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Tranquillity trails – design, implementation and benefits for healthy leisure

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ABSTRACT

Tranquillity trails (TTs) are designed to provide a quiet and peaceful walk through mainly leafy lanes and roads and connect green open spaces where visitors can stop for thought and relaxation. There are numerous health benefits from being in close proximity to nature and TTs can facilitate this contact in mainly urban areas. This study involved the design of a trail in Tramore, a coastal town in south east Ireland. The trail links an old coastguard station, now converted to a cultural centre and coffee shop, with a Japanese garden. The trail includes a coastal path with fine views across a bay, wooded areas as well as leafy residential streets. The design of the trail was facilitated by the use of a previous developed tranquillity rating prediction tool (TRAPT) that involved the estimation of the level of man-made noise and the percentage of natural features in view. Participants who had completed the whole of the trail were encouraged to complete a questionnaire to gauge any benefits. As expected, it was reported that there were increased levels of relaxation and reduced stress. It was concluded that the approach can be used elsewhere to improve the well-being of residents and visitors.

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Introduction

Much research has shown that tranquil spaces are restorative environments that can help reduce stress and relieve anxiety (Grahn & Stigsdotter, 2003; Hunter et al., 2010; Lechtzin et al., 2010; Takano et al., 2002; Ulrich et al., 1991; Van den Berg et al., 2015). Questionnaire surveys of open green spaces have shown a strong association between the rated tranquillity of a place and the percentage of visitors feeling more relaxed after their visit (Watts et al., 2013). As an indicator of soundscape quality, perceived tranquillity has a part to play in eco-tourism. Indeed, perceived tranquillity could then be a manageable resource, which, is substantially beneficial to human health and well-being (Marafa et al., 2018).

Laboratory studies conducted at the University of Bradford have shown that the significant factors affecting rated tranquillity of a place tranquillity rating (TR), are the

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average level of man-made noise and the percentage of natural and contextual features (NCF) in the landscape (Pheasant et al., 2010). The equation TRAPT (Tranquillity Rating Prediction Tool) expresses this relationship in urban areas (Watts et al., 2013) as

$$\mathrm{TR} = 10.55 + 0.041\mathrm{NCF} - 0.146L_{\mathrm{day}} + \mathrm{MF}, \tag{1}$$

where TR is the tranquillity rating on a 0–10 rating scales. NCF is the percentage of NCF and L_{day} is the equivalent constant A-weighted level during daytime (e.g. from 7am to 7pm) from man-made noise sources. Contextual features include listed buildings, religious and historic buildings, landmarks, monuments, and elements of the landscape, such as traditional farm buildings, that directly contribute to the visual context of the natural environment. It can be argued that when present, these visually cultural and contextual elements are as fundamental to the construction of "tranquil space" as are strictly natural features. The evaluation of the contextual features can be determined with reference to formula (2) further below.

The behaviour of this equation has been studied by examining trends in TR with L_{day} at different levels of NCF. It was noted that at the extremes of L_{day}, where TR becomes greater than 10 or less than 0 then TR values are set to 0 and 10, respectively. MF is a moderating factor that was added to the equation following a study that was designed to take account of the presence of litter and graffiti that would depress the rating, or natural water sounds that would improve it (Watts & Marafa, 2017). This minor adjustment is designed to take account of the actual environmental conditions at the time of assessment and is unlikely to influence the calculated TR by more than ±1 scale point.

TR values in urban open spaces have been related to the level of rated relaxation of people after visiting such spaces where there was a very close relationship $R^2 = 0.96$ (Watts et al., 2013). For example, for a TR value of 5.0 nearly 50% of visitors report that they are "more relaxed" after visiting the park while at a value of 8 approximately 80% report being "more relaxed". These results have been used to validate the following category limits for TR defined previously (Watts et al., 2013):

<5 unacceptable;
5.0–5.9 just acceptable;
6.0–6.9 fairly good;
7.0–7.9 good;
≥ 8.0 excellent.

