






Using the Behaviour Change Wheel to Design an App to Change Tourist Behaviour and Increase Dispersal into Regional Areas

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Abstract. Currently, many tourism destinations are experiencing greatly reduced tourism due to COVID-19. In order to ensure that regions that wish to engage in tourism can share the benefits of it more equally, and to prevent the predicted future problem of overuse of popular areas once pre-COVID visitor numbers resume, an app to encourage tourists and leisure-seekers to change their behaviour and disperse into regional areas has been developed. The Behaviour Change Wheel was used to define the problem, find suitable intervention functions and design methods of delivery that could increase tourists' capability, opportunity and motivation to disperse farther into regions. The Huon Valley of Tasmania, Australia, was used as a research area. Our application of the Behaviour Change Wheel methodology determined that active engagement in logistic, value-based, and social information has the greatest chance of changing behaviour in this region and a list of Behaviour Change Techniques has been developed and considered in the design of a gamified travel app.

Keywords: Mobility · Behaviour change intervention · Gamification · Dispersal

1 Introduction

In the wake of ongoing lockdowns in Australia and border closures in the state of Tasmania, hospitality and leisure businesses in regional areas have become increasingly reliant on locals engaging in short intrastate tourism experiences [1]. Before COVID-19, tourist dispersal into regional areas had already been identified as a goal of many tourism destinations [2] and posited as a behaviour that could reduce overcrowding and enhance sustainability [3]. However, barriers to this goal are that tourists may not be aware of the value of local regional areas, nor engage in learning about what nearby areas offer.

To combat this, we set out to determine whether we could design an app, built upon the Tourism Tracer technology [4], that would encourage behaviour change using gamification, thus increasing dispersal throughout the Huon Region of Tasmania.

Gamification refers to the use of game elements in non-game contexts [5]. These elements can be minor additions, such as loyalty points, or be experienced as full-fledged games, and they have been used to enhance experiences, retain engagement,

and change behaviour. Gamification has been found to generally provide positive results in a meta-review of studies, however, it was most likely to have a neutral or negative effect when researchers were attempting to change user behaviour [6]. This unreliability is generally contributed to poor design that utilises generic points, badges and leaderboards, rather than thoughtful and user-centred design [7]. The former approach means that gamification is relegated to an extrinsic reward system, that can only motivate users' participation so long as they are invested in the rewards, it fails to intrinsically motivate or to solve problems that could lead to change [8].

Gamification technology has been used increasingly often in tourism, although so far the major focus of its implementation has been in experience enhancement within specific destinations, rather than behaviour change [9], the goal of behaviour change via interventions is not new to tourism research and practice. There are a plethora of studies that seek to change tourists' behaviour, ranging from those which use nudge theory to change the environment around tourists to reduce friction and move them towards behaviours such as reducing plate wastage [10] through to those which use the Theory of Planned Behaviour and Value-Belief-Norm Theory to understand factors that contribute to tourist intention and thereby design interventions to elicit environmentally friendly behaviour such as reduced littering in marine protected areas [11]. Likewise, in Gamification studies, Self-determination theory [12] is commonly used to explain how activities can meet individuals' motivational needs and this model is used to design interventions that change behaviour [7].

These frameworks can all be effective in appropriate contexts, however they can also be poor predictors of behaviour in tourism and leisure contexts [13] and methodologies based on them can be poor mechanisms for behaviour change [14, 15]. The inconsistency of results when utilising designed interventions can be explained by the limitations of each theory; Michie, et al. [16] identified in a systematic review of behaviour change theories that no single framework existed that considered all possible influences on behaviour, or all intervention and policy techniques, and that many theories had components with overlapping definitions, making it difficult to select an appropriate theory in many contexts, or to reproduce results across studies.

