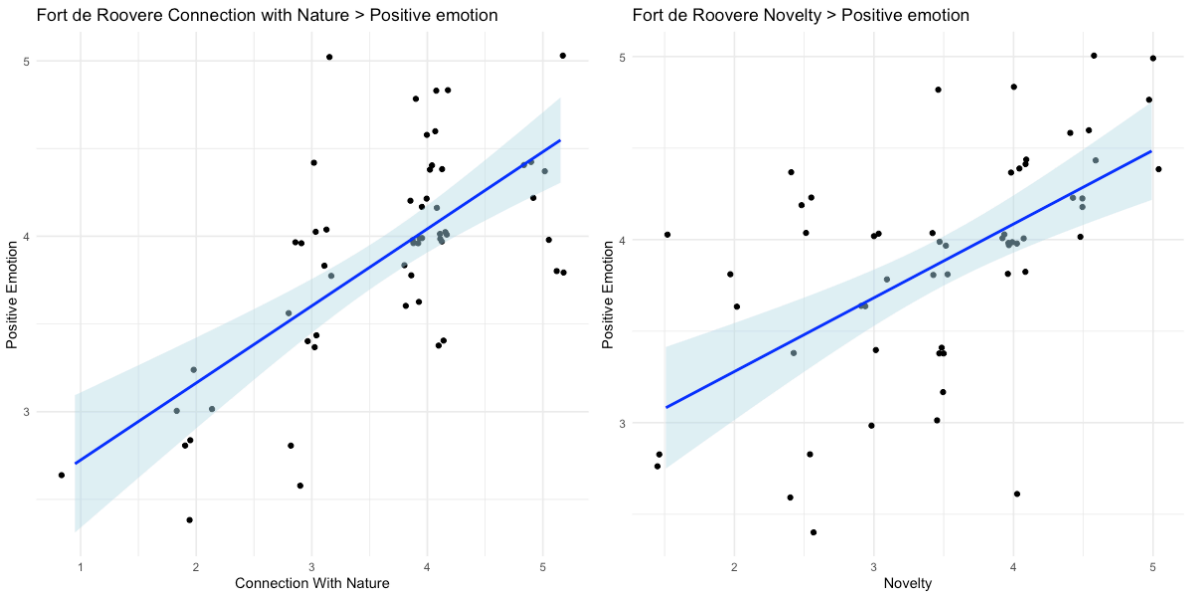

Figure 7. The relationship between connection with nature and novelty, respectively, and positive emotion after a visit to Fort de Roovere.

The following *emotion effectiveness maps* visualize where these effects seemed to occur most strongly. The hexagons on the map show correlations between skin conductance and later, self-reported connection with nature (Figure 8) and novelty (Figure 9); focusing on the area of the fort itself only. These maps show that higher connection with nature and especially novelty are slightly higher in the areas approaching the Pompejus tower and in the thickly wooded area of the former eastern defensive line. In the case of novelty, there is also a positive effect of emotion near the lunchroom.

In sum, the maps and statistics should be interpreted as follows. Psychology of experiences suggests that emotions triggered by our environments color what we take from those experiences with meaning. We found that at Fort de Roovere, **positive emotions were associated with nature and novelty, and this connection seemed to be sparked most at the tower, lunchroom, and forest-water boundaries.**

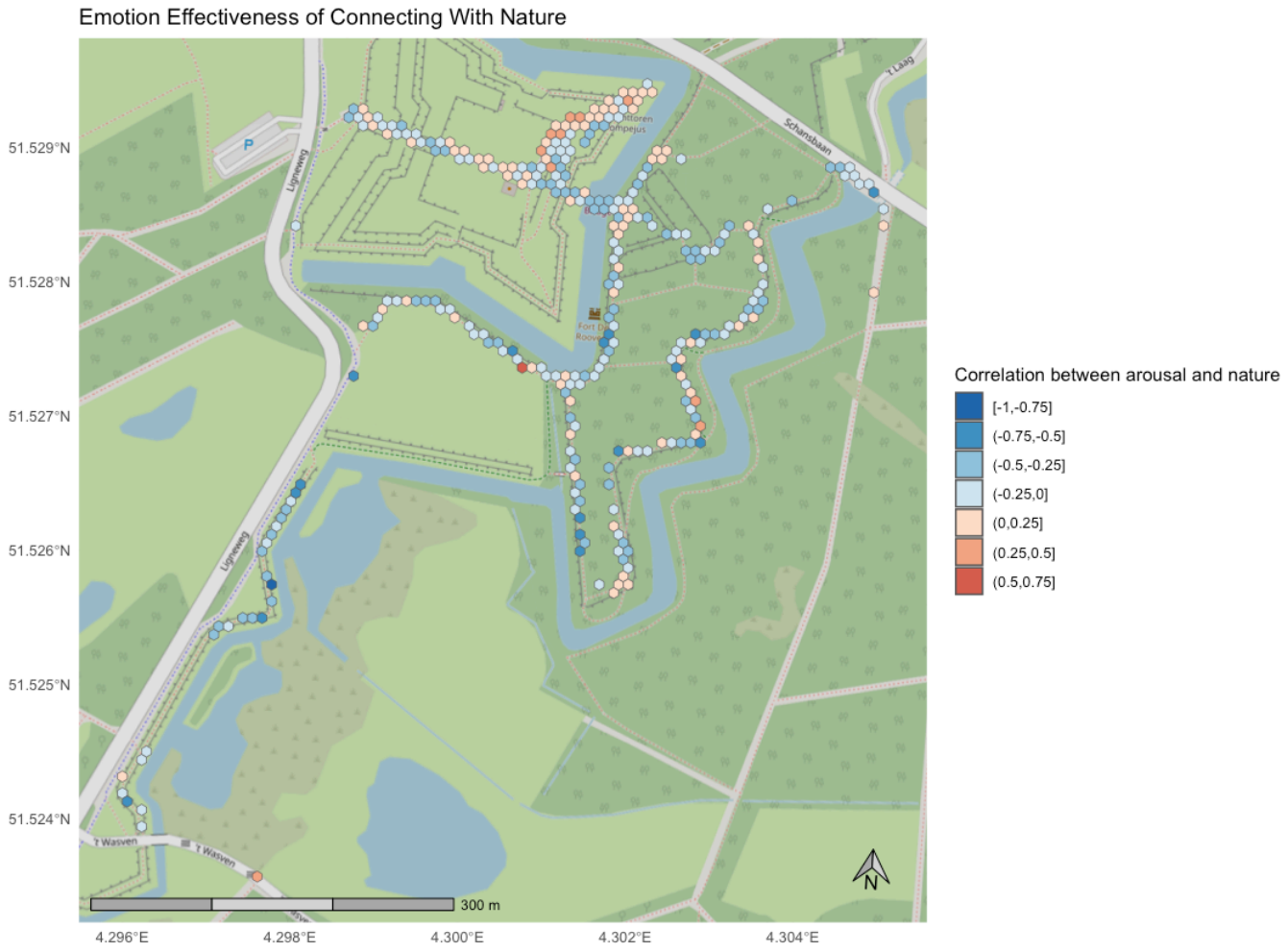

Figure 8. Emotion effectiveness of connection with nature.

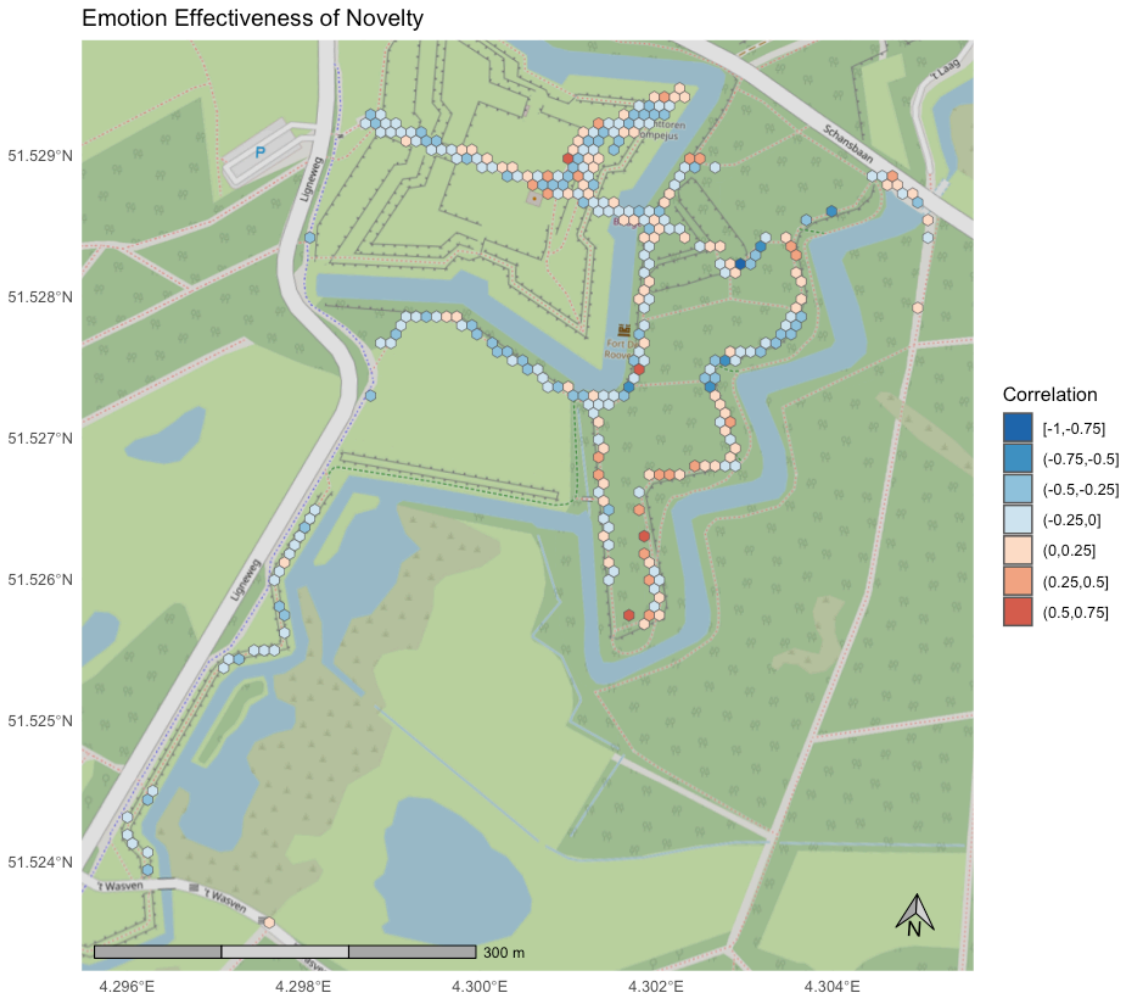

Figure 9. Emotion effectiveness of novelty.

Respondents were invited to type into a blank text field what they found most memorable or impressive during their visit to Fort de Roovere. A total of 52 responses were given. Three themes stood out in these brief responses. The Pompejus tower (n = 14) and the Moses bridge (n = 13) were mentioned most often as memorable or impressive. To a lesser extent, nature (n = 8) was mentioned as the most memorable or impressive experience.

A few weeks later, we asked respondents what had stayed with them most about their visit. Respondents gave a total of 60 answers. Again, the Pompejus tower (n = 14) and Moses bridge (n = 13) were indicated as aspects of the visit what respondents remembered most. To a lesser extent was nature (n = 7).