A previous study (Watts, 2017) employed TRAPT to gauge the benefits of "greening" urban areas. However, in this article, we look at a means of encouraging people to visit existing green and tranquil spaces for healthy leisure activities. The study described in this paper uses TRAPT to identify tranquil spaces and then to develop a tranquillity trail (TT). TTs are walking routes that have been designed to enable residents and tourists to reflect and recover from stress while receiving the benefits of healthy exercise.

On a community level it is important that people use green spaces for leisure activities so they experience, connect, and benefit from contact with nature, and so

are more likely to support nature friendly policies now and in the future (Bragg et al., 2013).

In this study, a TT is described that has been designed for relatively small seaside community and then predictions of the rated tranquillity have been made along the walking route. The TR profile of the TT is then examined by calculating the percentage of time a walker would spend experiencing the different levels of TR described above.

It is important to consider the benefits of walking around the TTs since this will help gauge usefulness and could be used to promote usage. Feedback from the site using a self-completed questionnaire was used to assess the benefits of using this TT.

Method

Study site

The present study used the insights gained from previous surveys and experiments to devise a walking route or TTs that linked quiet green spaces in a community using relatively tranquil paths and roads. The aim is to design a route that is simple and safe to follow and will allow users to experience a relatively high degree of tranquillity despite being in an urban area. In particular, there is a tranquil Japanese garden in the town that would benefit from increased visitor numbers. The first TT was designed for the city of Bradford in West Yorkshire, and because of the concentration of heavily trafficked roads, this was particularly challenging (Watts & Pheasant, 2015). The lessons learnt facilitated the design of further trails in both large and small communities. The current study examines a coastal community in South East Ireland (Tramore) with a census population of 10,381.

Determination of TR profile

To assess the likely tranquillity experienced along the TT, it was considered necessary to determine the variation of TR values around the TT. This involved calculating the values of the important factors L_{day} and NCF (see Equation (1)) at a sufficient number of points to define a profile.

At this site, traffic noise was the major source of disturbance. Since flows were low and road layout complex spot readings of the average A-weighted levels were carried out near the middle of the day, informed by advice given in Department of Transport and Welsh Office traffic noise prediction method (Department of Transport, 1988).

As in previous studies, in order to calculate the percentage of NCF, an eye height of 1.5 m was also assumed. The field of view was restricted in the vertical plane to ±20°. This was approximately the angle of view using a standard camera lens and relates well to studies of the eye's central field of view, i.e. the angle over which objects can be recalled without moving the eyes (Cambridge in Colour, n.d.). In the horizontal plane, calculations were made over 360° as it is assumed that the observer would make scanning movements in the horizontal plane to take in the full scene. These assumptions were made in earlier surveys which found a close relationship between predicted tranquillity using such a measure and average ratings given by participants visiting a variety of open spaces (Watts et al., 2013).

For the present study, calculations were made of the variable NCF by using image processing software (ImageJ, n.d.). By using a cursor to draw around natural features the program calculates the number of pixels within these areas. This is then compared with the total number of pixels by drawing around the landscape excluding the sky. This process is followed for each of 6 or 7 contiguous photographic images covering 360° in the horizontal plane and the average value taken. The value NCF is given by

$$\mathrm{NCF} = \frac{\sum_{\theta=1}^{7} \frac{An_\theta \,.100}{(At_\theta)}}{7}, \tag{2}$$

where An_θ and At_θ are the areas (number of pixels) in the photographic images of natural (including contextual) features and total area, excluding sky, respectively, in image θ. Note that in order to facilitate analysis of images at each location, they were pasted into PowerPoint and arranged in two rows of contiguous images. The resulting slide was converted into jpeg file suitable for the imageJ analysis. Each block of images was treated as a single analysis unit that reduced analysis time.