In response to this, Michie, et al. [16] created the Behaviour Change Wheel (BCW) from an amalgamation of elements from nineteen behaviour change frameworks which were found to be comprehensive, coherent, and grounded in a behaviour theory. The BCW walks users through the process of designing behaviour change interventions from identifying the problem to selecting effective interventions, to choosing best methods of delivering interventions and allows comprehensive evaluation. Arguably, the advantages the BCW has over methods created within single behaviour frameworks are that it is comprehensive, and therefore able to be used in broad contexts [16], meaning that the risk of choosing a framework that does not consider a factor that is significant in tourism contexts is absent and it is systemised, and therefore no steps in the evaluation process can be missed.

The BCW was designed within health research and has mostly been used within health contexts to address patient and carer practices [17]. It has also become increasingly common in contexts regarding environmental concerns like energy conservation [18] and to promote physical activity [19], however using it within the

tourism industry, and to design behaviour change interventions to promote tourist dispersal, is a novel test of the methodology.

Due to the novelty of using gamification in a tourist dispersal context, and the evidence that selective and context-specific design is necessary for successful behaviour change, a comprehensive methodology was necessary to design a gamified intervention system with the prospect of changing behaviour and dispersing tourists. Given that the BCW has been designed to identify and apply methods to encourage behaviour change, and is designed for application in a broad range of contexts [20] it was considered appropriate for application in tourism and this study. To date, BCW has, to the authors' knowledge, not been applied to tourism. The goal of this paper is to outline and critically assess the potential for the application of BCW to a tourism context.

2 Methods

The Behaviour Change Wheel methodology was employed to identify techniques to change behaviour and app components were considered that could administer these techniques. This study intends to use these designed interventions as a new frontend to the already existing Tourism Tracer Technology [4]. This app collects the GPS and survey data of participating tourists, allowing for fine-grained spatiotemporal analysis of tourist mobility, informed by tourists' demographic and preference information [3]. This mixed-methods data has the potential to measure dispersal and attitudes towards the interventions in real-time.

2.1 BCW Methodology

The BCW methodology contains three stages: the first involves defining the central behaviour that requires change, and the components of that behaviour that are potentially powerful targets for creating change. The BCW uses the COM-B behaviour system to define these components. COM-b stands for Capability Opportunity Motivation [leads to] Behaviour. COM-b is a system that was created by Michie, et al., in 2011 in response to their initial evaluation of nineteen behaviour change intervention models [16] it was developed to synthesise and simplify their categories of factors that influence behaviour. Physical and psychological capability, physical and social opportunity, and reflective and automatic motivation are all components that this system uses to clarify the drives behind a behaviour, and it is understood that each behaviour will be the result of a web of these components influencing one another, and in turn influencing behaviour. In the second stage, broad intervention functions such as 'training' and 'modelling' are identified and in the third stage, relevant techniques and ways of delivering them are matched to the intervention function and the situation.

Stage 1: Understand the Behaviour

Step 1: Define the problem in behavioural terms. Defining the problem as a behaviour helps designers clarify the 'who' 'what' and 'where' of the problem.

Step 2: Select the target behaviour. In this step a list is developed of all potential factors that could contribute to the problem behaviour and analyse them for a) level of impact b) likelihood of behaviour change and c) spill over to other behaviours.

Step 3: Specify the target behaviour. The context of the highest priority target behaviours are clarified so that the most appropriate point of intervention can be found.

Step 4: identifying what needs to change. This step involves using the COM-B model. The COM-B model assumes that all components have some effect on behaviour, however this step finds components that will be most effective at changing the target behaviour. It is not relevant, for instance, to create an intervention that increases motivation to travel to regional areas if tourists are already eager to go, but are physically incapable. In that case, interventions that bridge physical difficulties would be necessary.

Stage 2: Identify Intervention Options

Step 5: Identify intervention functions. Intervention functions are broad categories of ways in which behaviour can be changed: an intervention based on training will be different to an intervention based on incentivization. The BCW has already identified which COM-B components are effectively targeted by which intervention functions.

Step 6: Selecting Intervention functions. In this step, the APEASE criteria (Affordable, Practical, Effective, Acceptable, Safe and Equitable) is used to select the intervention functions are most practical and ethical to focus on. The APEASE criteria was developed 2014 by Michie et al. to be used as a simple evaluation tool within the BCW [21]. This study used functions only if they met every point of the APEASE criteria.