Nationaal Park Sallandse Heuvelrug

On the four items measuring people's reflections on their thoughts during the experience, they reported a very high levels of natural beauty (about 4 on a 1 to 5 scale) and a high level connection with nature. Thus, we would conclude the Sallandse Heuvelrug experience is characterized by nature. Novelty and connection with other people actually scored below the scale midpoint, at around 2.7 (Figure 10).

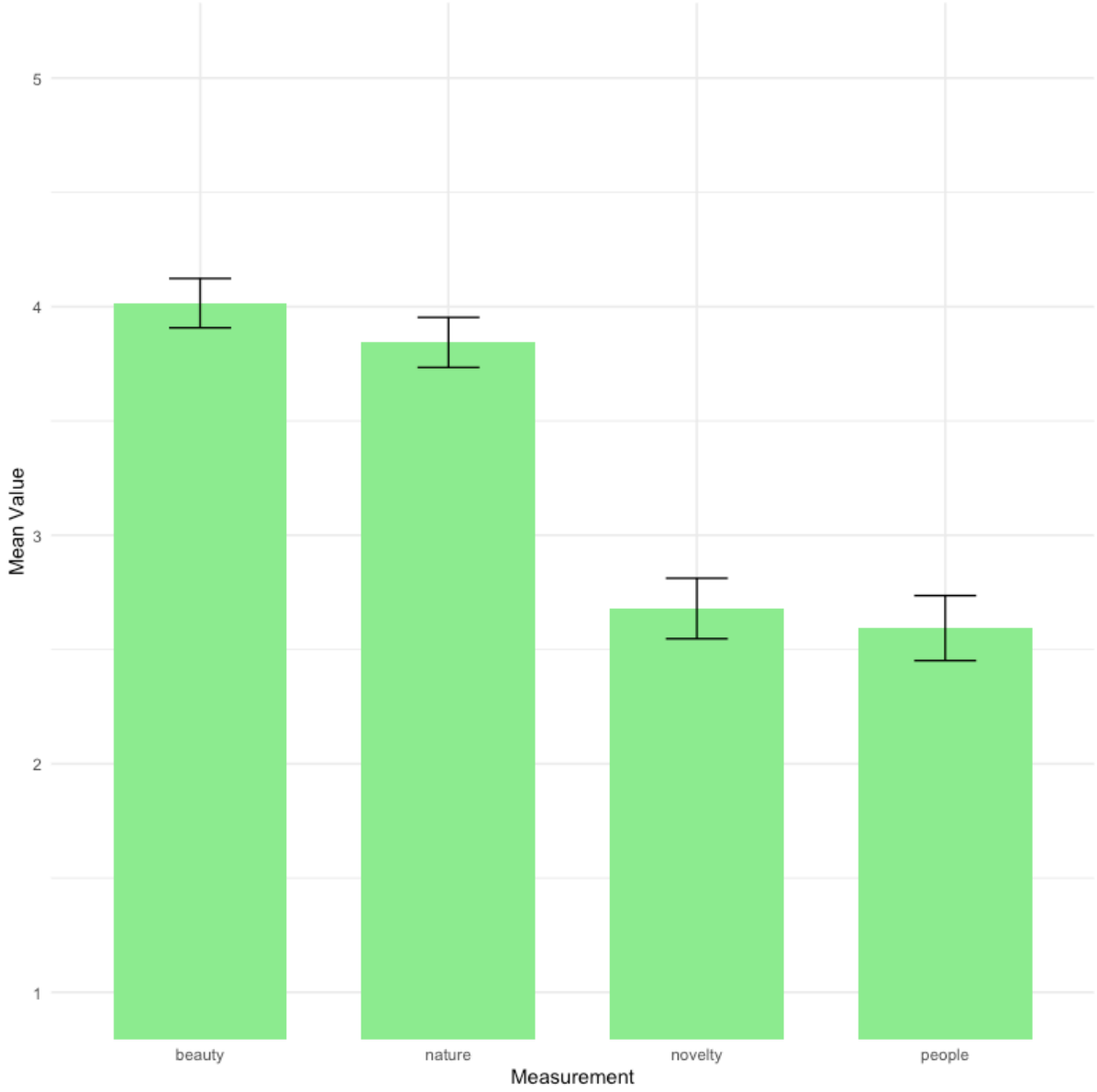

Figure 10. The experience of the Sallandse Heuvelrug

All self-report data bivariate correlations are shown in Figure 11.

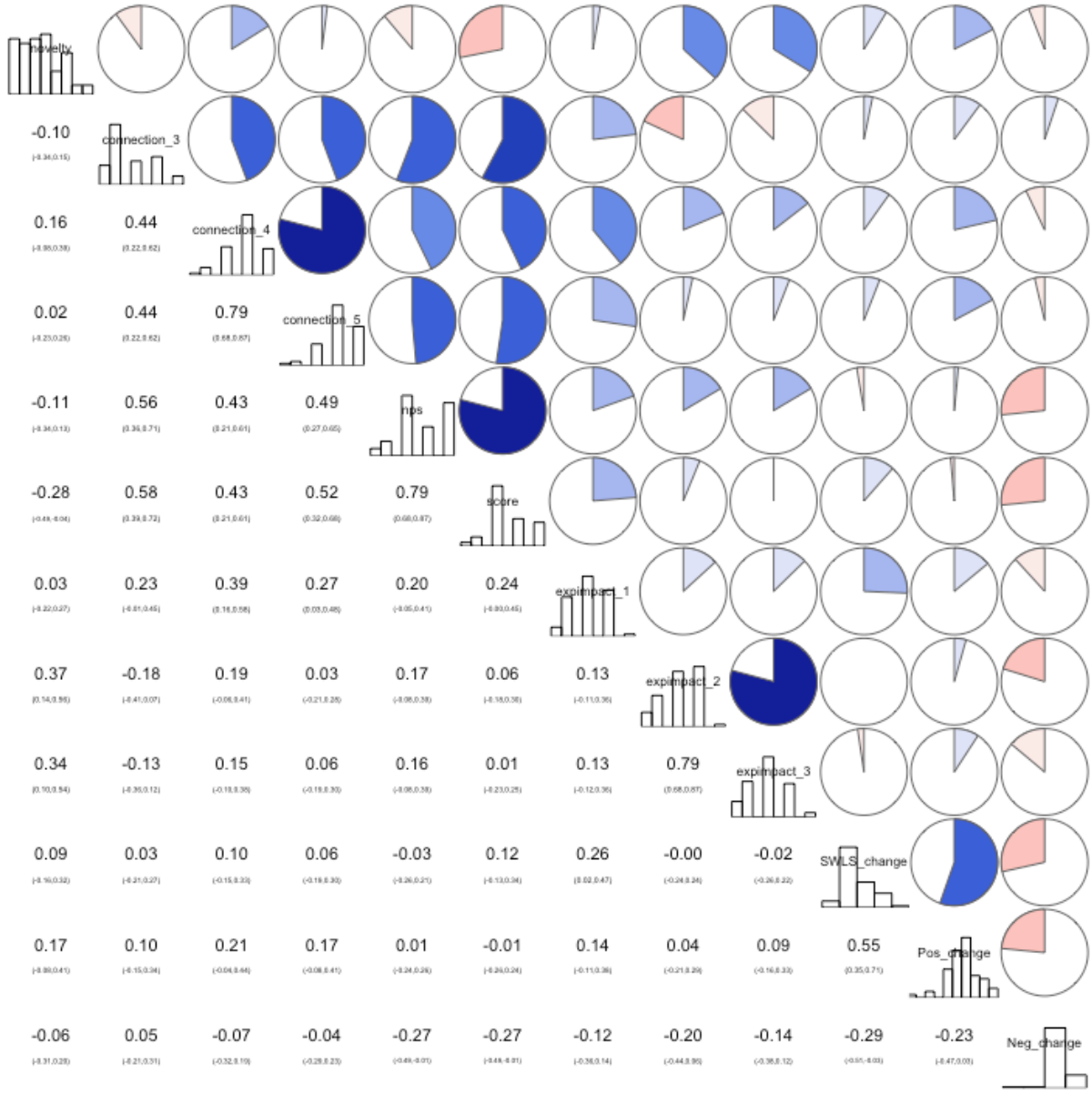

Figure 11. Correlogram for Sallandse Heuvelrug self-report data.

The map of skin conductance (Figure 12) shows the data by 10-meter hexagonal bins with minimum 5 participants in each. Note that these bins are larger, and require more participants (5 instead of 3), than the Fort de Roovere map, due to the much larger area covered. Emotional arousal over the park varied. Of the locations with more data points, paths on the east side stand out as being most emotional. This may be because of boundary between woods and moorland, much like the more arousing paths at Fort de Roovere are at boundaries between woods and water. The heavily visited area around the visitor center has varying emotional arousal—the location right in front of the entrance appears to be a strongly emotional location, while the beginning of the path heading south is among the least emotional of the entire map. Other very calm areas are deep in the woods, not unlike at Fort de Roovere.

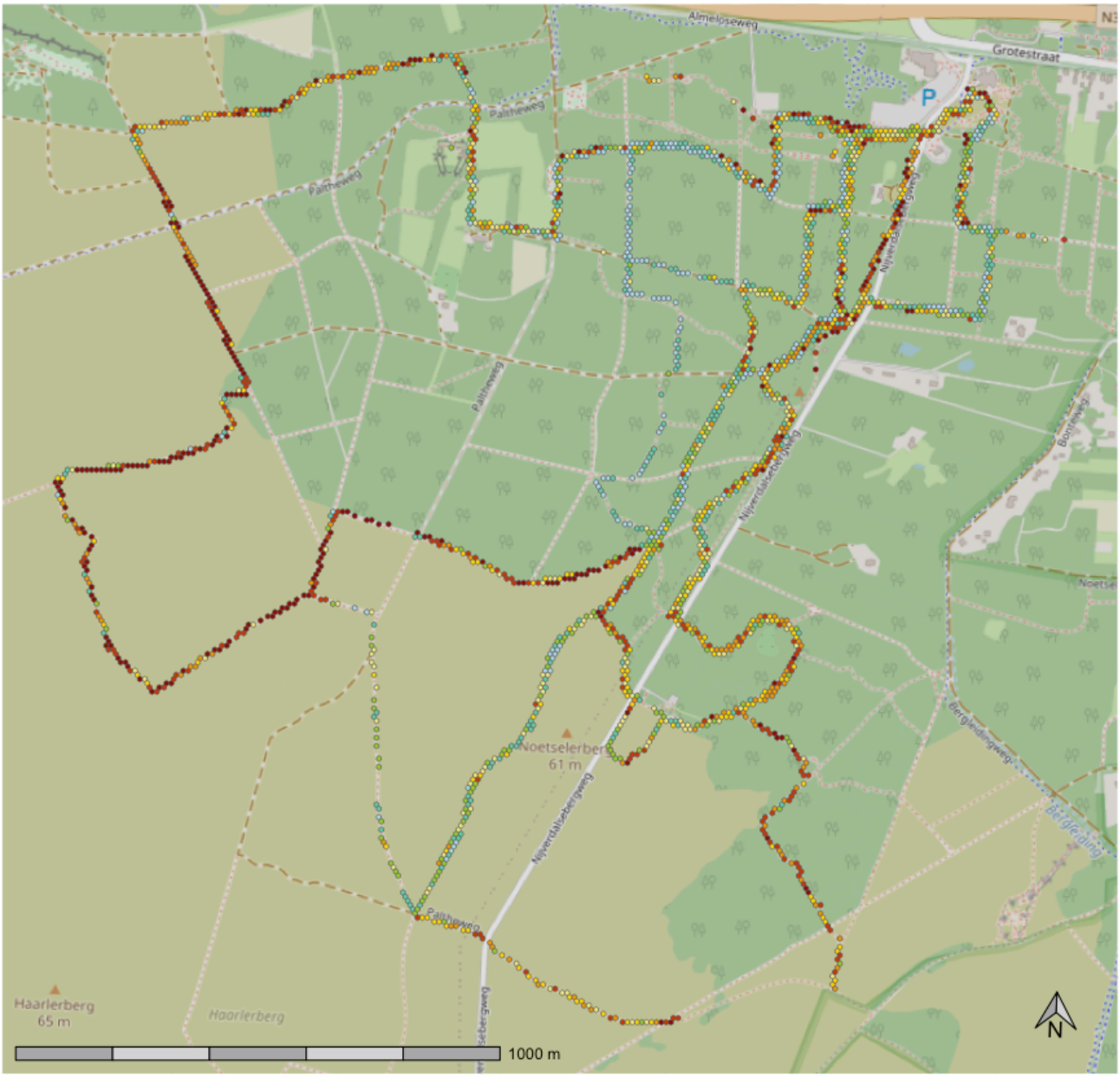

Figure 12. Map of phasic skin conductance in the Sallandse Heuvelrug.