Guidelines for route selection

Using this technique, it is possible to make predictions of TR for paths, squares, and parks, as well as town streets and residential roads. In this way, it is possible to consider the type of spaces and roads in a community that is likely to have acceptable levels of tranquillity. This is the first step in producing a TT that links tranquil spaces, so that the average and range of tranquillity levels experienced on the route provide appropriate levels of tranquillity to facilitate health and well-being. Further guidelines for route selection have been considered based on predictions and survey information. These can be summarized as:

- Access is important and so trails that commence near a public transport hub will be useful, e.g. town or city centre;
- Locate larger open spaces within easy reach of the start, as these are likely to have the highest levels of tranquillity and could act as a focus for the walk;
- Consider various routes both to and from these larger open spaces;
- Locate smaller open spaces on these routes that, although not having the highest levels of TR, to match the larger open spaces may nevertheless have acceptable levels. These could act as "stepping stones" to the larger open areas;
- Consider the links to the small and larger open areas, selecting where possible routes that avoid heavily trafficked roads, and where there are relatively high levels of vegetation visible, e.g. hedges, trees, grassy verges;
- Consider suitable road crossing points and state of footpaths for safe walking;
- Consider points of interest that add interest and motivate the walker to continue, e.g. historic sites, interesting architecture, beautiful trees and flowers, view points;
- Walk the alternative route options that are expected to have relatively high levels of tranquillity and interest and collect relevant data, i.e. traffic flow to predict traffic noise, sound level measurements, and photographic records, so that NCF can be calculated;

Figure 1. Leaflet describing Tramore TT.

- Analyze data and predict TR in open spaces and along the possible linking paths and roads;
- Choose a suitable route that has the highest average and smallest range of predicted tranquillity levels, but consider points of interest and safety aspects among the options that may prove a deciding factor where alternatives have similar TR values.

Description of TT for tourist information

The TT for Tramore is described in Figure 1. The leaflet is folded into three panels.

The introduction on the front of the leaflets describes the health and well-being benefits of being in tranquil environments in terms of stress reduction and the healthy exercise required to complete the route. Also, an indication of the time required to complete the route at a steady walking pace.

The route starts at the old Coastguard Station that had been converted into a meeting place and cultural centre with coffee shop. The trail includes very tranquil sections along the coastal path, with views of Tramore Bay and boat harbour. Of particular note is the Lafcadio Hearn Japanese Garden, where it was hoped the TT would encourage more tourist footfall. These gardens are a haven of beauty and tranquillity with secret pathways, streams, pools, and waterfalls. There are also leafy residential roads and pathways hidden from traffic.

Questionnaire

It was considered important to obtain feedback from users of the TT to determine if there were perceived benefits and to understand the nature of any problems that might preclude further visits. A questionnaire was used to gather opinions from those who had completed the route. To improve participation, free drinks and cakes were offered for every completed questionnaire.

The questions included:

- Importance of tranquillity;
- Rating of the overall tranquillity of the TT;
- Changes in states of relaxation and anxiety;
- Problems encountered;
- Benefits;
- Biographic information.

The Appendix contains the full questionnaire.

Results

TR profiles

Based on the calculations of the TRs at various points along the TT, it was possible to plot the variation with distance from the start of the route and then convert to time elapsed based on a steady walking speed of 4.8 km/h. This variation in TR is given in Figure 2 together with descriptive labels for significant sections of the walk.

It can be seen that the highest TR values were for coastal path and Japanese Garden. Such paths and spaces were well away from traffic and had a high degree of natural features in view. By contrast, the lowest levels were noted for town streets where traffic was ever present and there was little greenery. Based on the profile, the average TR values for the TT is 4.4 points. These averages can be increased if additional time is spent in the most tranquil spaces. To illustrate this, 20 extra minutes could be spent in the most tranquil spaces. If an extra 10 min is spent on the coastal walk section and in the Japanese garden, then the average TR rises to 5.7. The resulting profiles are shown in Figure 3.

Using the profile, it was possible to calculate the percentage of time in each TR range with and without stops. The results are shown in Figure 4. Clearly with stops in the most tranquil places, the exposure to relatively high levels of tranquillity increases substantially. With stops, the percentage of time with acceptable levels of tranquillity was nearly 60%.