Stage 3: Identify Content Options

Step 7: Identifying Behaviour Change Techniques. Using Michie, et al.'s *Taxonomy of BCTs* [22], Behaviour Change Techniques (BCTs) are identified that have been found to link to the intervention functions selected.

Step 8: Determine mode of delivery. Once BCTs have been identified, we can design app features that use them.

3 Results

3.1 Stage 1: Identify Tourists' Behaviour

We identified the problem of regional tourism as: Tourists and local leisure-seekers tend to either go to iconic locations and stay on major touring routes or not leave Hobart.

And our Intervention aim: To encourage them to disperse to more diverse locations and regional areas.

Thirty-two factors were identified that impact this behaviour. The factors that were chosen related to issues such as knowledge of the region, perception of risk, time, money, travel group, peer referrals, social media influence, marketing, weather, ability to travel, physical ability and personal preferences. These were chosen based upon the authors knowledge of the tourism industry in Tasmania [23], the authors' previous research into factors that influence dispersal in Tasmania [3] and research conducted by others authors into factors which effect behaviour such as weather [24, 25] and digital connectivity [26]. Focusing only on factors rated with a high level of potential impact, high likelihood of potential behaviour change, and high level of potential to spill over to other behaviours reduced our list to a small number of promising behaviours to target. Some behaviours, such as perceiving lower ability to mitigate bad weather in regional areas, are accurate assessments, so there is a low chance of changing that behaviour, nor is it reasonable to expect tourists to continue into regional outdoor areas on days where the weather is severe. In other cases, such as tourists lacking adequate transport, the potential impact would be high if we could change it, but it is outside of the scope of this study.

Three target behaviours were found that had promise to change this behaviour, and which were within the scope if this **study**:

1. **Access and engage in logistical information on regional locations:** To visit regional areas, tourists and leisure-seekers must be aware of the locations, and the distances and difficulties associated with travel to them. If we can develop the behaviour of exploring and planning with this information in individuals who were not previously, it has potential to increase dispersal to these areas.
2. **Access and engage in information that raises the perceived value of regional locations:** Besides knowing about locations and how to get to them, tourists must also widely value a location to visit it in significant numbers. If we can develop the behaviour of engaging with a) information on which regional locations are attuned to a personal interest, or b) a new goal system within a game that raises the value of a location, it has potential to increase dispersal to these areas.
3. **Access and share social information on regional locations:** Learning where others have gone and seeing recommendations from others for new areas as well as sharing information about their own trips are behaviours that can raise the interest and decision making of tourists. One tourists public demonstration of having gone to and enjoyed a regional area could also be useful in changing the behaviour of others.

For all three identified Target Behaviours, the contexts were similar. These behaviours are principally enacted in the planning phase of a trip, although they could also potentially be engaged in while on a trip in the region to add extra stops. The exception was the sharing of social information which can be done in the post-trip reflection stage. All Target Behaviours can be done alone or as a group of travelers.

Next the COM-B components were analysed. These were found to be same for the three target behaviours: the app should change the psychological capability, the social opportunity, and the reflective motivation (Table 1).

Table 1. COM-B component analysis of target behaviours

COM-b model components	What needs to happen for the target behaviour to occur?	Is there a need for change?
Capability Physical	tourists must be able to access and consume information about locations and reasons to visit them	No: it is reasonable to expect tourists are psychically capable of finding and reading information in vast majority of cases
Capability Psychological	Tourists know where to look to access information, remember and consider possibilities, and make travel decisions that include regional locations	Yes: it is currently easy for tourists to miss seeing regional tourism information, or to forget it in the face of more constant highlight marketing
Opportunity physical	Tourists must have a device and internet access, or equivalent physical resources to access information	No: it is reasonable to expect tourists have internet access and/or access to tourism marketing and books
Opportunity Social	Tourists must be in a similar mind to travel party members to seek out information and make travel decisions together or be inspired to seek out information by social interactions that raise their interest	Yes: information accessed should motivate anyone in travel party, not just seeker, and information should not be accessed in a way that pulls the user out of the moment and away from socialising on a trip [27]
Motivation reflective	Tourists must be interested and engaged by the process of learning about travel to regional locations and want to seek out the information	Yes: Tourists do not currently know where to find this specific information, and it is often packaged in a more complicated and boring way than highlight marketing