Fort visitors evaluated the experience as very positive, with intent to recommend (NPS) and grade of around 8.5 on a 0-to-10 scale. The experience was not evaluated as very impactful, however, with scores for a memorable (impact1), meaningful (impact2), and transformational (impact3) experience all below the scale midpoint of 5 (Figure 13).

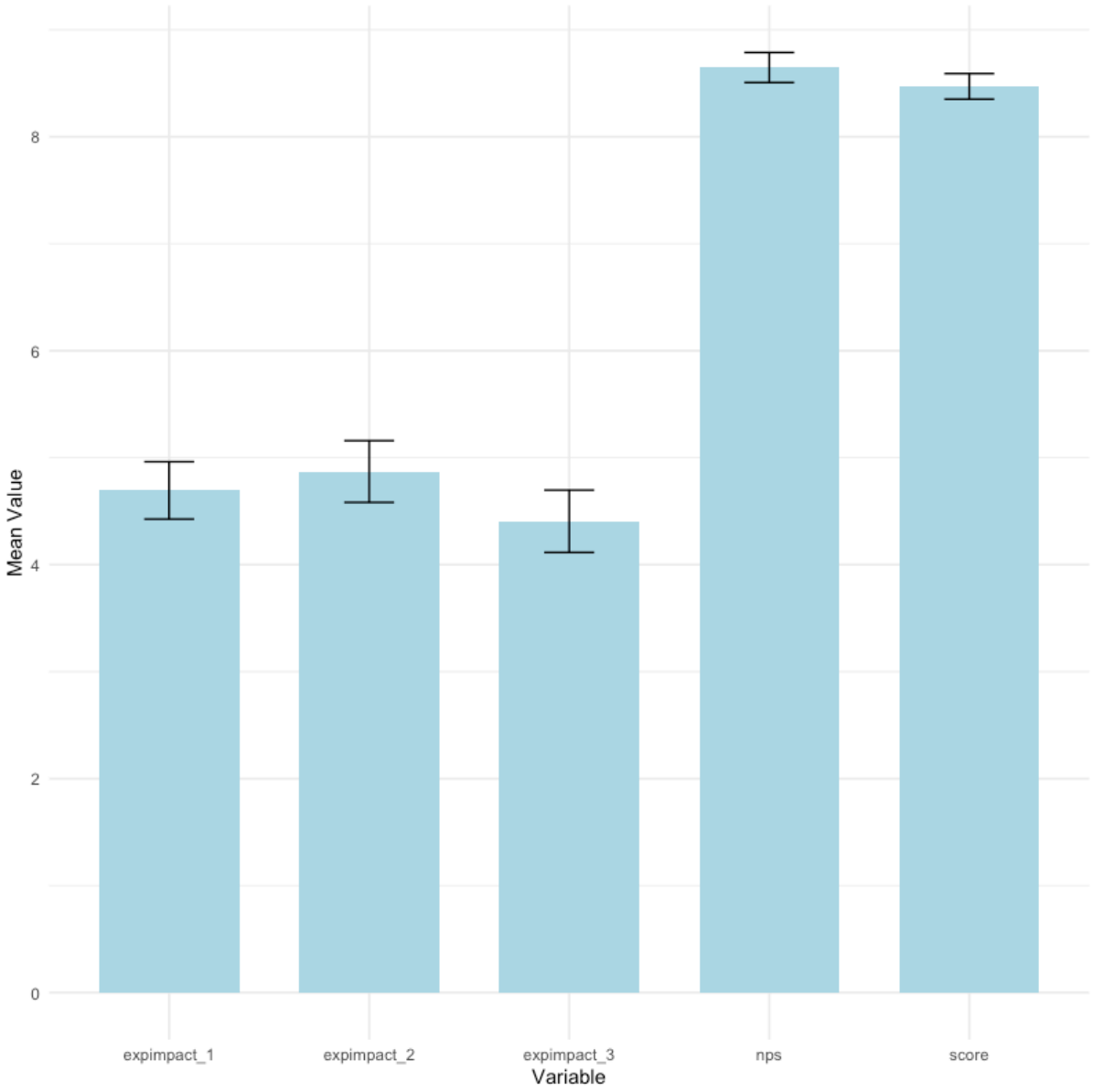

Figure 13. Experience outcomes of visit to the Sallandse Heuvelrug.

Despite the low impact scores, the experience contributed robustly to wellbeing. From the start to the end of the experience, life satisfaction (SWLS) increased slightly, positive emotions increased remarkably (about 0.65 on a 5-point scale), and negative emotions did not change at all (Figure 14).

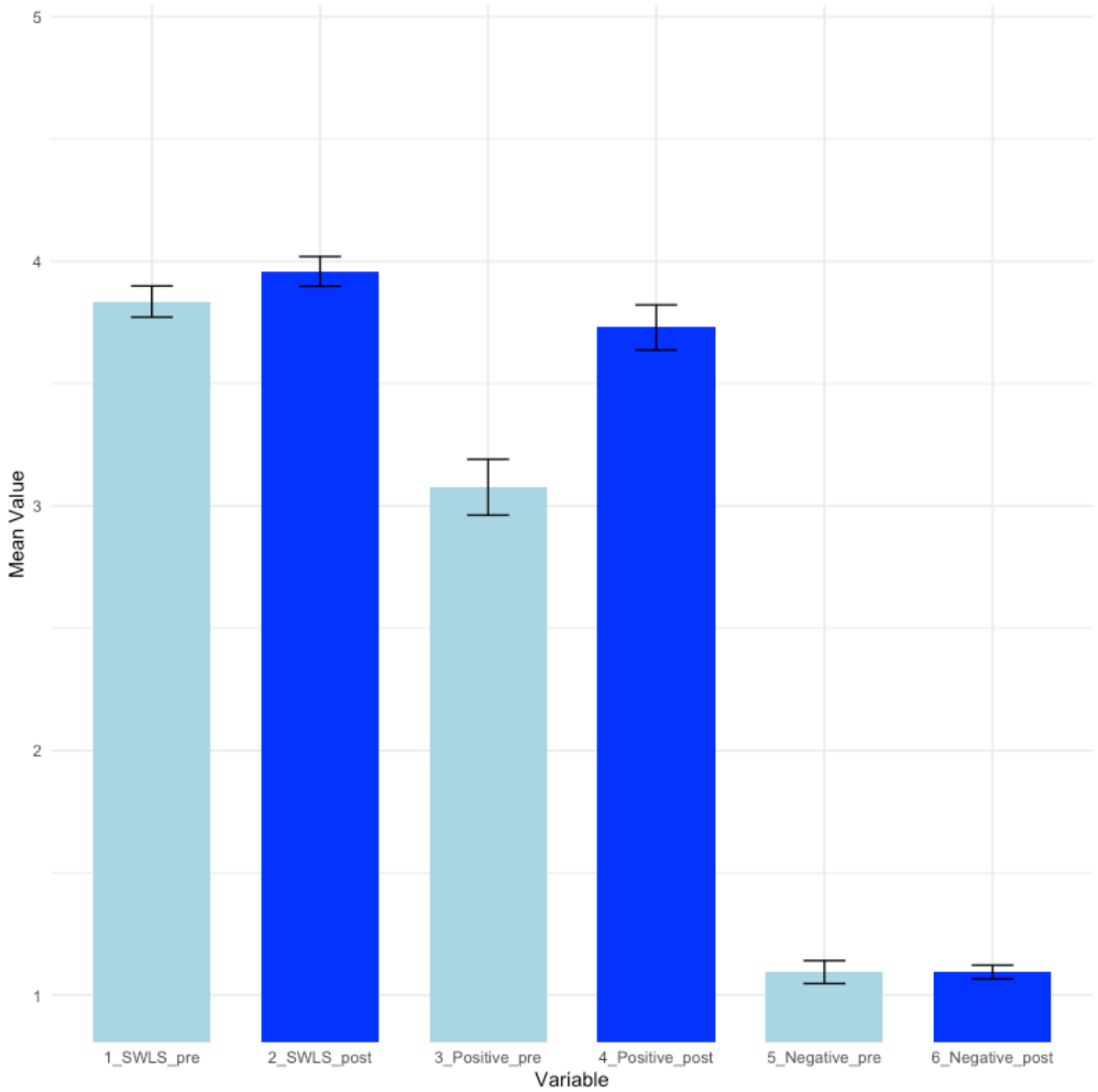

Figure 14. Change in well-being over a visit to the Sallandse Heuvelrug.

To determine the relative importance of different parts of the experience for wellbeing, we ran a linear multiple regression model of life satisfaction after the visit as a function of pre-visit life satisfaction, connection with nature and other people, novelty, and natural beauty. Together these variables explained 50% of the variation between people in life satisfaction, and the only significant predictor was their life satisfaction before the visit. Connection, novelty, and beauty did not have an effect.

We ran a similar model for positive emotions, explaining 77% of the variation. Here we found that baseline positive emotion did *not* have an effect; rather all four aspects of the experience were significant, namely novelty, connection with nature, connection with other people, and natural beauty. By far the strongest of these was the effect of natural beauty, but there was also much variation in the relationship between beauty and positive emotion. In contrast, the effect of connection with nature was rather marginal, but keep in mind that these two items (connection with nature and natural beauty) overlap a great deal (49%), an overlap which the model controls for. Natural beauty uniquely explained 4% of variation in positive emotion. Connection with other people explained more (6%), but the effect was less strong;

there was less variation around this effect. The scatterplots show that this is due to the fact that people scored all over the scale in connection with others, but almost nobody scored low in natural beauty (Figure 15).