Questionnaire results

Fifty-three completed replies were returned. Over half (53%) considered tranquillity on the route "very important," and 43% considered it "fairly important". The average rating over the whole route was 7.1 (i.e. "good"). It was considered by 81% of the respondents that they were "more relaxed" after completing the TT and 41% indicated they were "less

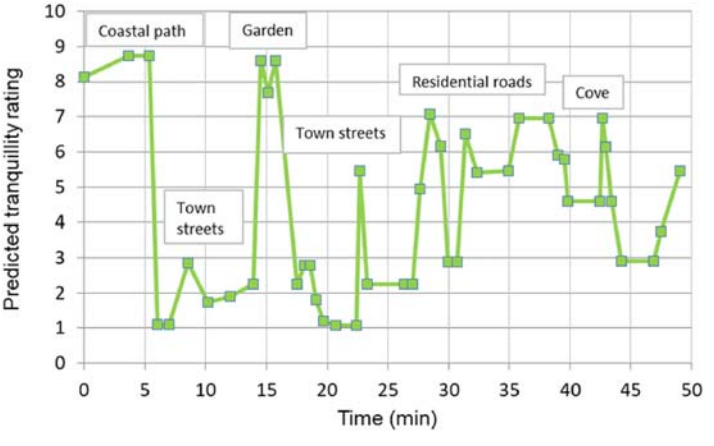

Figure 2. Tranquillity rating profile.

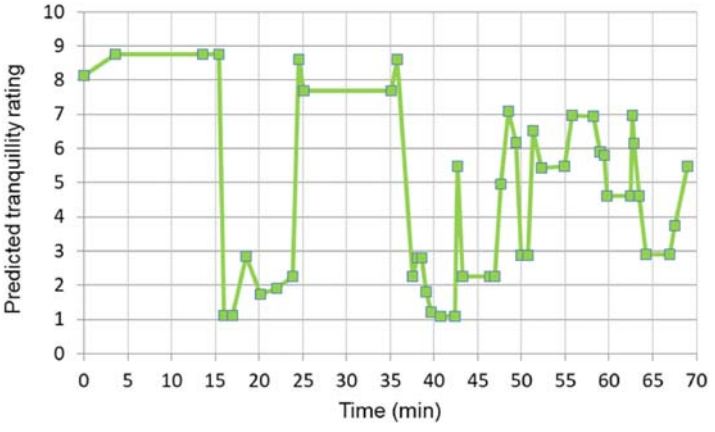

Figure 3. Tranquillity rating profile with extra 20 min.

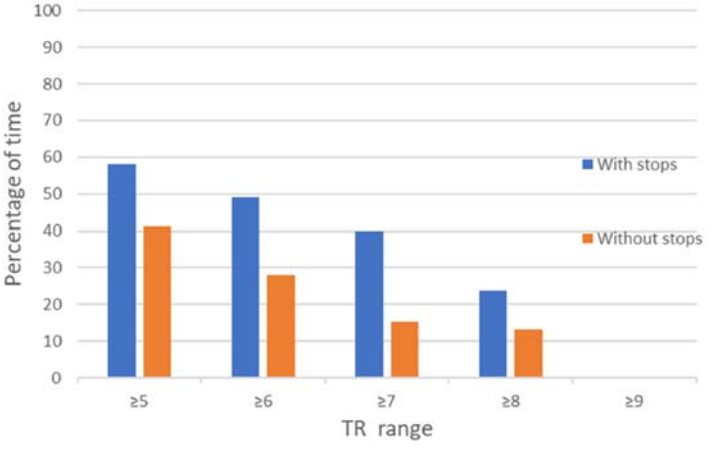

Figure 4. Percentage of time in each tranquillity range.

anxious," and only 1.9% reported they were "more anxious." The remainder stated there was "no change." The median age was between 61 and 70, with 64% being female and 79% being local residents.

The average TR given by respondents after completing the TT was 7.1, while the predicted value was lower at 5.7. This may be because participants spent longer in the tranquil spaces than expected. This can be inferred from the fact that the total time assumed for completing the TT and spending 20 min in the most tranquil spaces was 69 min, in contrast to the much longer average reported completion time of 90 min.