3.2 Stage 2: App Intervention Options

This combination of components corresponded to every intervention function, however in an APEASE review, ‘Restriction’ and ‘Coercion’ were not considered as candidates as they are not acceptable or safe, and ‘Environmental restructuring’ was discounted for being impractical and potentially unacceptable for environmental damage. Therefore, ‘Training’, ‘Modelling’, ‘Enablement’, ‘Education’, ‘Persuasion’ and ‘Incentivisation’ were the selected Intervention Functions.

3.3 Stage 3: App Content

Using the intervention taxonomy [22] corresponding BCTs were found and analysed for appropriateness in the tourist context. For this, the APEASE criteria was used again.

As tourism is an innately hedonic activity, interventions were considered appropriate if they added, rather than detracted, from playful and escapist behaviours. therefore “6.1 Demonstration of the behaviour”, which requires watching and learning

rather than participating, was considered an ineffective intervention in this context while “Identification of self as role model” does meet a common need of travellers to gain pleasure from proving competence in an unusual arena [28] (Table 2).

Table 2. Target behaviour change techniques

Target BCT	App element equivalence	Review with APEASE & target behaviours
1.1 Goal setting	Mechanic to view info on locations and accept them as quests	Simplifies acting on new knowledge and raises value
1.2 Problem solving	Info screen on locations includes what users need to bring (i.e. protective clothes and water if outdoors)	Raises knowledge
1.4 Action planning	Suggest pre-planning of trips and rearrangeable accepted quests to help tourists plan an itinerary	Simplifies acting on new knowledge and raises value
2.2 Feedback on behaviour	Statistics/badges for locations visited by type	Raises value of visiting locations
2.3 Self-monitoring of behaviour	Screen: travel map that shows progress	Raises value and knowledge of locations
2.7 Feedback on outcomes on behaviour	Information on help given to small businesses	Not effective (impact is small, separate from own goals of enjoyment)
3.1 Social support	Promote travel-party to work together with group-friendly challenges	Raises social satisfaction and value
4.1 Instruction on how to perform a behaviour	App tutorial: popup explanations	Raises knowledge
6.1 Demonstration of the behaviour	App tutorial: video/walkthrough	Not effective (uninteresting)
6.2 Social comparison	Users may plant virtual trees in locations where they have completed challenges, other users can see which locations are widely visited by tree counts	Raises social satisfaction and knowledge
6.3 Information about others' approval	Allow comments/reaction to users visiting new places	Raises social satisfaction
7.1 Prompts/cues	Map where all are visible + suggestion popups when close	Raises knowledge
10.3 Reward (self, social or material)	Extra activities in locations/collection of apples from planted trees	Raises value of places

(continued)

Table 2. (continued)

Target BCT	App element equivalence	Review with APEASE & target behaviours
12.5 Adding objects to the environment	QR codes, caches to find	Not practical or acceptable: cannot add to public spaces/parks
13.1 Identification of self as role model	If users ‘plant a tree’, they can help other players gain more seeds, will be told how many players have picked from their tree	Raises social satisfaction
13.2 Framing and reframing	Give users challenges/things to identify and collect in locations to reframe reason for going	Raises value of places
14.5 Rewarding completion	Reveal new goals/locations after they have been to enough locations, and gained enough clues to solve puzzle	Raises value of places
15.3 Focus on past success	Remind of results of previous days using app with maps/result updates	Not effective (users may not be capable of going to region again - e.g. tourists)