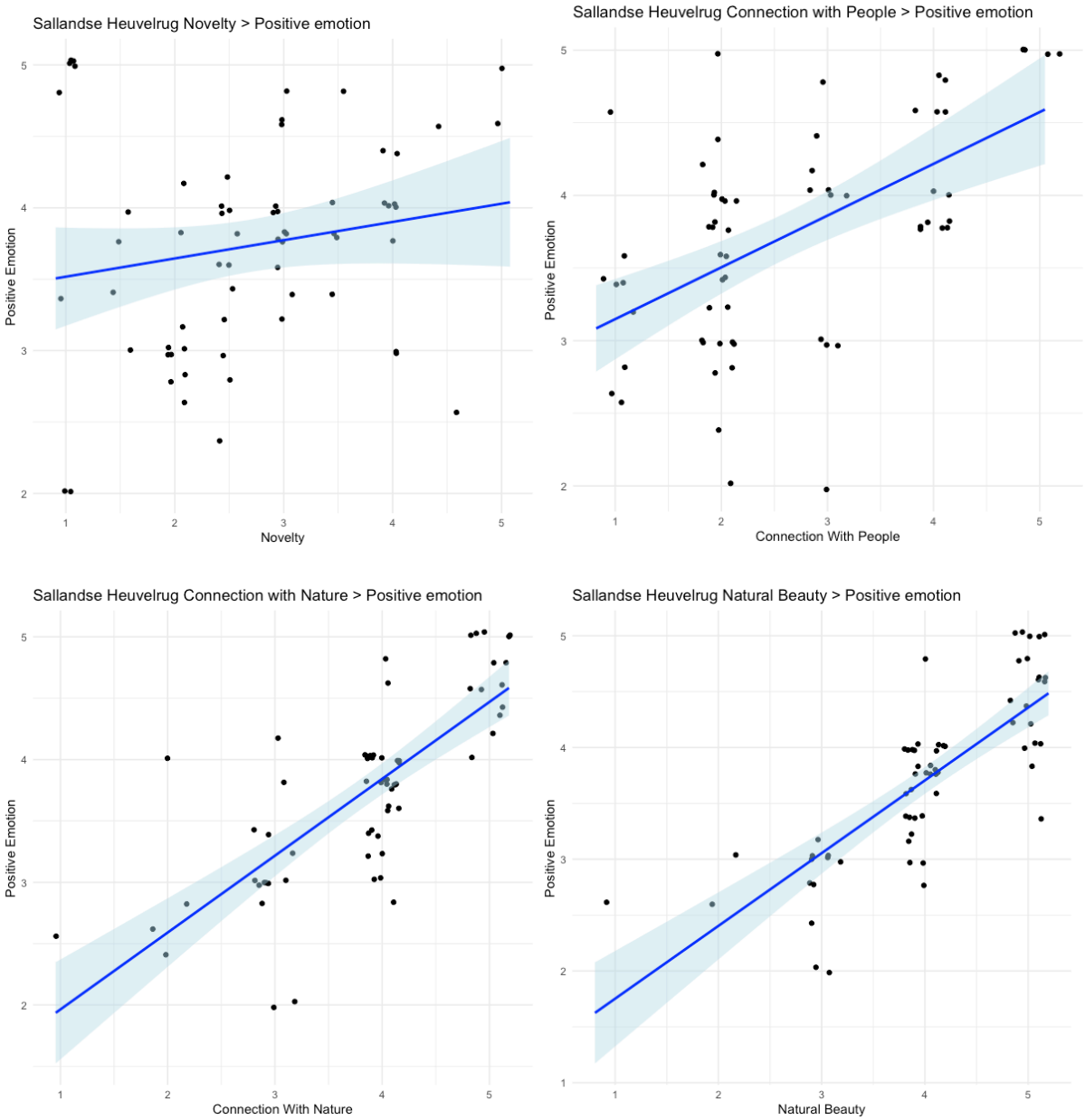

Figure 15. The relationship between connection with nature, connection with people, novelty, and natural beauty, respectively, and positive emotion after a visit to the Sallandse Heuvelrug.

For the sake of comparison and simplicity, of these four important experiential variables in the Sallandse Heuvelrug, we once again used novelty and connection with nature to visualize emotion effectiveness. The following *emotion effectiveness maps* visualize where emotional effects that drive novelty and connection with nature were strongest. The hexagons on the map show correlations between skin conductance and later, self-reported connection with nature (Figure 16) and novelty (Figure 17). Please note: for the Fort de Roovere data,

these maps showed correlations based on 10 or more participants. As participants at the Sallandse Heuvelrug were more dispersed, the maps here show correlations for 5 or more participants instead. Furthermore, the size of the grid cells used to calculate correlations was increased to 20 meters, as visitors were more widely dispersed between, but also on, the trails causing spurious differences between nearby cells. Thus, the maps show correlations for 5 or more participants within each 20 meters. These maps show that emotional arousal on a specific north-south trail is associated with connecting with nature, and to some degree with novelty. The northernmost east-west trail is also links emotional arousal to novelty, and somewhat to connecting with nature. Emotional arousal at the Noestelerberg lookout point is positively associated with novelty and especially with connecting with nature. Emotional arousal at the visitor center is negatively associated with connecting with nature and novelty. In sum, at the Sallandse Heuvelrug, **positive emotions were associated with people, nature and novelty, and this connection seemed to be sparked most at the specific north-south trail obvious in the maps below, and at the Noestelerberg lookout point.**

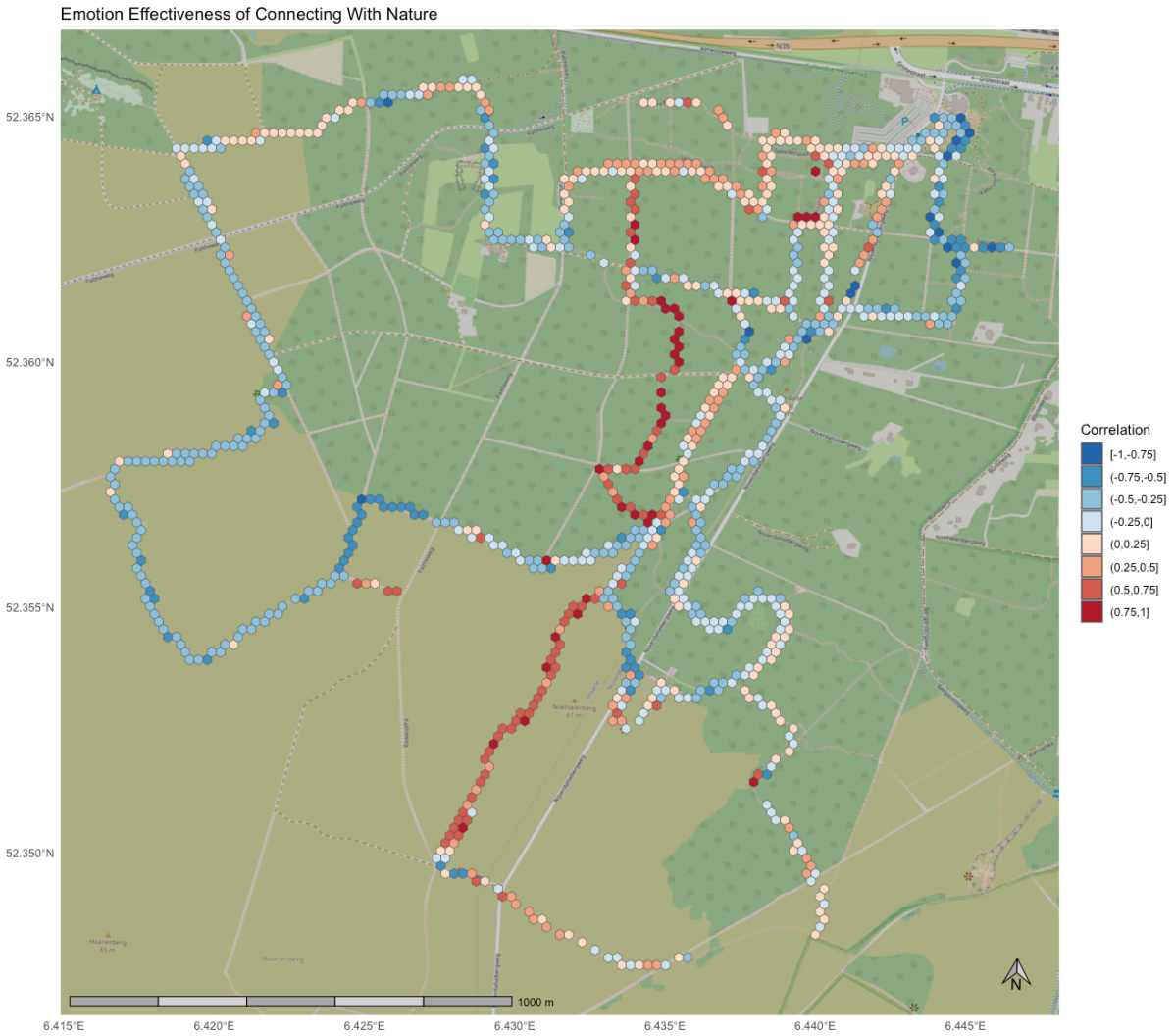

Figure 16. Map of emotion effectiveness of connecting with nature at the Sallandse Heuvelrug.

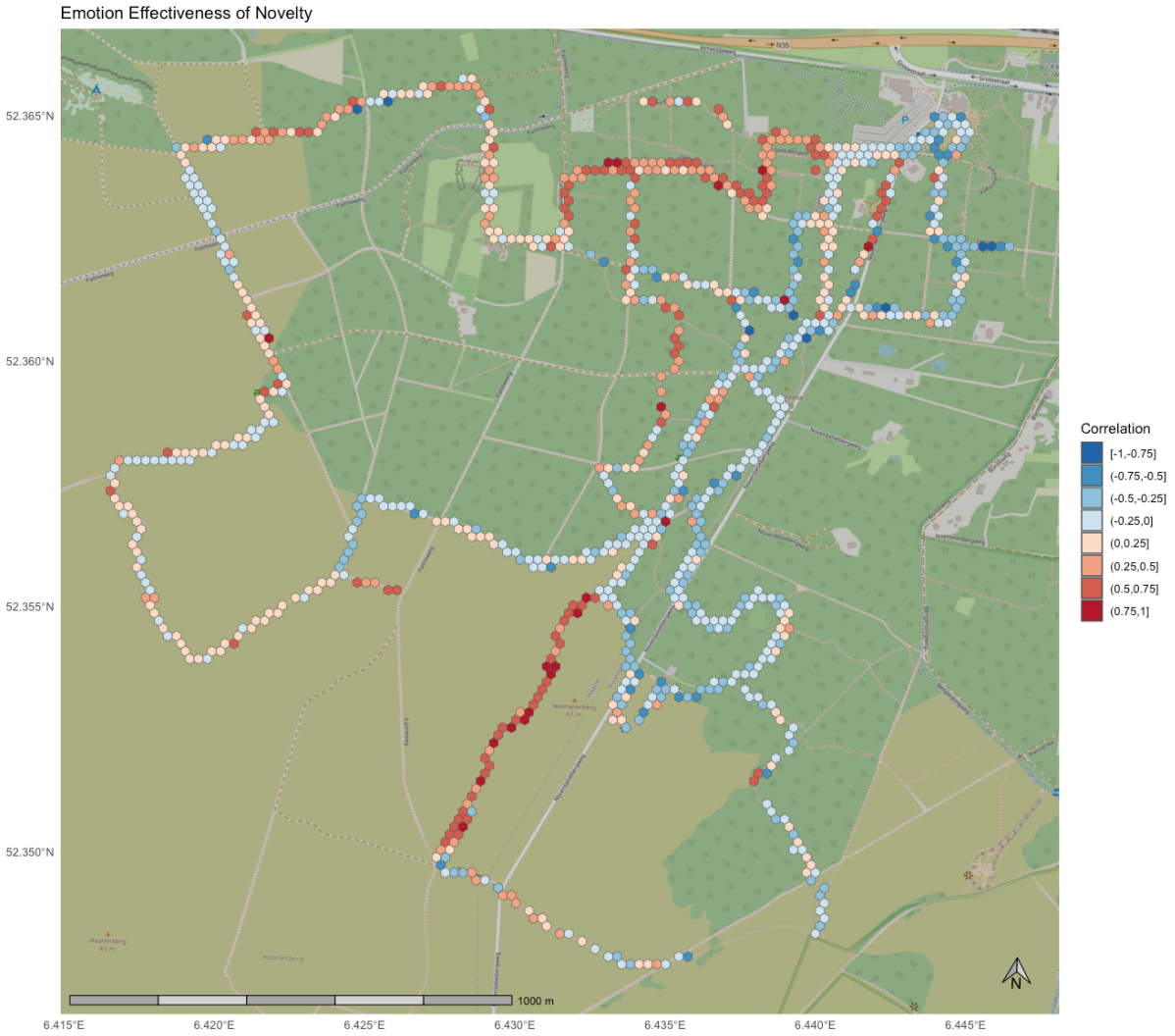

Figure 17. Map of emotion effectiveness of novelty at the Sallandse Heuvelrug.