Discussion and conclusions

There is abundant evidence in the literature that tranquil environments can provide relief from the stresses of everyday life and can be considered restorative environments. For example, it has been established that tranquillity levels relate well to a measure of well-being such as a state of relaxation (Watts et al., 2013). The prediction tool (TRAPT)

has been used to make estimates of the benefits along TTs in terms of perceived tranquillity. The tool has been validated and calibrated by relating TR predictions in green spaces with average ratings obtained from visitors (Watts et al., 2013). It was found that there was a good correlation between these two sets of values $r = 0.94$ ($p < 0.001$). A further study in Hong Kong looked at whether the method could be applied across residents from diverse countries (Watts & Marafa, 2017). These studies indicate that the tool can be used with some confidence. The effects on predicted perceived tranquillity of town squares, city parks alongside major roads and residential roads, and gardens under varying conditions have all been examined (Watts, 2017). This illustrates the approach that can be taken by concerned groups, such as the tourist office, planners, environmentalists, civic leader, and citizens, in order to determine changes in tranquillity levels brought about by various interventions, both positive and negative. In particular, the method can be used to select suitable green spaces and linking paths and roads to create viable TTs that have demonstrable well-being benefits. This could be promoted by the tourist information office as a healthy leisure activity.

While the idea of TTs anticipates a more audio-visual approach to analyzing and designing the environment, the evaluation of the contextual features and their impact on the tranquillity level is subject to further discussion. For example, what is considered contextual or not? Are landscapes and buildings that are prominent less contextual than those blending into it? What influence do thermal comfort and (day-)light have on the perception of the tranquillity of a space? Do such tranquil spaces aid concentration and therefore improve cognitive function? These and other related questions could be the subject of further research.

The literature shows that in the past TTs have been confined to rural locations with substantial numbers of tourists (Hiking in Mississippi, n.d.; NI Water, n.d.; Outdoor Active, n.d.) because of the absence of disturbing noise sources and natural surroundings. The concepts of linking tranquil spaces to form a walking route in urban areas are entirely novel and address the need to provide relief from the stresses and strains of urban living and healthy exercise for tourists and residents alike. Because these walking routes can all be easily accessed from urban centres, it reduces the need to use private or public transport and is therefore additionally a sustainable solution.

It was clear that there were generally high levels of tranquillity along the TT with the percentage of time where the tranquillity was acceptable reaching nearly 60%. The questionnaire results obtained from a sample of 53 participants showed that the majority rated the overall level of tranquillity as “good” (average rating 7.1). Returns showed that overwhelmingly participants reported improved levels of relaxation (81%), and a substantial number reported reduced anxiety (41%) after completing the TT. An 8-park survey showed a similar relationship between rated tranquillity of a green space and the percentage feeling more relaxed after visiting. For an overall rating of 7.1, the predicted percentage reporting being more relaxed was 73.4% and that is similar to that reported in Tramore, i.e. 81%. Benefits of completing the TT in addition to relaxation and reduced stress would most likely include healthy exercise, new experiences and social aspect where the walk was conducted with friends. It is hoped that many residents and tourists will continue to make use of the trail and derive these benefits. In addition, it is expected that the route will encourage greater numbers to visit and enjoy the beautiful, tranquil Japanese Garden.

It is likely than an important means of encouraging the usage of TTs is to improve the conditions on the walk. For example, providing safe places to cross roads and seating for rest purposes. Further improvements involving greening measures along the route and reduction of noise along linking roads could be informed by TRAPT. Currently, efforts are being made to identify and characterize TTs both in the UK and abroad.

Making residents and tourists aware of the presence of the TT is another issue that has to be considered. One approach that is currently being explored is to add the TT under "Things to do" on the TripAdvisor website (TripAdvisor, n.d.). This should increase the numbers requesting the leaflet and subsequently completing the route. It is expected that the posted comments will be a useful additional source of information on benefits and problems.

Finally, it can be concluded that the approach could be used elsewhere to improve the well-being of residents and visitors and to improve visitor numbers in valued green spaces.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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