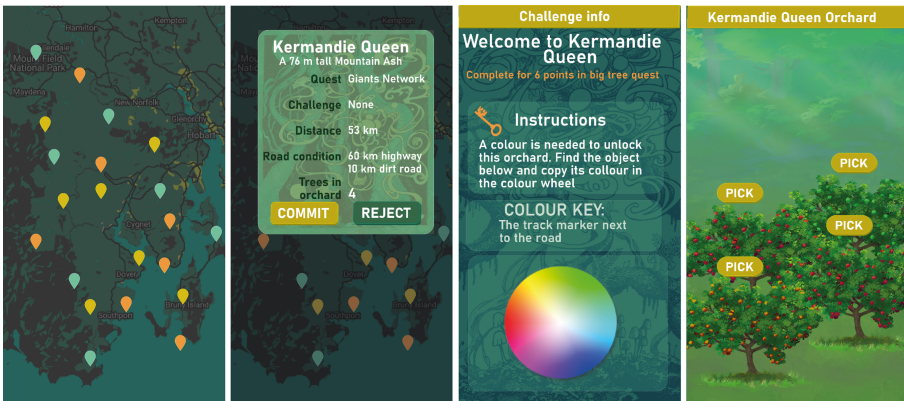


Fig. 1. Prototype designs of app elements.

4 Discussion

This study used the BCW methodology to design a gamified app with interventions aimed at changing tourist and leisure-seeker behaviour to disperse into regional areas at a greater rate Fig. 1. BCW has been designed to apply to a broad range of contexts [21] – however, the vast majority of its uses so far have been in health and medicine [17].

The application of the BCW makes significant contributions to tourism research. This is the first time that the BCW has been applied to a hedonic context (tourism). As a result of this, our research has augmented a suite of behaviour change techniques applicable to hedonic environments that can be used by future tourism researchers.

Practically, this research project has developed an app that can be used in other tourism destinations. Its application in Tasmania will assist in dispersing the benefits of tourism beyond 'hotspots', and the gamified aspect of the app will arguably enhance the tourism experience in Tasmania and beyond.

In applying the methodology to tourism, it did prescribe some ineffective Behaviour Change Techniques, and some had to be reconfigured to be more in line with a game element rather than a health intervention. This may be because the ultimate goals of the users are significantly different from the original context of BCW use. In some health interventions, there is a presupposition that the user wants and benefits from the outcomes of the behaviour change but the behaviour is too boring, tedious, or forgettable to incorporate in daily life without intervention, while in the context of dispersal, the intended outcome most benefits area stakeholders and the environment [29]. However, the methodology exhibited advantages, as it allowed for a systematic examination of the process of designing interventions to increase dispersal throughout a regional area, from problem identification to promising content identification in one methodology.

We found BCW had another advantage over more traditionally used tourism behaviour theories such as the Theory of Planned Behaviour: there has been evidence of an attitude-behaviour gap in tourist behaviour [30] which means that tourists with pro-environmental or social attitudes will still act in self-serving ways on holidays where they are hedonically motivated [14]. By giving equal consideration to all possible influences on behaviour as potential targets, BCW has a level of flexibility that makes it a useful methodology in various circumstances, including tourism, where more hedonic, less commonsense influences can be rated as more impactful.

This process also made it evident that there are many factors inhibiting regional dispersal in which an app cannot intervene. Time constraints, increased dangers associated with remoteness, transport access limitations and undeliverable personal preferences are all factors affecting tourist movement into these areas that this study cannot influence. Future work with a larger scope could work with policymakers and providers to influence some of these, however others, such as time constraints for tourists on fixed schedules are unavoidable impediments.

For tourists and leisure-seekers without these impediments, we found the most promising behaviour to target is their engagement with information, whether logistic, value-based or social. We used Behaviour Change Techniques to design the most engaging method within our limitations to raise people's capability, opportunity and motivation to engage with information on regional areas, and use it to plan trips. With these component prescriptions, an app was prototyped for the Huon Valley Region of Tasmania, Australia.

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