Respondents had the opportunity to indicate what they found most memorable or impressive during their visit to Sallandse Heuvelrug National Park. They gave a total of 69 responses. Answers were aggregated and categorized. Mentioned most frequently was nature in general (n = 18). Terms such as the "fresh green nature," "clean nature," "the green," "nature bursting to life in this season" and "lots of green" were used. Space, expansive surroundings, large area and vastness (n = 6), wildlife (n = 6), variety/diversity of landscape types (n = 5), views (n = 5) and tranquility (n = 5) were also mentioned. A few weeks later, we also asked respondents who had visited National Park Sallandse Heuvelrug what stuck with them most about their visit. In total, respondents gave 61 answers here. Respondents especially remembered the tranquility they experienced in the area (12).

Findings across both sites

Effect of architecture on emotional arousal

A central question driving the present research was how different sorts of built and natural environments affect emotional arousal over the course of a visit. For this analysis, we grouped the environment context into three types: *nature-enhancing architecture,* which were built features aimed at bringing visitors in contact with nature, such as lookout towers, benches at scenic viewpoints, and nature museums; *non-nature architecture*, including parking lots, roads, and restaurants, which served a functional purpose and were not designed to bring visitors in contact with nature; and all other locations, which generally offered visitors unmediated contact with *nature.* Statistical modeling of emotional arousal as a function of architecture (in comparison to non-built-up, natural areas) demonstrated that nature-enhancing architecture was associated with lower emotional arousal than natural areas ($t = -5.022$; $p = <0.001$), while non-nature architecture was associated with higher emotional arousal than natural areas ($t = 32.183$; $p <0.001$).

These effects differed by specific architectural features, however. Taking *nature* as the reference category, at Fort de Roovere, the parking lot, lunchroom, and Pompejus tower were all relatively more emotionally arousing, while the Moses bridge was relatively less emotionally arousing. At the Sallandse Heuvelrug, all the features near the entrance/visitor center were more emotionally arousing, while both the lookout point and the bench at the Noestelerberg were less emotionally arousing. This is a highly consistent pattern. While we categorized the Heuvelrug visitor center and Pompejus tower as *nature-enhancing* architecture, they actually have a highly expressive, human-built character. In contrast, the arousal-lowering Moses bridge and Noestelerberg lookout are truly low-key built features which put nature first. There is still the important difference in emotion effectiveness: the visitors who connected with nature most reported lower arousal at the Moses bridge, but still got relatively more excited at the Noestelerberg.

Lifestyle

Lifestyle was operationalized using the “Leefstijlvinder” data by MarketResponse, which matches a certain percentage of individuals in each of six lifestyles by postcode. We translated this to assume that each *individual* in our dataset reflected not one lifestyle, but the percentage of *each* lifestyle present in their postcode. It goes without saying that this gives, at best, only a very rough, geographically driven indication of each respondent’s lifestyle. Furthermore, it was not possible to match all postcodes. Thus, the following findings are a geographically-driven indication of the effects of lifestyle.

Of the self-report variables, Pleasure Seeking was associated with higher intent to recommend ($r = 0.27$), grade ($r = 0.28$), and change in life satisfaction ($r = 0.25$). Visitors from higher Pleasure Seeking areas seemed to simply enjoy their visit more. Connection Seeking had a negative relationship with positive emotion change ($r = -0.31$), suggesting that visitors from these regions did not experience the same boost in positive emotions as other visitors. Style Seeking correlated significantly with connection with people ($r = 0.42$) and with nature ($r = 0.27$), but not with any other experience or outcome variable. Harmony Seeking, Rest Seeking, and Insight Seeking was not associated with any other self-report variable (Figure 18).

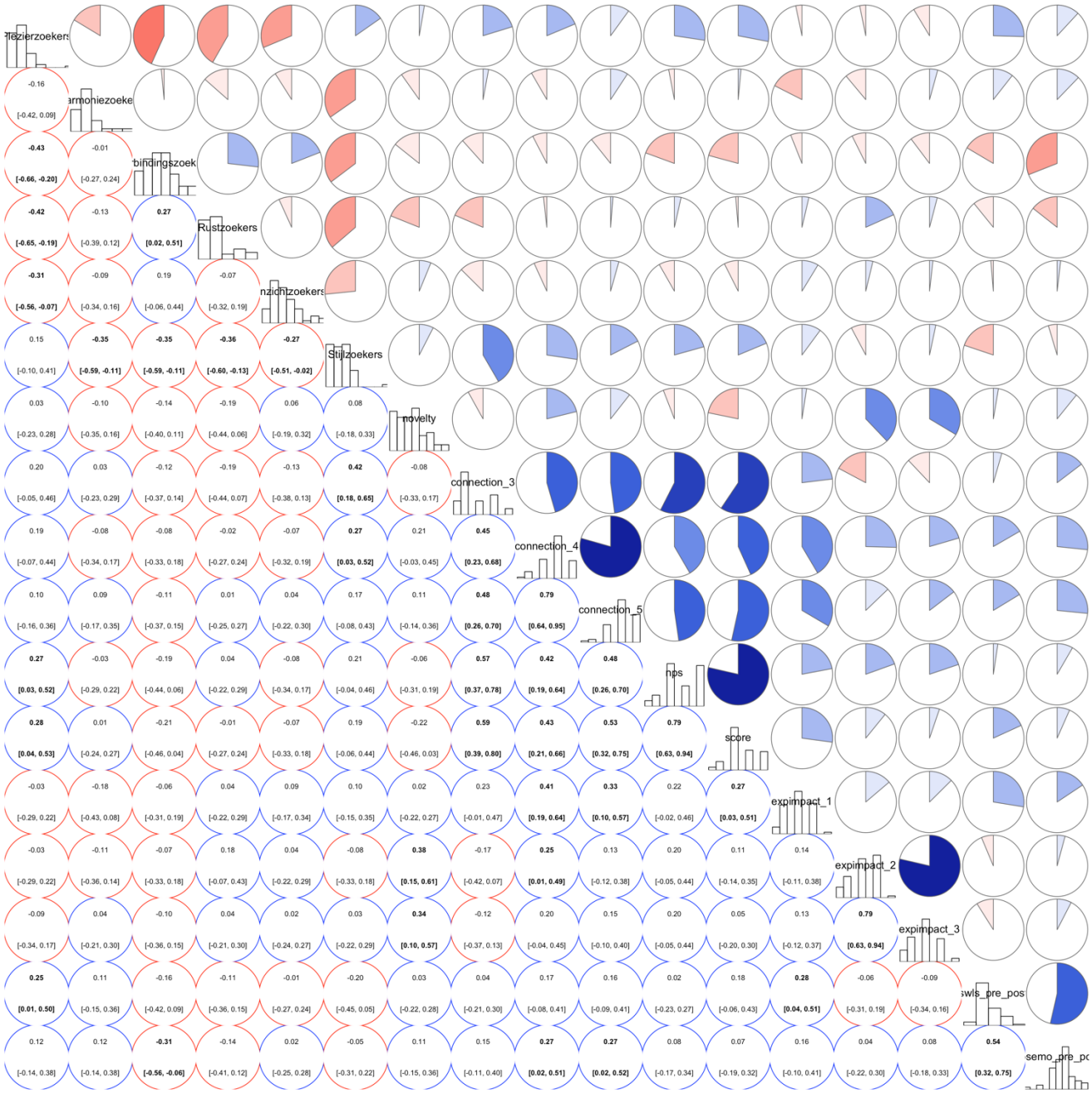

Figure 18. Correlogram of self-report data and lifestyles. Note: **Some zooming is necessary to view, due to the large number of variables**. (Connection_3) Connection with people, (Connection_4) Connection with nature, (Connection_5) Natural beauty, (ExpImpact_1) memorable, (ExpImpact_2) meaningful, and (ExpImpact_3) transformative.

Looking deeper into the three lifestyles (Pleasure, Connection, and Style Seeking) which significantly correlated with experiential variables, the strongest correlation for each lifestyle is visualized in a scatterplot (Figure 19). Each of these lifestyles can also be correlated with skin conductance at various locations at each site. However, just because an analysis can be done does not mean it should. In this case, given the questionable meaning of the lifestyles in the data, we omit these maps, although they are available on request.

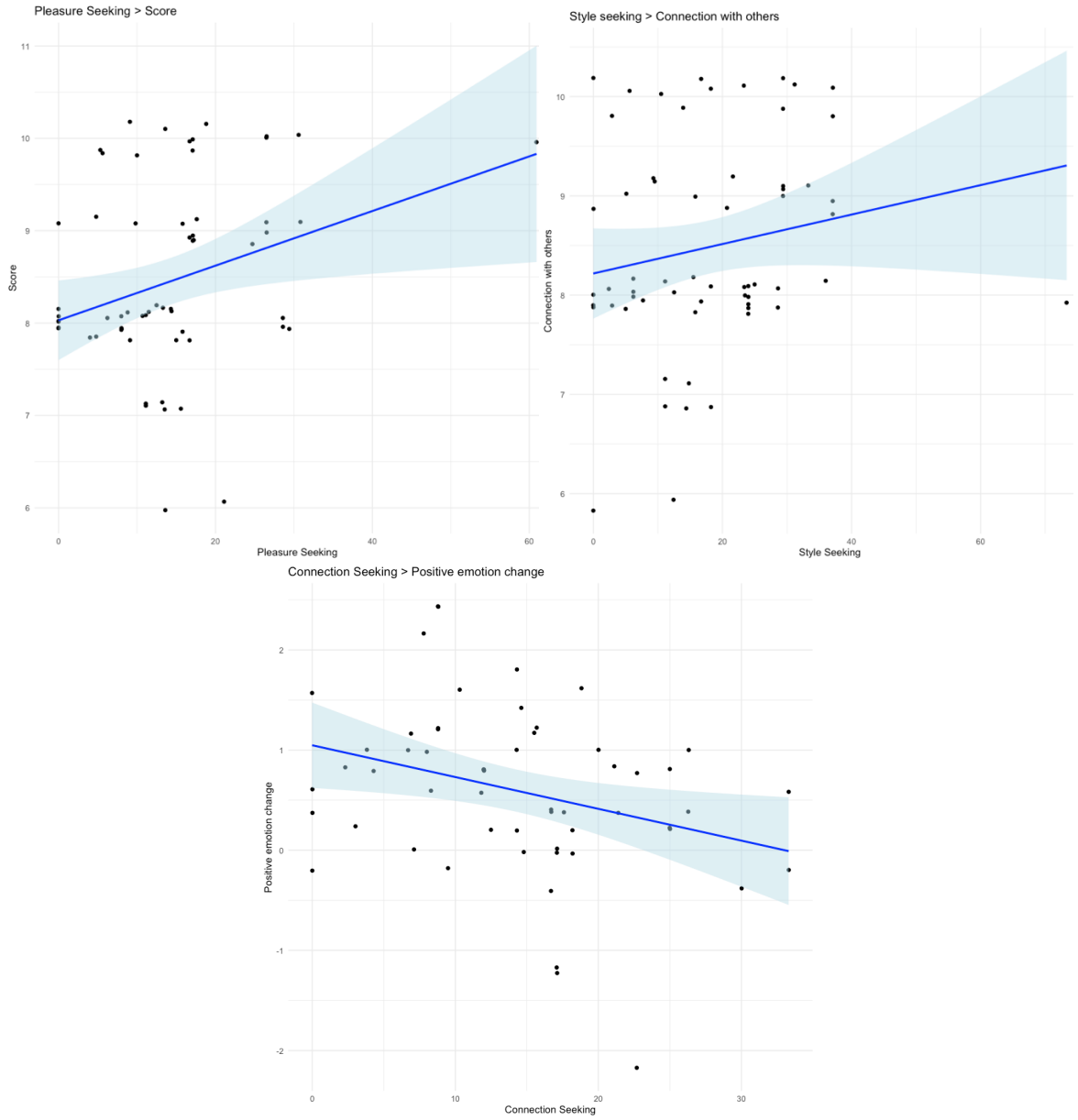

Figure 19. Relationships between lifestyles and their highest-correlating experiential or outcome variable: Pleasure seeking and score evaluation of the visit; Style seeking and connection with others; and Connection seeking and positive emotion change, respectively.

Comparing 'residents' to 'visitors'

In this research project, we sought to distinguish between people who lived in the vicinity of each natural attraction ('locals') and people who traveled to see it ('visitors.') We decided on an arbitrary boundary of 15km from the site to make this distinction. Using postcode data, a different division, such as by municipality, province, or percentile split would be possible. Taking the 15km boundary, however, there were 8 locals and 50 visitors in our Fort de Roovere sample, and 19 locals and 45 visitors in our Sallandse Heuvelrug sample. We analyzed the differences between these groups separately for the two sites, as each site's geographical context is fairly different, not to mention the difference in area.

In short, none of the relevant well-being outcomes of the visit (change in life satisfaction, health, or positive emotion) were significantly different for locals compared to visitors at either site. Nor did visitors and locals differ in terms of connection with nature they experienced.

However, we replicated the spatial models of emotional arousal (Z- and log-transformed skin conductance) as a function of natural, built non-nature, and built nature-enhancing locations, this time probing for differences between locals and visitors. Here we found significant differences. At Fort de Roovere, locals experienced relatively lower emotional arousal at nature-enhancing built locations and relatively higher emotional arousal in natural areas (Figure 20) compared to visitors (Figure 21). Emotional arousal at non-nature built locations was the same for locals and visitors. This might be because the awe or novelty at the bridge and tower are much lower after repeat visits, and perhaps locals make more repeat visits. At the Sallandse Heuvelrug, locals experienced higher emotional arousal at all built locations (Figure 22) compared to visitors (Figure 23). Emotional arousal in natural areas was the same for locals and visitors. Again, there is no obvious interpretation, but locals might feel the greater concentration of people at the built sites more acutely and thus more emotionally. Note that the rather minimal data visible on the maps of local residents' experiences reflects that fairly few locals responded to the data collection.

Figure 20. Map of **local residents'** phasic skin conductance at Fort de Roovere.

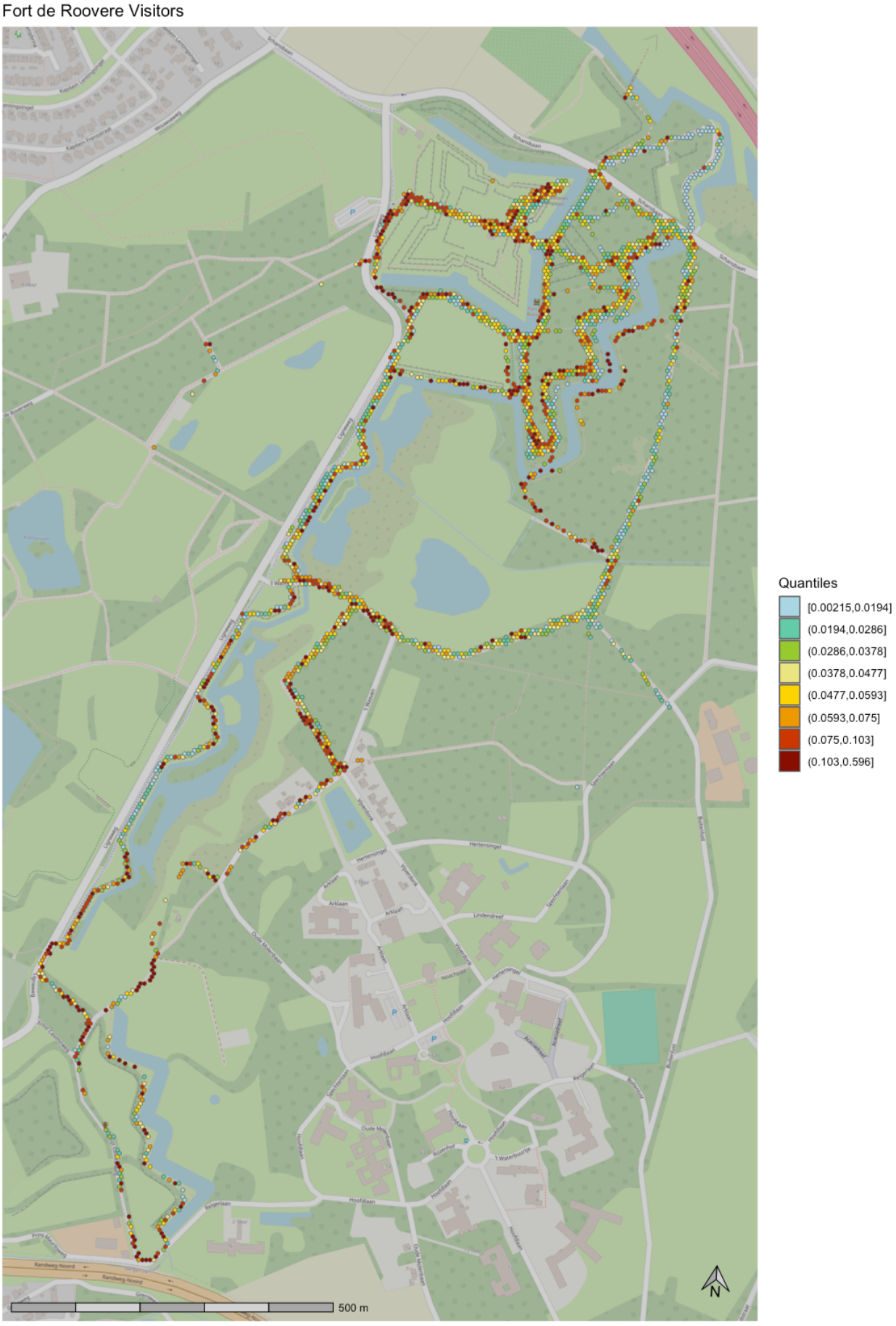

Figure 21. Map of **visitors'** phasic skin conductance at Fort de Roovere.

Figure 22. Map of **local residents'** phasic skin conductance in the Sallandse Heuvelrug.

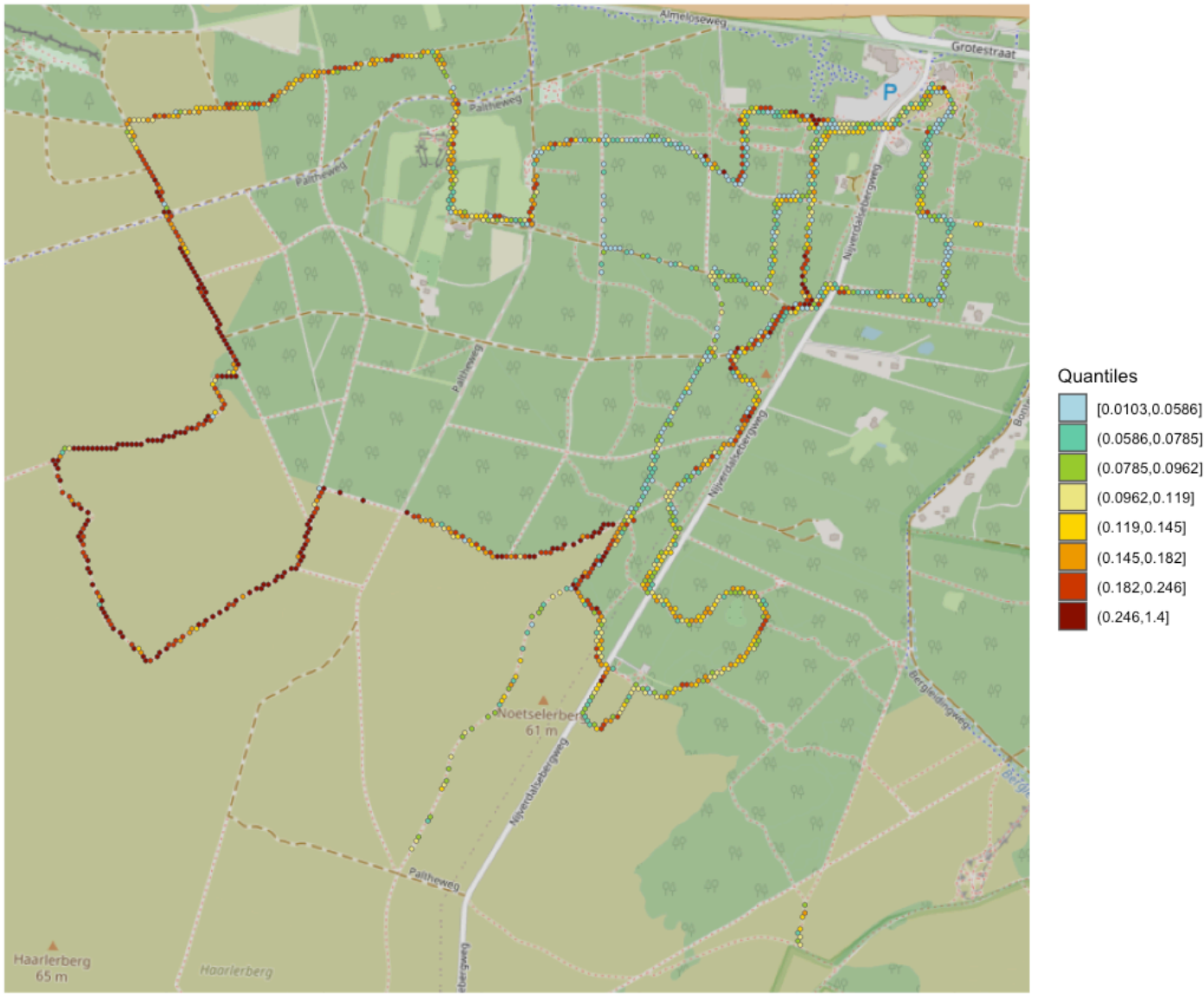

Figure 23. Map of **visitors'** phasic skin conductance in the Sallandse Heuvelrug.

Resident perception of visitor impacts

Based on several previous studies, we asked respondents who lived within 15km of each site to rate the impact of tourism on the site. We did this in terms of 7 items: (1) increased traffic, (2) crowded footpaths, (3) better maintenance, (4) improved quality of public services, (5) increased recreational opportunities, (6) increased employment opportunities, and (7) pride. We ran an exploratory factor analysis under the assumption that these items should be highly correlated. They were not. All correlations are visualized in Figure 24.

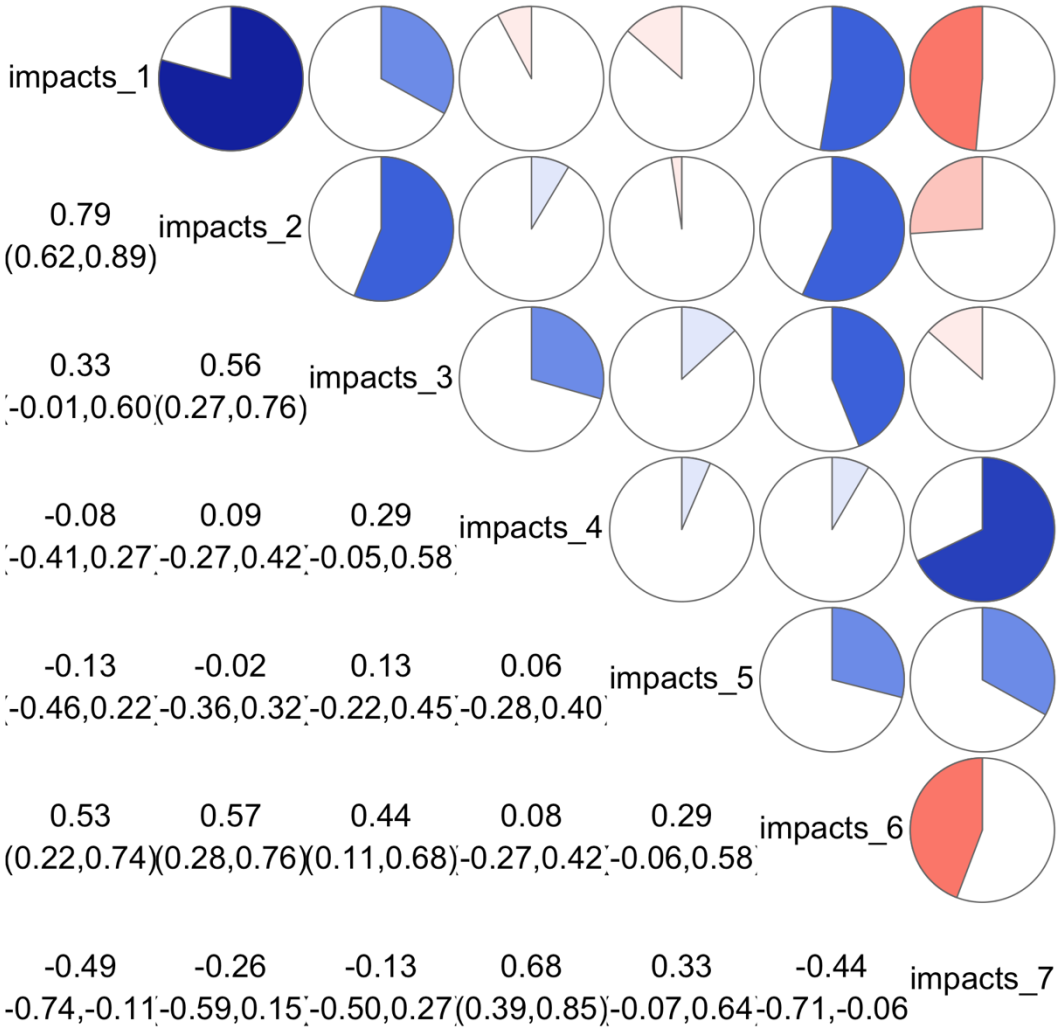

Figure 24. Correlogram of visitor impacts. Note: (1) increased traffic, (2) crowded footpaths, (3) better maintenance, (4) improved quality of public services, (5) increased recreational opportunities, (6) increased employment opportunities, and (7) pride.

Public services and recreational opportunities were basically uncorrelated with the other items, while traffic, crowding, maintenance, and employment were all correlated with one another, and negatively correlated with pride. Pride was especially negatively correlated with employment and traffic. Taken together, traffic, crowding, maintenance, employment, and pride (reverse coded) together form a highly coherent index (Cronbach alpha = 0.81; Revelle's omega = 0.89; 57% of variance explained by first factor in EFA). Thus, we averaged these five items together into a variable called "impact."

Impact differed by site. The average impact perceived at Fort de Roovere was right in the middle of the range ("Neither agree nor disagree"; mean = 2.96; sd = 0.69). At the Sallandse Heuvelrug, this was more than half a point higher (mean = 3.52; sd = 0.59; t approaching significance at p = 0.06).

Finally, we examined if any of our key well-being outcomes—change in life satisfaction, health, and positive emotions—were related to perceived impact. These effects

were not statistically significant, although the sample size of 23 'local residents' is very small and does not afford enough statistical power for this analysis. Interestingly, the effect was in a negative direction for all three variables. It would be worthwhile exploring in a larger sample. Also, there was a significant *positive* relationship between impact and experience of 'connection with nature' among locals. In fact, impact explains about 20% of connection with nature. This is fairly remarkable. It might be an instance of common method bias, which is that some people tend to give higher ratings on all items across the board with disregard for what they are actually about. However, assuming there is some validity in this correlation, it could be the result of a common sense of environmental consciousness or sensitivity, where the same people who care about, enjoy, and thus connect with nature at the sites are also perceive the impacts of visitors more sensitively. This concretely concerns a cluster of 8 visitors on the right side of the scatterplot below (Figure 25).

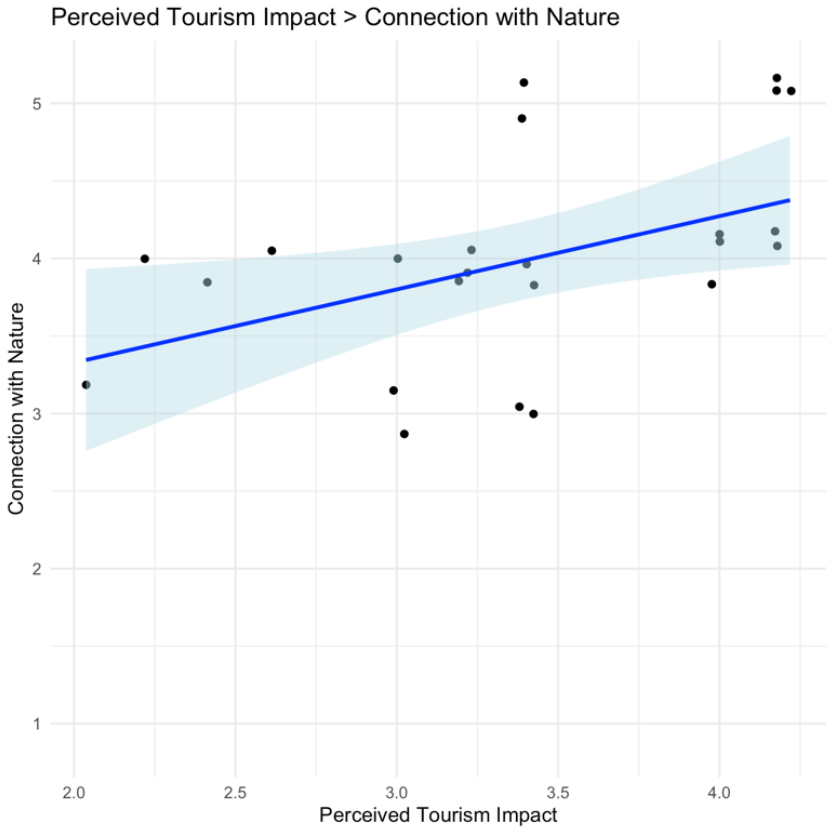

Figure 25. Scatterplot of perceived tourism impact and connection with nature.

Changes toward more sustainable behavior

An intention in the design of the research was to determine if visiting nature-enhancing built features inspires visitors to behave in more sustainable ways in their daily life. To this end, we measured three behaviors we encouraged with a brochure given to participants (taking short showers, planting seeds, cooking vegetarian) and three behaviors that were not explicitly mentioned to them (donating to nature conservation organization, gardening in general, and visiting nature areas). Percentages of these behaviors reported two weeks later varied, from visiting nature areas (85%), gardening (77%), shorter showering (71%), cooking a vegetarian recipe (45%), planting the provided seeds (36%), to making a donation (10%). Furthermore, 62% of participants reported telling others about one or more of these actions.

Of the previously discussed experiential variables (novelty, connection with others and with nature, experience evaluation, wellbeing change over the visit) there were relatively few sustainable behaviors that were affected. Only two of the mentioned actions—planting seeds and telling others about the sustainable actions—were related to any experiential variable at a correlation of 0.3 or higher. Planting seeds was significantly associated with connection with nature during the visit ($r = 0.36$), natural beauty ($r=0.24$), overall score given to the visit ($r = 0.32$), and with memorable experience ($r = 0.24$). Telling others about the above actions was significantly associated with connection with others ($r = 0.26$), connection with nature ($r = 0.28$), natural beauty ($r=0.4$), and both meaningful ($r = 0.39$) and transformational ($r = 0.3$) experience. In sum, participants who were more impressed by nature during their visit were more likely to plant the seeds they were given, and to tell others about their sustainable behavior. All correlations are visualized in Figure 26.

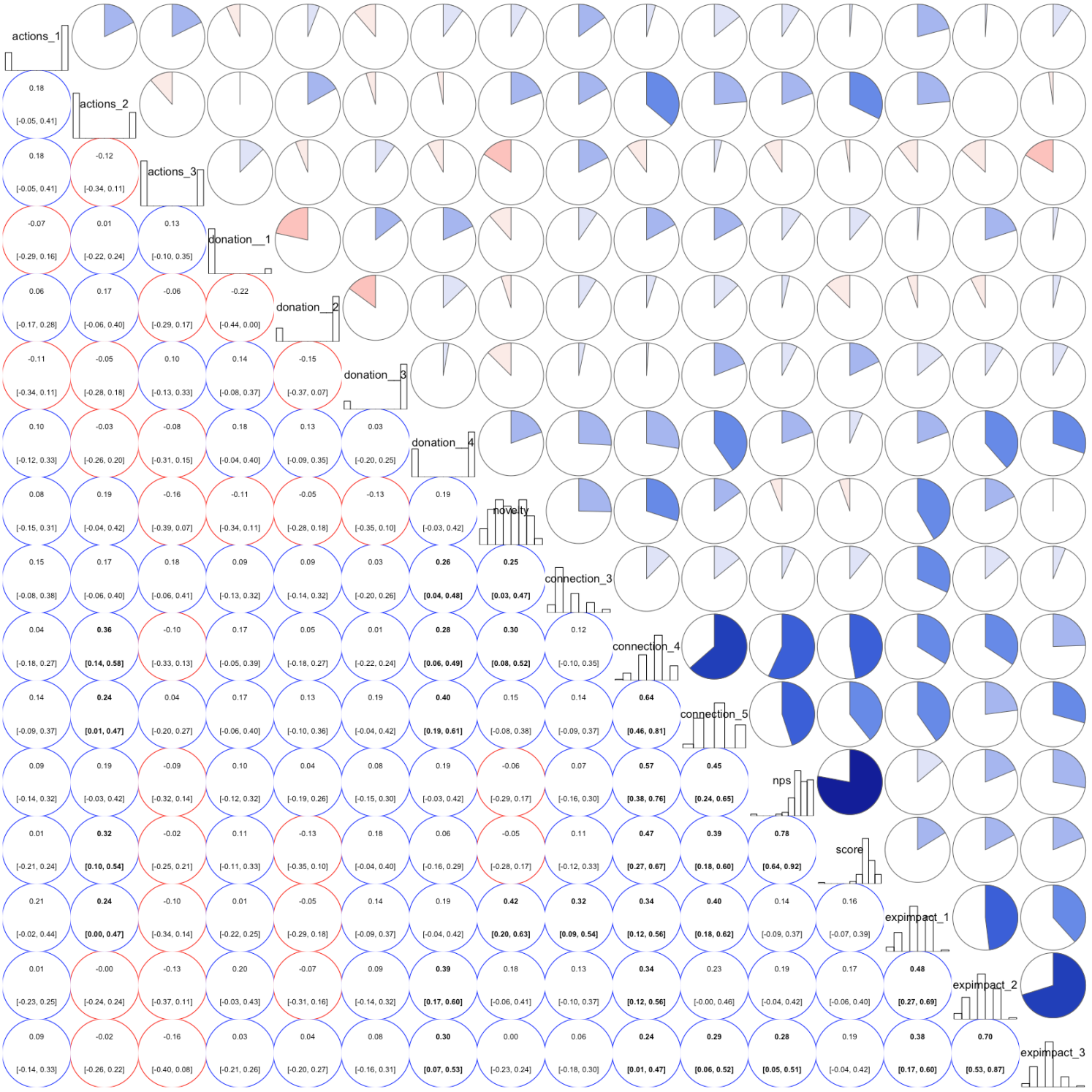

Figure 26. Correlogram of changes toward more sustainable behavior. Note: **Some zooming is necessary to view, due to the large number of variables**. (actions 1) saving water when showering, (actions 2) planting seeds, (actions 3) cooking vegetarian, (donation1) donating to nature organizations, (donation 2) gardening, (donation 3) visiting a nature area, (donation 4) telling others about these actions, (Connection_3) Connection with people, (Connection_4) Connection with nature, (Connection_5) Natural beauty, (ExpImpact_1) memorable, (ExpImpact_2) meaningful, and (ExpImpact_3) transformative.

Conclusions

Summary of findings: Answering the questions

1 - How do visitors experience protected natural areas over the course of their visit?

Quite positively. They experienced improvement in life satisfaction, positive emotions, and some even in health. Their visits were memorable and likely to be recommended to others. These effects were related to connection with nature and experiencing novelty (a change from the every day).

2 - How do experiences of nature vary by visitor lifestyle and residential proximity?

Lifestyle data should be interpreted with extreme caution due to the lack of individual-level data. That being said, it seems that Pleasure seekers did indeed find pleasure at the sites, reporting high evaluations and better life satisfaction. Style seekers found connection with others and with nature. Connection seekers experienced a decline (or a diminished increase) in positive emotions. Thus, the lifestyle of geographic origin markets clearly does affect the experience, with Pleasure and Style seekers faring better and Connection seekers faring worse.

For the current report, we analyzed proximity in a binary way, dividing participants into 'locals' and 'visitors.' See question and answer 6.

3 - Do visitors experience natural areas with built features differently when a) built features are in view, b) built features are not in view, and c) when the visitor is inside or near the built feature?

With the current analyses it is possible to answer 3c. Answering 3a and 3b requires a viewshed analysis, which will come later. Visitors to natural areas experience built features as generally more emotionally arousing, while natural areas (no built features) are less emotionally arousing.

Taking natural spaces at each location as a reference category, the most calm locations during the experiences were modest, unobtrusive built features which let nature shine. The most exciting locations were larger, more dominant built features, including expressive ones like the visitor center and lookout tower, but also restaurants and parking lots. Furthermore, it is important to note that some trails, especially those at boundaries between landscape types, were far more exciting than others. The calmest ones tended to be in the deep woods, but other wooded trails were exciting.

4 - Do visitors to natural areas with architecturally-designed built features have different experiences from visitors to natural areas with only basic built features?

Probably, but a surprising though important finding in the present study was, all of the visitors we surveyed had at least some contact with several key architecturally-designed built features. That may be because these (visitor center Sallandse Heuvelrug, Pompejus tower, Mozes bridge) dominate the sites, at least at the point that visitors enter the sites. These architectural features are experienced almost as a "must-do."

With that said, answers to the open questions make very clear that the most memorable and impressive elements of the Fort de Roovere experience are the bridge and the tower—the built features enhancing connection with nature—while the most memorable and impressive elements of the Sallandse Heuvelrug are natural elements themselves, with no built features in them.

5 - Do built features make a difference in pro-environmental behavior, and to what extent is this effect, if it exists, mediated by experience?

The experience makes fairly little difference in pro-environmental behavior, but it clearly helps to be impressed by nature. In fact, the biggest effect of the experience appears to be in getting participants to talk to others about their behavior.

6 - How do the above effects differ for tourists and nearby residents?

Experiences by proximity ('locals' vs. 'visitors') vary little in terms of outcomes. However, visitors to Fort de Roovere are more emotional at nature-enhancing built locations, and less emotional in natural areas, than locals. Visitors to the Sallandse Heuvelrug are less emotional in all built areas than locals.

7 - Among nearby residents in particular, what are perceptions of tourism development and impacts on natural areas, and are these related to quality of life?

Nearby residents—the rather few in our sample—perceived middling tourism development impacts, though somewhat more at the Sallandse Heuvelrug than at Fort de Roovere. The somewhat 'positive' impacts of employment and maintenance correlated with those of traffic and crowding, and negatively with pride. As a whole, these impacts were positively related with connection with nature during the visit. There were no significant relationships with quality of life measures after the visit, or change in these from before to after the visit, but a larger sample could uncover some effects.

Recommendations

Based on the present findings, several recommendations can be made. Some also refer to the accompanying report, namely the conference paper to the Bled 2024 eConference which is also based on the current project.

- Some footpaths are exciting, while others are quiet. This is good, and should probably stay that way. Not only do they vary in in how exciting they are, but also in their correlation between emotion and valuable outcomes like health and connection with nature.
- Lookout towers are exciting, memorable, and positively evaluated. Furthermore, they are quite often funded by EU project. Thus, we recommend lookout towers. They don't belong in the middle of gorgeous vistas, but if a carefully chosen site is available, they can attract large numbers of new and repeat visitors.
- On the other hand, lookout towers don't have the same potency to enhance especially the calming effects of nature that more nature-blended, light-handed architectural interventions do, like benches and bridges. The examples in this project really let nature shine. We see these interventions as even more valuable.

- Heavily built areas at park entries can be exciting, and sometimes positively so. However, in the forest, it is not connection with other people that visitors are looking for. It is connection with nature. Paths should be designed accordingly, with a concealing and revealing pattern of vistas that keeps contact between separate groups of hikers to a minimum.
- There may be a group of locals who is especially sensitive to both nature and tourism impacts. There is a chance that they are the loudest voices in policy discussions; but in any case, if overtourism occurs, they are the most affected. Their concerns should be taken seriously. Remember the benefits of quiet hiking paths. Their life may depend on it.
- We recommend the use of other scales than the one we used to measure impacts. This topic requires further study.
- In general, we recommend parks to regularly survey visitors, ideally both at the beginning and end of their visit. They should not be shy to “annoy” visitors with questionnaires. Instead, make it a privilege, giving away a free branded water bottle and sending participants an attractive report of study results. The information is crucial for other difficult management choices not covered here.

References

Bastiaansen, M., Lub, X., Mitas, O., Jung, T. H., Passos Acenção, M., Han, D., Moilanen, T., Smit, B., & Strijbosch, W. (2019). Emotions as core building blocks of an experience. *International Journal of Contemporary Hospitality Management*, *31*, 651-668.

Benedek, M., & Kaernbach, C. (2010). Decomposition of skin conductance data by means of nonnegative deconvolution. *Psychophysiology*, *47*(4), 647-658.

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of personality assessment*, *49*(1), 71-75.

Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological bulletin*, *125*(2), 276. https://doi.org/https://doi.org/10.1037/0033-2909.125.2.276

Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D.-w., Oishi, S., & Biswas-Diener, R. (2010). New well-being measures: Short scales to assess flourishing and positive and negative feelings. *Social Indicators Research*, *97*(2), 143-156.

Filep, S., Moyle, B. D., & Skavronskaya, L. (2022). Tourist wellbeing: Re-thinking hedonic and eudaimonic dimensions. *Journal of hospitality & tourism research*, *48*(1), 184-193. https://doi.org/https://doi.org/10.1177/10963480221087964

Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. Cambridge university press.

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of environmental psychology*, *15*(3), 169-182.

Lundberg, N., Ward, P., Lundberg, G., Hill, B., Bown, J., Zabriskie, R., Duerden, M., & Ashby, H. (2021). Developing the Experience Impact Scale: A qualitative study using a study abroad and international internship program. *Journal of Leisure Research*, 1-20. https://doi.org/10.1080/00222216.2021.1916798

Mitas, O., & Bastiaansen, M. (2018). Novelty: A mechanism of tourists' enjoyment. *Annals of tourism research*, *72*, 98-108.

Mitas, O., Mitasova, H., Millar, G., Boode, W., Neveu, V., Hover, M., van den Eijnden, F., & Bastiaansen, M. (2020). More is not better: The emotional dynamics of an excellent experience. *Journal of hospitality & tourism research*, 1096348020957075.

Mitas, O., Shahvali, M., Ward, P., Duerden, M., & Bastiaansen, M. (2023). Human connection: A crucial ingredient in vacation experience. In *Handbook of Tourism and Quality-of-Life Research II: Enhancing the Lives of Tourists, Residents of Host Communities and Service Providers* (pp. 225-236). Springer.

Reichheld, F. F. (2003). The one number you need to grow. *Harvard business review*, *81*(12), 46-55.

Strijbosch, W., Mitas, O., van Blaricum, T., Vugts, O., Govers, C., Hover, M., Gelissen, J., & Bastiaansen, M. (2021). When the parts of the sum are greater than the whole: Assessing the peak-and-end-theory for a heterogeneous, multi-episodic tourism experience. *Journal of Destination Marketing & Management*, *20*, 100607.

Ulrich, R. S., Dimberg, U., & Driver, B. L. (1991). Psychophysiological indicators of leisure benefits. In B. L. Driver, L. R. Brown, & G. L. Peterson (Eds.), *Benefits of Leisure.* (pp. 73-89). Venture.

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of environmental psychology*, *11*(3), 201-230.